United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-1910
Supplement 2

Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming

Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities

Final Report

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and
Environmental Management Programs

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) issues licenses for the possession and use of source material provided that proposed facilities meet NRC regulatory requirements and would be operated in a manner that protects public health and safety and the environment. Under the NRC environmental protection regulations in the Code of Federal Regulations (CFR), Title 10, Part 51, which implement the National Environmental Policy Act of 1969 (NEPA), issuance of a license to possess and use source material for uranium milling, as defined in 10 CFR Part 40, requires an environmental impact statement (EIS) or a supplement to an EIS.

In May 2009, NRC issued NUREG–1910, the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an *in-situ* leach uranium recovery facility [also known as an *in-situ* recovery (ISR) facility] located in four specified geographic regions of the western United States. As part of this assessment, NRC determined which potential impacts would be essentially the same for all ISR facilities and which would result in varying levels of impact for different facilities, thus requiring further site-specific information to determine potential impacts. The GEIS provides a starting point for the NRC NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses.

By letter dated November 30, 2007, Uranerz Energy Corporation (Uranerz), referred to herein as the applicant) submitted a license application to NRC for a new source material license for the Nichols Ranch ISR Project. The proposed Nichols Ranch ISR Project would be located in Campbell and Johnson Counties, Wyoming, which is in the Wyoming East Uranium Milling Region identified in the GEIS. The NRC staff prepared this Supplemental EIS (SEIS) to evaluate the potential environmental impacts from the applicant proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium milling facility at the proposed Nichols Ranch ISR Project. This SEIS describes the environment potentially affected by the proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes the applicant environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. NRC staff then determined relevant sections, findings, and conclusions in the GEIS that could be incorporated by reference, and areas that needed additional analysis. Based on its environmental review, the NRC staff recommends that, unless safety issues mandate otherwise, the source material license be issued as requested.

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CONTENTS

Section Page

ABSTRACT iii
CONTENTS v
FIGURES xvi
TABLES xvii
EXECUTIVE SUMMARY xix
ABBREVIATIONS/ACRONYMS xxxv
SI* (MODERN METRIC) CONVERSION FACTORS xxxix

1 INTRODUCTION 1-1
1.1 Background 1-1
1.2 Proposed Action 1-1
1.3 Purpose and Need for the Proposed Action 1-1
1.4 Scope of the Supplemental Environmental Analysis 1-3
1.4.1 Relationship to the GEIS 1-3
1.4.2 Public Participation Activities 1-4
1.4.3 Issues Studied in Detail 1-5
1.4.4 Issues Outside the Scope of the SEIS 1-6
1.4.5 Related NEPA Reviews and Other Related Documents 1-6
1.5 Applicable Regulatory Requirements 1-8
1.6 Licensing and Permitting 1-9
1.6.1 NRC Licensing Process 1-9
1.6.2 Status of Permitting with Other Federal, Tribal, and State Agencies 1-9
1.7 Consultations 1-10
1.7.1 Endangered Species Act of 1973 Consultation 1-10
1.7.2 National Historic Preservation Act of 1966 Consultation 1-11
1.7.3 Coordination with Other Federal, Tribal, State, and Local Agencies 1-12
1.7.3.1 Coordination with Bureau of Land Management 1-13
1.7.3.2 Coordination with Bureau of Indian Affairs 1-13
1.7.3.3 Interactions with Tribal Governments 1-14
1.7.3.4 Coordination with Wyoming Department of Environmental Quality 1-15
1.7.3.5 Coordination with Wyoming Game and Fish Department 1-15
1.7.3.6 Coordination with Wyoming State Engineer's Office 1-16
1.7.3.7 Coordination with Wyoming Governor's Planning Office 1-16
1.7.3.8 Coordination with Wyoming Community Development Authority 1-16
1.7.3.9 Coordination with Localities 1-16
1.8 Structure of the SEIS 1-16
1.9 References 1-17

CONTENTS (continued)

Section Page

2 *IN-SITU* URANIUM RECOVERY AND ALTERNATIVES 2-1
2.1 Alternatives Considered for Detailed Analysis 2-1
2.2 The Proposed Action (Alternative 1) 2-1
2.2.1 Proposed ISR Facility Including Deep Well Injection 2-1
2.2.1.1 Site Description 2-2
2.2.1.2 Construction Activities 2-3
2.2.1.2.1 Site Preparation 2-3
2.2.1.2.2 Buildings 2-6
2.2.1.2.3 Access Roads 2-9
2.2.1.2.4 Wellfields 2-9
2.2.1.2.4.1 Injection and Production Wells 2-13
2.2.1.2.4.2 Monitoring Wells 2-13
2.2.1.2.4.3 Well Construction and Testing 2-14
2.2.1.2.4.4 Pipelines 2-14
2.2.1.2.5 Other Structures and Systems 2-17
2.2.1.2.6 Construction Workers and Equipment 2-17
2.2.1.2.7 Schedule 2-17
2.2.1.3 Operation Activities 2-18
2.2.1.3.1 Uranium Mobilization 2-18
2.2.1.3.1.1 Lixiviant Chemistry 2-18
2.2.1.3.1.2 Lixiviant Injection and Recovery 2-18
2.2.1.3.1.3 Excursion Monitoring 2-19
2.2.1.3.1.4 Uranium Processing 2-24
2.2.1.3.1.5 Ion Exchange 2-24
2.2.1.3.1.6 Elution 2-25
2.2.1.3.1.7 Precipitation, Drying, and Packaging 2-25
2.2.1.3.2 Management of Production Bleed and Other Liquid Effluents 2-25
2.2.1.3.3 Schedule 2-26
2.2.1.4 Aquifer Restoration Activities 2-26
2.2.1.4.1 Groundwater Transfer 2-27
2.2.1.4.2 Groundwater Sweep 2-28
2.2.1.4.3 Groundwater Treatment 2-28
2.2.1.4.4 Monitoring and Stabilization 2-29
2.2.1.4.5 Schedule 2-30
2.2.1.5 Decontamination, Decommissioning, and Reclamation Activities 2-30
2.2.1.5.1 Radiological Surveys and Contamination Control 2-30
2.2.1.5.2 Wellfields 2-30
2.2.1.5.3 Process Buildings and Equipment and Other Structures 2-31
2.2.1.5.4 Engineered Structures and Site Roads 2-31
2.2.1.5.5 Final Contouring and Revegetation 2-31
2.2.1.5.6 Schedule 2-32
2.2.1.6 Effluents and Waste Management 2-32
2.2.1.6.1 Gaseous and Airborne Particulate Emissions 2-32

CONTENTS (continued)

Section Page

2.2.1.6.1.1 Fugitive Dust and Diesel Emissions 2-33
2.2.1.6.1.2 Radioactive Emissions 2-34
2.2.1.6.2 Liquid Waste 2-35
2.2.1.6.3 Solid Wastes 2-36
2.2.1.7 Transportation 2-38
2.2.1.8 Financial Surety 2-38
2.2.2 Alternative Wastewater Disposal Options 2-39
2.2.2.1 Evaporation Ponds 2-40
2.2.2.2 Land Application 2-41
2.2.2.3 Surface Water Discharge 2-42
2.2.2.4 Class V Injection Well 2-43
2.2.3 No-Action (Alternative 2) 2-43
2.2.4 Modified Action–No Hank Unit (Alternative 3) 2-43
2.3 Alternatives Eliminated from Detailed Analysis 2-44
2.3.1 Conventional Mining and Milling at the Nichols Ranch ISR Project Site 2-44
2.3.2 Conventional Mining and Heap Leaching at the Nichols Ranch ISR Project Site 2-45
2.3.3 Alternate Lixiviants 2-46
2.3.4 Modified Action–No Nichols Ranch Unit 2-46
2.4 Comparison of the Predicted Environmental Impacts 2-48
2.5 Final Recommendation 2-48
2.6 References 2-48

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT 3-1
3.1 Introduction 3-1
3.2 Land Use 3-1
3.2.1 Rangeland 3-2
3.2.2 Hunting and Recreation 3-2
3.2.3 Minerals and Energy 3-4
3.3 Transportation 3-4
3.4 Geology and Soils 3-7
3.4.1 Geology 3-7
3.4.1.1 Nichols Ranch Unit Geology 3-11
3.4.1.2 Hank Unit Geology 3-11
3.4.2 Soils 3-12
3.5 Water Resources 3-12
3.5.1 Surface Waters and Wetlands 3-12
3.5.1.1 Drainage Basins 3-13
3.5.1.2 Surface Water Features 3-13
3.5.1.3 Surface Water Flow 3-13
3.5.1.4 Surface Water Quality 3-15
3.5.1.5 Wetlands 3-16
3.5.2 Groundwater 3-17
3.5.2.1 Regional Groundwater Resources 3-17
3.5.2.2 Local Groundwater Resources 3-18
3.5.2.3 Uranium-Bearing Aquifer 3-18

CONTENTS (continued)

Section Page

3.5.2.3.1 Hydrogeologic Characteristics 3-22
3.5.2.3.2 Level of Confinement 3-22
3.5.2.3.3 Groundwater Quality 3-23
3.5.2.3.4 Current Groundwater Uses 3-26
3.5.2.4 Surrounding Aquifers 3-27
3.6 Ecology 3-28
3.6.1 Terrestrial Ecology 3-29
3.6.1.1 Vegetation 3-29
3.6.1.2 Wildlife 3-30
3.6.1.2.1 Big Game 3-30
3.6.1.2.2 Upland Game Birds 3-34
3.6.1.2.3 Raptors 3-35
3.6.1.2.4 Waterfowl and Shorebirds 3-35
3.6.1.2.5 Nongame/Migratory Birds 3-36
3.6.1.2.6 Other Mammals 3-37
3.6.1.2.7 Reptiles 3-37
3.6.2 Aquatic Ecology 3-38
3.6.3 Protected Species 3-38
3.7 Meteorology, Climatology, and Air Quality 3-48
3.7.1 Meteorology and Climatology 3-48
3.7.1.1 Temperature 3-49
3.7.1.2 Wind 3-49
3.7.1.3 Precipitation 3-50
3.7.1.4 Evaporation 3-50
3.7.1.5 Climate Change and Greenhouse Gases 3-51
3.7.2 Air Quality 3-52
3.8 Noise 3-53
3.9 Historical, Cultural, and Paleontological Resources 3-55
3.9.1 Cultural History 3-56
3.9.1.1 Prehistoric Era 3-57
3.9.1.2 Protohistoric/Historic Era 3-57
3.9.2 Historic and Cultural Resources Identified and Places of Cultural Significance 3-58
3.9.2.1 Nichols Ranch Unit 3-58
3.9.2.2 Hank Unit 3-58
3.9.2.3 Places of Cultural Significance 3-59
3.9.3 Tribal Consultation 3-61
3.9.4 Paleontological Resources 3-62
3.10 Visual and Scenic Resources 3-62
3.10.1 Nichols Ranch Unit 3-63
3.10.2 Hank Unit 3-63
3.11 Socioeconomics 3-64
3.11.1 Demographics 3-65
3.11.2 Income 3-66
3.11.3 Housing 3-66
3.11.4 Employment Structure 3-66
3.11.5 Local Finance 3-68

CONTENTS (continued)

Section Page

3.11.6 Education 3-69
3.11.7 Health and Social Services 3-69
3.12 Public and Occupational Health and Safety 3-69
3.12.1 Background Radiological Conditions 3-70
3.12.2 Public Health and Safety 3-72
3.12.3 Occupational Health and Safety 3-73
3.13 Waste Management 3-73
3.13.1 Liquid Waste Disposal 3-73
3.13.2 Solid Waste Disposal 3-74
3.14 References 3-74

4 ENVIRONMENTAL IMPACTS OF CONSTRUCTION, OPERATION, AQUIFER RESTORATION, AND DECOMMISSIONING ACTIVITIES AND MITIGATIVE ACTIONS 4-1
4.1 Introduction 4-1
4.2 Land Use Impacts 4-2
4.2.1 Proposed Action (Alternative 1) 4-2
4.2.1.1 Construction Impacts 4-2
4.2.1.2 Operations Impacts 4-3
4.2.1.3 Aquifer Restoration Impacts 4-3
4.2.1.4 Decommissioning Impacts 4-4
4.2.2 No-Action (Alternative 2) 4-4
4.2.3 Modified Action–No Hank Unit (Alternative 3) 4-4
4.2.3.1 Construction Impacts 4-4
4.2.3.2 Operations Impacts 4-5
4.2.3.3 Aquifer Restoration Impacts 4-5
4.2.3.4 Decommissioning Impacts 4-5
4.3 Transportation Impacts 4-5
4.3.1 Proposed Action (Alternative 1) 4-6
4.3.1.1 Construction Impacts 4-6
4.3.1.2 Operation Impacts 4-7
4.3.1.3 Aquifer Restoration Impacts 4-10
4.3.1.4 Decommissioning Impacts 4-10
4.3.2 No-Action (Alternative 2) 4-12
4.3.3 Modified Action–No Hank Unit (Alternative 3) 4-13
4.3.3.1 Construction Impacts 4-13
4.3.3.2 Operation Impacts 4-13
4.3.3.3 Aquifer Restoration Impacts 4-14
4.3.3.4 Decommissioning Impacts 4-14
4.4 Geology and Soils Impacts 4-15
4.4.1 Proposed Action (Alternative 1) 4-15
4.4.1.1 Construction Impacts 4-15
4.4.1.2 Operation Impacts 4-16
4.4.1.3 Aquifer Restoration Impacts 4-17
4.4.1.4 Decommissioning Impacts 4-18
4.4.2 No-Action (Alternative 2) 4-19
4.4.3 Modified Action–No Hank Unit (Alternative 3) 4-19

CONTENTS (continued)

Section Page

4.5 Water Resources Impacts 4-20
4.5.1 Surface Waters and Wetlands Impacts 4-20
4.5.1.1 Proposed Action (Alternative 1) 4-20
4.5.1.1.1 Construction Impacts 4-20
4.5.1.1.2 Operation Impacts 4-22
4.5.1.1.3 Aquifer Restoration Impacts 4-24
4.5.1.1.4 Decommissioning Impacts 4-24
4.5.1.2 No-Action (Alternative 2) 4-25
4.5.1.3 Modified Action–No Hank Unit (Alternative 3) 4-25
4.5.2 Groundwater Impacts 4-25
4.5.2.1 Proposed Action (Alternative 1) 4-26
4.5.2.1.1 Construction Impacts 4-26
4.5.2.1.2 Operation Impacts 4-27
4.5.2.1.2.1 Operation Impacts Shallow (Near-Surface) Aquifers 4-27
4.5.2.1.2.2 Operation Impacts to Production and Surrounding Aquifers 4-29
4.5.2.1.2.3 Operation Impacts to Deep Aquifers Below the Production Aquifers 4-36
4.5.2.1.3 Aquifer Restoration Impacts 4-37
4.5.2.1.4 Decommissioning Impacts 4-39
4.5.2.2 No-Action (Alternative 2) 4-40
4.5.2.3 Modified Action–No Hank Unit (Alternative 3) 4-40
4.5.2.3.1 Construction Impacts 4-40
4.5.2.3.2 Operation Impacts 4-40
4.5.2.3.3 Aquifer Restoration Impacts 4-40
4.5.2.3.4 Decommissioning Impacts 4-41
4.6 Ecological Resources Impacts 4-41
4.6.1 Proposed Action (Alternative 1) 4-41
4.6.1.1 Construction Impacts 4-41
4.6.1.1.1 Terrestrial Ecology 4-42
4.6.1.1.1.1 Vegetation 4-42
4.6.1.1.1.2 Wildlife 4-42
4.6.1.1.2 Aquatic Ecology 4-46
4.6.1.1.3 Protected Species 4-47
4.6.1.2 Operation Impacts 4-50
4.6.1.3 Aquifer Restoration 4-51
4.6.1.4 Decommissioning Impacts 4-51
4.6.2 No-Action (Alternative 2) 4-53
4.6.3 Modified Action–No Hank Unit (Alternative 3) 4-53
4.7 Air Quality Impacts 4-53
4.7.1 Proposed Action (Alternative 1) 4-55
4.7.1.1 Construction Impacts 4-55
4.7.1.2 Operation Impacts 4-57
4.7.1.3 Aquifer Restoration Impacts 4-57
4.7.1.4 Decommissioning Impacts 4-58
4.7.2 No-Action (Alternative 2) 4-58
4.7.3 Modified Action–No Hank Unit (Alternative 3) 4-59

CONTENTS (continued)

Section Page

4.7.3.1 Construction Impacts 4-59
4.7.3.2 Operation Impacts 4-59
4.7.3.3 Aquifer Restoration Impacts 4-60
4.7.3.4 Decommissioning Impacts 4-60
4.8 Noise Impacts 4-61
4.8.1 Proposed Action (Alternative 1) 4-62
4.8.1.1 Construction Impacts 4-62
4.8.1.2 Operation Impacts 4-62
4.8.1.3 Aquifer Restoration Impacts 4-63
4.8.1.4 Decommissioning Impacts 4-63
4.8.2 No-Action (Alternative 2) 4-64
4.8.3 Modified Action–No Hank Unit (Alternative 3) 4-64
4.8.3.1 Construction Impacts 4-64
4.8.3.2 Operation Impacts 4-64
4.8.3.3 Aquifer Restoration Impacts 4-65
4.8.3.4 Decommissioning Impacts 4-65
4.9 Historical, Cultural, and Paleontological Resources Impacts 4-65
4.9.1 Proposed Action (Alternative 1) 4-65
4.9.1.1 Construction Impacts 4-65
4.9.1.2 Operation Impacts 4-69
4.9.1.3 Aquifer Restoration Impacts 4-70
4.9.1.4 Decommissioning Impacts 4-70
4.9.2 No-Action (Alternative 2) 4-71
4.9.3 Modified Action–No Hank Unit (Alternative 3) 4-71
4.9.3.1 Construction Impacts 4-71
4.9.3.2 Operation Impacts 4-72
4.9.3.3 Aquifer Restoration Impacts 4-72
4.9.3.4 Decommissioning Impacts 4-72
4.10 Visual and Scenic Resources Impacts 4-73
4.10.1 Proposed Action (Alternative 1) 4-73
4.10.1.1 Construction Impacts 4-74
4.10.1.1.1 Nichols Ranch Unit 4-74
4.10.1.1.2 Hank Unit 4-74
4.10.1.2 Operation Impacts 4-75
4.10.1.3 Aquifer Restoration Impacts 4-76
4.10.1.4 Decommissioning Impacts 4-76
4.10.2 No-Action (Alternative 2) 4-76
4.10.3 Modified Action–No Hank Unit (Alternative 3) 4-77
4.10.3.1 Construction Impacts 4-77
4.10.3.2 Operational Impacts 4-77
4.10.3.3 Aquifer Restoration Impacts 4-77
4.10.3.4 Decommissioning Impacts 4-78
4.11 Socioeconomic Impacts 4-78
4.11.1 Proposed Action (Alternative 1) 4-78
4.11.1.1 Construction Impacts 4-78
4.11.1.1.1 Demographics 4-79

CONTENTS (continued)

Section Page

4.11.1.1.2 Income 4-79
4.11.1.1.3 Housing 4-79
4.11.1.1.4 Employment Rate 4-80
4.11.1.1.5 Local Finance 4-80
4.11.1.1.6 Education 4-80
4.11.1.1.7 Health and Social Services 4-80
4.11.1.2 Operation Impacts 4-80
4.11.1.2.1 Demographics 4-81
4.11.1.2.2 Income 4-81
4.11.1.2.3 Housing 4-81
4.11.1.2.4 Employment Rate 4-81
4.11.1.2.5 Local Finance 4-82
4.11.1.2.6 Education 4-82
4.11.1.2.7 Health and Social Services 4-82
4.11.1.3 Aquifer Restoration Impacts 4-82
4.11.1.4 Decommissioning Impacts 4-83
4.11.2 No-Action (Alternative 2) 4-83
4.11.3 Modified Action–No Hank Unit (Alternative 3) 4-83
4.12 Environmental Justice Impacts 4-83
4.12.1 Analysis of Impacts 4-84
4.12.2 Proposed Action (Alternative 1) 4-86
4.12.3 No-Action (Alternative 2) 4-87
4.12.4 Modified Action–No Hank Unit (Alternative 3) 4-87
4.13 Public and Occupational Health and Safety Impacts 4-88
4.13.1 Proposed Action (Alternative 1) 4-88
4.13.1.1 Construction Impacts 4-88
4.13.1.2 Operation Impacts 4-88
4.13.1.2.1 Radiological Impacts to Public and Occupational Health and Safety from Normal Operations 4-89
4.13.1.2.2 Radiological Impacts to the Public and Occupational Health and Safety from Accidents 4-92
4.13.1.2.3 Nonradiological Impacts from Normal Operations 4-94
4.13.1.2.4 Nonradiological Impacts to Public and Occupational Health and Safety from Accidents 4-96
4.13.1.3 Aquifer Restoration Impacts 4-97
4.13.1.4 Decommissioning Impacts 4-97
4.13.2 No-Action (Alternative 2) 4-98
4.13.3 Modified Action–No Hank Unit (Alternative 3) 4-98
4.13.3.1 Construction Impacts 4-98
4.13.3.2 Operation Impacts 4-98
4.13.3.3 Aquifer Restoration Impacts 4-99
4.13.3.4 Decommissioning Impacts 4-99
4.14 Waste Management Impacts 4-99
4.14.1 Proposed Action (Alternative 1) 4-100
4.14.1.1 Disposal Via Class I Injection Well 4-100
4.14.1.1.1 Construction Impacts 4-100
4.14.1.1.2 Operation Impacts 4-100

CONTENTS (continued)

Section Page

4.14.1.1.3 Aquifer Restoration Impacts 4-102
4.14.1.1.4 Decommissioning Impacts 4-102
4.14.1.2 Alternative Wastewater Disposal Options 4-104
4.14.1.2.1 Evaporation Ponds 4-104
4.14.1.2.2 Land Application 4-106
4.14.1.2.3 Surface Water Discharge 4-107
4.14.1.2.4 Class V Injection Well 4-109
4.14.2 No-Action (Alternative 2) 4-110
4.14.3 Modified Action–No Hank Unit (Alternative 3) 4-110
4.15 References 4-111

5 Cumulative Impacts 5-1
5.1 Introduction 5-1
5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions 5-1
5.1.1.1 Uranium Recovery Sites 5-2
5.1.1.2 Coal Mining 5-5
5.1.1.3 Oil and Gas Production 5-5
5.1.1.4 Coal Bed Methane Development 5-8
5.1.1.5 Other Mining 5-8
5.1.1.6 Environmental Impact Statements as Indicators of Past, Present, and Reasonably Foreseeable Future Actions 5-9
5.1.2 Methodology 5-9
5.2 Land Use 5-10
5.3 Transportation 5-19
5.4 Geology and Soils 5-21
5.5 Water Resources 5-23
5.5.1 Surface Waters and Wetlands 5-23
5.5.2 Groundwater 5-26
5.6 Ecological Resources 5-30
5.6.1 Terrestrial Ecology 5-30
5.6.2 Aquatic Ecology 5-32
5.6.3 Protected Species 5-32
5.7 Air Quality 5-35
5.7.1 Global Climate Change and Greenhouse Gas Emissions 5-39
5.7.1.1 Greenhouse Gas Emissions in the Region 5-39
5.7.1.2 GHG Emissions from the Proposed Nichols Ranch ISR Project 5-40
5.7.1.3 Nichols Ranch ISR Project GHG Emissions Impact 5-41
5.7.1.4 Effect of Climate Change on the Nichols Ranch ISR Project Facility 5-42
5.7.1.5 GHG Mitigation Measures 5-43
5.7.1.6 Other Mining Activities in the Powder River Basin 5-43
5.8 Noise 5-45
5.9 Historical and Cultural Resources 5-46
5.10 Visual and Scenic Resources 5-49
5.11 Socioeconomics 5-51

CONTENTS (continued)

Section Page

5.12 Environmental Justice 5-54
5.13 Public and Occupational Health and Safety 5-55
5.14 Waste Management 5-57
5.15 References 5-59

6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS 6-1
6.1 Introduction 6-1
6.2 Radiological Monitoring 6-1
6.2.1 Airborne Radiation Monitoring 6-1
6.2.2 Soils and Sediment Monitoring 6-2
6.2.3 Vegetation, Food, and Fish Monitoring 6-7
6.2.4 Surface Water Monitoring 6-7
6.2.5 Groundwater Monitoring 6-7
6.3 Physiochemical Monitoring 6-12
6.3.1 Wellfield Groundwater Monitoring 6-12
6.3.1.1 Preoperational Groundwater Sampling 6-12
6.3.1.2 Groundwater Quality Monitoring 6-15
6.3.2 Wellfield and Pipeline Flow and Pressure Monitoring 6-15
6.3.3 Surface Water Monitoring 6-16
6.3.4 Meteorological Monitoring 6-16
6.4 Ecological Monitoring 6-16
6.4.1 Vegetation Monitoring 6-16
6.4.2 Wildlife Monitoring 6-17
6.5 References 6-17

7 COST-BENEFIT ANALYSIS 7-1
7.1 Introduction 7-1
7.2 No-Action Alternative 7-1
7.3 Benefits and Costs from the Proposed Action in Campbell County and Johnson Counties 7-1
7.3.1 Benefits from Potential Production 7-3
7.3.2 Costs to the Local Communities 7-3
7.4 Evaluation Findings of Alternative 3 (Modified Action—No Hank Unit 7-3
7.5 Evaluation of Findings 7-5
7.6 References 7-5

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES 8-1
8.1 Proposed Action (Alternative 1) 8-1
8.2 No-Action (Alternative 2) 8-2
8.3 Modified Action–No Hank Unit (Alternative 3) 8-2
8.4 References 8-3

9 LIST OF PREPARERS 9-1
9.1 U.S. Nuclear Regulatory Commission Contributors 9-1
9.2 Center for Nuclear Waste Regulatory Analyses (CNWRA®) Contributors 9-2
9.3 CNWRA Consultants and Subcontractors 9-5

CONTENTS (continued)

Section Page

10 DISTRIBUTION LIST 10-1
10.1 Federal Agency Officials 10-1
10.2 Tribal Government Officials 10-2
10.3 State Agency Officials 10-3
10.4 Local Agency Officials 10-4
10.5 Other Organizations and Individuals 10-4

APPENDIX A—CONSULTATION CORRESPONDENCE A-1

APPENDIX B—PUBLIC COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE NICHOLS RANCH ISR PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING, AND NRC RESPONSES B-1

APPENDIX C—ALTERNATE CONCENTRATION LIMITS C-1

APPENDIX D—NONROAD COMBUSTION ENGINE EMISSIONS ESTIMATES D-1

FIGURES

Figure Page

1-1 Geographic Location of the Nichols Ranch ISR Project 1-2

2-1 Nichols Ranch ISR Project Schedule 2-2
2-2 Nichols Ranch Unit Site Layout 2-4
2-3 Hank Unit Site Layout 2-5
2-4 General Layout of the Nichols Ranch Unit Buildings 2-7
2-5 General Layout of the Hank Unit Buildings 2-8
2-6 Access Roads for the Nichols Ranch ISR Project 2-10
2-7 Nichols Ranch Unit Production Areas 2-11
2-8 Hank Unit Production Areas 2-12
2-9 Typical Injection/Recovery Well Design 2-15
2-10 Typical Monitoring Well Design 2-16
2-11 General Flow Schematic for the ISR Process 2-19
2-12 Deep Disposal Well Design 2-36

3-1 Nearest Residential Receptors to the Nichols Ranch ISR Project 3-3
3-2 Transportation Routes Near the Nichols Ranch ISR Project 3-6
3-3 Geologic Composition at the Nichols Ranch ISR Project 3-9
3-4 Aquifers at the Nichols Ranch ISR Project 3-10
3-5 Drainage Basins at the Nichols Ranch ISR Project 3-14
3-6 Nichols Ranch Unit Location of Existing Wells 3-20
3-7 Hank Unit Location of Wells 3-21
3-8 Sage-Grouse Lek and Core Areas 3-47
3-9 Annual Wind Rose for the Antelope Coal Company 3-51

4-1 Drawdowns in an Unconfined Aquifer and Confined Aquifer From an Extraction Well Operating at Same Rate 4-32

5-1 Conventional and ISR Uranium Recovery Facilities, BLM Pasture Allotments And Croplands near the Proposed Nichols Ranch ISR Project 5-13
5-2 Oilfields, Coalfields, CBM Project Areas, Uranium Occurrences, and Uranium Facilities near the Proposed Nichols Ranch ISR Project 5-15
5-3 Energy Developments Within a 50-Mile Radius of Proposed Nichols Ranch ISR Project 5-16
5-4 Wyoming, Campbell County and Johnson County Population, 1970 to 2020 5-52
5-5 Projected Campbell County Population and Employment, 2000 to 2020 5-53

6-1 Nichols Ranch Unit Air Particulate and Radon Monitoring Locations 6-3
6-2 Hank Unit Air Particulate and Radon Monitoring Locations 6-4
6-3 Nichols Ranch Unit Sediment Sample Locations 6-5
6-4 Hank Unit Sediment Sample Locations 6-6
6-5 Nichols Ranch Unit Surface Water Sample Locations 6-8
6-6 Hank Unit Surface Water Sample Locations 6-9
6-7 Nichols Ranch Unit Monitoring Well Locations 6-10
6-8 Hank Unit Monitoring Well Locations 6-11

TABLES

Table Page

1-1 ISL GEIS Range of Expected Impacts in the Wyoming East Uranium Milling Region 1-4
1-2 Environmental Approvals for the Nichols Ranch ISR Project 1-11

2-1 Comparison of Different Liquid Wastewater Disposal Options 2-20
2-2 Impacts Summary for the Nichols Ranch ISR Project 2-52

3-1 CBM and Oil and Gas Wells on and Within 4.8 km [3 mi] of the Nichols Ranch ISR Project 3-5
3-2 Traffic Counts for State Routes Near the Nichols Ranch ISR Project 3-7
3-3 Peak Flows of Major Drainages for the Nichols Ranch ISR Project 3-16
3-4 Water Quality of Specific Aquifers in the Nichols Ranch Unit 3-24
3-5 Water Quality of Specific Aquifers in the Hank Unit 3-25
3-6 Plant Species by Habitat Occurrence at the Nichols Ranch ISR Project 3-31
3-7 Wildlife Species Observed on or Near the Nichols Ranch ISR Project 3-34
3-8 Federal, State, and BLM Listed Species That Occur in Johnson and Campbell Counties 3-39
3-9 Climate Data for Stations in the Wyoming East Uranium Milling Region 3-49
3-10 Existing Conditions—Ambient Air Quality Monitoring Data (2006–2008) 3-54
3-11 Nichols Ranch Unit Archaeological Sites 3-59
3-12 Hank Unit Archaeological Sites 3-60
3-13 Population and Percent Growth in Campbell and Johnson Counties, Wyoming From 1980 to 2050 3-65
3-14 Demographic Profile of the Population in Campbell and Johnson Counties in 2000 3-67
3-15 Demographic Profile of the Population in Campbell County, (2006–2008 3-Year Estimate) and Johnson County (2008 Estimate) 3-67
3-16 Estimated Income for Campbell County (2006–2008) and Johnson County (2008) 3-68
3-17 Housing in Campbell and Johnson Counties, Wyoming in 2000 (Actual) and 2008 (Estimated) 3-68

4-1 Percent Population Living in Poverty and Percent Minority Population in 2000 4-85
4-2 Estimated Radon-222 Releases 4-91
4-3 Generic Accident Dose Analysis for ISR Operations 4-92

5-1 Uranium Recovery Sites Near the Proposed Nichols Ranch ISR Project 5-3
5-2 Coal Mines Near the Proposed Nichols Range ISR Project 5-6
5-3 Cumulative Impacts on Environmental Resources 5-11
5-4 Comparison of Annual Mass of Carbon Dioxide Emissions by Source 5-40
5-5 Wyoming Historical and Reference Case GHG Emission in Million MT (Million MT) 5-40
5-6 Annual Greenhouse Gas Emissions at the West Antelope II Mine 5-44
5-7 Estimated Annual Equivalent CO_2 Emissions at the Black Thunder, Jacobs Ranch and North Antelope Rochelle Mines 5-45

TABLES (continued)

Table Page

7-1 Towns Near the Proposed Nichols Ranch ISR Project 7-4
7-2 Summary of Costs and Benefits of the Nichols Ranch ISR Project 7-5

8-1 Summary of Environmental Consequences of the Proposed Action..... 8-4

EXECUTIVE SUMMARY

BACKGROUND

By letter dated November 30, 2007, Uranerz Energy Corporation (Uranerz) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the Nichols Ranch *In-Situ* Uranium Recovery Project, located in the Powder River Basin in Campbell and Johnson Counties, Wyoming. The applicant is proposing to recover uranium using the *in-situ* leach (ISL) [also known as the *in-situ* recovery (ISR) process]. The proposed Nichols Ranch ISR Project is divided into two units, the Nichols Ranch Unit and the Hank Unit. Proposed facilities for the Nichols Ranch ISR Project include a central processing plant at the Nichols Ranch Unit, a satellite facility at the Hank Unit, and wellfields, and deep disposal wells located at each unit for the disposal of liquid effluent.

The Atomic Energy Act of 1954 (AEA), as amended by the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), authorized NRC to issue licenses for the possession and use of source material and byproduct material. These statutes require NRC to license facilities, including ISR operations in accordance with NRC regulatory requirements to protect public health and safety from radiological hazards. Under the NRC environmental protection regulations in 10 CFR Part 51, which implement the National Environmental Policy Act of 1969 (NEPA), preparation of an environmental impact statement (EIS) or supplement to an EIS is required for issuance of a license to possess and use source material for uranium milling [see 10 CFR 51.20(b)(8)].

In May 2009, NRC staff issued NUREG–1910, the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (hereafter referred to as the GEIS). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specified geographic regions of the western United States. The proposed Nichols Ranch ISR Project site is located lies within the Wyoming East Uranium Milling Region identified in the GEIS. The GEIS provides a starting point for the NRC NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to either amend or renew existing ISR licenses. This supplemental environmental impact statement (SEIS) incorporates by reference information from the GEIS and also uses information from the applicant's license application and other independent sources to fulfill the requirements set forth in 10 CFR 51.20(b)(8).

This SEIS includes the NRC staff analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures to either reduce or avoid adverse effects. It also includes the NRC staff's recommendation regarding the proposed action.

PURPOSE AND NEED OF THE PROPOSED ACTION

NRC regulates uranium milling, as defined in 10 CFR 40.4, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The applicant is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the Nichols Ranch and Hank Units at the proposed Nichols Ranch ISR Project. The purpose and need for the proposed Federal action is to either grant or deny the license application to use ISR technology to recover uranium and produce yellowcake at the Nichols Ranch ISR Project. Yellowcake is the uranium oxide product of the ISR milling process used to produce various products including fuel for commercially operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in either the AEA-required safety review or in the NEPA environmental analysis that would lead NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

THE PROJECT AREA

The proposed Nichols Ranch ISR Project is located in the Pumpkin Buttes Uranium Mining District of the Powder River Basin in Campbell and Johnson Counties, Wyoming. The proposed site is located approximately 74 km [46 mi] south-southwest of the City of Gillette and approximately 98 km [61 mi] north-northeast of the City of Casper. The total land area of the proposed Nichols Ranch ISR Project is approximately 1,365 ha [3,371 ac]. Sections within the proposed project area are split estate in which the surface and subsurface mineral rights are owned by two or more parties. The surface rights are both publicly and privately owned. Approximately 1,251 ha [3,091 ac] of land is privately owned primarily by the T-Chair Livestock Company, and the remaining 110 ha [280 ac] of surface rights are owned by the U.S. Government and administrated by the Bureau of Land Management (BLM). The subsurface mineral rights are owned by various private entities, including oil and gas and mineral extraction companies, and federally owned by the U.S. Government.

Of the total land surface project area, the applicant estimated that the area that would be affected by the proposed ISR operations would be approximately 120 ha [300 ac]. The proposed facilities (buildings and structures) to be constructed as part of the Nichols Ranch ISR Project include the buildings associated with a central processing plant and a satellite facility; storage and maintenance structures, wells, and their associated infrastructure (e.g., header houses and pipelines); and access roads. The proposed Nichols Ranch ISR Project would be divided into two noncontiguous units, the Nichols Ranch Unit and the Hank Unit, located west and southwest of the North Middle Butte. The proposed Nichols Ranch project area is located, in part, on federally owned subsurface minerals that are overlain by private lands and part on BLM administered lands.

IN-SITU RECOVERY PROCESS

During the ISR process, an oxidant-charged solution, called a lixiviant, is injected into the production zone aquifer (uranium ore body) through injection wells. Typically, a lixiviant uses native groundwater (from the production zone aquifer), carbon dioxide, and sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As the lixiviant circulates though the production zone, the lixiviant oxidizes and dissolves the mineralized uranium. The resulting uranium-rich solution is drawn to recovery wells by pumping and then transferred to a processing facility via a network of pipelines buried just below the ground surface. At the processing facility, the uranium is removed from the solution as the solution is passed through ion-exchange columns. The resulting barren solution is then recharged with the oxidant and reinjected to recover more uranium.

During production, the uranium recovery solution continually moves through the aquifer from injection wells to recovery wells. These wells can be arranged in a variety of geometric patterns depending on the location and orientation of the ore body, aquifer permeability, and operator preference. Wellfields are often designed in a five-spot or seven-spot pattern, with each recovery (i.e., production) well located inside a ring of injection wells. Monitoring wells then surround the wellfield pattern area, drilled to the same depth as the production zone aquifer to detect any horizontal migration of lixiviant away from the production zone. Monitor wells are

also installed in both the overlying and underlying aquifers and are screened (i.e., open to) in the appropriate stratigraphic horizon to detect the potential vertical migration of lixiviant out of the production zone. The uranium that is recovered from the solution is processed, dried into yellowcake, packaged into NRC- and U.S. Department of Transportation (DOT)-approved 205-L [55-gal] steel drums, and trucked offsite to a licensed uranium conversion facility. Once production is complete, the production zone groundwater is restored to NRC-approved groundwater protection standards which are protective of the surrounding groundwater. The site is decommissioned according to a NRC-approved decommissioning and in accordance with NRC-approved standards. Once decommissioning is approved, the site may be released for public use.

ALTERNATIVES

The NRC environmental review regulations that implement NEPA in 10 CFR Part 51 require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action. The NRC staff considered a range of alternatives that would fulfill the underlying purpose and need for the proposed action. From this analysis, a set of reasonable alternatives was developed, and the impacts of the proposed action were compared with the impacts that would result if a given alternative were implemented. This SEIS evaluates the potential environmental impacts of two alternatives to the proposed action, including the No-Action alternative, and also considers alternative wastewater disposal options to the proposed action. Under the No-Action alternative, the applicant would not construct and operate ISR facilities at the proposed sites. A third alternative considered constructing and operating facilities for ISR uranium recovery and processing at only the Nichols Ranch Unit, but not the Hank Unit. Other alternatives considered but eliminated from detailed analysis include conventional mining and milling at the proposed Nichols Ranch ISR Project site, conventional mining and heap leach processing at the proposed Nichols Ranch ISR Project site, constructing and operating facilities for ISR uranium recovery and processing at only the Hank Ranch Unit, and alternate lixiviants.

SUMMARY OF THE ENVIRONMENTAL IMPACTS

This SEIS includes the NRC staff analysis that considers and weighs the environmental impacts from the construction, operation, aquifer restoration, and decommissioning of ISR operations at the proposed Nichols Ranch ISR Project site and two alternatives. The SEIS also describes mitigation measures for the reduction or avoidance of potential adverse impacts that (i) the applicant has committed to in its NRC license application, (ii) would be required under other state or federal permits or processes, or (iii) are additional measures NRC staff identified as having the potential to reduce environmental impacts but that the applicant did not commit to in its application. The SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

As discussed in the GEIS and consistent with NUREG–1748, the significance of potential environmental impacts is categorized as follows:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Chapter 4 provides the NRC evaluation of the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project. The significance of impacts from the ISR facility lifecycle is listed next followed by a brief summary of impacts by environmental resource area by ISR phase for the proposed action.

Impacts by Resource Area and ISR Facility Phase

Land Use

Construction: Impacts would be SMALL. Approximately 120 ha [300 ac] of the 1,364 ha [3,371 ac] or approximately 9 percent of the proposed project area would be disturbed during the construction phase of the Nichols Ranch ISR Project. Land would be graded for construction of wellfields and access roads and to build the central processing plant and satellite facility. Approximately 24 to 32 ha [60 to 80 ac] would be fenced to grazing activities over the life of the project.

Operation: Impacts would be SMALL. Land use impacts during the operations phase would be similar to, or less than, those during the construction phase since no additional area would be disturbed. Operational areas would remain fenced to grazing. No new facilities would be constructed that would result in additional land disturbance during operations.

Aquifer Restoration: Impacts would be SMALL. Land use impacts during the aquifer restoration phase would be similar to, or less than, those during the operations phase. Wellfield access would be restricted from other uses as described for the operations phase. No additional land would be disturbed to construct facilities.

Decommissioning: Impacts would be SMALL. Land use impacts during the decommissioning phase would be similar to those during the construction phase. Decommissioning the buildings, wellfields, access roads, and removing potentially contaminated soil would result in a temporary, short-term increase in land-disturbing activities. Upon completion of the plugging and abandonment of wells in the wellfield areas, the soil would be reseeded and reclaimed in areas where it had been removed. At the end of decommissioning, because the reclaimed land would be released for other uses and no longer restricted, the land use impact in disturbed areas would be MODERATE until the reestablishment of vegetation. Once vegetation was reestablished in reclaimed areas, the land would be returned to a condition that could support a variety of land uses; therefore, the impact would be SMALL.

Transportation

Construction: Impacts would be SMALL. Vehicle traffic during the ISR construction phase would result in an approximate 2 to 3 percent increase in local traffic on State Route 50 and State Route 387. Localized fugitive dust emissions would be limited because of the State-required dust mitigation measures to treat the main plant access road and haul road between the Nichols Ranch and Hank Units with water or chemical dust suppressants.

Operation: Impacts would be SMALL. Transportation impacts would be similar to those during the construction phase. Additionally, the transport of yellowcake product, hazardous materials,

uranium-loaded resins from the Hank Unit to the Nichols Ranch Unit, and of wastes could result in spills or leakage if an accident were to occur; however, this risk was determined to be low and would be further limited by compliance with existing NRC and USDOT transportation regulations and the implementation of best management practices (BMPs) for containing leakage and spills. The applicant would carry out ranch road maintenance in conjunction with landowners.

Aquifer Restoration: Impacts would be SMALL. Transportation impacts would be less than that estimated for the construction and operation phases because the need to transport yellowcake product, hazardous materials, and uranium-loaded resins between units would decrease as aquifer restoration progressed. The decrease in the supply shipments, waste shipments, and employee commuting (because fewer workers would be involved) would reduce the potential for spills or leakage from accidents.

Decommissioning: Impacts would be SMALL. Transportation impacts would be less than that during the construction and operation phases because the transport of yellowcake product and processing chemicals would end during decommissioning. Access roads would either be reclaimed or left in place for future use. Waste shipments would increase temporarily, but would still represent a small contribution to daily traffic. Fewer workers would be employed, further reducing the potential transportation impact during this phase.

Geology and Soils

Construction: Impacts would be SMALL. Earthmoving activities associated with construction of surface facilities, access roads, wellfields, and pipelines would include topsoil clearing and land grading. Topsoils removed during these activities would be reclaimed for future use to restore disturbed areas. The limited areal extent of the construction area, the soil stockpiling procedures, the implementation of BMPs (berms, seeding method), the short duration of the construction phase, and mitigative measures such as the reestablishment of native vegetation would further minimize the potential impact on soils.

Operation: Impacts would be SMALL. The operation phase would not remove rock matrix or structure. Therefore, no significant matrix compression or ground subsidence would be expected. The occurrence of potential spills during transfer of uranium-bearing lixiviant to and from the central processing plant at the Nichols Ranch Unit would be mitigated by implementing onsite standard procedures and by complying with NRC and WDEQ requirements for spill response reporting of surface releases and cleanup of any contaminated soils.

Aquifer Restoration: Impacts would be SMALL. During aquifer restoration, groundwater consumptive use would occur; however, groundwater use does not remove rock matrix or structure. The formation groundwater pressure within the extraction zone would be decreased during restoration as groundwater is removed, to ensure that the direction of groundwater flow was into the wellfields to reduce the potential for lateral migration of constituents. However, the change in groundwater pressure would not result in collapse of overlying rock strata as it is supported by the rock matrix of the formation. The potential impact on soils from spills and leaks would be comparable to that described for in the operations phase. The NRC and WDEQ requirements for spill response and recovery and routine monitoring programs would also apply.

Decommissioning: Impacts would be SMALL. Disruption or displacement of soils would occur during dismantling of the facilities and reclamation of the land; however, the disturbed lands would be restored to their preextraction land use. Topsoil would be reclaimed and the surface regraded to the original topography.

Surface Waters and Wetlands

Construction: Impacts would be SMALL. The occurrence of surface water at the Nichols Ranch ISR Project is limited, and surface water flow in channels is intermittent. Although the proposed construction activities such as laying pipeline and drilling wells could generate surface water runoff, implementation of BMPs and mitigative measures such as grading and contouring, culvert installation, stone low-water crossings, water contour bars, and designated traffic routes would further minimize potential impacts. The applicant would avoid well construction in channels whenever possible but if wells were placed in a stream or within the 25-year floodplain appropriate measures would be taken to provide wellhead protection. Temporary disturbances to the soil from traffic during construction could result in surface water runoff and sediment transport during periods of surface flow. No wetlands are located in an area that would be affected by construction activities and wetland areas would be avoided.

Operation: Impacts would be SMALL. The central processing plant at the Nichols Ranch Unit and the Hank Unit satellite facility would be constructed on curbed concrete pads to contain potential spills. Routine well maintenance would require vehicular crossings of some ephemeral channels; however, the applicant would implement sedimentation and erosion control protection measures to further minimize surface water runoff from such temporary disturbances. No wastewater would be discharged to surface water via a WYPDES permit. Furthermore, the potential impact on surface water would be mitigated by the WDEQ-required storm water permit and stormwater management plan to meet WYPDES permit requirements, the implementation of a site-specific emergency response plan to address accidental spills, and the applicant's commitment to conduct operations in accordance with standard operating procedures for spill prevention control and cleanup.

Aquifer Restoration: Impacts would be SMALL. No wastewater would be discharged to surface water via a WYPDES permit, but be disposed of via deep well disposal. Automated sensors on the disposal wells would monitor the injection process to detect potential leaks or pipe/well ruptures. Potential impacts to surface water from surface water runoff would be managed as described for the operation phase.

Decommissioning: Impacts would be SMALL. Impacts would be similar to those during the construction phase. Well and pipeline removal in ephemeral channels could temporarily impact surface water (if present) in areas where pipeline crossed a channel. Land recontouring would be done to restore the land surface to its preconstruction contours to minimize potential long-term impacts to ephemeral stream crossings during well maintenance. Work would be performed during the dry season to minimize sedimentation in surface waters.

Groundwater

Construction: Impacts would be SMALL. The primary impact to groundwater during the construction phase of the proposed Nichols ranch ISR Project would be from the consumptive use of groundwater for dust control, drilling support, and cement mixing. During well installation, drilling fluids (mud) would have the potential to impact the surficial aquifer; however once the casing was set, the wellbore would be isolated from the surrounding environment. The use of BMPs during facility construction and wellfield installation, including the implementation of a spill prevention and cleanup program to prevent soil contamination with an immediate cleanup response requirement would limit soil contamination or infiltration to groundwater.

Operation: Impacts would be SMALL. The operations phase of the proposed Nichols Ranch ISR Project could impact shallow (near-surface) aquifers, the aquifer containing the ore body and surrounding aquifers, overlying and underlying aquifers to the ore zone and deep aquifers below the ore production zone used for the disposal of liquid effluent. Shallow aquifers underlying the Nichols Ranch ISR Project are not hydraulically connected with more significant local and regional water supply aquifers. One well near the Nichols Ranch Unit is completed (open) in the shallow aquifer and is used for stock watering. Other wells completed in the shallow aquifer are not used for domestic or livestock watering in the Nichols Ranch ISR Project area. A potential release at or near the ground surface would result in a SMALL impact on shallow (near-surface) groundwater if mitigation measures such as a leak detection program, a spill cleanup program, and well mechanical integrity testing were implemented.

Groundwater modeling of the ore production zone predicted that the potential drawdown at the Nichols Ranch Unit during operations could affect the well yield of private wells located 6.4 km [4 mi] beyond the unit boundary and cause a well to stop flowing. The applicant has agreements in place with the potentially affected landowners to recover water by installing a pump, for example. Groundwater modeling at the Hank Unit predicted the potential drawdown would not extend beyond the unit boundary. Because of NRC license conditions that would be imposed, the applicant's negotiated agreements with private well owners, and no indication of leakage from overlying and underlying aquifers, the potential impact from groundwater consumptive use would be SMALL. ISR operations would degrade groundwater quality in the ore production zone. However, the establishment of an inward hydraulic gradient, as well as the applicant-installed groundwater monitoring network to detect potential vertical and horizontal excursions, would limit the potential for undetected groundwater excursions that could degrade groundwater quality. Because the ore production zones at both the Nichols Ranch and Hank Units are overlain and underlain by thick, areally extensive aquitards which further ensures hydraulic isolation, the potential for groundwater contamination of aquifers located stratigraphically above and below these production zones would be minimized. By license condition, NRC will require the applicant to provide detailed hydrologic test data packages for both the Nichols Ranch Unit and Hank Unit prior to operations. Given the applicant's aquifer characterization, testing, monitoring and NRC license conditions, the estimated impact to water quality as a result of ISR operations would be SMALL.

Liquid effluent generated from operation of the proposed Nichols Ranch ISR Project would be disposed of via deep well disposal into WDEQ-permitted Class I disposal wells. The groundwater in the formations being considered for deep well disposal must not be a potential underground source of drinking water and must comply with the WDEQ Water Quality and Regulations for Underground Management of Hazardous or Toxic Waste (Chapter 8, Section 6). If the WDEQ were to issue a permit for deep well disposal, the potential impact on deep aquifers located stratigraphically below the ore production zone aquifer from the injection of liquid effluent would be SMALL.

Aquifer Restoration: Impacts would be SMALL. Groundwater modeling estimated drawdown in the ore production zone at the Nichols Ranch Unit predicted the potential drawdown at the Nichols Ranch Unit would affect an area within an 8 km [5 mi] radius which could affect the well yield of wells located in this radius. The applicant formed agreements with the potentially affected landowners to supplement existing wells (e.g., intall a pump) so the wells could continue to be used. Modeling at the Hank Unit predicted limited and localized drawdown. Because groundwater levels would recover with time after production and restoration were complete and the applicant identified measures to mitigate potential impacts to the water yield in

private wells, the potential long-term environmental impact from groundwater consumptive use would be SMALL.

The potential impact on groundwater quality would be SMALL. The groundwater quality of near-surface aquifers would be protected by BMPs, such as the implementation of a leak detection program, spill cleanup program, and well mechanical integrity testing. The goal of aquifer restoration would be to restore groundwater quality in the ore production zone to preextraction baseline conditions. If the aquifer could not be restored to baseline conditions, then the NRC would require that either the production zone be returned to maximum contaminant levels in Table 5C of 10 CFR Part 40 Appendix A, or to NRC-approved alternate concentration limits. Postrestoration groundwater quality would be protective of public health and the environment.

Liquid effluent generated from aquifer restoration of the proposed Nichols Ranch ISR Project would be disposed of via deep well injection into WDEQ-permitted Class I disposal wells. If WDEQ were to issue an underground injection control (UIC) permit, the potential impact to deep aquifers below the ore production zone from deep well injection of byproduct material would be SMALL.

Decommissioning: Impacts would be SMALL. The potential impact to groundwater quality during decommissioning and reclamation would be comparable to that for the construction phase of the proposed Nichols Ranch ISR Project. Monitoring, injection, and production wells would be plugged and abandoned in accordance with Wyoming program requirements to properly isolate the wellbores from the flow domain; therefore, the potential impact would be SMALL. Before NRC terminates an ISR source material license, the licensee must demonstrate that there would be no long-term impacts to underground sources of drinking water (USDWs). NRC review and approval of the wellfield restoration would ensure that the restoration standards were met and were protective of public health and safety.

Ecological Resources

Construction: Impacts would be SMALL. Approximately 120 ha [300 ac] of land would be disturbed during construction, which would result in some habitat loss or alteration, displacement of wildlife, and injury or mortality from encounters with vehicles or heavy equipment, although wildlife species would likely disperse from the area when construction commenced. The applicant could mitigate these impacts by observing Wyoming Game and Fish Department (WGFD) guidelines regarding noise, vehicular traffic, and human proximity during the construction phase. No federally threatened or endangered species are known to occur on the proposed Nichol Ranch ISR Project. However, the Greater safe-grouse, a candidate species for federal listing is known to occur in the vicinity of the proposed project area. The applicant has committed to implement mitigative measures consistent with WGFD and BLM guidelines during construction to minimize potential impacts to the Greater sage-grouse.

Operation: Impacts would be SMALL. Impacts would be similar to, but less than, those experienced during the construction phase because fewer earthmoving activities would occur. The applicant would reseed disturbed areas with WDEQ- or BLM-approved seed mixtures to restore habitat. Access to crucial wintering habitat and water could be limited by fencing; however, the applicant has committed to using fencing techniques that would minimize impediments to game movement. The impacts could be further reduced by implementing the mitigative measures discussed in Section 4.6 of the SEIS.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to those experienced during the operation phase. The existing infrastructure would be used during this phase, and mitigation measures in force during the construction and operation phases would continue into aquifer restoration.

Decommissioning: Impacts would be SMALL. Temporary disturbances to land and soils during decommissioning could displace vegetation and wildlife species that had recolonized the proposed project area since initiation of ISR activities. Revegetation and recontouring would restore habitat previously altered during construction and operations.

Air Quality

Construction: Impacts would be SMALL. Combustion engine exhausts from nonroad mobile diesel equipment used during construction would generate air emissions. The magnitude of these emissions would be well below Clean Air Act (CAA) thresholds for major stationary sources of air pollution. This conclusion is based on a requirement in a WDEQ-issued construction air permit that requires the applicant to obtain a minor source operating permit. Considered along with meteorological conditions that are generally favorable for dispersion, the emissions would be unlikely to change the present attainment status with National Ambient Air Quality Standards (NAAQS) or impact the air quality of the nearest Class I Prevention of Significant Deterioration (PSD) area. Fugitive dust emissions would be mitigated by a permit condition in the WDEQ-approved construction air permit condition which requires the implementation of road dust control measures. The applicant plans to reclaim disturbed soil using vegetative covers on soil piles and to use stationary equipment to reduce the traffic volume on the roads.

Operation: Impacts would be SMALL. Impacts would be similar to, but less than, those experienced during construction. ISR facilities are not major point source emitters of regulated nonradiological pollutants, and emissions would be well below CAA thresholds for major sources of air pollution and therefore would be unlikely to change the present status of attainment with the NAAQS. The state construction permit has not classified the proposed facility as a major source that would require permitting under the CAA Title V permitting program.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar in type and degree to those experienced during the operational phase. Less vehicular traffic would be required during the aquifer restoration phase than during operations because there would be fewer yellowcake shipments than during operations. The use of existing infrastructure and the reduced traffic volume would reduce fugitive dust and road vehicle exhaust emissions. Fugitive dust emissions from road travel would be further mitigated by the applicant's plan to implement road dust control measures.

Decommissioning: Impacts would be SMALL. Impacts to air quality would be similar to those experienced during construction since the same types of activities would occur (e.g., earthmoving activities that generate fugitive dust and combustion engine emissions). The emissions would decrease as decommissioning progressed.

Noise

Construction: Impacts would be SMALL. Increased traffic and the use of drill rigs, heavy trucks, bulldozers, and other equipment to construct and operate the wellfields, drill wells, construct

access roads, and build the central processing plant and satellite facility would generate noise audible above the undisturbed background levels. The sound from construction activities would return to preexisting conditions at a distance of approximately 300 m [1,000 ft]. Therefore, there would be no audible noise at the location of the nearest resident located approximately 960 m [0.6 mi] north of the Nichols Ranch Unit. Noise impacts from traffic would be transient and SMALL because of the limited traffic volume associated with the proposed project. Greater sage-grouse leks occur within the vicinity of the proposed project. The applicant has committed to implement mitigation measures following WGFD guidelines to reduce noise impacts to the Greater sage-grouse.

Operation: Impacts would be SMALL. Traffic noise would be the primary noise-generating activity that could be heard offsite. The nearest resident, located approximately 960 m [0.6 mi] north of the Nichols Ranch Unit, would not notice a change in noise. Impacts from traffic-related noise would be similar to that during construction and would be SMALL. Mitigation measures to reduce the potential noise impact on the Greater sage-grouse as discussed in Section 4.8.1.1 would result in a SMALL impact.

Aquifer Restoration: Impacts would be SMALL. Noise impacts would be similar to, or less than, those experienced during the operation phase. Pumps and other wellfield equipment contained in buildings would reduce the potential sound impact to an offsite individual. Because the location of the nearest resident is located approximately 960 m [0.6 mi] north of the Nichols Ranch Unit, there would be no change in background noise. Noise impacts from traffic would be SMALL as there would be fewer vehicular trips than during the operations phase. Mitigation measures to reduce the potential noise impact on the Greater sage-grouse as discussed in Section 4.6.1.1.3 would result in a SMALL impact.

Decommissioning: Impacts would be SMALL. Noise impacts would be similar to, or less than, those experienced during the construction phase. Noise during this phase would be temporary, and when decommissioning and reclamation activities were complete, the noise level would return to baseline. At the nearest resident location is approximately 960 m [0.6 mi] north of the Nichols Ranch Unit, there would be no change in background noise. Noise impacts from traffic would be SMALL since there would be fewer shipments to and from the proposed site as decommissioning progressed. Mitigation measures to reduce the potential noise impact on the Greater sage-grouse as discussed in Section 4.6.1.1.3 would result in a SMALL impact.

Historical, Cultural, and Paleontological Resources

Construction: Impacts would be MODERATE. One archaeological site at the Nichols Ranch Unit is eligible for listing on the National Register for Historic Places (NRHP). This site is located near a proposed wellfield; however, the applicant has committed to avoiding this site through the use of protective fencing. At the Hank Unit, seven archaeological sites are eligible for listing on the NRHP; two archaeological sites remain unevaluated for NRHP eligibility. Of the seven NRHP-eligible sites at the Hank Unit, there would be an adverse effect to the visual setting of five traditional cultural properties (TCPs), which include the Pumpkin Buttes TCP. These sites would be marked, fenced, and avoided. Mitigation for the Pumpkin Buttes TCP would be conducted in accordance with a Programmatic Agreement (PA) between BLM and the Wyoming State Historic Preservation Office (WY SHPO) which applies to BLM-administered lands and federal uranium leaseholders extracting uranium from federally owned subsurface minerals (overlain by private surface lands) within 3.2-km [2-mi] of the Pumpkin Buttes TCP. Should historical or cultural resources be encountered during construction, the applicant would stop work and contact the appropriate State and Federal agencies. The execution of

Memorandum of Agreement (MOA) among NRC, the WY SHPO, BLM, interested Native American tribes, and the applicant could further reduce impacts to the five TCPs, including the Pumpkin Buttes TCP.

Construction would impact surficial Quaternary deposits and near-surface deposits. Although paleontological specimens may be present at both the Nichols and Hank Units, based on the geology of the site and poor exposure of fossil-bearing deposits, the proposed Nichols Ranch ISR Project would not significantly impact fossil remains.

Operation: Impacts would be SMALL. No sites would be directly affected by facility operations or maintenance activities since the sites would be marked, fenced, and avoided. However, there would be an adverse effect to the visual setting of five TCPs at the Hank Unit. However, the applicant committed to mitigation measures during the ISR operation to mitigate the impact. Should historical or cultural resources be encountered during routine maintenance activities, the applicant would stop work and contact the appropriate Federal and State officials.

Operations would not involve ground-disturbing activities that could potentially affect fossil-bearing deposits. Ground-disturbance during the operation phase would be limited to pre-disturbed areas.

Aquifer Restoration: Impacts would be SMALL. No sites would be directly affected by restoration activities, since sites would be marked, fenced, and avoided. However, there would be an adverse effect to the visual setting of five TCPs, The applicant committed to a number of mitigation measures to reduce the impact. Should historic or cultural resources be encountered during aquifer restoration, the applicant would stop work and notify the appropriate State and Federal agencies.

Aquifer restoration would not involve ground-disturbing activities that could potentially affect fossil-bearing deposits. Ground-disturbance during the aquifer restoration phase would be limited to pre-disturbed areas.

Decommissioning: Impacts would be SMALL. No sites would be directly affected by decommissioning activities, since sites would be marked, fenced, and avoided. However, there would be an adverse effect to the visual setting of five TCPs. The applicant has committed to mitigation measures to reduce the impact. As decommissioning progressed, buildings would be dismantled and lands would be reclaimed and returned to pre-extraction use. Over time the visual impact to the TCPs would be reduced. Should historical or cultural resources be encountered during decommissioning, work would stop and the appropriate State and Federal agencies would be notified.

Should decommissioning activities involve ground disturbance in excess of a few feet, the applicant would have a monitor in place and its procedures would cover any inadvertent discoveries. Ground-disturbance during the decommissioning would be limited to pre-disturbed areas.

Visual/Scenic Resources

Construction: Overall impacts would be MODERATE. Visual impacts would result from construction equipment, dust and diesel emission, and project facilities. Moderate visual impacts to five identified TCPs would occur based on the proximity of the Hank Unit to the Pumpkin Buttes. The applicant has committed to follow the mitigation measures outlined in the

PA for the Pumpkin Buttes TCP for construction activities occurring within a 3.2 km [2 mi] radius of the TCP. These measures would include avoiding dense vegetation stands and painting buildings and structures to blend into the landscape. The Nichols Ranch Unit is located about 9.6 km [6 mi] west of the Pumpkin Buttes, beyond the 3.2 km [2 mi] radius stipulated in the PA between BLM and the WY SHPO; therefore, the mitigative stipulations in the PA would not apply to the Nichols Ranch Unit.

Operation: Impacts would be SMALL. Visual impacts would be similar to, but less than, those experienced during construction. The Nichols Ranch ISR Project operations would occur in an area where extensive CBM development has occurred and where additional CBM development is planned. CBM installations include networks of wells, underground piping, pump structures, and overhead power lines which are much larger and more extensive than ISR facilities. Buildings and other structures would be painted to blend in to the natural landscape and power lines and pipelines would be buried where appropriate.

Aquifer Restoration: Impacts would be SMALL. Visual impacts would be similar to, but less than, those experienced during the operation phase. Aquifer restoration activities would use in-place infrastructure. Mitigation measures such as dust suppression could be used to further reduce visual impacts. In addition, implementing the applicant-identified mitigation measures would further reduce the visual impact on the Pumpkin Buttes TCP.

Decommissioning: Impacts would be SMALL. Visual impacts would be similar to, but less than, those experienced during construction. By the end of the decommissioning phase, land would be returned to its pre-extraction use, removing most visual impacts resulting from the proposed Nichols Ranch ISR Project. Buildings and equipment would be removed from the site. However, the reestablishment of vegetation would require time resulting in a short-term visual impact during the decommissioning phase.

Socioeconomics

Construction: Impacts would be SMALL. Because a small number of workers would be required to construct the proposed Nichols Ranch ISR Project and because the short duration of the ISR construction phase, the overall potential socioeconomic impact including the effects of ISR facility construction on demographic conditions, income, housing, employment rate, local finance, education, and health and social services would be SMALL.

Operation: Impacts could range from SMALL to MODERATE. The in-migration of workers and their families to nearby towns, the payment of wages comparable to the average income in Wyoming, the potential creation of new jobs in the small workforce and in migration of certain skilled positions, would have a SMALL impact. The local economy would experience a SMALL beneficial impact from the purchase of local goods and services and an increase in sales and income tax revenues. An increased demand for schools would have a SMALL impact on education because the current school systems are not at full capacity and could accommodate a small increase in the number of students. Increased demand for health and social services would have a SMALL impact. Housing demand would increase in local areas with low vacancy rates. However, the impact on housing could range from SMALL to MODERATE because of the limited availability of housing in the immediate area surrounding the proposed ISR facility

Aquifer Restoration: Impacts would be SMALL. Impacts would be less than those experienced during ISR facility operations due to the smaller number of workers required during this phase. Most workers would have already relocated their families to the area.

Decommissioning: Impacts would be SMALL. Impacts would be less than those during the construction and operations phase because fewer workers would be required. Demand for services would also be reduced.

Environmental Justice

All Phases: The percentage of people living below the poverty level within the Census Block Groups containing the proposed Nichols Ranch ISR Project ranged from 7.6 to 12.5 percent, which is less than the 13 percent of the population living below poverty level in the U.S. according to the 2000 Census. The minority populations in the Census block groups containing the proposed Nichols Ranch ISR Project ranged from 3.3 to 4.0 percent which are both below the state average of 11 percent. No minority populations were identified as residing near the proposed Nichols Ranch ISR Project site. Therefore, there would be no disproportionately high and adverse impacts to minority and low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project.

Public and Occupational Health and Safety

Construction: Impacts would be SMALL. Construction activities, including the use of construction equipment and vehicles, could disturb the topsoil and create fugitive dust emissions. Radiological environmental monitoring data indicate that radioactivity levels in the soils at the proposed Nichols Ranch ISR Project site are within the range of typical background exposure rates in the Western United States. Therefore, the dose from inhalation of these concentrations of residual radioactivity would be comparable to that from natural background exposure. Construction equipment would likely be diesel powered and would exhaust particulate diesel emissions. The potential impacts and potential human exposures from these emissions would be SMALL because of the short duration of the release and because the emissions would be readily dispersed into the atmosphere.

Operation: The radiological impacts from normal operations would be SMALL. Public and occupational exposure rates at ISR facilities during normal operations have historically been well below regulatory limits. The remote location of the proposed Nichols Ranch ISR Project site and the use of the proposed ISR technology coupled with the applicant procedures to minimize exposure, demonstrate that the potential impact on public and occupational health and safety from facility operation would be consistent with historical observations. The radiological impacts from accidents would be SMALL for workers (if the applicant's radiation safety and incident response procedures in an NRC-approved radiation protection plan were followed) and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health and safety impacts from normal operations and accidents, due primarily to risk of chemical exposure, would be SMALL if handling and storage procedures were followed.

Aquifer Restoration: Impacts would be SMALL. The impact would be similar to, but less than that during the operation phase. The reduction or elimination of some operational activities would further reduce the magnitude of potential worker and public health impacts and safety hazards.

Decommissioning: Impacts would be SMALL. The impacts would be similar to those during construction. Soil and facility structures would be decontaminated, and lands would be restored to preoperational conditions.

Waste Management

Construction: Impacts would be SMALL. Small-scale and incremental wellfield development would generate small volumes of construction waste consisting primarily of building materials, piping, and other solid wastes. No byproduct material would be generated during construction. Nonhazardous solid waste would be disposed of at a nearby municipal solid waste landfill. Operation of the facility could generate small volumes of hazardous waste such as used batteries. The facility could be considered a Conditionally Exempt Small Quantity Generator under the Resource Conservation and Recovery Act.

Operation: Impacts would be SMALL. Liquid waste, including process bleed, restoration water, resin transfer wash, filter washing, brine, and plant washdown, would be disposed of according to applicable NRC, Federal, and State permits. Applicable permit requirements would mitigate potential adverse impacts from liquid waste management. The applicant will obtain WDEQ permits for eight Class I deep disposal wells (4 each at the Nichols Ranch and Hank Units). However, at the beginning of operations, NRC will only require two disposal wells be installed at the Nichols Ranch and two disposal wells be installed at the Hank Unit for disposal of liquid effluent. Solids classified as Atomic Energy Act Section 11e.(2) byproduct material (herein called “byproduct material”) would be disposed of at a licensed facility. Contaminated materials would be decontaminated and disposed of in accordance with applicable NRC regulations.

Aquifer Restoration: Impacts would be SMALL. The same waste decontamination and disposal procedures during the operation phase would occur; therefore, resulting in similar impacts. Although the wastewater volume could increase, this would be offset by the reduction in production capacity from completion of wellfield production and removal from service.

Decommissioning: Impacts would be SMALL. All process or potentially contaminated equipment and materials would be removed to a new location for future use, removed to another licensed facility, disposed of as byproduct material at a licensed facility, or decontaminated to meet unrestricted release criteria. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a decommissioning plan, which would be approved by the NRC before decommissioning commenced. A preoperational agreement with a licensed disposal facility to accept byproduct material would ensure the availability of sufficient disposal capacity for decommissioning activities. Nonhazardous solid waste would be disposed of at a nearby municipal solid waste landfill and associated construction and demolition pit. If hazardous waste were generated by decommissioning activities, it would be handled in accordance with applicable standards.

CUMULATIVE IMPACTS

Cumulative impacts from past, present, and reasonably foreseeable future actions were also considered, regardless of what agency (Federal or non-Federal) or person undertook the action, as part of this SEIS. The NRC staff determined that the SMALL to MODERATE impacts from the proposed Nichols Ranch ISR Project are not expected to contribute perceptible increases to the SMALL to MODERATE cumulative impacts, due primarily to the CBM activities concurrently going on in the area, oil and gas exploration and production, and the ongoing mining activities throughout the Powder River Basin.

SUMMARY OF THE COSTS AND BENEFITS OF THE PROPOSED ACTION

The implementation of the proposed action would generate primarily regional and local costs and benefits. The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Costs associated with the proposed Nichols Ranch ISR Project are, for the most part, limited to the immediate area surrounding the site. The NRC staff determined the benefit from constructing and operating the facility would outweigh the economic, environmental, and social costs.

COMPARISON OF ALTERNATIVES

The NRC analysis indicates the impacts from implementing the reasonable alternatives would differ from those evaluated for the proposed action.

For the No-Action alternative, the applicant would not construct and operate ISR facilities at the proposed site. As a result, no uranium ore would be recovered from this proposed site. This alternative would result in neither positive nor negative impacts to any resource area.

Another alternative NRC considered was to construct and operate an ISR uranium milling processing facility only at the Nichols Ranch Unit. The potential environmental impacts from implementing this alternative on each of the resource areas would either be similar to, or smaller than, the impacts from the proposed action. Since a smaller land area would be disturbed, there would be no impact on geology and soils or ecological resources at the Hank Unit. Generally, less equipment and workers would be needed, which would reduce the impact on transportation, air quality, noise, visual and scenic resources, and socioeconomics. Because the Hank Unit would not be developed, there would be no impact on the five TCPs including the Pumpkin Butte TCP.

FINAL RECOMMENDATION

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action. Unless safety issues mandate otherwise, the NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that the source material license be issued as requested. This recommendation is based upon (i) the license application, including the environmental report the applicant submitted, and the applicant's supplemental letters and responses to the NRC staff requests for additional information; (ii) consultation with Federal, State, Tribal, and local agencies; (iii) the NRC staff independent review; (iv) the NRC staff consideration of comments received on the draft SEIS; and (v) the assessments discussed in this SEIS.

ABBREVIATIONS/ACRONYMS

Ac	acre
AADT	annual average daily traffic count
ADAMS	Agency Wide Documents Access and Management System
ACL	alternate concentration limit
AEA	Atomic Energy Act
AMSL	above mean sea level
APLIC	Avian Power Line Interaction Committee
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	best management practice
B.P.	before present
CAA	Clean Air Act
CBM	coal bed methane
CBNG	coal bed natural gas
CCESC	Campbell County Educational Services Center
CCS	Center for Climate Strategies
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CO	carbon monoxide
CWA	Clean Water Act
dBA	decibels
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERP	emergency response plan
ESA	Endangered Species Act of 1973
FCR	fire-cracked rock
FHWA	Federal Highway Administration
FR	Federal Register
FSME	Office of Federal and State Materials and Environmental Management Programs
ft	feet
FWS	U.S. Fish and Wildlife Service

ABBREVIATIONS/ACRONYMS (CONTINUED)

GCRP	U.S. Global Change Research Program
GEIS	Generic Environmental Impact Statement
GHG	greenhouse gas
gpm	gallons per minute
ha	hectare
HDPE	high-density polyethylene
HKM	HKM Engineering, Inc.
I	Interstate
ISL	*in-situ* leach
ISR	*in-situ* recovery
JCSD	Johnson County School District
km	kilometer
kph	kilometers per hour
lb	pound
LQD	Land Quality Division
Lpm	liters per minute
MCL	Maximum Contaminant Level
MIT	mechanical integrity test
MOA	Memorandum of Agreement
mph	miles per hour
MSDS	material safety data sheets
MRPL	Most Restrictive Proposed Limit
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NCRP	National Council for Radiation Protection
NCTHPO	Northern Cheyenne Tribal Historic Preservation Office
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966, as amended
NMSS	Nuclear Materials Safety and Safeguards
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWS	National Weather Service

ABBREVIATIONS/ACRONYMS (CONTINUED)

OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PM	particulate matter
ppm	parts per million
PRI	Power Resources, Inc.
PRRCT	Powder River Regional Coal Team
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PVC	plastic polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RFFA	reasonably foreseeable future action
ROI	region of influence
RQ	Reportable Quantity
RTV	Restoration Target Value
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SGIT	Sage-Grouse Implementation Team
SMZ	sage-grouse management zone
SR	State Route
T&E	threatened and endangered
TCP	traditional cultural property
TEDE	total effective dose equivalent
TDS	total dissolved solids
THPO	Tribal Historic Preservation Office
TPQ	threshold planning quantity
TQ	threshold quantity
TR	Technical Report
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage, or Disposal
UCL	upper control limit
UIC	underground injection control
UMTRCA	Uranium Mill Tailings Radiation Control Act
U.S.	United States (or) United States Highway
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USCB	U.S. Census Bureau
USDOT	U.S. Department of Transportation
USDW	underground sources of drinking water
USGS	U.S. Geological Survey

ABBREVIATIONS/ACRONYMS (CONTINUED)

VOC	volatile organic compound
VRM	Visual Resource Management
WBC	Wyoming Business Council
WDE	Wyoming Department of Education
WDEQ	Wyoming Department of Environmental Quality
WDOR	Wyoming Department of Revenue
WGFD	Wyoming Game and Fish Department
WLS	Western Land Services
WQD	Water Quality Division
W.S.	Wyoming Statute
WSEO	Wyoming State Engineer's Office
WUS	Waters of the United States
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System
WY SHPO	Wyoming State Historic Preservation Office

SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
Cm	centimeters	0.39	inches	In
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
m^3	cubic meters	0.0008107	acre-feet	acre-feet
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or t)	megagrams (or metric ton)	1.103	short tons (2000 lbs)	T
Temperature (Exact Degrees)				
°C	Celsius	1.8C + 32	Fahrenheit	°F

*SI is the symbol for the International System of Units. Appropriate rounding should be performed to comply with Section 4 of ASTM E380 (Reference: ASTM International. "Standard for Metric Practice Guide." West Conshohocken, Pennsylvania: ASTM International. Revised 2003.).

1 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC) prepared this supplemental environmental impact statement (SEIS) in response to an application Uranerz Energy Corporation (Uranerz or the applicant) submitted on November 30, 2007, to develop and operate the Nichols Ranch *In-Situ* Uranium Recovery (ISR) Project (herein referred to as Nichols Ranch ISR Project), located in Campbell and Johnson Counties, Wyoming (Uranerz, 2007a). Figure 1-1 shows the geographic location of the proposed project. This site-specific SEIS supplements the Generic Environmental Impact Statement for *In-Situ* Leach (ISL) Uranium Milling Facilities (herein referred to as GEIS) in accordance with the process described in GEIS Section 1.8 (NRC, 2009a) and as detailed in Section 1.4.1 of this chapter. The NRC Office of Federal and State Materials and Environmental Management (FSME) Programs prepared this SEIS as required by Title 10, Energy, of the U.S. Code of Federal Regulations (10 CFR), Part 51. These regulations implement the requirements of the National Environmental Policy Act of 1969 (NEPA), as amended (Public Law 91-190), which requires the Federal Government to assess the potential environmental impacts of major federal actions that may significantly affect the human environment.

The GEIS used the terms "*in-situ* leach (ISL) process" and "11e.(2) byproduct material" to describe this uranium milling technology and the waste stream generated by this process. For the purposes of this SEIS, "*in-situ* recovery" or ISR is synonymous with "*in-situ* leach" or ISL. The SEIS also uses the term "byproduct material" instead of "11e.(2) byproduct material" to describe the waste stream generated by this milling process to be consistent with the definition in 10 CFR 40.4.

1.2 Proposed Action

On November 30, 2007, Uranerz initiated the proposed federal action by submitting an application for an NRC source material license to construct and operate an ISR facility at the Nichols Ranch ISR Project site and to conduct subsequent aquifer restoration and site decommissioning and reclamation activities. Based on the application, the NRC's federal action is the decision is to either grant or deny the license. The applicant's proposal is detailed in SEIS Section 2.2.

1.3 Purpose and Need for the Proposed Action

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The applicant is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the Nichols Ranch ISR Project site. The purpose and need for the proposed federal action is to either grant or deny the applicant's license application to use ISR technology to recover uranium and produce yellowcake at the Nichols Ranch ISR Project site. Yellowcake is the uranium oxide product of the ISR milling process used to produce various products including fuel for commercially operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act (AEA) or findings in the NEPA environmental analysis that would lead NRC to reject a license application, NRC has no role in

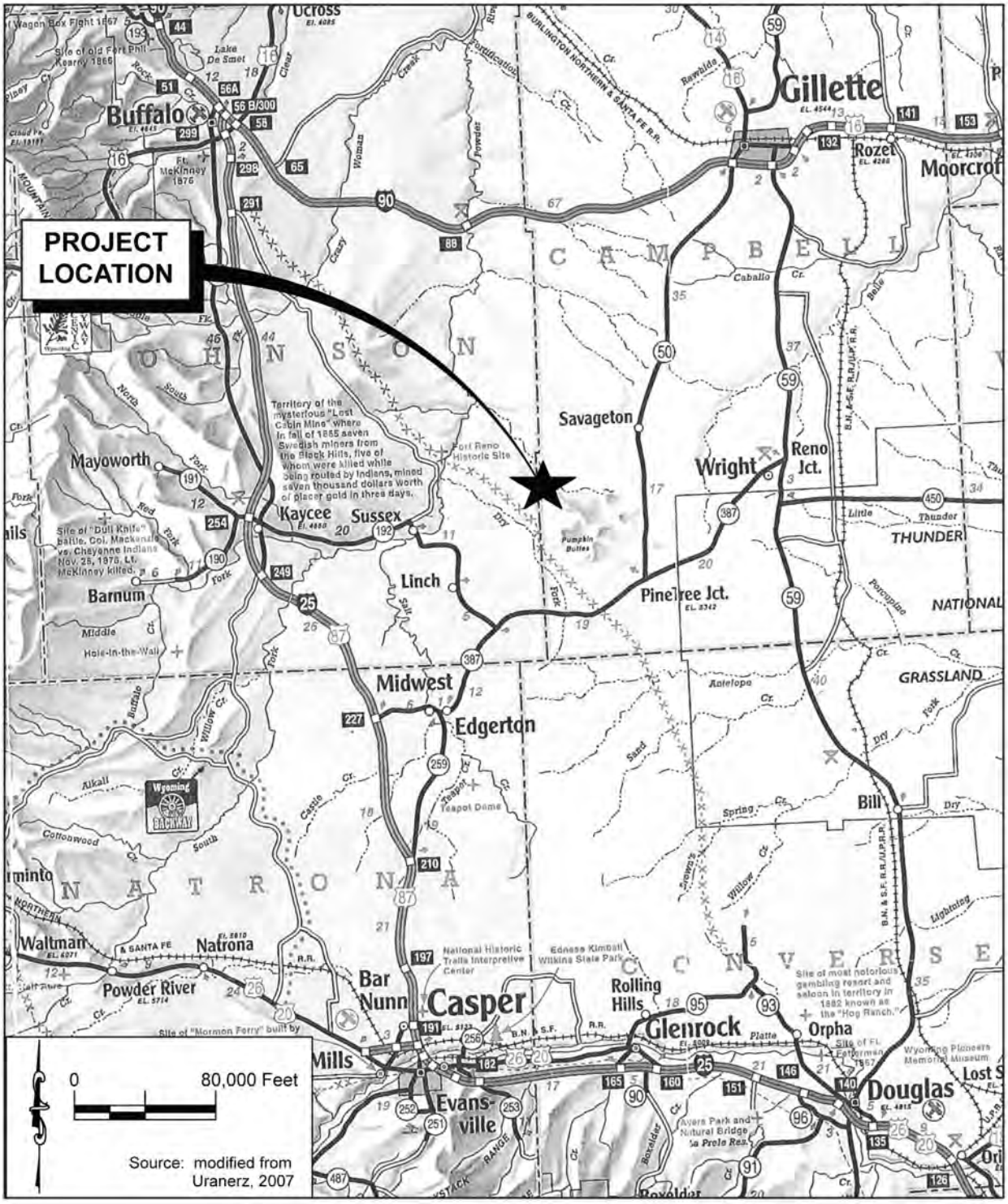

Figure 1-1. Geographic Location of the Nichols Ranch ISR Project
Source: Modified from Uranerz (2007b)

a company's business decision to submit a license application to operate an ISR facility at a particular location.

1.4 Scope of the Supplemental Environmental Analysis

NRC prepared this SEIS to analyze the potential environmental impacts (i.e., direct, indirect, and cumulative) of the proposed action and of reasonable alternatives to the proposed action. The scope of this SEIS considers both radiological and nonradiological (including chemical) impacts associated with the proposed action and its alternatives. This SEIS also considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and the irreversible and irretrievable commitments of resources.

1.4.1 Relationship to the GEIS

As discussed previously, this SEIS supplements the GEIS, which was published as a final report in May 2009 (NRC, 2009a). The final GEIS assessed the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specific geographic regions of the western United States. The proposed Nichols Ranch ISR Project is located in the Wyoming East Uranium Milling Region considered in the GEIS. Table 1-1 summarizes the potential environmental impacts by resource area in the Wyoming East Uranium Milling Region based on the GEIS analyses.

The NRC staff considers the scope of the GEIS to be sufficient for the purposes of defining the scope of this SEIS. NRC accepted public comments on the scope of the GEIS from July 24 to November 30, 2007, and held three public scoping meetings, one of which was in the State of Wyoming, to aid in this effort. Additionally, NRC held eight public meetings to receive comments on the draft GEIS, published in July 2008. Three of these public meetings were held in the State of Wyoming. Comments on the draft GEIS were accepted between July 28 and November 8, 2008. Comments received both during scoping and on the draft GEIS are available through the NRC Agencywide Documents Access and Management System database on the NRC website (http://www.nrc.gov/reading-rm/adams.html). Transcripts of both the scoping meeting and draft GEIS comment meetings that occurred in Wyoming are available at http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html. A scoping summary report is provided as GEIS Appendix A (NRC, 2009a). Responses to comments on the GEIS that were submitted during the GEIS public comment period are provided as GEIS Appendix G (NRC, 2009a).

This SEIS was prepared to fulfill the requirement in 10 CFR 51.20(b)(8) to prepare either an Environmental Impact Statement (EIS) or supplement to an EIS for the issuance of a source material license for an ISR uranium recovery facility (NRC, 2009a). The GEIS provides a starting point for the NRC NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. As discussed in the GEIS, the GEIS provides criteria by each environmental resource area to assess the significance level of potential impacts (i.e., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to the site-specific conditions at the proposed Nichols Ranch ISR Project.

This SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions concerning potential environmental impacts. The extent to which NRC incorporates GEIS impact conclusions depends on the consistency between (i) the applicant’s proposed facilities, activities, and conditions at the proposed Nichols Ranch ISR Project and (ii) the

Table 1-1. ISL GEIS Range of Expected Impacts in the Wyoming East Uranium Milling Region

Resource Area	Construction	Operation	Aquifer Restoration	Decommissioning
Land Use	S to L	S	S	S to M
Transportation	S to M	S to M	S to M	S
Geology and Soils	S	S	S	S
Surface Water	S	S to M	S to M	S to M
Groundwater	S	S to L	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S	S	S
Air Quality	S	S	S	S
Noise	S to M	S to M	S to M	S to M
Historical and Cultural Resources	S to L	S	S	S
Visual and Scenic Resources	S	S	S	S
Socioeconomics	S to M	S to M	S	S to M
Public and Occupational Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S

S: SMALL impact
M: MODERATE impact
L: LARGE impact
Source: NRC (2009a)

reference facility description, activities, information, and conclusions in the GEIS. NRC's determinations regarding potential environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are discussed in Chapter 4 of this SEIS. GEIS Section 1.8.3 details the relationship between the GEIS and the conduct of site-specific reviews as documented in this SEIS (NRC, 2009a).

1.4.2 Public Participation Activities

As part of the preparation of this SEIS, NRC staff met with Federal, State, and local agencies and authorities over the course of an expanded visit to the proposed Nichols Ranch ISR Project site and vicinity in January 2009 (NRC, 2009b). The purpose of these meetings was to gather additional site-specific information to support the NRC staff's environmental review and to aid the staff in making its consistency determination between site-specific and local information and that which was used to inform the GEIS analysis. As part of information gathering, the NRC

staff also contacted potentially interested Native American tribes and local authorities, entities, and public interest groups in person and via email and telephone.

NRC published a Notice of Opportunity for Hearing on the Nichols Ranch ISR Project license application in the Federal Register (FR) on June 16, 2008 (73 FR 34052). No hearing requests were received. NRC also published a Notice of Intent to prepare this SEIS on August 5, 2009 (74 FR 39116).

On December 11, 2009, the NRC staff published an FR notice requesting public review and comment on the draft SEIS for the proposed Nichols Ranch ISR Project (74 FR 65808). The NRC staff provided information regarding the public comment period and how to obtain copies of the draft SEIS. The NRC staff initially established February 1, 2010, as the deadline for submittal of public comments on the Draft SEIS. On February 5, 2010, the NRC staff published a notice in the FR to extend the public comment period on the Draft SEIS to March 3, 2010 (75 FR 6066), in response to public requests for an extension submitted in comment letters and emails. The 81-day period for public comments (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations. The NRC staff received 20 documents containing comments on the Nichols Ranch ISR Project Draft SEIS. Appendix B of the SEIS contains a summary of the public participation process, the public comments, and the NRC staff responses to the public comments, including discussion of changes made to the SEIS in response to comments.

In addition to the opportunities provided through SEIS development, NRC also provided multiple opportunities for public input during the staff's safety review. Specifically, the staff held 10 meetings or teleconferences with the applicant from 2006 to 2010, and all of these interactions included an opportunity for public comment or questions.

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Nichols Ranch ISR Project license application, the NRC staff has conducted an independent, detailed, comprehensive evaluation of the potential environmental impacts from construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed site and reasonable alternatives. As discussed in GEIS Section 1.8.3, the GEIS (i) evaluated the types of environmental impacts that may occur from ISR uranium milling facilities, (ii) identified and assessed impacts that are expected to be generic (the same or similar) at all ISR facilities (or those with specified facility or site characteristics), and (iii) identified the scope of environmental impacts that needed to be addressed in site-specific environmental reviews. Therefore, although all of the environmental resource areas identified in the GEIS would be addressed in site-specific reviews, certain resource areas would require a more detailed analysis, because the GEIS analysis concluded there could be a range in the significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) depending upon site-specific conditions (see Table 1-1).

Based on the GEIS analyses, this SEIS provides a more detailed analysis of the following resource areas:

- Land Use
- Transportation
- Geology and Soils
- Surface Water
- Groundwater

- Terrestrial Ecology
- Threatened and Endangered Species
- Meteorology, Climatology, and Air Quality
- Noise
- Historic and Cultural Resources
- Visual and Scenic Resources
- Socioeconomics
- Public Health and Safety
- Waste Management

Furthermore, certain site-specific analyses that were not conducted in the GEIS (e.g., assessment of cumulative impacts, analysis of environmental justice) are also considered in this SEIS.

Additionally, NRC discusses the effects from implementing the proposed action on global climate change based on a 10-year licensing period and the effect of climate change on the Nichols Ranch ISR Project.

1.4.4 Issues Outside the Scope of the SEIS

Some issues and concerns raised during the public scoping process on the GEIS (NRC, 2009a, Appendix A) were determined to be outside the scope of the GEIS. These issues and concerns (e.g., general support or opposition for uranium milling, potential impacts associated with conventional uranium milling, comments regarding the alternative sources of uranium feed material, comments regarding energy sources, requests for compensation for past mining impacts, and comments regarding the credibility of NRC) were also determined to be outside the scope of this SEIS.

1.4.5 Related NEPA Reviews and Other Related Documents

The following NEPA documents were reviewed as part of the development of this SEIS to obtain relevant information:

- **NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities, Final Report (NRC, 2009a)**. As previously discussed, the GEIS was prepared to assess the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four different geographic regions of the western United States, including the Wyoming East Uranium Milling Region in which the proposed Nichols Ranch ISR Project would be located. The environmental analysis in this SEIS tiers from the GEIS.

- **NUREG–0706, Final Generic Environmental Impact Statement on Uranium Milling (NRC, 1980)**. This generic EIS provided a detailed evaluation of the impacts and effects of anticipated conventional uranium milling operations in the United States through the year 2000 including analysis of tailings disposal programs. The environmental impacts of underground mining and conventional milling would be more severe than using ISR technology. As discussed in Section 2.2.1 of the final SEIS, conventional mining and milling were considered but eliminated from the detailed analysis of the proposed Nichols Ranch ISR Project.

- **NUREG–1508, Final Environmental Impact Statement To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico (NRC, 1997)**. This EIS evaluated the use of ISR technology at the Church Rock and Crownpoint sites at Crownpoint, New Mexico. Alternative uranium mining methods were not evaluated, because the proposed sites were too deep to be extracted economically and the GEIS concluded that underground mining would have more significant environmental impacts than ISR recovery.

- **Final Environmental Impact Statement for the Wright Area Coal Lease Applications (BLM, 2009a)**. The Bureau of Land Management (BLM) prepared this EIS to evaluate the environmental impacts of leasing six tracts of federal coal reserves in the southern portion of the Powder River Basin, located approximately 56 km [35 mi] north of the town of Wright and 72 km [45 mi] north of the proposed Nichols Ranch ISR Project. All six tracts are operating surface coal mines and would be run by the operators of three adjacent mines (Black Thunder, Jacobs Ranch, and North Antelope Rochelle).

- **Final Environmental Impact Statement for the South Gillette Area Coal Lease Applications WYW172585, WYW173360, WYW172657, and WYW161248 (BLM, 2009b)**. BLM prepared this EIS to evaluate the environmental impacts of leasing four tracts of federal coal reserves in the east-central portion of the Powder River Basin, located approximately 80 km [50 mi] northeast of the proposed Nichols Ranch ISR Project. All four tracts are operating surface coal mines and are adjacent to the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines.

- **Final Environmental Impact Statement for the West Antelope II Coal Lease Application WYW163340 (BLM, 2008b)**. BLM prepared this EIS to evaluate the environmental impacts of leasing and mining coal on approximately 1,663 ha [4,109 ac] of land located 32 km [20 mi] southeast of the town of Wright and 38 km [30 mi] southeast of the Hank Unit adjacent to the Pumpkin Buttes. BLM estimates an average annual production of 33 to 38 million t [36 to 42 million T] of coal per year over the proposed 9- to 11-year life of the mine.

- **Fortification Creek Area Draft Resource Management Plan Amendment/Environmental Assessment (BLM, 2008c)**. BLM prepared this environmental assessment (EA) and Resource Management Plan Amendment to evaluate the impacts of allowing coal bed natural gas development within the Fortification Creek Planning Area, which encompasses 40,734 ha [100,655 ac] of land within Campbell, Johnson, and Sheridan Counties. About 26,300 ha [65,000 ac] of this land are federally owned, and 37,700 ha [93,159 ac] are BLM-managed mineral resources.

- **Environmental Assessments for Anadarko Petroleum Corporation, Dry Willow Phase I and Dry Willow Phase II (BLM, 2007)**. BLM prepared two EAs to evaluate the environmental impacts of authorizing the development of 33 coal bed natural gas wells and associated infrastructure in the Big George coal zone in Campbell County, located approximately in the Pumpkin Buttes between North and North Middle Buttes and approximately 8 km [5 mi] west of the proposed Nichols Ranch ISR Project. These EAs tier from the Powder River Basin Oil and Gas Project EIS and Resource Management Plan Amendment WY-070-02-065 (BLM, 2003).

- **Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project WY-070-02-065 (BLM, 2003)**. BLM prepared this EIS and Proposed Resource Management Plan Amendment to evaluate the environmental impacts from the continuation and expansion of coal bed methane development within the Powder River Basin by a group of oil and gas companies collectively referred to as the Powder River Basin Companies. The document assesses the drilling, operation, and reclamation of approximately 39,400 new natural gas wells and associated infrastructure in Campbell, Converse, Johnson, and Sheridan Counties.

The following NRC documents were also reviewed for the development of this SEIS:

- **NRC Safety Evaluation Report (SER) for the Nichols Ranch ISR Project**. The NRC staff is conducting a safety review that will be documented in an SER. The SER evaluates the applicant's proposed facility design, operational procedures, and radiation protection program to ensure the applicant-proposed action can be accomplished in accordance with the applicable provisions in 10 CFR Part 20; 10 CFR Part 40; and 10 CFR Part 40, Appendix A. The SER also provides the NRC staff analysis of the applicant's initial funding estimate to complete site decommissioning and reclamation.

- **NRC Environmental Review for the Moore Ranch ISR Project (NRC, 2010d)**. NRC completed its review of the Uranium One license application for a source material license to recover uranium via the ISR process at the Moore Ranch ISR Project, located in Campbell County about 32 km [20 mi] from the proposed Nichols Ranch ISR Project site. The Moore Ranch ISR Project would encompass 877 ha [7,110 ac] of privately owned and State of Wyoming lands, but only 61 ha [150 ac] would be disturbed as a result of the project.

- **NRC Environmental Review for the Irigaray/Christensen Ranch ISR Projects License Renewal**. NRC is reviewing an application from Uranium One, Inc. for the renewal of Source Material License SUA-1341, which is located in Campbell and Johnson Counties about 8 km [5 mi] north of the Nichols Ranch ISR Project. The Irigaray project was licensed for commercial ISR operations in August 1978. In June 1987, the license was amended to include the Christensen Ranch satellite facility and associated production areas. Production ended in June 2000, and the site has since been undergoing wellfield restoration and site decommissioning.

- **NRC License Application Review for the Smith Ranch Highland Uranium Project License Renewal**. NRC is reviewing an application from Power Resources Inc., doing business as Cameco Resources, for renewal of Source Material License SUA-1548, which includes the North Butte and Ruth Projects, located approximately 3.5 km [2.2 mi] to the north-northwest of the Hank Unit and 12 km [7.4 mi] southwest of the Nichols Ranch Unit, respectively. The licensee will be submitting a new operations plan for the North Butte Project during 2011.

1.5 Applicable Regulatory Requirements

NEPA establishes national environmental policy and goals to protect, maintain, and enhance the environment. NEPA provides a process for implementing these specific goals for those Federal agencies responsible for an action. This SEIS was prepared in accordance with NEPA

requirements, NRC-implementing regulations in 10 CFR Part 51, and other regulations that were in effect at the time of writing. GEIS Appendix B summarizes other Federal statutes, implementing regulations, and Executive Orders that are potentially applicable to environmental reviews for the construction, operation, aquifer restoration, and decommissioning of an ISR facility. GEIS Sections 1.6.3.1 and 1.7.5.1 summarize the State of Wyoming statutory authority pursuant to the ISR process, relevant state agencies involved in ISR facility permitting, and the range of state permits that would be required (NRC, 2009a).

1.6 Licensing and Permitting

NRC has statutory authority through the AEA as amended by the Uranium Mill Tailings Radiation Control Act to regulate uranium ISR facilities. In addition to obtaining an NRC license, uranium ISR facilities must obtain the necessary permits from the appropriate Federal, State, Tribal, and local governmental agencies. The NRC licensing process for ISR facilities was described in GEIS Section 1.7.1. GEIS Sections 1.7.2 through 1.7.5 describe the role of other Federal, State, and Tribal agencies in the ISR permitting process.

The following sections summarize the status of the NRC's licensing process at the proposed Nichols Ranch ISR Project site and the status of the applicant's permitting with respect to other applicable Federal, Tribal, and State requirements.

1.6.1 NRC Licensing Process

By letter dated November 30, 2007, the applicant submitted a license application to NRC for the Nichols Ranch ISR Project (Uranerz, 2007a). As discussed in GEIS Section 1.7.1, NRC initially conducts an acceptance review of a license application to determine whether the application is complete enough to support a detailed technical review. The NRC staff accepted the Nichols Ranch ISR Project license application for detailed technical review by letter dated April 14, 2008 (NRC, 2008d).

The NRC's detailed technical review of the Nichols Ranch ISR Project license application includes both a safety review and an environmental review. These two reviews are conducted in parallel (see GEIS Figure 1.7-1). The safety review focuses on assessing compliance with the applicable regulatory requirements in 10 CFR Part 20 and 10 CFR Part 40, Appendix A. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51.

The NRC hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with proposed licensing actions. NRC published a Notice of Opportunity for Hearing in the FR on June 16, 2008 (see 73 FR 34052), related to the Nichols Ranch license application. No request for a hearing was received.

1.6.2 Status of Permitting with Other Federal, Tribal, and State Agencies

In addition to obtaining a source material license from NRC prior to conducting ISR operations at the proposed Nichols Ranch ISR Project site, the applicant is required to obtain necessary permits and approvals from other Federal, Tribal, and State agencies. These permits and approvals would address issues such as (i) the underground injection of solutions and liquid effluent from the ISR process, (ii) the exemption of all or a portion of the ore zone aquifer from

regulation under the Safe Drinking Water Act, and (iii) the discharge of storm water during construction and operation of the ISR facility.

1.7 Consultations

As a Federal agency, NRC is required to comply with consultation requirements in Section 7 of the Endangered Species Act (ESA) of 1973, as amended, and Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The GEIS took a programmatic look at the environmental impacts of ISR uranium recovery operations on four distinct geographic regions and acknowledged that each site-specific review would include its own consultation process with relevant agencies. Sections 7 and 106 consultations conducted for the proposed Nichols Ranch ISR Project are summarized in Sections 1.7.1 and 1.7.2. Copies of the correspondence for this consultation are provided in Appendix A of this SEIS. Section 1.7.3 discusses NRC coordination with other Federal, Tribal, State, and local agencies conducted during the development of the SEIS. Table 1-2 provides the status of the applicant efforts to obtain these necessary permits.

1.7.1 Endangered Species Act of 1973 Consultation

The ESA was enacted to prevent the further decline of threatened and endangered species and to restore those species and their critical habitats. ESA Section 7 requires consultation with the U.S. Fish and Wildlife Service (FWS) to ensure that actions FWS authorizes, permits, or otherwise carries out would not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

By letter dated July 3, 2008, NRC staff initiated consultation with the FWS, requesting information on threatened and endangered species or critical habitat in the proposed Nichols Ranch ISR Project area (NRC, 2008a). NRC received a response from the FWS Ecological Services Field Office in Cheyenne, Wyoming, dated August 15, 2008, that (i) listed the threatened and endangered species that may occur in the proposed project area, (ii) discussed obligations to protect migratory birds, (iii) noted the negative impacts that can result from the land application of ISR wastewater, and (iv) recommended avoidance of wetland and riparian areas and protection of sensitive species (FWS, 2008). Four emergent wetlands are located on the southeastern portion of the proposed Nichols Ranch Unit and are addressed in detail in SEIS Section 3.5.1.

NRC staff also met with the FWS Buffalo Field Office on January 14, 2009, to discuss site-specific issues (NRC, 2009b). The main concern the Buffalo Field Office expressed was potential impacts to the Greater sage-grouse (*Centrocercus urophasianus*), and typical mitigation measures were discussed (see SEIS Section 4.6.1.1.3).

No federally listed species are known to occur in the vicinity of the site; however, black-tailed prairie dog (*Cynomys ludovicianus*) colonies, which are potential habitat for black-footed ferrets (*Mustela nigripes*), are located on and in the vicinity of the proposed Nichols Ranch ISR Project site. NRC has consulted with the FWS and concluded that no adverse impacts would occur to the black-footed ferret as a result of the proposed project (NRC, 2009c). Threatened and endangered species are addressed in detail in SEIS Sections 3.6.3 and 4.6.1.1.3.

Table 1-2. Environmental Approvals for the Nichols Ranch ISR Project

Issuing Agency	Description	Status
U.S. Nuclear Regulatory Commission (NRC)	Source Material License (10 CFR Part 40)	Application under review
Wyoming Department of Environmental Quality (WDEQ)	Permit to Mine	Application submitted and under review. Anticipated approval 4th Quarter 2010.
	WDEQ Drilling Permit (for exploration)	Permit No. 336DN-TFN 4 5/276
	Wellfield Authorization Permit	Application under preparation
	Deep Disposal Well Permits	Application submitted September 2010 and under review
	Wyoming Pollutant Discharge Elimination System (WYPDES) Permit	Application under preparation. One permit will need to be submitted 30 days prior to construction, and one permit will be needed for the plant sites.
	WDEQ Air Quality Permit	Permit No. CT-8644
U.S. Environmental Protection Agency (EPA)	Aquifer Exemption (40 CFR Parts 144 and 146)	Aquifer exemption application would be forwarded to EPA following WDEQ action
Wyoming State Engineer's Office (WSEO)	Permit to Appropriate Groundwater	Existing wells are approved; new well permits would be obtained prior to drilling
Bureau of Land Management (BLM) Casper Field Office	BLM Drilling Permit (for exploration)	Permit No. W-169662 (permit expired)
Johnson County Office of County Sanitarian	Permit to Construct Septic Leach Field	Application under preparation
N/A	Byproduct/Waste Disposal Agreement	Application under preparation
Source: Uranerz (2010)		

1.7.2 National Historic Preservation Act of 1966 Consultation

NHPA Section 106 requires that Federal agencies take into account the effects of their undertakings on historic properties and allow the Wyoming State Historic Preservation Office (WY SHPO) to comment on such undertakings.

By letter dated July 1, 2008, NRC requested information from the WY SHPO to facilitate the identification of historic and cultural resources that could be affected by the proposed project (NRC, 2008c). A response from the WY SHPO dated July 25, 2008, noted the Pumpkin Buttes

Traditional Cultural Property (TCP), a site eligible for listing in the National Register of Historic Places (NRHP), is of interest to numerous Native American tribes and that consultation with these tribes would be appropriate (WY SHPO, 2008).

NRC staff also met with a member of the WY SHPO on January 12, 2009, to discuss site-specific issues, including the WY SHPO review process, cumulative impacts to historical sites, and best management practices (NRC, 2009b). NRC forwarded the WY SHPO copies of three Class III surveys on August 26, 2009 (NRC, 2009d), and one Class III survey on June 15, 2010 (NRC, 2010a). By letters dated July 8 and July 19, 2010, the WY SHPO concurred with NRC's determination on most of the archaeological sites identified in the proposed project area (WY SHPO, 2010a, b). For two of the sites, WY SHPO recommended that the sites remain unevaluated for the NRHP, although both sites will not be affected by the project as planned (using fencing and avoidance). The WY SHPO recommended that five more sites (48CA268, 48CA6148, 48CA6748, 48CA6751, and 48CA6753) remain unevaluated for the NRHP pending Native American consultations.

On July 7, 2010, Uranerz hosted a site visit for representatives from the Northern Cheyenne and the Ft. Peck Assiniboine/Sioux Tribes. The Tribal representatives agreed that, as a part of the project, site 48CA268 (Pumpkin Buttes TCP) should be formally nominated for listing on the NRHP for protection. No other issues were identified during this site visit regarding the Pumpkin Buttes TCP. A followup site visit was conducted on July 30, 2010, with representatives from both Tribes to specifically evaluate and conduct consultation for sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753. The tribes consider these sites to possess traditional cultural and religious significance and to be TCPs. NRC has determined that sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 are eligible for listing on the NRHP for their religious and cultural significance. By letter dated November 3, 2010, the WY SHPO concurred with this determination (WY SHPO, 2010c).

NRC staff is continuing to consult with interested parties throughout the environmental review process regarding a Memorandum of Agreement (MOA) among NRC, BLM, WY SHPO, interested Native American tribes, and the applicant for mitigation of adverse effects to the viewshed of five TCPs (48CA268 [Pumpkin Buttes], 48CA6148, 48CA6748, 48CA6751, and 48CA6753). A draft MOA was forwarded to interested parties by letter dated July 22, 2010, for review and comment. However, the draft MOA only considered impacts to the Pumpkin Buttes TCP. Since four additional TCPs have been identified through consultation with Native American Tribes, NRC will consult with the above parties to develop a MOA that address impacts to the visual setting of the five TCPs. If issued, the license would contain license conditions that incorporate any mitigation measures in the license application and any agreements that address historic and cultural resources. These sites and the development of the MOA are discussed in more detail in SEIS Chapters 3 and 4.

NRC also consulted with potentially affected Native American Tribes as part of the Section 106 consultation process per 36 CFR 800.2(c). These interactions are detailed in Section 1.7.3.3 in this SEIS.

1.7.3 Coordination with Other Federal, Tribal, State, and Local Agencies

NRC staff interacted with multiple Federal, Tribal, State, and local agencies and entities during preparation of this SEIS to gather information on potential issues, concerns, and environmental impacts related to the proposed Nichols Ranch ISR Project. The consultation and coordination process included, but was not limited to, discussions with BLM, the Bureau of Indian Affairs

(BIA), Tribal governments, Wyoming Department of Environmental Quality (WDEQ), Wyoming State Engineer's Office (WSEO), and local organizations (NRC, 2009b).

1.7.3.1 Coordination with Bureau of Land Management

BLM is responsible for administering the National System of Public Lands and the federal minerals underlying these lands. BLM is also responsible for managing split estate situations where federal minerals underlie a surface that is privately held or owned by State or local government. In situations where BLM administers the surface rights, operators of mining claims, including ISR uranium recovery operations, must submit a plan of operations and obtain BLM approval before beginning operations beyond those for casual use.

While BLM was not a cooperating agency for this SEIS, NRC staff coordinated with BLM during SEIS preparation. In January 2009, NRC staff met with personnel from the BLM State Office in Cheyenne, the BLM Coal Group in Casper, the BLM Buffalo Field Office, and the BLM Casper Field Office (NRC, 2009b). During the visit, BLM clarified how it administers mineral claims and leases on BLM lands. BLM expressed concerns related to water quality and hydrology at ISR sites, cumulative effects due to the other energy operations (coal, oil and gas, wind energy, and operating ISR facilities) in the vicinity of the proposed ISR site, and the potential socioeconomic impact on the communities surrounding the proposed ISR site. BLM provided guidance documents on its typical mitigation measures to protect cultural resources and the Greater sage-grouse. BLM also has a Cooperating Agency agreement with WDEQ and a programmatic agreement (PA) with WY SHPO.

BLM and WY SHPO have a PA to mitigate adverse effects to the Pumpkin Buttes, a TCP, from federal minerals development in Campbell County (BLM, 2009c). Based on the proposed Nichols Ranch ISR Project's proximity to Pumpkin Buttes, the BLM Buffalo Field Office was contacted in November 2008 for a list of tribes that might have an interest in activities surrounding the Pumpkin Buttes; BLM provided the NRC staff with a list of tribes that have expressed interest in the Pumpkin Buttes (BLM, 2008a).

Since the January 2009 meeting with BLM, the NRC staff has regularly consulted with the Wyoming BLM offices regarding the progress on the staff's environmental review for the proposed Nichols Ranch ISR Project. This has been done through regular teleconference calls with the appropriate BLM state and field offices, by sharing preliminary sections and an SEIS draft with BLM, and by ensuring NRC correspondence with the applicant was also shared with BLM. In addition to corresponding with the Wyoming BLM Offices for the proposed Nichols Ranch ISR Project, the NRC staff held quarterly teleconferences to discuss environmental issues relating to all uranium recovery projects, current and planned.

1.7.3.2 Coordination with Bureau of Indian Affairs

The BIA mission is to enhance the quality of life, promote economic opportunity, and protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives. BIA is responsible for the administration and management of 27 million ha [66 million ac] of land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives.

NRC staff met with staff from BIA in Fort Washakie, Wyoming, on January 15, 2009 (NRC, 2009b). NRC staff briefed BIA on potential ISR facilities proposed in Wyoming and discussed how BIA and Indian tribes would be involved in the NRC environmental review

process. BIA stated Tribal governments should be consulted for any projects in the state. BIA also recommended Tribal elders be involved in cultural and historic surveys.

1.7.3.3 Interactions with Tribal Governments

In response to guidance from WY SHPO and BIA and to implement the requirements in Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," the NRC staff initiated discussions with potentially affected Native American tribes. Letters dated December 24, 2008, were sent to the following nine tribes to solicit their comments or concerns regarding cultural resources and the proposed Nichols Ranch ISR Project (NRC, 2008b):

- Blackfeet Tribe
- Cheyenne River Sioux Tribe
- Crow Tribe
- Eastern Shoshone Tribe
- Ft. Peck Assiniboine/Sioux Tribe
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Three Affiliated Tribes

By email dated February 12, 2009, Mr. Conrad Fisher of the Northern Cheyenne Tribal Historic Preservation Office provided comments (NCTHPO, 2009), which are detailed in Chapters 3 and 4 of this SEIS. No additional responses from these tribes were received regarding the NRC's request for cultural resource information and/or concerns regarding the proposed Nichols Ranch ISR Project.

On April 23, 2010, NRC sent a letter (NRC, 2010b) to the nine tribes to request information regarding cultural resources potentially affected by the proposed Nichols Ranch ISR Project and to invite the nine tribes to become signatories to an MOA for mitigation of potential adverse effects to the Pumpkin Buttes TCP. NRC contacted each of the tribes via telephone from May 10 to 14, 2010, to ensure the tribes had received the letter and to answer questions posed by the tribes. Eight of the nine tribes (all tribes listed previously except the Three Affiliated Tribes) expressed interest in being a signatory to an MOA.

As noted in Section 1.7.2, on July 7, 2010, Uranerz hosted a site visit for representatives of the Northern Cheyenne and Ft. Peck Assiniboine/Sioux Tribes. The representatives agreed that, as a part of the project, site 48CA268 (Pumpkin Buttes TCP) should be formally nominated for listing on the NRHP. A follow up site visit was conducted on July 30, 2010, with representatives from both Tribes to specifically evaluate and conduct consultation for sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753. The tribes determined that these sites possess traditional cultural and religious significance and consider them to be TCPs. NRC has determined that sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 are eligible for listing on the NRHP for their religious and cultural significance.

NRC forwarded the MOA for review and comment to the eight interested tribes on July 22, 2010 (NRC, 2010c). However, the draft MOA only considered impacts to the Pumpkin Buttes TCP. Since four additional TCPs have been identified through consultation with Native American Tribes, NRC will consult with the above parties to develop a MOA that address impacts to the visual setting of the five TCPs. Two tribes, the Northern Cheyenne and the Ft. Peck

Assiniboine/Sioux Tribes, have requested a government-to-government meeting regarding the TCPs and the proposed action.

1.7.3.4 Coordination with Wyoming Department of Environmental Quality

NRC staff met with WDEQ in Cheyenne, Wyoming, on January 12, 2009, to discuss the WDEQ role in the NRC environmental review process for the proposed Nichols Ranch ISR Project (NRC, 2009b). Topics discussed during the meeting were the Water Quality Division (WQD) storm water program, air quality review and permitting, and noise quality. WDEQ also provided clarification on deep well injection classifications. WDEQ expressed concern related to reclamation and restoration and noted groundwater quality should be returned to baseline conditions. WDEQ indicated it would review the NRC SEISs for the Nichols Ranch ISR Project, the Moore Ranch ISR Project, and the Lost Creek ISR Project when they are issued to the public in draft. They also emphasized coordination with BLM when ISR projects are located on BLM lands.

NRC staff also met with the WDEQ-Land Quality Division (LQD) on January 14, 2009 (NRC, 2009b). WDEQ-LQD explained the Underground Injection Control Class III well application process and expressed concern about potential excursions and unconfined aquifers. WDEQ-LQD staff also stated its position that groundwater affected by ISR operations should be restored to its preoperational quality. It supported the use of solar evaporation ponds for wastewater disposal, but stated that ISR applicants, Native American tribes, and FWS have expressed concerns regarding the use of evaporation ponds. NRC staff continues to coordinate with WDEQ staff to monitor the WDEQ permitting process. Such interactions have included periodic telephone calls and meetings regarding the status of regulatory actions and issues of concern to each agency.

1.7.3.5 Coordination with Wyoming Game and Fish Department

The Wyoming Game and Fish Department (WGFD) is responsible for controlling, propagating, managing, protecting, and regulating all game and nongame fish and wildlife in Wyoming under Wyoming Statutes (W.S.) 23-1-301-303 and 23-1-401. Regulatory authority given to WGFD allows for the establishment of hunting, fishing, and trapping seasons, as well as the enforcement of rules protecting nongame and state-listed species.

The proposed project area includes habitat for a variety of big game animals, raptors, migratory birds, and small mammals that could be affected by the project. In addition, the area surrounding the proposed Nichols Ranch ISR Project does not contain core breeding areas for the Greater sage-grouse (WGFD, 2010). WGFD expressed interest regarding potential impacts on migratory behavior patterns, long-term population sustainability, and the effects on local hunting of big game; impacts to nesting raptors; and the loss of nesting habitat for the Greater sage-grouse.

Based on the FWS recommendation, NRC staff initiated consultation with WGFD via a letter sent on October 29, 2008 (NRC, 2008e), requesting information on the Greater sage-grouse habitats within the proposed project area and appropriate mitigation measures to minimize potential impacts to the Greater sage-grouse. Since that time, the Governor's Sage-Grouse Implementation Team (SGIT) has been meeting and has recommended changes to protect sage-grouse. NRC staff received regular updates from the SGIT on the proposed changes. On August 18, 2010, the Governor signed Executive Order (E.O.) 2010-4 (replacing E.O. 2008-

2) for Greater Sage-Grouse Core Area Protection that was reviewed and considered during SEIS preparation.

1.7.3.6 Coordination with Wyoming State Engineer's Office

NRC staff met with the Wyoming State Engineer's Office (WSEO) on January 12, 2009, to discuss well permitting (NRC, 2009b). WSEO was primarily concerned that proposed ISR facilities may degrade the water quality and that potential groundwater contamination should be constrained to the project site. It also expressed the need for applicants to ensure there was close, professional supervision of well construction.

1.7.3.7 Coordination with Wyoming Governor's Planning Office

NRC staff met with the Wyoming Governor's Planning Office on January 13, 2009 (NRC, 2009b), and again on June 25, 2009. The Wyoming Governor's Planning Office briefed NRC on the BLM Resource Management Plan for the Buffalo region. It stated they are a cooperating agency with BLM and is specifically involved in the development of BLM resource management plans with WY SHPO and WDEQ. The planning office informed NRC of the statewide conservation and management efforts for Greater sage-grouse and noted that the Governor had created a management plan to protect sage-grouse with the assistance of SGIT. It emphasized that potential ISR facilities need to be geographically flexible to protect core sage-grouse areas. Since that time, NRC staff has been in continuous communication with SGIT.

1.7.3.8 Coordination with Wyoming Community Development Authority

NRC staff met with the Wyoming Community Development Authority on January 13, 2009, to discuss housing availability for employees of potential ISR facilities (NRC, 2009b). The authority noted that employees would typically look for housing in the communities surrounding the project by which they are employed, possibly including hotels, apartments, or single-family homes.

1.7.3.9 Coordination with Localities

The NRC staff interacted with several county and city entities in the vicinity of the proposed project area, which included phone calls and face-to-face meetings. NRC met with several county and city entities on January 13 and 15, 2009, to discuss site-specific issues for the proposed Nichols Ranch ISR Project (NRC, 2009b). Meetings were held with the City of Casper Planning Office, City of Gillette and Campbell County Office, Converse Area New Development Organization, and the town of Wright. Meetings with the local county and city entities focused on local economies, housing availability, and community services.

1.8 Structure of the SEIS

As noted in Section 1.4.1 of this document, the GEIS (NRC, 2009a) evaluated the broad impacts of ISR projects in a four-state region but did not reach site-specific conclusions for new ISR projects. In this SEIS, the NRC staff evaluated the extent to which information and conclusions in the GEIS could be incorporated by reference. The NRC staff also determined whether site-specific information would change the expected environmental impact beyond that evaluated in the GEIS.

SEIS Chapter 2 describes the proposed action and reasonable alternatives considered for the proposed action; Chapter 3 describes the affected environment for the proposed Nichols Ranch ISR Project site; and Chapter 4 evaluates the potential environmental impacts from implementing the proposed action and the impacts from reasonable alternatives. Cumulative impacts are discussed in Chapter 5. Chapter 6 details the applicant's proposed environmental measurement and monitoring programs. A cost-benefit analysis is provided in Chapter 7, and potential environmental consequences from the proposed action and alternatives are summarized in Chapter 8.

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2 *IN-SITU* URANIUM RECOVERY AND ALTERNATIVES

This chapter describes the proposed action and alternatives for issuance of a U.S. Nuclear Regulatory Commission (NRC) license to Uranerz Energy Corporation (Uranerz), herein referred to as the applicant, for the construction, operation, aquifer restoration, and decommissioning of the Nichols Ranch *In-Situ* Recovery (ISR) Project. These alternatives include a consideration of the No-Action alternative as required under the National Environmental Policy Act of 1969 (NEPA). Under the No-Action alternative, Uranerz would not construct, operate, restore the aquifer, or decommission the proposed Nichols Ranch ISR Project. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impact of the proposed action and alternatives.

Section 2.1 of this Supplemental Environmental Impact Statement (SEIS) describes the alternatives considered for detailed analysis, including the proposed action described in Section 2.2. Section 2.3 describes those alternatives that were considered but eliminated from detailed analysis. Section 2.4 of the SEIS compares the predicted environmental impacts of the proposed action and other alternatives. Section 2.5 sets forth the final NRC staff recommendation on the proposed federal action. Section 2.6 provides references cited for this chapter.

2.1 Alternatives Considered for Detailed Analysis

NRC used a variety of sources to determine a range of alternatives to consider for detailed analysis in this SEIS. Those sources included the application, including the environmental report (ER) (submitted by Uranerz); the scoping and draft comments on NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS); the information gathered during the NRC staff site visit in January 2009; comments on the draft SEIS; and multidisciplinary discussions held among NRC staff and various stakeholders. This SEIS evaluates the potential environmental impacts from three alternatives: the Proposed Action (Alternative 1), the No-Action (Alternative 2), and the Modified Action—No Hank Unit (Alternative 3). The description of the alternatives is primarily based on information provided by the applicant in its license application unless otherwise noted.

2.2 The Proposed Action (Alternative 1)

Under the proposed action, the applicant is seeking an NRC source material license for the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the Nichols Ranch ISR Project site as described in the license application. The applicant's proposed action includes disposal via a Class I injection well discussed in Section 2.2.1.6.2 of this SEIS; however, alternative wastewater disposal options for the proposed action are discussed in Section 2.2.2 of this SEIS.

2.2.1 Proposed ISR Facility Including Deep Well Injection

The proposed Nichols Ranch ISR Project includes several facilities and wellfields, which are described in the following sections. The general ISR process is described in GEIS Chapter 2 (NRC, 2009). The schedule for the proposed action is shown in Figure 2-1.

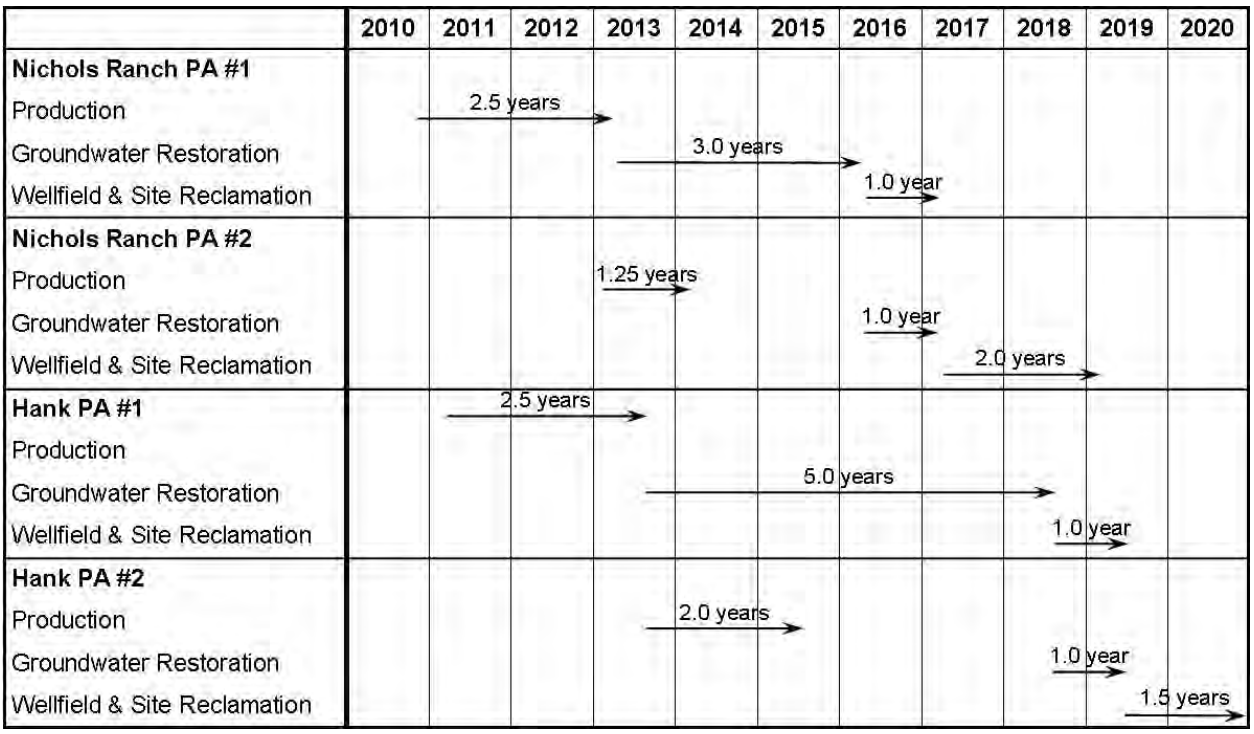

Figure 2-1. Nichols Ranch ISR Project Schedule
Source: Modified from Uranerz (2007)

2.2.1.1 Site Description

The proposed Nichols Ranch ISR Project is located in the Pumpkin Buttes Uranium Mining District of the Powder River Basin in Campbell and Johnson Counties, Wyoming. The proposed site is located approximately 74 km [46 mi] south-southwest of the city of Gillette and approximately 98 km [61 mi] north-northeast of the city of Casper (Figure 1-1). The total area of the proposed Nichols Ranch ISR Project covers approximately 1,365 ha [3,371 ac]. Certain sections within the proposed project area are split estate, where two or more parties own the surface and subsurface mineral rights. The surface rights includes approximately 1,251 ha [3,091 ac] of privately owned land held mainly by the T-Chair Livestock Company and approximately 113 ha [280 ac] of surface rights owned by the U.S. Government and administrated by the Bureau of Land Management (BLM). The subsurface mineral rights are owned by private entities, including both oil and gas and mineral extraction companies, and the U.S. Government.

Of the total land surface area, the applicant estimates that the proposed ISR operations would affect approximately 120 ha [300 ac]. The proposed Nichols Ranch ISR Project would be divided into two noncontiguous units, the Nichols Ranch Unit and the Hank Unit, located west and southwest of the North Middle Butte (see Figure 2-8). Two access roads would be constructed to connect the two units with existing roads. Additional details on the affected environment at the proposed site are contained in Chapter 3.

The Nichols Ranch Unit (located in Township 43N; Range 76 West; Sections 7, 8, 17, 18, and 20) would cover approximately two-thirds of the project site and be located in Johnson and Campbell Counties. The Nichols Ranch Unit is located near the confluence of the Cottonwood

Creek drainage and the Dry Fork of the Powder River (see Figure 3-5). The topography at the proposed Nichols Ranch Unit is relatively flat with gently rolling hills and low ridges. The elevation in the proposed Nichols Ranch Unit ranges from 1,424 to 1,494 m [4,670 to 4,900 ft] above mean sea level (AMSL) (Figure 2-2).

The Hank Unit (located in Township 44N; Range 75 West; Sections 30 and 31; Township 43N; Range 75 West; Sections 5, 6, 7, and 8) occupies one-third of the proposed project site and would be located near the western flank of the North Middle Butte in southwest Campbell County (Figure 2-3). The Hank Unit is located approximately 6.8 km [4.2 mi] northeast of the Nichols Ranch Unit in the Dry Willow and Willow Creek drainages and is located approximately 26 km [16 mi] upstream of the confluence of Willow Creek with the Powder River. The topography at the proposed Hank Unit is gently rolling hills, low ridges, and steep terrain near the North Middle Butte and in and along Dry Willow Creek. The elevation at the proposed Hank Unit ranges from 1,541 to 1,588 m [5,055 to 5,209 ft] AMSL (Figure 2-3).

2.2.1.2 Construction Activities

As described in GEIS Section 2.3, general construction activities associated with ISR facilities include drilling wells, clearing and grading associated with road construction and building foundations, trenching, and laying pipelines (NRC, 2009). The proposed facilities would consist of the central processing plant, satellite facility, and associated infrastructure, such as the wellfields, pipelines, and roads.

2.2.1.2.1 Site Preparation

Tractor-trailers would deliver the materials and equipment necessary to construct the facilities and wellfields at both the Nichols Ranch and Hank Units. Because the installation of ISR facilities is a small-magnitude construction project, the magnitude of trucking activities to support this stage of the project would be minor compared to other industrial activities (NRC, 2009). Beyond commuter traffic, trucks would transfer nonhazardous solid waste (e.g., rags, trash, packing materials, broken parts or equipment) to the local landfill. Construction equipment would be used intermittently and would generate diesel emissions. Gas and diesel vehicles associated with the proposed Nichols Ranch ISR Project would be equipped with air pollution control devices to limit combustion products (Uranerz, 2007). The applicant-estimated road traffic during the construction phase would include eight passenger vehicles (standard, light-duty trucks or ¾-ton trucks, gas or diesel fuel) per weekday along with six tractor-trailers (diesel) per week (Uranerz, 2007).

Topsoil salvaged during construction activities would be stored in designated topsoil stockpiles located onsite and designed to minimize material loss from wind and water erosion. Topsoil from building sites, permanent storage areas, main access roads, and chemical storage areas would be salvaged prior to construction in accordance with Wyoming Department of Environmental Quality-Land Quality Division (WDEQ-LQD) requirements. Both the central processing plant and satellite facility sites are expected to cover approximately 0.8 to 1.6 ha [2 to 4 ac]. Therefore, approximately 2,470 m^3 [3,230 yd^3] of topsoil would be removed from each unit and stockpiled for the life of the project. Additional topsoil would be removed for the construction of wellfields, new access roads, and header houses. The applicant estimated an area of 37 ha [92 ac] would be affected by access road and header house construction resulting in the removal of approximately 56,781 m^3 [74,213 yd^3] of topsoil. Topsoil would be salvaged from building sites, permanent storage areas, access roads, chemical storage areas, and at

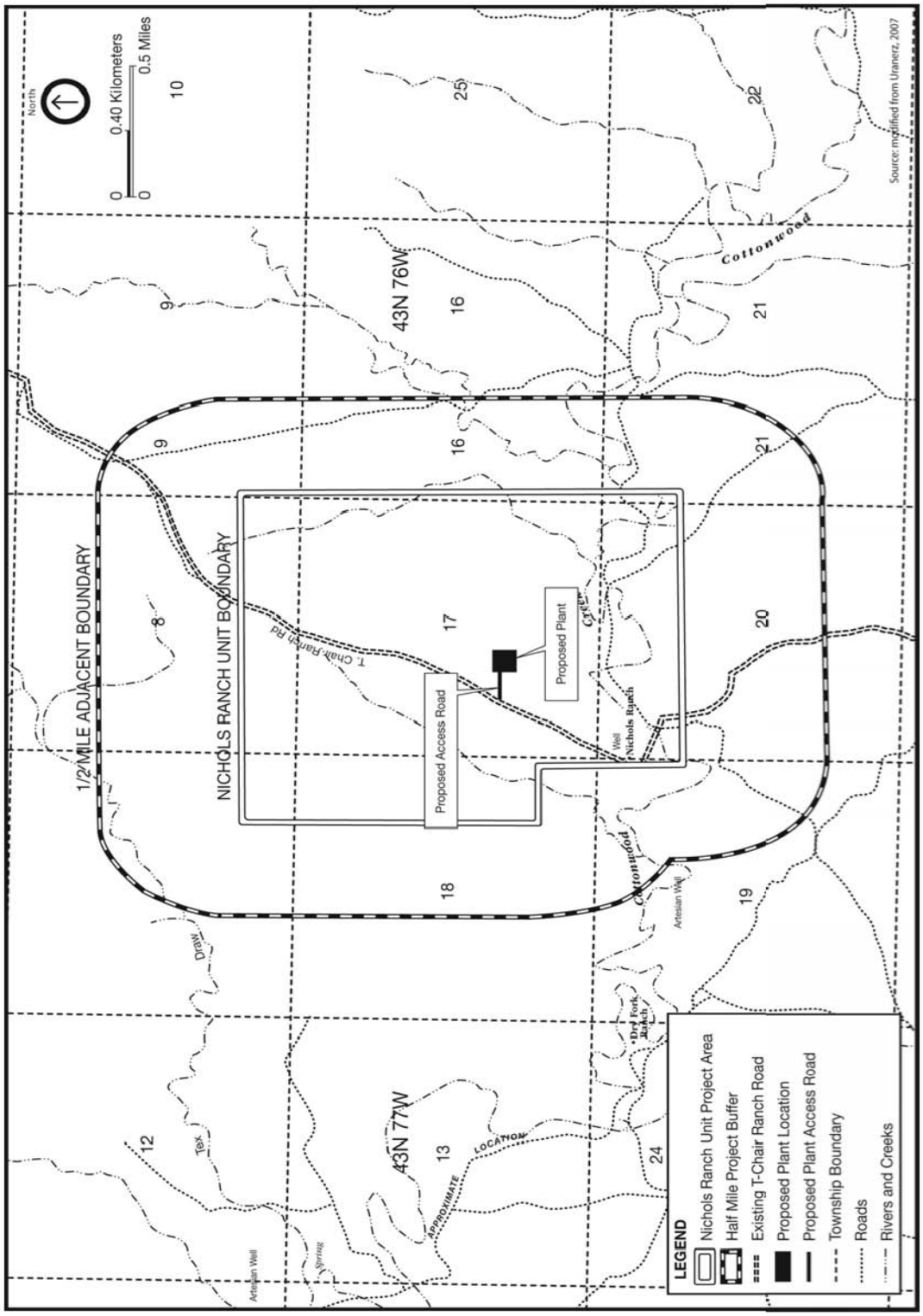

Figure 2-2. Nichols Ranch Unit Site Layout
Source: Modified from Uranerz (2007)

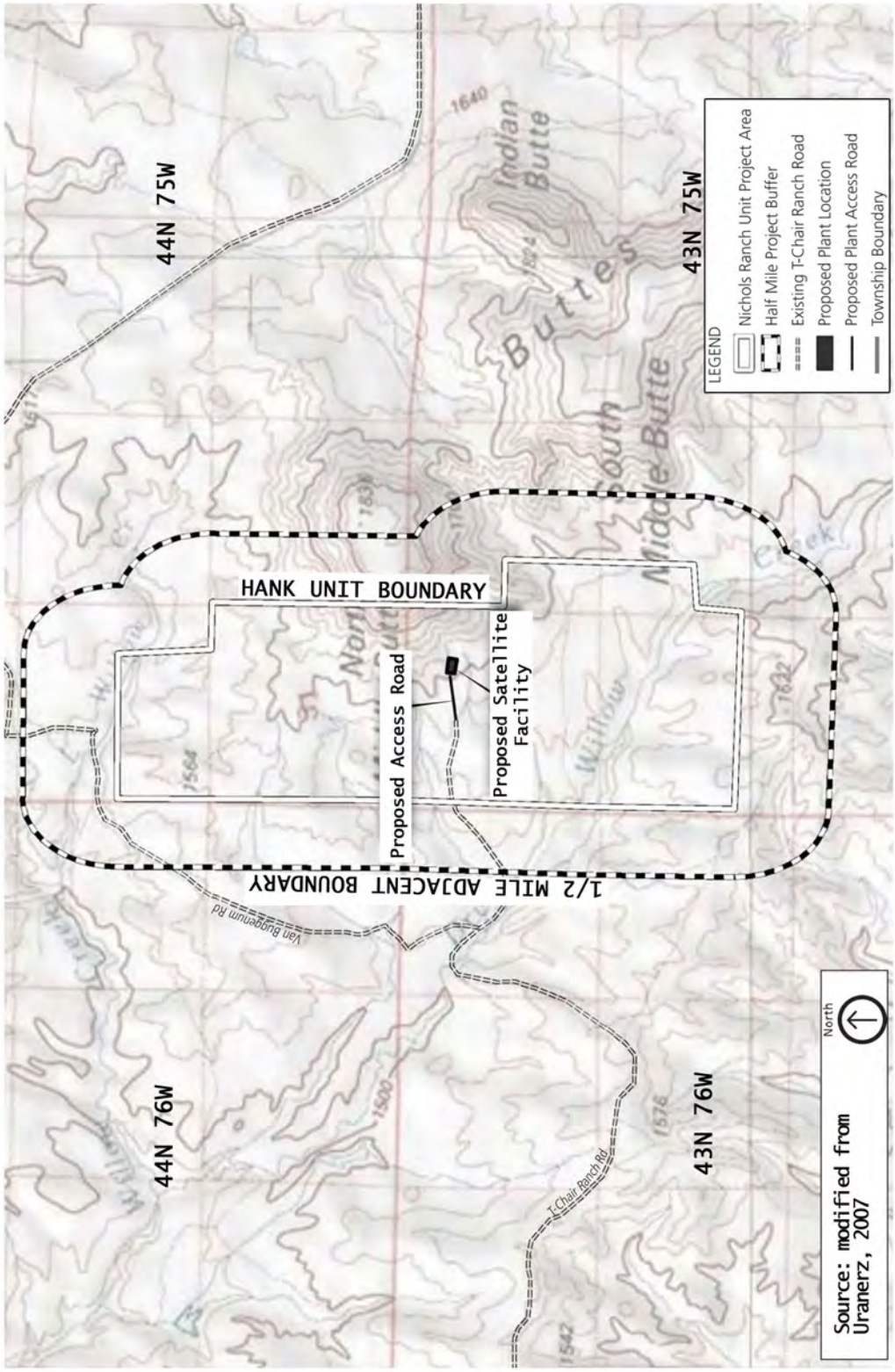

Figure 2-3. Hank Unit Site Layout
Source: Modified from Uranerz (2007)

header house locations in the wellfields prior to construction. The applicant committed to salvaging 15 cm [6 in] of topsoil in these areas resulting in a total of approximately 40 ha [100 ac] of topsoil during the life of the proposed project (Uranerz, 2007). The topsoil would not be reapplied until final reclamation and restoration had occurred. The applicant estimated that 24 to 32 ha [60 to 80 ac] of land would be fenced to grazing activities at any given time over the life of the proposed project (Uranerz, 2007).

2.2.1.2.2 Buildings

The proposed infrastructure to be constructed as part of the Nichols Ranch ISR Project includes the buildings, wells, wellfield structures, underground piping, and access roads for both the Nichols Ranch and Hank Units. The Nichols Ranch Unit would contain the central processing plant, which includes ion exchange, resin elution, and the yellowcake drying and packaging systems. The Hank Unit would contain a satellite facility, which would include an ion-exchange system. Uranium-loaded resins from the Hank Unit satellite facility would be transported to the Nichols Ranch Unit central processing plant for processing and packaging. The general location of the Nichols Ranch Unit buildings within the proposed project area is shown in Figure 2-2. The general layout of the Nichols Ranch Unit facilities (central processing plant and auxiliary buildings) is shown in Figure 2-4. The central processing plant would be a metal building with dimensions of approximately 46 × 76 m [150 × 250 ft] and eave heights of less than 15 m [50 ft]. Bulk storage tanks for process chemicals such as hydrogen peroxide, hydrochloric acid, oxygen, and carbon dioxide would be located outside of the central processing plant. Two auxiliary buildings would be located adjacent to the central processing plant. An office building, approximately 46 × 18 m [150 × 60 ft] in size, would house work space in addition to a lunch room, restroom facilities, a security monitoring room, a computer service room, and an onsite laboratory. A maintenance building would include a dedicated area for vehicle, electrical, and rotating equipment maintenance and additional office space for field and operating personnel. As shown in Figure 2-4, the central processing plant, outdoor storage areas, and support buildings would be fenced in a controlled access area.

The general location of the Hank Unit facilities (satellite facility and maintenance building) within the proposed project area is shown in Figure 2-3. The Hank Unit would house a satellite facility, approximately 10 km [6 mi] northeast of the proposed central processing plant located at the Nichols Ranch Unit, and a maintenance building, as shown in Figure 2-5. The satellite facility would be an approximately 24 × 49 m [80 × 160 ft] metal building with eave heights less than 15 m [40 ft]. Major processing equipment would be housed in the satellite facility except for some bulk oxygen and carbon dioxide storage tanks that would be located outside of the facility as shown in Figure 2-5.

The applicant would construct both the Nichols Ranch Unit central processing plant and the Hank Unit satellite facility on curbed concrete pads to minimize the potential for liquids to enter the environment. The applicant would implement engineering controls and an operational monitoring program designed to quickly detect spills and leaks and to minimize the potential impact (Uranerz, 2007). Potential leaks from vessels and equipment, including equipment washdown water, would drain to a sump and either be pumped back into the process circuit or pumped to Class I deep disposal wells located on each unit. The deep disposal well locations would be near the central processing plant and satellite facility. Concrete floors within the satellite facility would be designed to support the full weight of any vessel and its contents and to meet all building codes and standards. Outside chemical storage locations would be constructed with concrete curbed secondary containment for tanks.

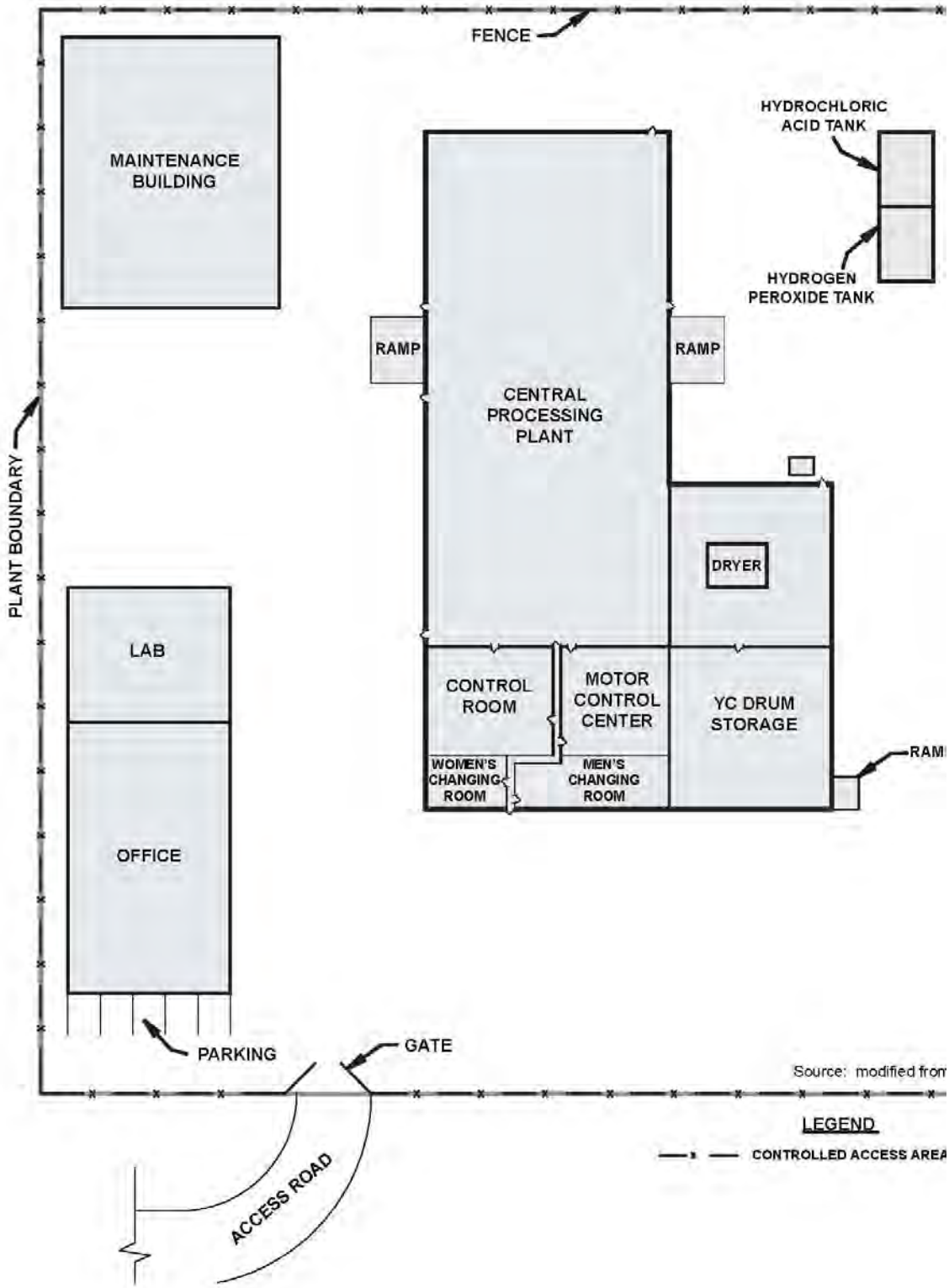

Figure 2-4. General Layout of the Nichols Ranch Unit Buildings
Source: Modified from Uranerz (2007)

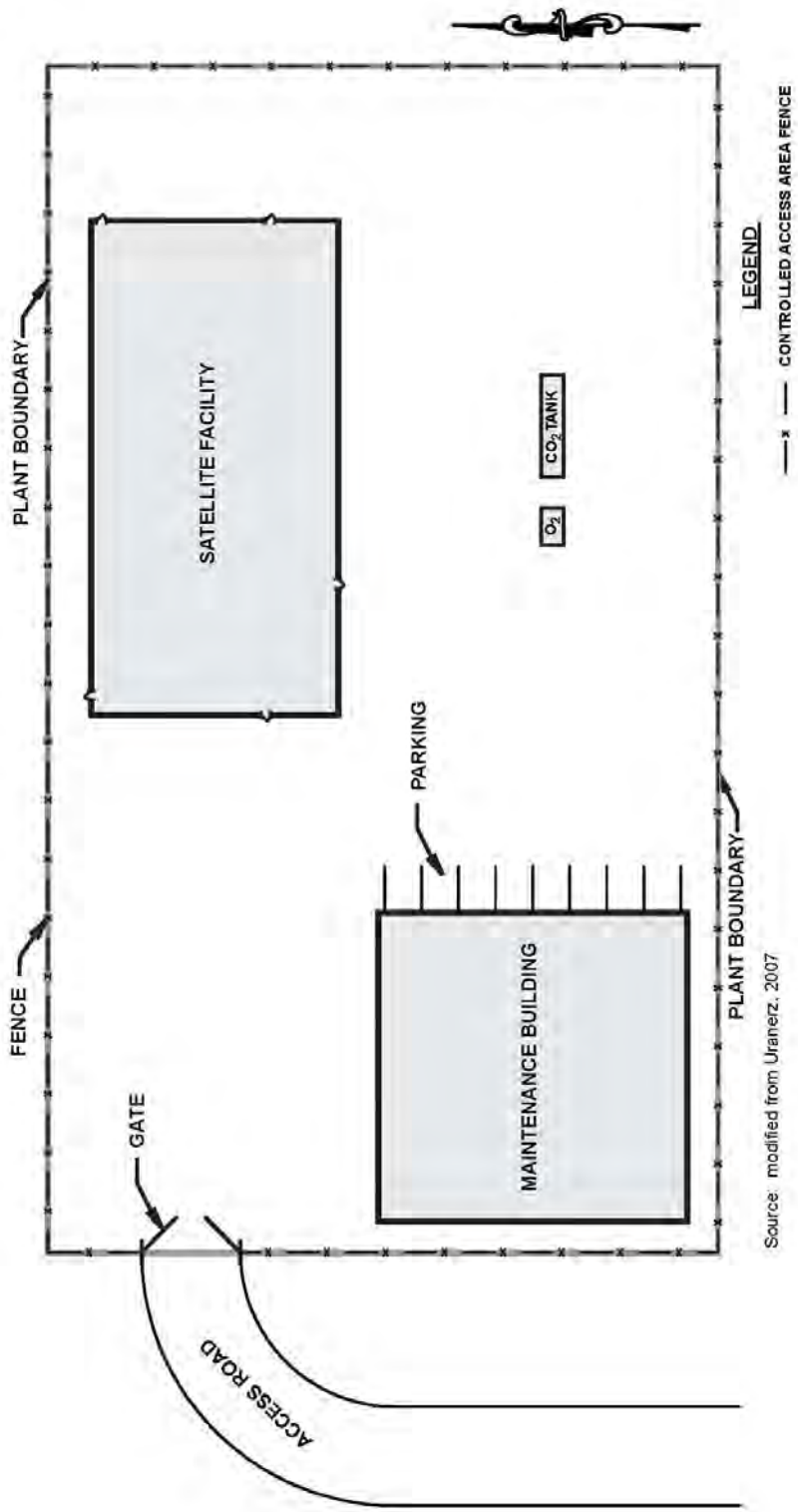

Figure 2-5. General Layout of the Hank Unit Buildings
Source: Modified from Uranerz (2007)

2.2.1.2.3 Access Roads

The primary method of transportation to and from the proposed Nichols Ranch ISR Project site is via highways and roadways. The site is accessible either via SR50 to Van Buggenum Road to T-Chair Livestock Company ranch roads or from SR387 north to T-Chair Livestock Company ranch roads (Figure 2-6). Van Buggenum Road is a crowned-and-ditched, county-maintained gravel road that ranges in width from 5.5 to 7.3 m [18 to 24 ft] and can accommodate two tractor-trailers passing one another. It has a posted speed limit of 72 kilometers per hour (kph) [45 miles per hour (mph)]. Ranch roads located on T-Chair Livestock Company property are also gravel crowned and ditched, ranging in width from 4.6 to 6.1 m [15 to 20 ft]. The roads were built by either the property owner or the coal bed methane (CBM) producers operating in the area and have been routinely improved by the latter. The ranch roads have a speed limit range of 32 to 48 kph [20 to 30 mph]. Numerous oil and gas and CBM companies active in the area use the county and ranch roads. While the proposed Nichols Ranch ISR Project would use existing roads to the extent possible, additional roads would need to be constructed. These roads fall into two categories: access roads to facilities within the Nichols Ranch and Hank Units and access roads to the wellfields. Two access roads would be constructed to connect the Nichols Ranch Unit central processing plant and the Hank Unit satellite facility with existing roads, as shown in Figures 2-2 and 2-3. Both access roads would be approximately 0.32 km [0.20 mi] in length, constructed using 7.7 cm [3.0 in] of scoria, conglomerate, or gravel for the road surface following BLM criteria for road-building material. One of the roads would run straight and easterly from the ranch road to the location of the proposed Nichols Ranch Unit central processing plant, and the other would extend in an easterly direction toward the flank of the North Middle Butte from an existing spur road that currently terminates at a pumpjack. The road widths would be similar to those of the T-Chair Livestock Company access roads, which range in width from 4.6 to 6.1 m [15 to 20 ft]. An approximate area of 0.15 to 0.20 ha [0.36 to 0.48 ac] would be disturbed to construct new access roads. Existing two-track roads and CBM roads would be used to the maximum extent possible before constructing new roads. All access roads would be constructed per landowner instructions and in accordance with U.S. Department of Transportation (USDOT) specifications for roads used by heavy equipment. During construction, the roads would be wetted to reduce dust emissions; ephemeral channels would be crossed at two locations on the Nichols Ranch Unit and at three locations on the Hank Unit (Uranerz, 2007).

2.2.1.2.4 Wellfields

Wellfields are located on the surface above the ore bodies and comprise the area that the applicant delineated for the installation of injection and production wells. The wellfields and associated disturbed area would cover approximately 46 ha [113 ac] at the Nichols Ranch Unit and approximately 63 ha [155 ac] at the Hank Unit. Both the Nichols Ranch and Hank Units would be divided into two production areas (or wellfields) as shown in Figures 2-7 and 2-8, respectively. The wellfields at each unit would be developed in sequence, moving from one area of the site to another. The Nichols Ranch Unit ore zone occurs at a depth of approximately 91 to 240 m [300 to 800 ft] below the surface in the A Sand aquifer. The Hank Unit ore zone occurs at a depth of approximately 45 to 180 m [150 to 600 ft] below the surface and in the F Sand aquifer. The ore zone at each unit is detailed in Section 3.4.1 of the SEIS. The applicant estimated the uranium (as U_3O_8) content to be 1,145,000 kg [2,521,000 lb] for the Nichols Ranch Unit and 841,100 kg [1,852,000 lb] for the Hank Unit. The average ore grade of the two units is above 0.1 percent (Uranerz, 2007).

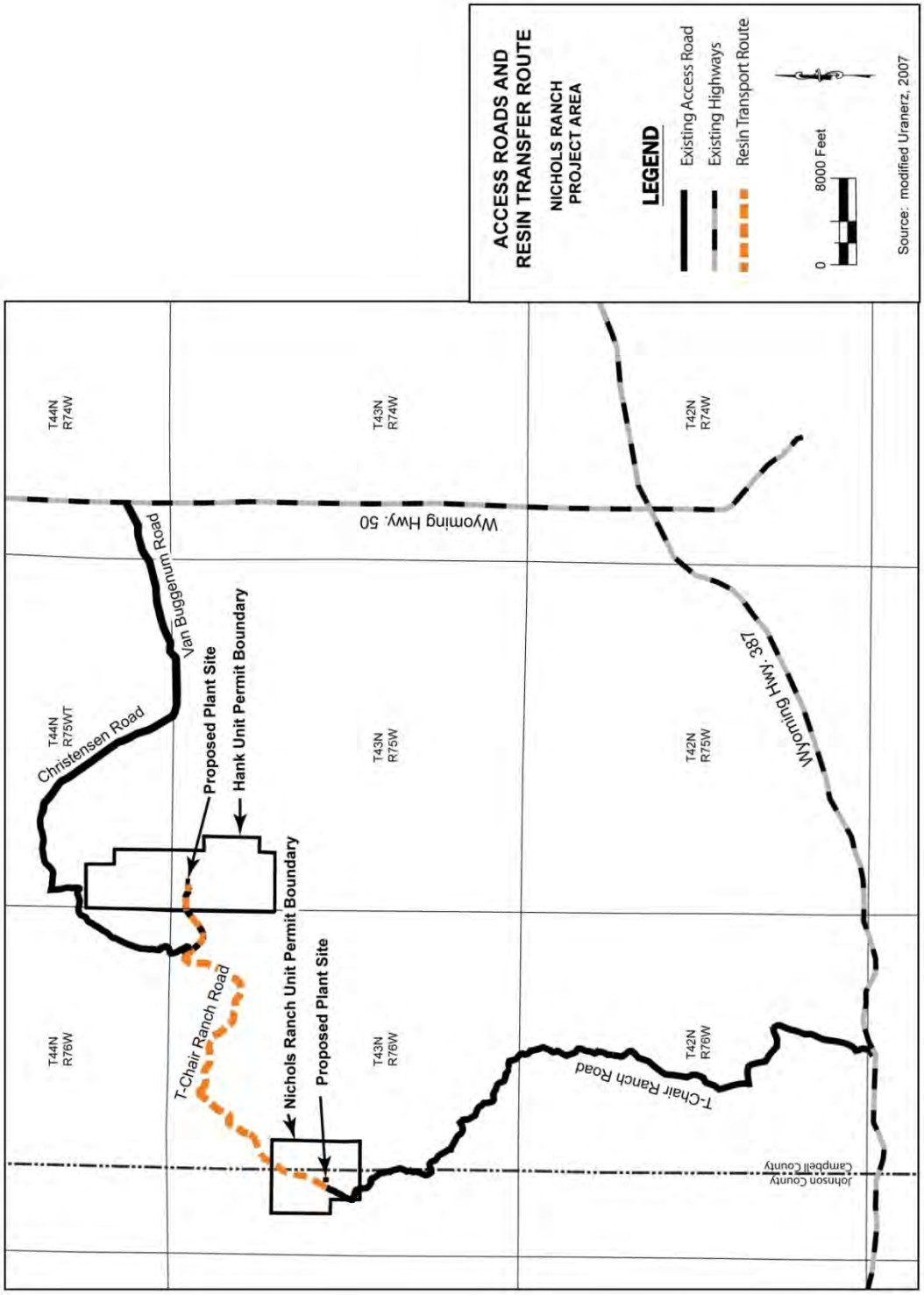

Figure 2-6. Access Roads for the Nichols Ranch ISR Project
Source: Modified from Uranerz (2007)

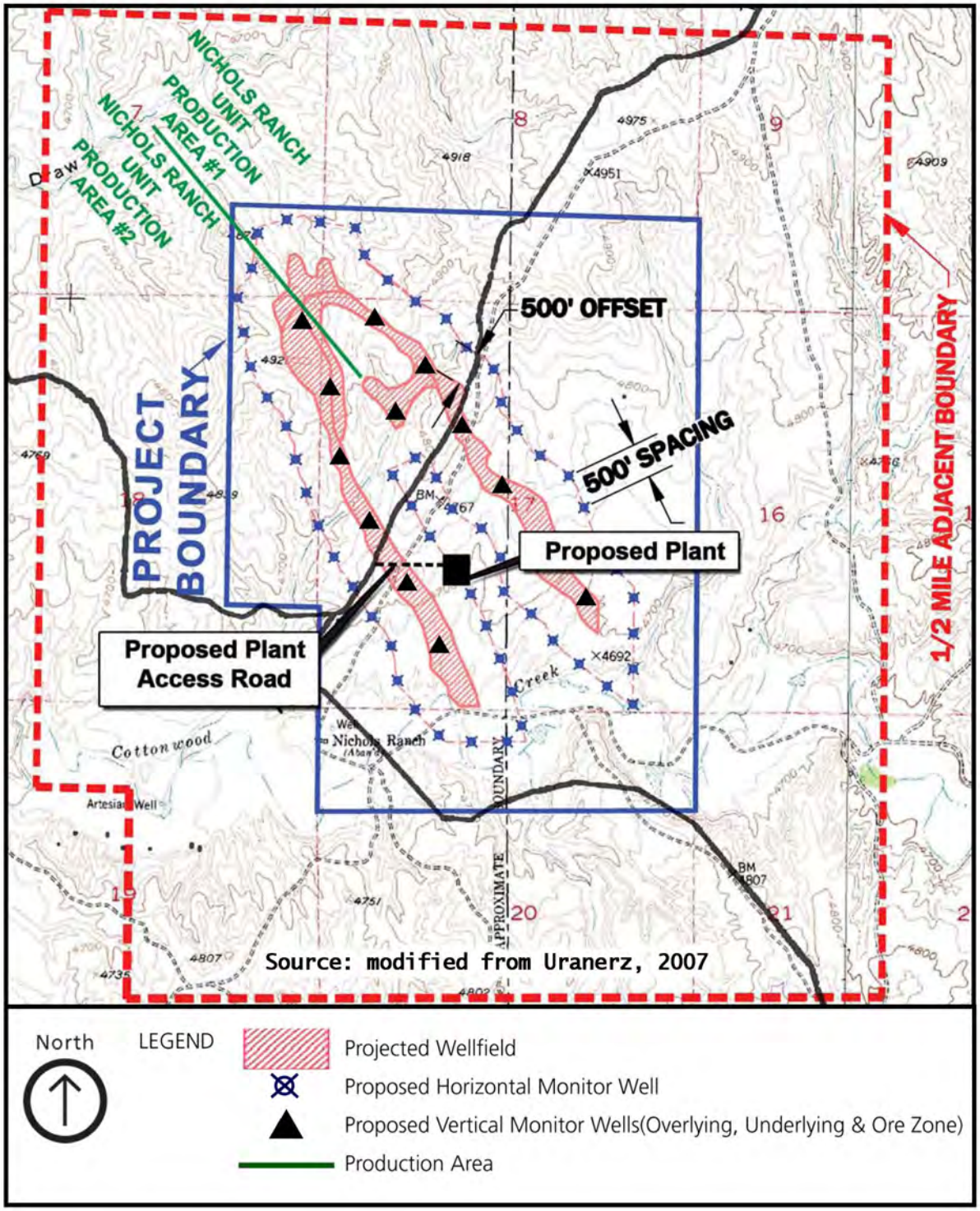

Figure 2-7. Nichols Ranch Unit Production Areas
Source: Modified from Uranerz (2007)

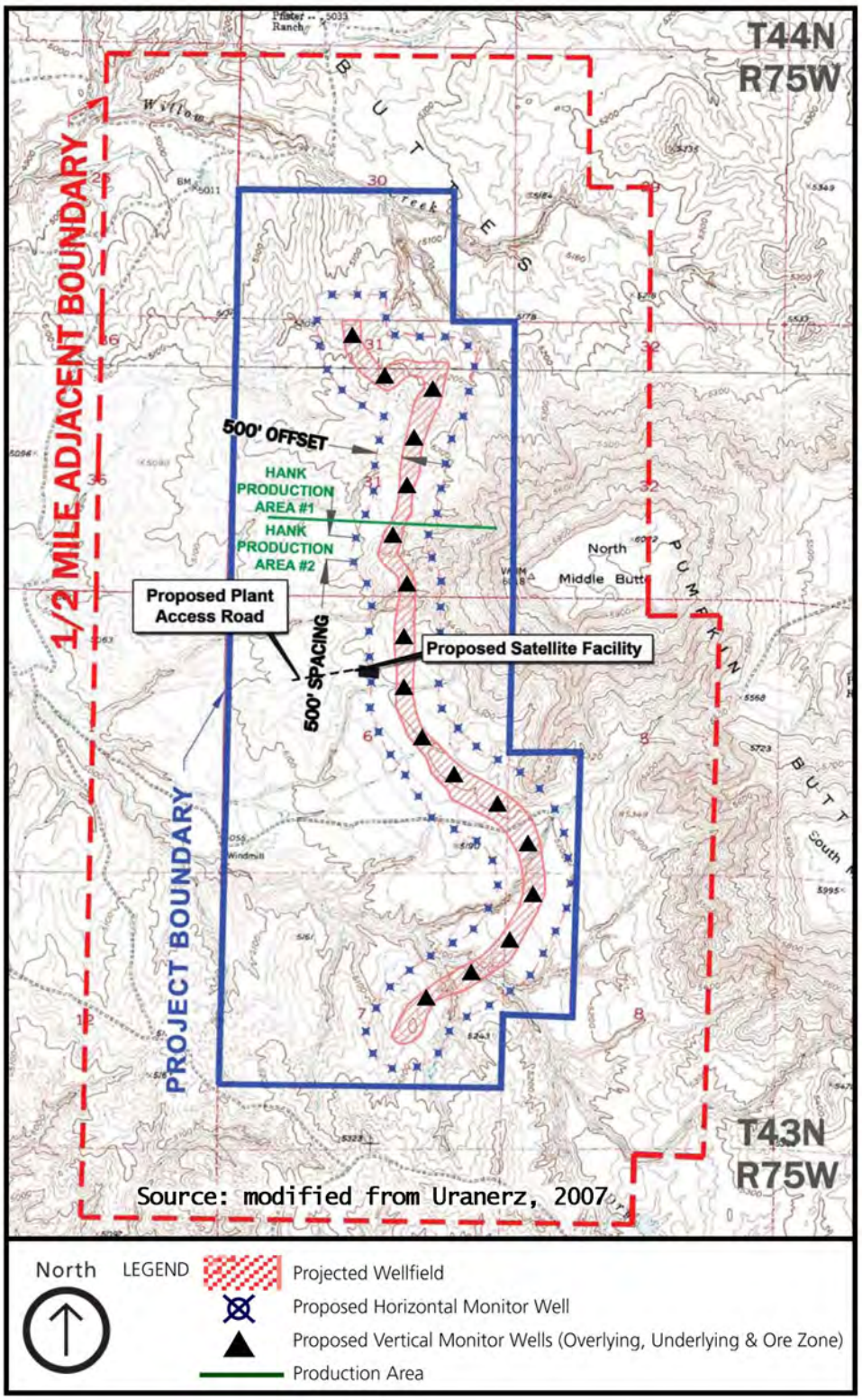

Figure 2-8. Hank Unit Production Areas
Source: Modified from Uranerz (2007)

2.2.1.2.4.1 Injection and Production Wells

The injection and production (or recovery) wells are used to inject the lixiviant and to recover pregnant lixiviant. GEIS Figure 2.3-1 shows a schematic diagram of a wellfield with typical injection/production well patterns, including five-spot and seven-spot patterns. In some cases, a line-drive pattern or staggered line-drive pattern may be utilized. The applicant plans to drill all wells so they could be used for either injection or recovery (Uranerz, 2007). By doing this, the applicant could change wellfield flow patterns as needed to improve uranium recovery and to more efficiently restore groundwater. Injection and recovery wells would be drilled using standard mud-rotary drilling techniques for deep-water wells. Within each wellfield, injection wells would be arranged near production wells in four-spot, five-spot, or seven-spot patterns. The injection and production wells would be completed in the ore zone intervals of the production sand (A Sand for the Nichols Ranch Unit, F Sand for the Hank Unit). The injection wells would be spaced between 15 and 46 m [50 and 150 ft] apart depending on the characteristics of the ore zone. Based on early delineation, the applicant estimates 490 injection and recovery wells would be drilled at the Nichols Ranch Unit production area #1 and 400 injection and recovery wells would be drilled at the Hank Unit production area #1. The applicant would conduct additional investigations to determine the number of injection and recovery wells needed for the second production areas located at the Nichols Ranch Unit and the Hank Unit.

The actual number and location of header houses would depend on the well placement. The applicant would construct well header houses, also located in the wellfields, to house the manifolds that connect to the individual injection and production wells. The header house would have approximate dimensions of 12 × 6 m [40 × 20 ft] constructed on a 15-cm [6-in] concrete pad floor. Based on early delineation, the applicant estimated nine header houses would be located at the Nichols Ranch Unit production area #1 and seven header houses would be located at the Hank Unit production area #1. The applicant would conduct additional delineation to determine the number of header houses needed for the second production areas located at both the Nichols Ranch Unit and the Hank Unit (Uranerz, 2007).

WDEQ-administered underground injection control (UIC) program regulates the design, construction, testing, and operation of injection wells. The WDEQ has primary regulatory authority for such actions as delegated by the U.S. Environmental Protection Agency (EPA). Injection wells for extraction are classified under UIC as Class III wells. The proposed operation would therefore require a UIC permit from WDEQ to use Class III injection wells. Before ISR operations could begin, the portion of the aquifer designated for uranium recovery must be exempted as an underground source of drinking water (USDW) in accordance with the Safe Drinking Water Act (SDWA) under 40 CFR Part 146. Aquifer exemptions must be approved by the EPA.

2.2.1.2.4.2 Monitoring Wells

Horizontal and vertical excursion monitoring wells would be installed at each wellfield as dictated by the underlying geologic and hydrogeologic conditions. The proposed well locations may be adjusted as the project progresses, as the geometry of the ore body becomes better understood, and as needed for variation in surface topography. The applicant would consider both the geometry of the ore body and surface topography to determine the appropriate wellfield pattern and monitoring well locations. The horizontal monitoring wells screened in the production zone would be located in a ring around the wellfields, at an approximate spacing of 150 m [500 ft] between monitoring wells. Vertical monitoring wells for underlying and overlying

aquifers would be spaced at a density of one well for every 1.6 ha [4 ac] of wellfield area (Uranerz, 2007). Figures 2-7 and 2-8 show the proposed monitoring well locations for the Nichols Ranch and Hank Units, respectively, and the approximate distance between the monitoring wells located around the perimeter of the wellfields.

2.2.1.2.4.3 Well Construction and Testing

GEIS Section 2.3.1.1 describes well drilling techniques (NRC, 2009). The applicant has proposed to use standard mud rotary drilling techniques to drill production, injection, and monitoring wells at the proposed Nichols Ranch ISR Project. The well casing for injection, production, and monitoring wells at both units would be constructed of plastic polyvinyl chloride (PVC) with centralizers to ensure the casing is centered in the borehole. The annular space between the well casing and the geologic formations would be grouted to ground surface with cement slurry and sand-cement grout to prevent vertical migration of fluids. After the well is cemented, the applicant proposes to underream the well through the mineralized zone and complete it either as an open hole or fit it with a slotted liner or screen assembly. Figures 2-9 and 2-10 are schematics of a typical injection/recovery well and of a monitoring well construction design that the applicant indicates could be used at the proposed Nichols Ranch ISR Project (Uranerz, 2007).

The applicant would perform a mechanical integrity test (MIT) at each well before operation (Uranerz, 2007). As described in GEIS Section 2.3.1.1, an MIT verifies that the well casing is not leaking, which could result in water loss during injection or recovery operations. The bottom and top of the casing are plugged (sealed) with a sealing device during an MIT, and the well is pressurized. Pressure gauges monitor pressure changes inside the casing. If a well fails the MIT and the casing cannot be repaired after several attempts, the well would be plugged and abandoned. MIT results are maintained onsite and would be available for NRC and WDEQ inspection. MIT results are also reported to the WDEQ on a quarterly basis.

During wellfield construction, drilling activities would include mudpit construction. During the mudpit excavation, the applicant would first remove topsoil and place it in a separate location. The subsoil would then be removed and deposited next to the mud pit. After mud pit use was complete (usually within 30 days of initial excavation), the applicant would redeposit the subsoil in the mud pit covered by topsoil. The mudpits would be temporarily fenced to prevent entrance by livestock/wildlife. The fencing would be constructed in accordance with the WDEQ rules and regulations concerning drilling located in the Wyoming Environmental Quality Act §35-11-406. The applicant would use the same technique for pipeline ditch construction (Uranerz, 2007).

2.2.1.2.4.4 Pipelines

The applicant proposes to use HDPE, PVC, and/or stainless steel piping for the wellfield distribution pipelines that would run between the ion-exchange facilities, header houses, and individual well lines. The majority of distribution lines would be buried to prevent freezing during winter months. All piping would be designed for an operating pressure of 150 pounds per square inch gauge (psig) and tested for mechanical integrity before use. Piping would be equipped with automatic valves for flow control. Main trunk lines would have electronic pressure gauges to monitor control room information. Based on early delineation, the applicant estimates 4,210 m [13,800 ft] of piping would be needed for the Nichols Ranch Unit production area #1 and 4,000 m [13,000 ft] of piping would be needed for the Hank Unit production area #1 (Uranerz, 2007).

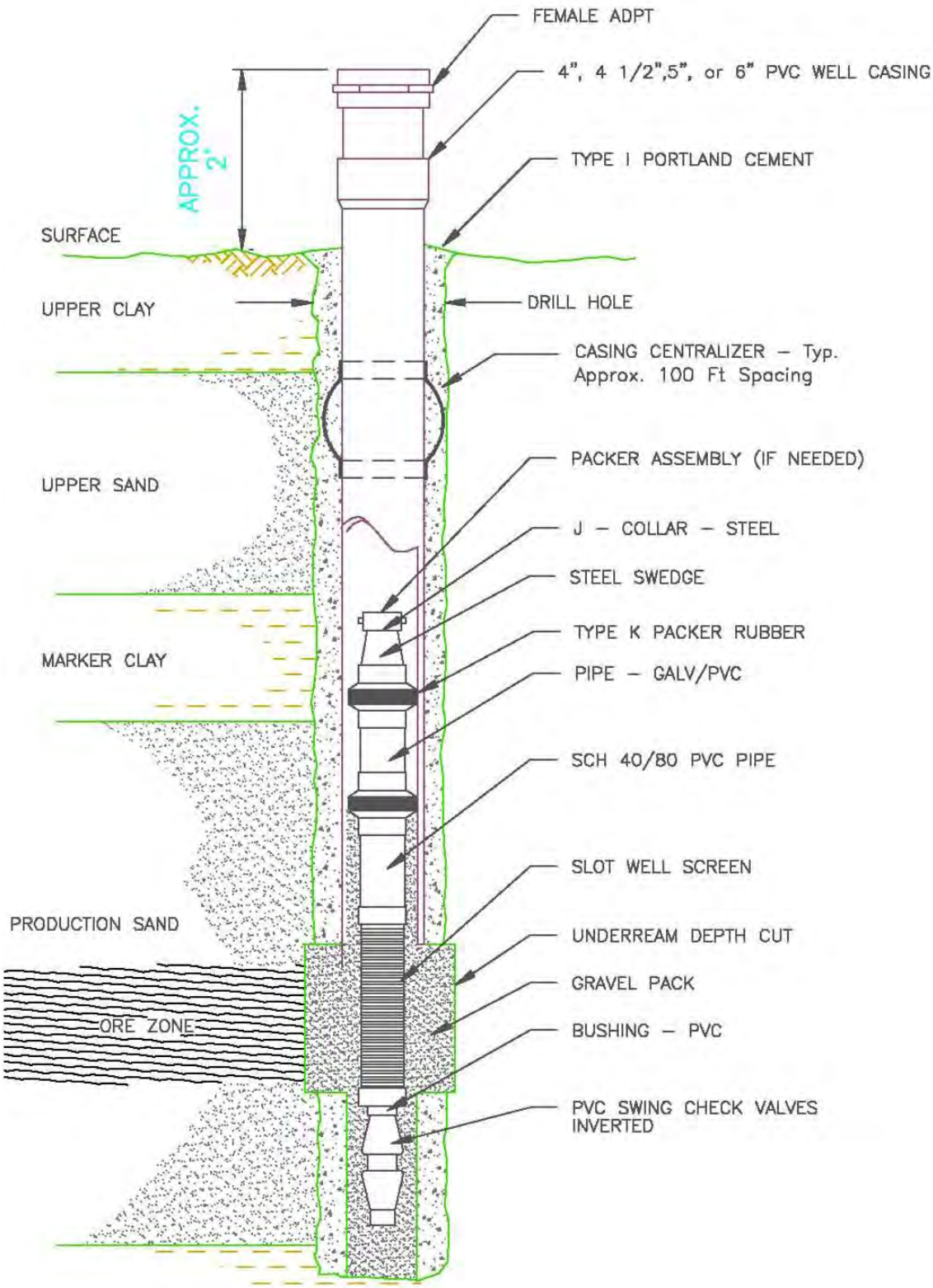

Figure 2-9. Typical Injection/Recovery Well Design
Source: Uranerz (2007)

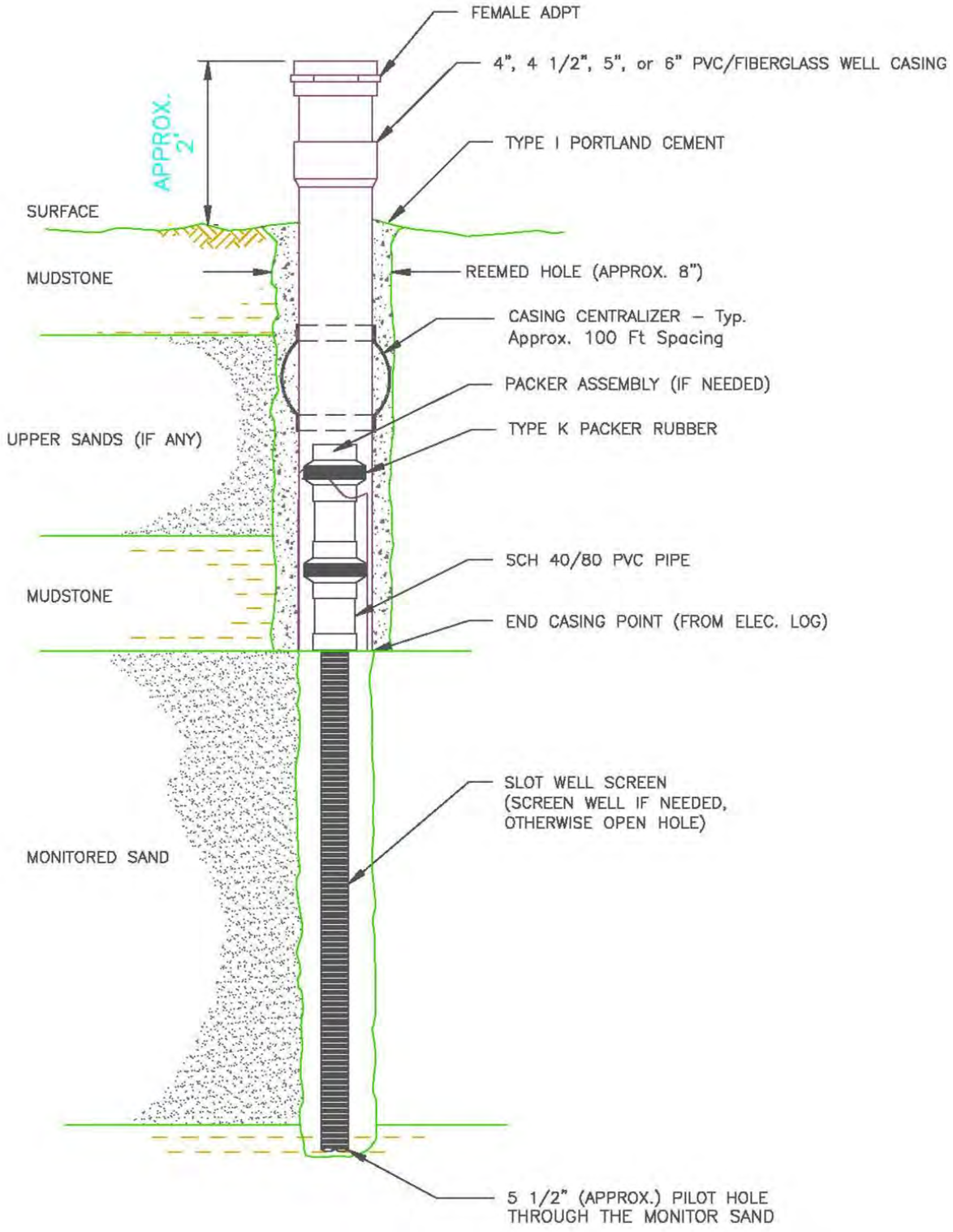

Figure 2-10. Typical Monitoring Well Design
Source: Uranerz (2007)

2.2.1.2.5 Other Structures and Systems

The applicant plans to dispose of liquid effluent generated during uranium recovery operations via Class I UIC disposal wells. Up to four deep disposal wells would be located at the Nichols Ranch Unit, and up to an additional four would be located at the Hank Unit (Uranerz, 2007). Uranerz has submitted an application to obtain UIC Class I permits for the construction and use of the Class I disposal wells from the WDEQ-Water Quality Division, which has EPA-authorized permitting authority. The application states that fluid would be injected in the Cretaceous Teckla, Teapot, and Parkman sandstones at depths of approximately 2,326 to 2,652 m [7,630 to 8,700 ft] below ground surface at the Nichols Ranch Unit and depths of approximately 2,360 to 2,652 m [7,740 to 8,700 ft] below ground surface at the Hank Unit. The application also states that the average daily injection rate would not exceed a total of 568 Lpm [150 gpm] for the Nichols Ranch Unit disposal well(s). The same average daily injection total rate of 568 Lpm [150 gpm] applies for the Hank Unit disposal well(s) (Uranerz, 2010a).

Sanitary wastes from the lunchroom and restrooms would flow to septic leach fields located at both the Nichols Ranch and Hank Units. The applicant stated the septic systems would be designed to accommodate 55 employees at each unit; the septic system for the Nichols Ranch Unit would be south of the central processing plant and the septic system for the Hank Unit would be located north of the satellite facility. The applicant would obtain a permit to construct the onsite septic systems from the respective county in which the unit was located (Uranerz, 2007).

The applicant would fence certain areas during construction. An area of approximately 12 to 16 ha [30 to 40 ac] would be fenced to grazing over the life of the proposed Nichols Ranch ISR Project. The applicant would fence wellfields during construction with a typical three-strand livestock fence to prevent livestock from entering the wellfield. Both the Nichols Ranch Unit central processing plant and auxiliary facilities and the Hank Unit satellite facility and auxiliary facilities would also be fenced with a chain link fence at least 1.8 m [6 ft] in height (Uranerz, 2007).

2.2.1.2.6 Construction Workers and Equipment

Earthmoving equipment such as rubber tire scrapers and front-end loaders would be used during construction. Passenger vehicles transporting workers and tractor trailers would also be used during construction, as discussed in Section 2.2.1.7 of the SEIS. As discussed in Section 4.11, the applicant estimated approximately 45 to 55 workers would be needed to support the construction phase (Uranerz, 2007).

2.2.1.2.7 Schedule

As shown in Figure 2-1, the applicant estimated that wellfield and building construction would take approximately 9 months to 1 year (Uranerz, 2007). The construction of the production area #1 wellfields at the Nichols Ranch Unit would overlap the construction of the production area #1 wellfields at the Hank Unit. The construction of production area #2 wellfields at the Nichols Ranch Unit and of production area #2 wellfields at the Hank Unit would overlap the operations phase of both the Nichols Ranch Unit and Hank Unit production area #1 wellfields.

2.2.1.3 Operation Activities

As discussed in GEIS Section 2.4, the ISR process involves two primary operations. First, uranium mobilization occurs in underground aquifers when barren lixiviant is injected into the ore body and uranium-laden solutions are recovered. Second, the uranium-laden solutions (referred to as pregnant lixiviant) would be pumped from the production wells to ion-exchange systems within surface facilities to recover the uranium and prepare it for shipment (NRC, 2009). The applicant proposed to conduct operations at the proposed Nichols Ranch ISR Project consistent with those activities described in the GEIS. The following sections describe the proposed operations at the proposed Nichols Ranch ISR Project.

2.2.1.3.1 Uranium Mobilization

Uranium mobilization at the proposed Nichols Ranch ISR Project would consist of the following steps: (i) injection of barren lixiviant into the production zone, (ii) oxidation and complexation of the uranium underground, (iii) extraction or production of the pregnant lixiviant from the subsurface, and (iv) excursion monitoring. Figure 2-11 is a generalized flow diagram that illustrates the proposed ISR process at the Nichols Ranch ISR Project.

2.2.1.3.1.1 Lixiviant Chemistry

The selected lixiviant must leach uranium from the host rock and keep it in solution during groundwater pumping from the host aquifer. The composition of the lixiviant is designed to reverse the natural geochemical conditions that led to the original deposition. At the proposed Nichols Ranch ISR Project, the applicant would use a lixiviant composed of native groundwater fortified with oxygen or hydrogen peroxide and sodium bicarbonate as a complexing agent (Uranerz, 2007). The lixiviant would oxidize the uranium to form a uranium-bearing solution of uranyl carbonate complexes. GEIS Table 2.4-1 summarizes typical lixiviant chemistry (NRC, 2009). As noted in GEIS Section 2.4.1.1, the principal geochemical reactions the lixiviant causes are the oxidation and subsequent dissolution of uranium and other metals from the ore body and its subsequent extraction (NRC, 2009).

2.2.1.3.1.2 Lixiviant Injection and Recovery

At the proposed Nichols Ranch ISR Project, the applicant would pump lixiviant into the ore body via injection wells; the solution would oxidize and dissolve uranium from the formation, which would be recovered via production wells. The applicant estimated the production rates would range from approximately 3,800 to 13,300 Lpm [1,000 to 3,500 gpm] at the Nichols Ranch Unit and from 3,800 to 9,500 Lpm [1,000 to 2,500 gpm] at the Hank Unit. The uranium-enriched pregnant solution would be pumped from production wells to either the Nichols Ranch Unit central processing plant or to the Hank Unit satellite facility for uranium extraction by ion exchange. The resulting barren lixiviant would then be chemically refortified with carbonate/bicarbonate and an oxidant and reinjected into the wellfield to repeat the extraction cycle (Uranerz, 2007).

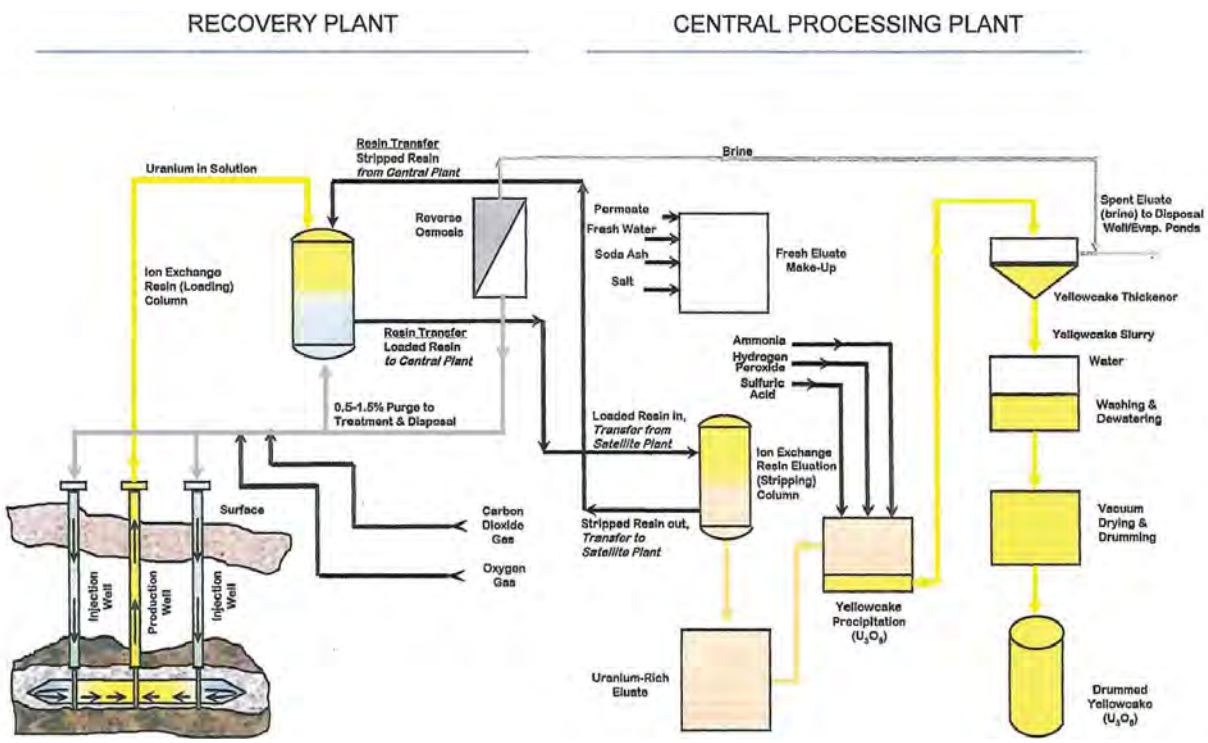

Figure 2-11. General Flow Schematic for the ISR Process
Source: Uranerz (2007)

As described in GEIS Section 2.4.3, the production wells at an ISR facility would extract slightly more water than is reinjected into the host aquifer to create a net inward flow of groundwater into the wellfield. This excess water, referred to as production bleed, would be byproduct material that must be properly managed (NRC, 2009). The production bleed would be withdrawn as a small portion of the barren solution from the ion-exchange circuit and then disposed of via the deep disposal wells at both the Nichols Ranch and Hank Units. Production bleed is detailed in SEIS Section 2.2.1.3.2.

2.2.1.3.1.3 Excursion Monitoring

GEIS Section 2.4.1.4 describes how ISR operations can potentially affect the groundwater quality near a site if lixiviant moves from the production zone away from the injection wells, resulting in either a vertical or lateral excursion (NRC, 2009). Excursions can be caused by improper water balance between injection and recovery rates, preferential flow paths through undetected high permeability strata or geological faults, improperly plugged and abandoned exploration boreholes, discontinuity within the confining layers, poor well integrity, or hydrofracturing of the ore zone or surrounding units (NRC, 2009). NRC regulations at 10 CFR Part 40, Appendix A, Criterion 7, require ISR licensees to have an operational monitoring program to detect excursions.

NRC guidance defines an excursion as occurring when two or more excursion indicators in a monitoring well exceed their upper control limits (UCLs). NRC license conditions require that licensees conduct biweekly sampling to detect excursions. If an excursion is detected, the licensee notifies the NRC and takes several steps to confirm the excursion through additional

Table 2-1. Comparison of Different Liquid Wastewater Disposal Options

	Class I Injection Well	Class V Injection Well	Evaporation Ponds Land	Application	Discharge to Surface Waters
Land Size/ Footprint	0.1 ha [0.25 ac]	0.1 ha [0.25 ac] Potential additional land area required for radium-settling basins 0.1 to 1.6 ha [0.25 to 4 ac] and purge reservoirs 4 ha [10 ac] or more]	Individual pond: 0.4 to 2.5 ha [1 to 6.25 ac], max 16.2 ha [40 ac] Pond System: about 40 ha [100 ac]	40 ha [100 ac] Potential additional land area required for radium-settling basins 0.1 to 1.6 ha [0.25 to 4 ac] and purge reservoirs 4 ha [10 ac] or more	0.1 ha [0.25 ac], depending on outfall Potential additional land area required for radium-settling basins 0.1 to 1.6 ha [0.25 to 4 ac] and purge reservoirs 4 ha [10 ac] or more] Potential separate storage facilities (impoundments, tanks) to maintain separate waste streams
Relevant Regulations and Permits	10 CFR Part 20, Subparts D, K UIC Class I permit (WDEQ)	10 CFR Part 20, Subparts D, K, Appendix B UIC Class V permit (WDEQ) WYPDES permit (WDEQ)	10 CFR Part 40, Appendix A Wyoming State Engineer's Office NESHAP permit (40 CFR Part 61, Subpart W) Contract for byproduct material disposal (liners, sludges)	10 CFR Part 20, Subparts D, K, Appendix B 10 CFR Part 40, Appendix A, Criterion 6(6) Zero release WYPDES permit (WDEQ) NESHAP permit (40 CFR Part 61)	10 CFR Part 20, Subparts D, K, Appendix B Zero-release WYPDES permit (WDEQ) NESHAP permit (40 CFR Part 61) Zero release WYDES permit (40 CFR Part 440, Subpart C)

Table 2-1. Comparison of Different Liquid Wastewater Disposal Options (continued)

	Class I Injection Well	Class V Injection Well	Evaporation Ponds	Land Application	Discharge to Surface Waters
Construction Requirements	Land clearing and excavation equipment for pad, mud pits Drilling rig	Land clearing and excavation equipment for pad, mud pits, radium-settling basins, treatment facilities Drilling rig	Land clearing and excavation equipment to prepare surface for pond(s) Construction equipment to construct pond liner(s)	Land clearing and excavation equipment for roads, radium settling basins, treatment facilities	Land clearing and excavation equipment for roads, radium-settling basins, treatment facilities
Is wastewater storage required prior to disposal?	Ten 64,350 L [17,000 gal] surge tanks	Storage/surge tank(s) Radium settling basins, treatment facility if needed to reduce Ra, U, and other contaminant concentrations		Storage/surge tanks Radium-settling basins, treatment facility if needed to reduce Ra, U, and other contaminant concentrations	Yes. Applicant may elect to maintain separate "process" and "mine" wastewater streams Radium-settling basins, treatment facility if needed to reduce Ra, U, and other contaminant concentrations
Wastewater Treatment Issues	No additional treatment, but may add antifouling agent to reduce scaling in well	Decontamination through ion exchange (IX)/reverse osmosis (RO). Additional treatment to injection zone class of use/primary drinking water, whichever more stringent. May add antifouling agent to reduce scaling in well	Decontamination through IX/RO. No additional treatment	Decontamination through IX/RO. Radium-settling basins, treatment facility if needed to reduce Ra, U, and other contaminant concentrations	Decontamination through IX/RO. Additional treatment class of use/primary drinking water, whichever more stringent

Table 2-1. Comparison of Different Liquid Wastewater Disposal Options (continued)

	Class I Injection Well	Class V Injection Well	Evaporation Ponds Land	Application	Discharge to Surface Waters
Decommissioning Issues	Plug and abandon well in accordance with WDEQ requirements	Radium-settling basin liners and sludges, treatment building debris to be disposed as byproduct material, additional transportation of wastes to licensed disposal facility Plug and abandon well in accordance with WDEQ requirements	Pond liners and sludges to be disposed as byproduct material, additional transportation of wastes to licensed disposal facility	Radium-settling basin liners and sludges, treatment building debris to be disposed as byproduct material, additional transportation of wastes to licensed disposal facility Application soils to be disposed as byproduct material if limits exceeded Additional transportation of wastes to licensed disposal facility	Radium-settling basin liners and sludges, treatment building debris to be disposed as byproduct material, additional transportation of wastes to licensed disposal facility
Environmental Benefits	Isolation from accessible environment. Low exposure to individuals at surface Smallest footprint, no additional decommissioning wastes No added transportation impacts for wastes No additional waste streams created Minimal and temporary visual impacts from drilling	Wastewater treated to drinking water standards	Wa	stewater treatment to reduce uranium, radium, and other constituents Limited construction needed for land application area	Wastewater treated to drinking water standards

Table 2-1. Comparison of Different Liquid Wastewater Disposal Options (continued)

	Class I Injection Well	**Class V Injection Well**	**Evaporation Ponds**	**Land Application**	**Discharge to Surface Waters**
Climatic Influences	Deeper drilling requires longer rig time, higher diesel emissions (approximately 20 X typical production well)	Deeper drilling requires longer rig time, higher diesel emissions (approximately 20 X typical production well) Additional equipment needed to construct wastewater storage and treatment facilities	Additional equipment needed to construct evaporation ponds	Additional equipment needed to construct wastewater storage and treatment facilities	Additional equipment needed to construct wastewater storage and treatment facilities
Health & Safety Issues	Potential pipeline leaks	Potential leaks from wastewater storage and treatment facilities Additional waste volume during decommissioning	Potential leaks from evaporation ponds Additional waste volume during decommissioning	Potential leaks from wastewater storage and treatment facilities Additional waste volume during decommissioning	Potential leaks from wastewater storage and treatment facilities Additional waste volume during decommissioning

sampling. As described in NRC guidance (Section 5.7.8.3), licensees typically retrieve horizontal excursions by adjusting the flow rates of the nearby injection and production wells to increase process bleed in the excursion area. If an excursion is suspected in a groundwater monitoring well, the licensee is required to notify WDEQ and NRC within 24 hours, confirm the excursion and the well on excursion is required to be monitored every 7 days until concentrations of excursion indicators are at or below the respective UCLs. The licensee is required to provide a report to NRC within 60 days, describing the excursion, the corrective actions taken and the results. If an excursion cannot be corrected in 60 days, the licensee may be required to stop lixiviant injection or increase the surety to cover the costs of cleanup of the excursion (NRC, 2003a).

The applicant proposed an operational groundwater monitoring program to detect and correct conditions that could result in an excursion affecting groundwater quality near the wellfields (Uranerz, 2007). The operational groundwater monitoring program would (i) monitor both flow rates and the operating pressure of wells (injection, production, and monitoring) and the main pipelines connecting to the central processing plant and satellite facility and (ii) monitor well sampling. During the safety review, NRC staff identified issues that could only be resolved after wellfield testing was completed. The applicant will be required by license condition to provide for NRC staff review and approval the Product Area Pump Test reports used to determine the placement of overlying, underlying, and perimeter monitoring wells for both the Nichols Ranch and Hank Units to verify monitoring well placement and the ability of the monitoring wells to detect potential excursions. The proposed monitoring program is detailed in Chapter 6 of the SEIS.

2.2.1.3.1.4 Uranium Processing

Figure 2-11 is a general flow schematic for the ISR process (Uranerz, 2007). At the proposed Nichols Ranch ISR Project, uranium would be recovered from the pregnant lixiviant and processed as yellowcake in a multistep process. Those steps include (i) loading uranium onto ion-exchange resin; (ii) eluting (stripping) uranium from the resin; and (iii) precipitating, drying, and packaging of uranium (Uranerz, 2007). This process is described in the following subsections.

2.2.1.3.1.5 Ion Exchange

At the proposed Nichols Ranch ISR Project, the pregnant lixiviant would be pumped from the wellfields to the ion-exchange systems located at either the central processing plant at the Nichols Ranch Unit or at the Hank Unit satellite facility to extract uranium. The proposed ion-exchange system for the Nichols Ranch ISR Project consists of a series of downflow ion-exchange columns. The applicant estimated approximately six ion-exchange columns would be located at the Nichols Ranch Unit and four ion exchange columns would be located at the Hank Unit. Uranium ranging in concentration from 20 to 250 mg/L [20 to 250 ppm] would be absorbed by ion exchange onto resin beads. As the ion-exchange column resins became saturated with uranium, the column would be taken offline for the elution circuit, discussed in the next section. The applicant estimated production ion-exchange flow rates of up to 13,300 Lpm [3,500 gpm] at the Nichols Ranch Unit and up to 9,500 Lpm [2,500 gpm] for the ion-exchange system at the Hank Unit. After the lixiviant has been pumped through the ion-exchange systems, the resulting barren lixiviant would then be chemically refortified with carbonate/bicarbonate and an oxidant and reinjected into the wellfield to repeat the leaching cycle (Uranerz, 2007).

2.2.1.3.1.6 Elution

GEIS Section 2.4.2.2 describes the elution circuit at ISR facilities (NRC, 2009). The Nichols Ranch Unit central processing plant would be designed to accept and elute (strip) uranium from the ion-exchange resins. Resins would either originate from the Nichols Ranch Unit or the Hank Unit satellite facility. Trucks would be used to transfer uranium-loaded resin from the Hank Unit satellite facility to the central processing plant at the Nichols Ranch Unit. These specially designed tanker trailers could each hold approximately 14 m^3 [500 ft^3] of loaded resin. The resin would flow via gravity into a dedicated elution vessel, which may include uranium-loaded resin from the Nichols Ranch Unit ion-exchange system. Based on the estimated yearly production rate at the Hank Unit, resin truck shipments from the Hank Unit to the Nichols Ranch Unit would occur approximately once every 2 to 3 days (Uranerz, 2007).

Uranium would be released from the loaded ion-exchange resin in the dedicated elution vessel (tank) in the elution circuit by applying either an aqueous solution or brine composed of salt and sodium carbonate or sodium bicarbonate. The resulting pregnant eluant would contain approximately 20 to 40 g/L [20 to 40 oz/gal] of uranium. Final precipitation and drying occurs in the final circuit to produce yellowcake as shown in Figure 2-11 (Uranerz, 2007).

2.2.1.3.1.7 Precipitation, Drying, and Packaging

GEIS Section 2.4.2.3 describes precipitation, drying, and packaging at ISR facilities (NRC, 2009). During precipitation and drying at the central processing plant, the pregnant eluant would be treated with hydrochloric acid to lower the pH and to break the dissolved uranium complex. Hydrogen peroxide would be used to precipitate the uranium. Either sodium hydroxide or ammonia could also be added to adjust the pH and precipitate uranium yellowcake slurry. Following settling, the precipitated yellowcake slurry would be filtered to remove excess liquid, flushed with fresh water to remove dissolved chlorides, and then dried in a vacuum to reduce the moisture content, reducing the formation of water soluble uranium oxides and other compounds and minimizing the potential for releases. The dryer would operate at a temperature range of approximately 74 to 88 °C [165 to 190 °F]. The dryer design would be similar to that used at the Power Resources, Inc. Smith-Highland facility located approximately 72 km [45 mi] southeast of the proposed Nichols Ranch ISR Project (Uranerz, 2010).

After drying, the yellowcake would be packaged in approved 205-L [55-gal] drums and trucked offsite to a licensed uranium conversion facility located in Metropolis, Illinois, approximately 1,900 km [1,200 mi] away. The applicant would transport the yellowcake to Metropolis via SR387 east to Wright, SR59 south to Douglas, Interstate (I)-25 south to Cheyenne, I-80 east to I-29, I-29 south to Kansas City, I-70 east to I-64 south, I-64 south to I-57 south, and then I-57 south to I-24 east to Metropolis. Packaging and transporting of yellowcake would be completed in compliance with NRC and USDOT regulations (Uranerz, 2007).

The applicant projects an initial production rate of 230,000 kg [500,000 lb] of yellowcake per year from the Nichols Ranch Unit and 140,000 kg [300,000 lb] of yellowcake per year from the Hank Unit (Uranerz, 2007). The project will be license to produce up to 907,100 kg [2 million lb] per year of yellowcake.

2.2.1.3.2 Management of Production Bleed and Other Liquid Effluents

As stated in GEIS Section 2.4.3, uranium mobilization would produce excess water that must be properly managed (NRC, 2009). The production wells at an ISR facility would extract slightly

more water than is reinjected into the host aquifer to create a net inward flow of groundwater into the wellfield. This excess water, referred to as production bleed, is considered byproduct material that must be properly managed.

The applicant has proposed to dispose of the production bleed via deep well injection at both the Nichols Ranch and Hank Units. The applicant would obtain a UIC permit for Class I injection wells from WDEQ, which EPA has authorized to implement the UIC program. The deep disposal wells would be located near the central processing plant and satellite facility and would be constructed similarly to the design of other permitted injection wells at other active ISR sites and drilled to comparable depths. The applicant's projected production bleed at the Nichols Ranch Unit would be approximately 1 percent of the production flow rate or 150 Lpm [40 gpm], and the production bleed for the Hank Unit would be approximately 3 percent of the production flow rate or 280 Lpm [75 gpm] (Uranerz, 2007).

Other liquid effluents produced as part of the proposed Nichols Ranch ISR Project would include liquids from process drains, well-development water, pump test water, elution circuit bleed, and washdown water. The applicant estimated the maximum flow rate of these other liquid effluents as 3.8 to 7.6 Lpm [1 to 2 gpm]. The applicant estimated a maximum flow rate of 83 to 340 Lpm [22 to 90 gpm] from groundwater restoration. These liquid effluents would also be disposed of via Class I injection wells (Uranerz, 2007).

2.2.1.3.3 Schedule

The applicant estimated the wellfields at each production area in each unit would operate from 1.25 to 2.5 years (Uranerz, 2007) with some overlap between wellfield operations at the Nichols Ranch and Hank Units. Because the timeframe for development of each wellfield is staggered, the construction of the second production area would overlap the restoration of the first production area, as shown in Figure 2-1. The applicant estimated approximately 45 to 55 workers would be needed during the operations phase comparable to that during the construction phase (Uranerz, 2007).

2.2.1.4 Aquifer Restoration Activities

Aquifer restoration within the wellfield ensures that the water quality and groundwater use in surrounding aquifers would not be adversely affected by the uranium recovery operation, as discussed in GEIS Section 2.5 (NRC, 2009). After the uranium is recovered, the production aquifer contains constituents that were mobilized by the lixiviant. Groundwater monitoring for selected constituents throughout the life of the project is discussed in Section 6.3.1.2 of the SEIS. In compliance with 10 CFR Part 40, Appendix A, Criterion 5B(5), groundwater quality in the exempted ore-bearing aquifer is required to be restored to (i) Commission-approved baseline; (ii) MCLs listed in Table 5C, if the constituent is listed in Table 5C and if the baseline level of the constituent is below the value listed; or (iii) alternate concentration limits (ACLs) the Commission established, if the constituent baseline level and the values listed in Table 5C are not reasonably achievable. The ACL development is described in Appendix C of the SEIS. These standards are implemented during aquifer restoration to ensure public health and safety. The applicant is required to provide financial sureties to cover planned and delayed restoration costs in accordance with 10 CFR Part 40, Appendix A, Criterion 9. NRC annually reviews the financial sureties.

Under the federal UIC program, the exempted production aquifer will no longer be protected under the SDWA as a USDW. In compliance with 40 CFR 146.4, the exempted aquifer does

not currently serve as a source of drinking water and cannot now and will not in the future serve as a source of drinking water. Hence, groundwater in exempted aquifers cannot be considered as a source of drinking water after restoration.

GEIS Section 2.5 describes aquifer restoration (NRC, 2009). Aquifer restoration in each wellfield would begin as the uranium recovery operations end, thereby shortening the period of groundwater contamination within the exempted aquifer. Restoration would be demonstrated to meet WDEQ and NRC requirements. Consistent with current ISR restoration practices, the applicant proposed that restoration criteria or restoration target values (RTVs) be established on a parameter-by-parameter basis. The primary restoration goal would be to return all parameters to compliance with the groundwater protection standards in 10 CFR Part 40 Appendix A Criterion 5B(5). Prior to operation, background (baseline) groundwater quality would be determined based on data collected from monitoring wells before ISR operations were initiated, as required by 10 CFR Part 40, Appendix A, Criterion 7.

There are three possible phases of aquifer restoration: groundwater transfer, groundwater sweep, and groundwater treatment. These three phases of aquifer restoration would be designed to optimize restoration equipment used in treating groundwater and to minimize the volume of groundwater consumed during the aquifer restoration phase of the ISR lifecycle. Depending on the restoration progress, an applicant may not need to implement all three phases to achieve RTVs. NRC gives licensees the flexibility to select each wellfield restoration method (NRC, 2003a). The WDEQ UIC program would review aquifer restoration plans for compliance with the applicable terms and conditions of the UIC permit. Stability monitoring would also be conducted as part of the restoration program. The aquifer restoration program for the proposed Nichols Ranch ISR Project would include two stages: restoration and stability monitoring. The following subsections describe the aquifer restoration phases proposed for the Nichols Ranch ISR Project.

2.2.1.4.1 Groundwater Transfer

During the groundwater transfer phase of the proposed Nichols Ranch ISR Project, water would be transferred between a production area beginning restoration operations to either another wellfield beginning ISR operations or within the same wellfield, if one area is in a more advanced restoration state than another. Groundwater with less total dissolved solids (TDS) would be pumped from the new production area and injected into the area being restored. The groundwater with higher TDS concentrations than the area beginning restoration would be recovered and injected into the production area beginning ISR operations to both lower the TDS in the wellfield being restored and to blend the water in the two wellfields until they are similar in conductivity. If the concentration of suspended solids creates a blockage problem in the injection well screens, then the recovered water from the wellfield being restored may be passed through an ion-exchange column and filtered (Uranerz, 2007).

For groundwater transfer to occur between production areas, a newly constructed production area must be ready to begin ISR. Therefore, the groundwater transfer this phase could be initiated at any time during the restoration process. If a new production area is not available to accept transferred water, then groundwater sweep would be used as the first phase of restoration. Because water is transferred from one wellfield to another, groundwater transfer does not typically generate liquid effluents. (NRC, 2009)

2.2.1.4.2 Groundwater Sweep

During the groundwater sweep phase of the proposed Nichols Ranch ISR Project, groundwater from a wellfield undergoing aquifer restoration would be pumped via production wells to the processing plant ion-exchange systems at the Nichols Ranch Unit central processing plant and Hank Unit satellite facility without reinjection. This pumping draws native groundwater into the ore zone aquifer to flush constituents from areas impacted by the lixiviant injection during uranium recovery. Groundwater produced during the sweep phase would contain uranium and other constituents mobilized during uranium recovery and residual lixiviant. Following treatment, groundwater pumped during the groundwater sweep phase would be disposed of as byproduct material via deep well injection at both the Nichols Ranch and Hank Units. The rate of groundwater sweep depends on the capacity of the deep disposal wells and the ability of the wellfield to sustain the withdrawal rate. The applicant may use a hydraulic barrier to prevent water from being drawn into a production area during the restoration phase from a production area in the extraction phase (Uranerz, 2007).

2.2.1.4.3 Groundwater Treatment

Groundwater treatment would occur either in conjunction with or following groundwater sweep. During the groundwater treatment phase of the proposed Nichols Ranch ISR Project, groundwater would be pumped from the area undergoing restoration to the processing facility and be passed through ion-exchange and reverse-osmosis treatment equipment. The ion-exchange columns would remove most of the soluble uranium. Either prior to or following ion exchange, groundwater would be passed through a decarbonation unit to remove residual carbon dioxide. During the reverse osmosis process, water would be forced through semipermeable membranes to remove the TDS and dissolved metals. Groundwater would be pretreated prior to passage through the reverse-osmosis system to avoid fouling the semipermeable membranes. The pH would be lowered, and chemicals to prevent mineral accumulation (antiscalants) would be added to the groundwater upstream of the reverse-osmosis unit to prevent precipitation of minerals (particularly calcium carbonate). The reverse-osmosis process would yield two fluids: treated water (permeate: about 70 percent) that could be reinjected into the aquifer and water with concentrated ions (brine: about 30 percent). The applicant proposed to either reinject the treated water or to store it for use in other parts of the production process. The brine would be disposed of via the Class I injection wells (Uranerz, 2007).

Before the treated water is reinjected into the production aquifer, the applicant could add a chemical reductant (sulfite or sulfite compound) to the injection stream (Uranerz, 2007). The reductant creates a reducing environment in the ore zone, thereby decreasing the potential concentration of oxidation-reduction-sensitive elements (e.g., arsenic, molybdenum, selenium, uranium, and vanadium). The concentration and quantity of reductant injected into the ore zone undergoing restoration would be determined by how the groundwater reacts with the reductant. The applicant has committed to developing a comprehensive safety plan and to implement it before using a reductant. The applicant may also consider using biological restoration to achieve groundwater restoration (Uranerz, 2007). As stated in the NRC's safety evaluation report, if the applicant chose this groundwater restoration technique, it would submit a detailed plan to NRC staff for review and approval.

Make-up water (which could come from water from a wellfield in a more advanced state of restoration, water being exchanged with a new wellfield production area, or water from a different aquifer) would be added to the injection stream to control the volume of bleed, or

consumed water, in the restoration area. The number of pore volumes treated and reinjected during this phase would depend on the efficiency of returning the production area back to pre-ISR baseline water quality conditions and the efficiency of the reverse osmosis process to remove contaminants (Uranerz, 2007). The rate of restoration in this phase would also be limited by the capacity of the deep disposal wells. NRC staff estimated the total volume of extraction solution as approximately 258,256 m3 [68,224 gal] per pore volume for the Nichols Ranch Unit and approximately 177,709 m3 [46,946 gal] per pore volume for the Hank Unit.

2.2.1.4.4 Monitoring and Stabilization

During aquifer restoration, lixiviant injection ceases and groundwater transfer, sweep, and treatment are used to attempt to restore the production aquifer groundwater quality to original background levels. Therefore, the possibility of an excursion is lessened and the frequency of sampling the monitoring wells can be reduced. During aquifer restoration, the applicant would sample the lateral and overlying and underlying aquifer monitoring wells once every 60 days for the excursion parameters of chloride, total alkalinity, and conductivity. The applicant would also measure static water levels prior to sampling (Uranerz, 2007).

Restoration is complete when the applicant can demonstrate the groundwater quality in the production aquifer meets the regulatory groundwater protection standards and is stable. NRC regulations require the groundwater quality be returned to the standards identified in 10 CFR Part 40, Appendix A, Criterion 5B(5). Those standards are either baseline; equivalent to the MCLs provided in the table in 10 CFR Part 40, Appendix A, Criterion 5C; equivalent to or an ACL NRC established in accordance with Criterion 5B(6). In accordance with this criterion, the applicant may propose ACLs, subject to NRC approval, when background concentrations or values listed in Table 5C are not practically achievable at the site and no substantial hazard to human health or the environment would be presented. A licensee would provide the bases required in 10 CFR Part 40, Appendix A, Criterion 5B(6) for the ACLs, including consideration of practicable corrective actions, and must show that the ACLs are as low as is reasonably achievable. The NRC process for reviewing and approving ACLs is described in Appendix C.

When the groundwater protection standard is reached, a licensee must demonstrate that the constituent concentrations are stable for four consecutive quarters (no statistically increasing trends). To demonstrate stability, a licensee would sample production aquifer wells on a quarterly basis and evaluate the data trends for the following parameters:

- Bicarbonate
- Calcium
- Carbonate
- Chloride
- Conductivity
- Dissolved aluminum
- Dissolved arsenic
- Dissolved barium
- Dissolved boron
- Dissolved cadmium
- Dissolved chromium
- Dissolved copper
- Dissolved iron
- Dissolved lead
- Dissolved manganese
- Dissolved mercury
- Dissolved molybdenum
- Dissolved nickel
- Dissolved selenium
- Dissolved uranium
- Dissolved vanadium
- Dissolved zinc
- Fluoride
- Gross alpha (pCi/L)
- Gross beta (pCi/L)
- Magnesium
- Nitrogen, Ammonia as N
- Nitrate + Nitrite as N
- pH
- Potassium
- Radium-226 (pCi/L)
- Radium-228 (pCi/L)
- Silica
- Sodium
- Sulfate
- Total Dissolved Solids
- Total iron
- Total manganese

The perimeter ring monitoring wells would also be sampled once every 2 months and analyzed for the UCL parameters of chloride, total alkalinity, and conductivity (Uranerz, 2010a).

2.2.1.4.5 Schedule

The applicant estimated the duration of wellfield groundwater restoration in each of the production areas at each unit would range from 1 to 5 years. There would be some overlap between the restoration activities and operation activities of certain wellfields at the Nichols Ranch and Hank Units, because of the staggered wellfield production schedule, as shown in Figure 2-1. The applicant estimated approximately 20 workers would be needed during the restoration phase (Uranerz, 2007).

2.2.1.5 Decontamination, Decommissioning, and Reclamation Activities

The decommissioning of an ISR facility would be based on an NRC-approved decommissioning plan. GEIS Section 2.6 describes the general process for decontamination, decommissioning, and reclamation of an ISR facility (NRC, 2009). A licensee would be required by 40 CFR Part 40.42 (d) to submit a detailed decommissioning plan to NRC for review and approval at least 12 months before the planned commencement of final decommissioning. When approved, this plan would amend the license and initiate the decommissioning process. If an ISR facility is located on lands administered by BLM or other surface management agencies, other reclamation standards could be applicable.

Prior to release of the property for unrestricted use, the licensee would conduct a comprehensive radiation survey to establish that any contamination is within limits identified in 10 CFR Part 40, Appendix A. A licensee would be required to return all lands to their previous land use, unless an alternative was justified and approved by both the state and landowner. For example, a rancher could decide to retain access roads. As part of the decommissioning and reclamation process, wells would be plugged and abandoned, disturbed lands would be reclaimed, contaminated equipment and materials would be removed, appropriate cleanup criteria for structures would be determined, items to be released for unrestricted use would be decontaminated to meet NRC requirements, and surveys would be performed to determine whether there was residual contamination in soils and structures. The following sections describe the general decommissioning activities that would occur at the proposed Nichols Ranch ISR Project.

2.2.1.5.1 Radiological Surveys and Contamination Control

Uranerz would conduct a preremediation radiological survey of soils, structures, and equipment to identify areas on the proposed Nichols Ranch ISR Project site that would need to be cleaned up to the applicable regulatory limits (Uranerz, 2007). The decommissioning surveys would assist a licensee in determining how to dispose of contaminated soils, structures, and other materials.

2.2.1.5.2 Wellfields

All production, injection, monitoring wells, and drill holes would be plugged and abandoned in accordance with WDEQ regulations. Wells would be plugged with a gel specifically designed for well abandonment. The casing would be cut off at the surface and plugged with well-abandonment gel from total depth to within 1.5 m [5 ft] of the collar. Either a cement or plastic plug would be placed at the top of the well casing. Wellfield decommissioning would

remove wellfield piping, well heads, and associated equipment. The wellfield piping, well heads, and associated equipment would be taken to a new production area if still usable. Equipment that could not be reused would be gamma surveyed and stored in either a contaminated or noncontaminated temporary storage area located near the central processing plant or satellite facility until disposal. If the final production area was being reclaimed, the unsalvageable contaminated piping, well heads, and associated equipment would be disposed of at an NRC-approved disposal facility. Uranerz has identified several low-level waste disposal sites: EnergySolutions in Clive, Utah; the uranium mill tailings site at Pathfinder-Shirley Basin in Mills, Wyoming; and White Mesa in Blanding, Utah (Uranerz, 2007).

The applicant would provide a land reclamation plan to NRC for review and approval within 12 months of wellfield reclamation beginning. The plan would include a description of the areas to be reclaimed, a description of the planned reclamation activities, a description of radiation protection methods for workers and the environment, a description of the planned final radiation survey, and a cost estimate (Uranerz, 2007).

2.2.1.5.3 Process Buildings and Equipment and Other Structures

According to Uranerz Technical Report Section 6.2.2 (2007), the Nichols Ranch Unit central processing plant, the Hank Unit satellite facility, and auxiliary facilities associated with both units would be decommissioned following completion of groundwater restoration in the final production area. All process equipment associated with the processing plant and satellite facility would be dismantled and either sold to another NRC-licensed facility or decontaminated in accordance with NRC regulations and guidance documents. Materials unable to be decontaminated would be disposed of at one of the NRC-approved facilities described in Section 2.2.1.5. Decontaminated materials would be reused, sold, or removed and disposed of offsite depending on the type of material, as further discussed in Section 2.2.1.5 of the SEIS. After buildings are removed, the former building sites would be contoured to blend in with the surrounding terrain. Gamma surveys would be conducted to verify that radiation levels were within acceptable NRC limits. The applicant would provide a decommissioning plan to NRC for review and approval within 12 months of wellfield reclamation beginning (Uranerz, 2007).

2.2.1.5.4 Engineered Structures and Site Roads

The site access and wellfield access roads would either be reclaimed or left in place when operations ceased, depending on the landowner. For those roads located on BLM lands, BLM would require complete reclamation. The scoria or gravel on the reclaimed road surface would be removed, and topsoil would be reapplied and then mulched and seeded (Uranerz, 2007).

2.2.1.5.5 Final Contouring and Revegetation

Topsoil salvaged during construction would be reapplied during reclamation. Surface disturbances would be contoured to blend in with the natural terrain. The stockpiled topsoil would be surrounded by a berm at its base and seeded with a mixture of Western Wheatgrass and Thickspike Wheatgrass to reduce sediment runoff. During final revegetation of the project, the area would be reseeded with a native seed mixture private landowners and WDEQ-LQD approved. For non-BLM-administered surface lands, the applicant's proposed reclamation seed mix would be a combination of Western Wheatgrass, Revenue Slender Wheatgrass, Bozoisky Russian Wildrye, Greenleaf Pubescent, Gulf Annual Ryegrass, Yellow Blossom Sweet Clover, and Ladak 65 Alfalfa. For BLM-administered surface lands, the seed mix would include a combination of Thickspike Wheatgrass, Western Wheatgrass, Bluebunch Wheatgrass, Green

Needlegrass, American Vetch, White or Purple Prairie Clover, Lewis, Winterfat, and Fourwing Saltbush. The seed mix would be applied at a rate of 7 to 14 kg [15 to 30 lb] per acre using a rangeland drill. Final revegetation and bond release for all the land within the proposed project area would be determined by the WDEQ-LQD (Uranerz, 2007).

2.2.1.5.6 Schedule

The applicant estimated that site reclamation of each wellfield production unit would range from 1 to 2 years (Uranerz, 2007) with some overlap between the site reclamation activities and the groundwater restoration activities at the Nichols Ranch and Hank Units, as shown in Figure 2-1.

2.2.1.6 Effluents and Waste Management

ISR facility operations generate various types of effluents and waste. This section describes the types and volumes of effluents or wastes that operations the proposed Nichols Ranch ISR Project would generate. The textbox below defines the different liquid and solid wastes that would be generated. The proposed methods and locations for liquid and solid waste disposal are described in Section 3.13 of the SEIS, and the impacts from generating and disposing of these wastes are described in Section 4.14 of the SEIS. Air quality and air emission impacts are discussed in Sections 3.7 and 4.7 of the SEIS.

The terms below define the various types of solid and liquid wastes generated at the Nichols Ranch ISR Project:

Liquid wastes

Liquid byproduct material (all liquid wastes resulting from the proposed action except for sanitary wastewater and well development and testing wastewater)

Sanitary Wastewater [ordinary sanitary (septic system) wastewater; this wastewater is nonhazardous, non-byproduct material wastewater]

Well development and testing wastewaters (wastewater generated during well development and pumping tests; this water is nonhazardous, non-byproduct material wastewater and would not require treatment before disposal)

Solid wastes

Solid byproduct material (all solid wastes resulting from the proposed action that exceed NRC limits in 10 CFR Part 20 for unrestricted release)

Nonhazardous solid waste [nonhazardous, solid waste, including domestic/municipal wastes (trash), construction/demolition debris, septic solids, and solid byproduct material resulting from the proposed action (e.g., equipment, soils) that has been determined to meet NRC criteria in 10 CFR Part 20 for unrestricted release]

Solid hazardous waste (Resource Conservation and Recovery Act or state-defined hazardous waste that is non-byproduct material and includes universal hazardous wastes)

2.2.1.6.1 Gaseous and Airborne Particulate Emissions

Gaseous and particulate emissions generated during the lifetime of the proposed Nichols Ranch ISR Project would primarily consist of fugitive dusts, combustion engine exhausts, and radon gas emissions from various stages of the processing system. Uranium airborne particulate emissions from yellowcake drying would be zero to near zero due to the use of the rotary vacuum drying process the applicant proposes. The vacuum draws solids and water vapor inward. No particulate emissions would be expected under normal

operating conditions for the proposed vacuum dryer. With the prevailing wind direction out of the south-southwest during the day time, airborne emissions from the Nichols Ranch ISR Project would generally blow in the northeast direction (Uranerz, 2007).

2.2.1.6.1.1 Fugitive Dust and Diesel Emissions

Fugitive dusts and engine exhausts would be generated primarily from construction equipment and vehicular traffic. Construction equipment emissions would be generated within the proposed Nichols Ranch ISR Project site primarily during the construction and decommissioning phases, and vehicle emissions would occur on and off the project site during all four ISR phases.

Travel on unpaved roads and disturbed land associated with the construction of wellfields, roads, and auxiliary facilities would generate fugitive dust. Using methods from EPA (1996) and estimated annual unpaved road traffic from the proposed action, the applicant estimates approximately 123 t [136 T] of fugitive dust would be emitted annually during the construction and operation phases of the project and approximately 99 t [109 T] of fugitive dust would be emitted annually during the decommissioning and aquifer restoration stages (Uranerz, 2007). The applicant expects that negligible amounts of fugitive dust would be generated from the soil disturbance during well construction based on its estimate that topsoil would be stripped from 40 ha [100 ac] or less (Uranerz, 2007). The applicant proposes to maintain access roads via motorized patrol and to minimize disturbance of natural vegetation when possible to minimize wind erosion.

Workers' vehicles commuting to and from the project site, trucks transporting construction materials and product, drill rigs, diesel-powered water trucks, and other construction equipment generate combustion engine exhaust. The NRC staff calculated emissions from diesel combustion engines in drilling rigs and construction equipment used predominantly during the construction and decommissioning phases, detailed in Appendix D. These calculations evaluated emissions of nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), particulate matter (PM_{10}), formaldehyde, volatile organic compounds (VOCs), and carbon dioxide (CO_2). Results indicate CO_2 and NO_x have the highest emissions of the pollutants evaluated. Based on the applicant's proposed schedule for wellfield construction during the first year (construction of the first wellfield and a portion of the second wellfield) and an NRC staff assumption that the applicant would drill four deep disposal wells in the first year, the calculated annual CO_2 and NO_x emissions during the construction phase are 1,541 and 31 t/yr [1,700 and 34 T/yr]. The results of the NRC staff emission calculations indicate the drilling of deep wells contributes a high proportion to the total emissions during construction. Therefore, if the applicant chose to drill all eight proposed deep wells in the first year, the calculated emissions increase to 2,810 t/yr [3,100 T/yr] CO_2 and 53 t/yr [58 T/yr] NO_x. The NRC emissions calculations for the decommissioning phase are based, in part, on the applicant's proposed schedule for plant and wellfield decommissioning (Figure 2-1). The maximum calculated annual emissions (considering overlapping wellfield reclamation activities) of CO_2 and NO_x during the decommissioning phase are 680 and 18 t/yr [750 and 20 T/yr]. These calculated annual emissions for the decommissioning phase are lower than the aforementioned annual emissions calculated for construction, in part because decommissioning activities would not involve drilling and the associated emissions from drilling equipment. Approximations of the total CO2 and NOx emissions from construction of all proposed wellfields and deep disposal wells and reclamation of the wellfields and all surface facilities are 5,712 and 132 t/yr [6,300 and 146 T/yr]. Results for all of the diesel engine emissions calculations are provided in Appendix D. Mobile road (vehicle) combustion emissions were not calculated, because these engine emissions are

controlled at the source by mandated emission controls, and the magnitude of proposed road vehicle activity is small relative to existing road traffic (SEIS Section 4.3).

2.2.1.6.1.2 Radioactive Emissions

In its license application, the applicant described radon gas (Rn-222) as the principal gaseous radioactive airborne effluent at the proposed Nichols Ranch ISR Project (Uranerz, 2007). The applicant stated Rn-222 would be released in the wellfield when the pregnant lixiviant is brought to the surface from the ore zone aquifer. Specific Rn-222 sources addressed in the license application included wellfield drilling, production, operation of the central processing plant and satellite facility, resin transfer operations, and aquifer restoration activities. The applicant calculated the potential Rn-222 emissions from the proposed Nichols Ranch ISR Project (Uranerz, 2007) using methods documented in NRC Regulatory Guide 3.59. The NRC staff assumed the highest annual Rn-222 releases occur when multiple, concurrent release activities occurred during a single year. Based on the proposed phased implementation of operations at each unit (Uranerz, 2007) and the proposed two wellfields per unit, the NRC staff selected the highest annual Rn-222 emissions from these results: approximately 28 TBq/yr [755 Ci/yr] for the combined operations of the Nichols Ranch Unit and the Hank Unit wellfields. As described in GEIS Section 2.7.1, radon gas quickly disperses in air. Additional information on proposed offsite radon emissions and the evaluation of potential impacts to the public is provided in SEIS Section 4.13.1.2.1.

The applicant has proposed the use of general area and local ventilation systems to help control radon buildup within onsite facilities. During operations, for example, the applicant has proposed to release radon gas when the downflow ion-exchange columns are taken offline for resin transfer and opened to the atmosphere. General area ventilation would involve forced air ventilation of work areas in process buildings (Uranerz, 2007). Local ventilation is proposed for process vessels where radon releases would be more likely. The applicant stated the proposed local ventilation would involve ducting or piping near the point of release and fans that exhaust to the outside. Additional information on proposed in-facility radon emissions and the evaluation of potential impacts to workers is provided in SEIS Section 4.13.1.2.1.

A potential source of airborne particulate emissions at an ISR facility is from yellowcake drying operations. The applicant has proposed using a vacuum yellowcake dryer located at the Nichols Ranch Unit central processing plant. As described in NUREG/CR–6733 (NRC, 2001), a vacuum dryer utilizes a heating source that is contained in a separate, isolated system so no radioactive materials are entrained in the heating system or the exhaust it generates. The system proposed by the applicant would include a drying chamber containing yellowcake slurry that would operate at negative pressure, a baghouse filtration system under negative pressure that discharges back to the drying chamber, a post-baghouse condenser system that captures residual particulate in the gas stream, and instrumentation to monitor drying and packaging operations that would provide an audible and/or visible alarm if the vacuum level exceeded specifications (Uranerz, 2007). The NRC guidance in NUREG–1569 (NRC, 2003a) for evaluating air emissions from an ISL facility states dust emissions from drying may be assumed to be negligible if a vacuum dryer is used for yellowcake.

2.2.1.6.2 Liquid Wastes

The proposed Nichols Ranch ISR Project would generate liquid waste from production bleed, restoration, miscellaneous plant wastewater, and domestic liquid waste. These wastes are described as either liquid byproduct material or other liquid wastes.

Liquid byproduct materials are generated during the uranium recovery process (NRC, 2000). Such effluents include liquid from maintaining a production bleed, process solutions, washdown water, and accidental releases during operations.

Liquid byproduct materials would be disposed in Class I deep disposal wells located near the central processing plant and satellite facility. These wells would be approximately 2,326 to 2,652 m [7,630 to 8,700 ft] below ground surface at the Nichols Ranch Unit and approximately 2,360 to 2,652 m [7,740 to 8,700 ft] below ground surface at the Hank Unit (Uranerz, 2007). The deep disposal well design is shown in Figure 2-12. Restoration water would be treated by reverse osmosis and then reinjected into the production area undergoing restoration (Uranerz, 2007). Restoration water bleed would also be disposed of via the Class I deep disposal wells. The WDEQ application for the deep disposal wells states that the average daily injection rate would not exceed a total of 568 Lpm [150 gpm] for the Nichols Ranch Unit disposal well(s). The same average daily injection total rate of 568 Lpm [150 gpm] applies for the Hank Unit disposal well(s) (Uranerz, 2010a). If NRC issues a license, it will contain a license condition requiring the applicant to install adequate deep disposal well capacity prior to the commencement of operations of the Nichols Ranch ISR Project. The applicant would obtain a UIC permit from WDEQ, which has regulatory authority for the program as authorized by EPA, to issue Class I disposal well permits. The applicant has submitted an application to WDEQ for eight deep disposal wells, four wells at each the Nichols Ranch and Hank Units (Uranerz, 2010b).

A small amount of uncontaminated wastewater would result from well development and well pump testing. This water would not need treatment and would be discharged to the ground surface in accordance with a WYPDES permit (Uranerz, 2007).

Sanitary wastewater would also be generated from restrooms and lunchrooms. Sanitary wastewater would be disposed of in onsite septic systems. The applicant estimated the proposed septic systems would be located south of the Nichols Ranch Unit central processing plant and north of the Hank Unit satellite facility. They would be designed to accommodate an estimated maximum of 55 employees at each unit. The applicant would obtain a county permit to construct the septic systems from the county in which the unit is located (Uranerz, 2007).

Storm water runoff would also need to be managed at the proposed Nichols Ranch ISR Project. Facility drainage would be designed to route storm water runoff away from or around the processing facilities, ancillary buildings, chemical storage buildings, and parking areas. Federal and State agencies regulate the discharge of both storm water runoff and the discharge of wastewater to surface waters through their permitting processes (Uranerz, 2007). The status of obtaining a storm water permit for the proposed Nichols Ranch ISR Project, as required under the Clean Water Act and WDEQ regulations, is summarized in Table 1-2 of the SEIS.

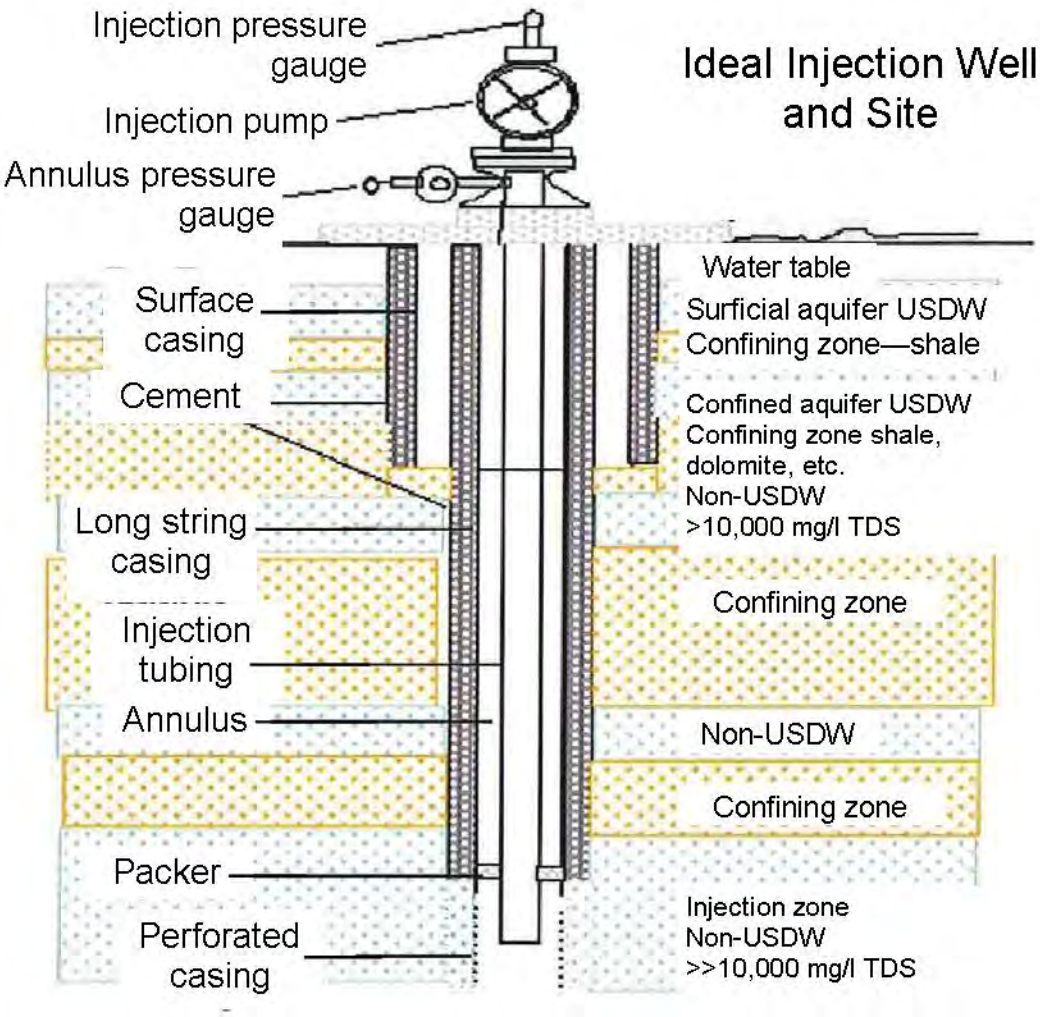

Figure 2-12. Deep Disposal Well Design
Source: Uranerz (2007)

2.2.1.6.3 Solid Wastes

As discussed in GEIS Section 2.7.3, all phases of the operational lifecycle of an ISR facility would generate solid byproduct material and nonhazardous solid wastes (NRC, 2009). Byproduct material could include spent resin, empty chemical containers and packaging, pipes and fittings, tank sediments, contaminated soils from leaks and spills, and contaminated construction and demolition debris. Nonhazardous solid wastes would include septic solid waste, municipal solid waste (general trash), and other solid wastes.

Solid byproduct material is material that does not meet the NRC criteria for unrestricted release (including any soils contaminated from the operations). This material must be disposed of at a licensed disposal site in accordance with 10 CFR Part 40, Appendix A, Criterion 2.

The proposed Nichols Ranch ISR Project is estimated to generate approximately 46 to 69 m^3 [60 to 90 yd^3] of solid byproduct material annually from facility operations (Uranerz, 2007). Based on the use of covered roll-off containers with a nominal capacity of 15 m^3 [20 yd^3], up to

five solid byproduct material shipments would occur per year. NRC staff calculated the highest volume of solid byproduct material that could be annually generated from decommissioning activities based primarily on information provided in the applicant's surety estimate (Uranerz, 2007) as 2,485 m^3 [3,250 yd^3] plus an additional 240 t [270 T] of concrete demolition material. This estimate includes materials resulting from removal of facilities and equipment, wellfield equipment and piping, and removal of any contaminated soils that do not meet NRC limits for unrestricted release. Because the occurrence of wellfield spills and leaks varies among sites, the NRC staff estimated the contaminated soil volume for each well in a wellfield based on review of a similar licensed ISR facility (PRI, 2007). Because the applicant is proposing to construct four wellfields, the NRC staff estimates that the cumulative solid byproduct material from decommissioning the plant facilities and all wellfields (over a planned 5-year period) would be 8,731 m^3 [11,410 yd^3] plus 245 t [270 T] of concrete.

The applicant does not have an agreement in place with a licensed site to accept the applicant's solid byproduct material for disposal. However, a license condition will require that the applicant have an agreement in place prior to operations to dispose byproduct material. The applicant has considered disposal at Pathfinder-Shirley Basin in Mills, Wyoming; Energy Solutions in Clive, Utah; and White Mesa in Blanding, Utah.

According to the license application, solid wastes that are nonhazardous and which either are nonradioactive or comply with NRC unrestricted release limits (hereafter referred to as nonhazardous solid waste) would be collected onsite in designated areas and disposed of in the Campbell County Landfill in the City of Gillette. The applicant estimated (Uranerz, 2007) approximately 540 to 770 m^3 [700 to 1,000 yd^3] of nonhazardous solid waste would annually be generated by the proposed Nichols Ranch ISR Project. NRC staff calculated the volume of nonhazardous solid wastes that could be generated annually from decommissioning activities based primarily on information provided in the applicant's surety estimate (Uranerz, 2007) as 917 m^3 [1,200 yd^3] plus an additional 2,074 t [2,288 T] of concrete demolition material. This estimate includes materials resulting from removal of facilities and equipment and wellfield equipment that does not contain radioactive materials or that meets NRC limits for unrestricted release. Because the applicant is proposing to construct four wellfields, the NRC staff estimated the cumulative solid waste volume from decommissioning the plant facilities and all wellfields (over a planned 5-year period) at 941 m^3 [1,230 yd^3] plus 2,074 t [2,288 T] of concrete. This cumulative estimate is similar to the single wellfield estimated nonhazardous solid waste because the applicant's surety assumed most of the wellfield decommissioning waste would be solid byproduct material. Therefore, increasing the number of wellfields reclaimed for the cumulative (i.e., facility lifecycle) estimate proportionately increased the amount of byproduct material but did not increase the amount of nonhazardous solid waste. The nonhazardous solid waste in the aforementioned estimates originated from central plant facilities decommissioning.

The applicant did not identify hazardous wastes that would be generated by the proposed project. Based on the operations and waste types generated at similar ISR facilities, NRC anticipates that the facility would be classified as a conditionally exempt small quantity generator of hazardous waste (CESQG), under RCRA and Wyoming regulations. This classification does not require a permit or license from WDEQ. A CESQG (i) must determine whether its waste is hazardous; (ii) must not generate more than 100 kg [220 lb] per month of hazardous waste or, except with regard to spills, more than 1 kg [2.2 lb] of acutely hazardous waste; (iii) may not accumulate more than 1,000 kg [2,205 lb]of hazardous waste onsite at any time; and (iv) must treat or dispose of its hazardous waste in a treatment storage or disposal (TSD) facility that meets specific requirements of 40 CFR 261.5. If the facility fails to meet these four criteria, it would lose CESQG status and be fully regulated as either a small-quantity

generator {more than 100 [220] but less than 1,000 kg [2,205 lb] of nonacute hazardous waste per calendar month} or a large-quantity generator {at least 1,000 kg [2,205 lb] nonacute hazardous waste per calendar month}. Any hazardous waste, such as organic solvents, paints, waste oil and paint thinners, empty chemical containers, tank sediments/sludges, chemical waste, and spent batteries, would be disposed of in accordance with a management program that the facility would develop to meet applicable local, State, and Federal regulatory requirements. The Campbell County Landfill is permitted to accept hazardous waste for disposal.

2.2.1.7 Transportation

GEIS Section 2.8 discusses transportation activities for ISR facilities (NRC, 2009). Primary transportation activities would involve truck shipping and commuting workers. A variety of truck shipments are planned during all phases of the facility lifecycle to support the proposed activities. Construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials would be shipped. Earth-moving equipment, such as rubber tire scrapers and front-end loaders, would be used during construction.

During the construction and operation phases of the proposed project, the applicant estimated traffic volumes as consisting of eight passenger vehicles (standard light-duty trucks or ¾-ton trucks, gas or diesel fuel) per day per week along with six tractor-trailers (diesel) per week (Uranerz, 2007). During the aquifer restoration phase, the applicant expected the traffic volume would decrease because there would be fewer workers, fewer yellowcake shipments would be expected, and there would be fewer chemical and supply shipments compared to the construction and operation phases. The decommissioning phase would be similar to the construction phase,, and most of the truck traffic during that phase would involve shipping waste materials offsite.

NRC staff estimated the annual and average daily number of shipments from the proposed decommissioning activities based on the calculated volume of decommissioning solid wastes discussed in Section 2.2.1.6.3. of the SEIS and the waste volume per shipment. About 340 waste shipments would occur, assuming the applicant completed decommissioning and reclamation of a single wellfield and of all the surface facilities in a single year. Approximately half of the waste shipments would go to a landfill, and the other half would go to a licensed byproduct material disposal facility. Assuming the disposal facilities accept shipments 5 days per week, shipments would occur throughout the year, and each shipment would result in 2 one-way truck trips, the contribution to the annual average daily traffic volume would be approximately 1.3 truck roundtrips per day and about 6.5 shipments per week or 13 one-way trips per week. This is comparable to the applicant's estimate of six tractor-trailers per week for truck traffic during the construction and operation phase at the site.

2.2.1.8 Financial Surety

As stated in GEIS Section 2.10, NRC regulations [10 CFR Part 40, Appendix A, Criterion (9)] require applicants to cover costs to conduct decommissioning, reclamation of disturbed areas, waste disposal, dismantling, disposal of all facilities including buildings and wellfields, and groundwater restoration. The applicant would be required to maintain financial surety arrangements to cover such costs for the proposed Nichols Ranch ISR Project. The initial surety estimate would be based on the first year of operation, which includes the construction of the Nichols Ranch Unit central processing plant, startup of the Nichols Ranch Unit production

area #1, construction of the Hank Unit satellite facility, and startup of the Hank Unit production area #1. NRC and WDEQ would require annual revisions to financial surety to cover existing and planned operations and existing and planned construction. When NRC, WDEQ-LQD, and Uranerz have agreed to the estimate, the applicant would submit a reclamation performance bond, irrevocable letter of credit, or other surety instrument to NRC and WDEQ-LQD. NRC reviews financial surety in detail as part of its review for the Safety Evaluation Report (SER). For additional information on financial surety requirements, see 10 CFR Part 40, Appendix A and GEIS Section 2.10.

2.2.2 Alternative Wastewater Disposal Options

Liquid wastes would be generated during the operations and aquifer restoration phases of the lifecycle for the proposed Nichols Ranch ISR Project. These wastes are considered byproduct materials and must be managed and disposed of in compliance with applicable state and federal regulations, as established by license and permit. The applicant states the normal operational waste stream would be nonhazardous under the Resource Conservation and Recovery Act (RCRA). Predominantly, the liquid waste stream would consist of the following:

- Process bleed ranging from 1 to 3 percent of the total water extracted from the ore horizon
- Effluents from the central processing plant and satellite facility, such as process drains, elution circuit bleed, and washdown water
- Wellfield purge water
- Ion exchange and reverse-osmosis reject brines produced during aquifer restoration.

Of these, the process bleed would be the largest component during operations. The applicant estimates operational wastewater that would ultimately need disposal could be as much as 150 L/min [40 gal/min] for the Nichols Ranch Unit, and 280 L/min [75 gal/min] for the Hank Unit. Other operations' effluent streams would comprise about 3.8 to 7.6 L/min [1 to 2 gal/min]. During the aquifer restoration phase, the majority of the liquid waste would consist of discharge from the ion exchange and/or reverse-osmosis processes used to treat groundwater. The applicant estimated that the total would increase to a maximum of about 340 L/min [90 gal/min] for disposal in each unit (Uranerz, 2007).

Wastewater disposal via deep injection in a UIC Class I well is discussed in Section 2.2.1.6.2 of this SEIS. The applicant submitted its UIC permit application for the Nichols Ranch and Hank Units to WDEQ for review. The application states that the average daily injection rate would not exceed a total of 568 Lpm [150 gpm] for the Nichols Ranch Unit disposal well(s), and that this same rate applies for the Hank Unit disposal well(s) (Uranerz, 2010a).

If the applicant fails to receive a UIC permit from WDEQ, then a licensee must apply for an amendment to utilize another disposal method. The NRC must approve the amendment request before the applicant initiates ISR operations. Though alternative wastewater disposal options were not proposed in the license application, NRC discussed alternative wastewater disposal options (described in the GEIS) and provides the following expanded discussion of these options. Table 2-1 compares the various options. The analysis of potential environmental impacts is discussed in Section 4.1.1.2 of the SEIS but is not included in the comparison of

alternatives in Table 2-1. Table 2-1 considers the applicant's proposed wastewater disposal option to use a Class 1 UIC injection well.

Historically, ISR facilities have used several other methods to manage and dispose of liquid effluent. These other methods include solar evaporation ponds, land application, and surface water discharge. The following sections consider these disposal options, as well as disposal via injection through UIC Class V wells (NRC, 2003a). Characteristics of each of these different wastewater disposal options are summarized in Table 2-1.

2.2.2.1 Evaporation Ponds

One commonly used method to dispose of liquid wastes is to pump the liquids to one or more ponds and allow for natural solar radiation to reduce the volume through evaporation. The waste streams are usually treated prior to being discharged into evaporation ponds, but radionuclides and other metals may still be present, which will concentrate as the liquids evaporate. The basic design criteria for an evaporation pond system are contained in 10 CFR Part 40, Appendix A. The location of the pond(s), design, and construction of the necessary clay or geotextile liner systems and embankments for the ponds, as well as pond inspection and maintenance, would be conducted in accordance with NRC regulations and established by NRC license conditions as necessary. NRC Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities" can assist the applicant (NRC, 2008). The siting and design of any impoundments would also take into account applicable EPA requirements at 40 CFR Part 264 (NRC, 2008). WSEO also has state permitting authority for new impoundments.

The effectiveness of this wastewater disposal option will depend on the evaporation rate compared to the rate at which liquid wastes are generated. The evaporation rate varies seasonally, depending on temperature and relative humidity; the rate tends to be highest during warm, dry conditions and is lower under cool, humid conditions. If the evaporation rate is low or the seasonal conditions favoring evaporation are short in duration, the operator can compensate to some extent by increasing the size, and therefore the surface area, of the evaporation pond(s). Historically, the area of an individual evaporation pond at uranium ISR facilities has ranged from about 0.04 to 2.5 ha [0.1 to 6.2 ac] (NRC, 1997, 1998a, 1998b; Cohen and Associates, 2008b), although these areas are for facilities that use a combination of waste disposal methods.

Regulatory requirements in 40 CFR Part 61, Subpart W limit maximum lined uranium mill tailings impoundments to 16.2 ha [40 ha], although these tailings ponds are intended for a somewhat different purpose. The total footprint of the evaporation pond system for all liquid waste streams has been estimated as high as 40 ha [100 ac] (NRC, 1997). The estimated average annual evaporation rate from free water surfaces in the vicinity of the proposed Nichols Ranch ISR Project is approximately 102 cm/yr [40 in/yr] (Wyoming State Climate Office, 2004). Using this estimate, the minimum total evaporation pond area needed to handle the anticipated wastewater volumes for the Nichols Ranch and Hanks Units combined would be about 23 to 35 ha [56 to 87 ac]. Taking into account annual precipitation effectively reduces the evaporation rate, thus requiring the pond system to be about 25 percent larger. Also, additional storage areas would need to be built to facilitate wastewater transfer between ponds for maintenance or repair work. During the winter months in Wyoming where temperatures would be anticipated to be below freezing, the ponds could ice over, effectively reducing the evaporation to zero. To maintain year-round liquid disposal capability at the proposed Nichols Ranch ISR Project facility,

the NRC staff conclude Uranerz would need to have either sufficient storage capacity or at least one other disposal option (e.g., deep well injection, land application) available.

To identify potential leaks into the subsurface from the evaporation pond system, the applicant would design, construct, and monitor a leak detection system and conduct routine inspections, typically on a daily, weekly, monthly, and quarterly basis, with special inspections as described in NRC guidance (NRC, 2008). According to Regulatory Guide 3.11, an applicant's design would need to incorporate freeboard (i.e., distance from the water level to top of the embankment) of about 1 to 2 m [3 to 6 ft], depending on the size of the individual pond, so precipitation or wind-driven waves would not result in overtopping of the embankment (NRC, 2008). Additionally, an applicant would need to maintain sufficient reserve capacity in the evaporation pond system to allow the entire contents of one or more pond(s) to be transferred to other ponds in the event of a leak and subsequent corrective action and liner repair (NRC, 2009). An applicant would also implement measures such as perimeter fencing and netting to protect humans and wildlife, as necessary. These measures would be established by license condition in the NRC license and enforced through the NRC inspection program.

An applicant may also be subject to a National Emission Standards for Hazardous Air Pollutants (NESHAP) review by WDEQ to evaluate whether radionuclides such as radon released to the air from this option would meet the criteria in 40 CFR Part 61, in particular with respect to the provisions of Subpart W that incorporate the requirements of 40 CFR Part 192 (NRC, 2008; Cohen and Associates, 2008a). In developing the impoundment design, an applicant would need to comply with EPA regulations for surface impoundments in 40 CFR Part 264 (NRC, 2008; Cohen and Associates, 2008b).

Because pond(s) are open to the air, dust and dirt can be blown into them, and dissolved solids concentrations may increase through evaporation to the point where salts precipitate from the solution. The ponds may need periodic maintenance to clean and maintain good repair and to adjust to the necessary freeboard. The accumulated salts and solids would be disposed as byproduct material at an NRC-licensed disposal facility. Similarly, when the operations and aquifer restoration phases end, the pond liners and any accumulated materials would be disposed of as byproduct material. As an example of decommissioning waste volumes, the amount of byproduct material generated during decommissioning and reclamation of evaporation ponds at the Smith Ranch ISR facility in Converse County, Wyoming, was estimated in 2007 at 52 m^3 [68 yd^3] (NRC, 2009).

2.2.2.2 Land Application

Land application is a disposal technique that uses agricultural irrigation equipment to broadcast wastewater on a relatively large area of land for subsequent evaporation. Land application is authorized at several ISR facilities (NRC, 1995, 1998b). Water released in this fashion would require treatment to meet NRC release requirements in 10 CFR Part 20, Subparts D and K and Appendix B, and WDEQ requirements imposed by a zero-release Wyoming Pollution Discharge Elimination System (WYPDES) permit (NRC, 2003a). Water, soils, and vegetation would be monitored on a regular basis established by license condition to ensure soil loadings and vegetation concentrations remained within permit limits (NRC, 1995, 2003a).

Pretreatment of liquid wastes using ion-exchange columns, reverse osmosis, and precipitation of barium/radium sulfate is typically incorporated into this process to decrease uranium and radium levels. This pretreatment is necessary to meet regulatory release limits and to minimize

the potential buildup of radionuclides in surface soils and vegetation. Despite pretreatment, however, liquid waste disposal by land application typically requires large areas to remain below release requirements. For example, the Crow Butte facility near Crawford, Nebraska, has identified about 40 ha [100 ac] as available for land application, if needed (NRC, 1998b), and the Highland Uranium Project in Converse County, Wyoming, identified two land application sites, each about 22 ha [54 ac] in area (NRC, 1995). Depending on how an applicant treated the wastewater prior to land application, this disposal option might have additional land requirements related to constructing radium-settling basins and storage reservoirs (NRC, 1995). The radium-settling basins would add to the required footprint for this disposal option. For example, radium-settling basins are typically on the order of 0.1 to 1.6 ha [0.25 to 4 ac] (NRC, 1995, 1997, 1998a); purge reservoirs for temporary storage of treated wastewater can be much larger, with a surface area on the order of 4 ha [10 ac] or more, depending on the terms of the necessary permit (NRC, 1998a).

An additional EPA conducted NESHAP review is required to demonstrate that radionuclides such as radon released to the air from this option meet the 40 CFR Part 61 requirements. Calculations NRC staff performed for land application over an area of 42 ha [104 ac], assuming average wastewater concentrations of 37 Bq/m^3 [1 pCi/L] for radium and 1 mg/L [1 ppm] for uranium, indicated the potential doses would be below regulatory limits (NRC, 1997). Similarly, representative calculations for 7 years of land application to an area of 18.5 ha [46 ac] with an assumed wastewater application rate of 1,514 L/min [400 gal/min] estimated a radon flux of 1.3 pCi/m^2-sec, not much greater than an assumed background of 1 pCi/m^2-sec (NRC, 2003a, Appendix D).

Areas used for land application would need to be included in decommissioning surveys at the end of the operation and aquifer restoration phases to ensure soil concentration limits would not be exceeded, potentially adding to the total amount of material for disposal at a licensed facility (NRC, 2003a). In addition, any pond liners and precipitated solids accumulated in a radium-settling basin system would need to be disposed of as byproduct material. For example, the annual amount of radium-bearing sludges generated in a 1.6-ha [4-ac] radium-settling basin was estimated to be about 22.4 m^3/yr [29.3 ft^3/yr] (Powertech, 2009).

2.2.2.3 Surface Water Discharge

Another disposal method historically used at uranium ISR facilities is treatment of waste and discharge at the surface. Similar to land application, the water would need to be pretreated to meet NRC release requirements in 10 CFR Part 20, Subparts D and K and Appendix B; the provisions of 10 CFR Part 40, Appendix A that require conformance with EPA regulations in 40 CFR Part 440; and WDEQ requirements imposed by a zero-release WYPDES permit. The WYPDES permit would specify calculated limits to ensure the discharge does not violate water quality standards. WDEQ would not issue the permit if the discharge would cause or contribute to the violation of water quality standards. Specific requirements for uranium ISR facilities are provided in EPA regulations at 40 CFR Part 440, Subpart C. Pretreatment of the liquid wastes using ion-exchange columns, reverse osmosis, and precipitation of barium/radium sulfate is typically incorporated into this process to decrease uranium and radium levels in the wastewater. As with the land application option, this treatment might require additional land for the construction of radium-settling basins and storage reservoirs (NRC, 2003a).

The regulatory framework for wastewater disposal by surface discharge is complicated and requires an applicant to make the distinction between “process wastewater” generated during uranium recovery operations, and “mine wastewater” generated during aquifer restoration

(NRC, 2003a). An applicant would need to develop storage capabilities, depending on whether it intended to maintain separate wastewater streams or commingle (mix) "process" and "mine" wastewater prior to treatment to 10 CFR Part 20 standards. In addition, an applicant would need to address any radioactivity at the discharge point or from storage facilities (tanks, impoundments), radium-settling basins, and related sludges as part of decommissioning the facility (NRC, 2003a; Cohen and Associates, 2008a). An applicant would not be allowed to discharge "process" wastewater to navigable waters of the United States in accordance with EPA regulations at 40 CFR 440.34 (NRC, 2003a).

2.2.2.4 Class V Injection Well

The techniques employed in disposing of liquid wastes through a UIC Class V deep injection well would be similar to those for deep well injection of liquid wastes in a UIC Class I disposal well, as described in Section 2.2.1.6.2 of the SEIS. The main difference would be the nature of the permit (WDEQ, 2001). For disposal via a UIC Class V well, WDEQ regulations assume at least one USDW would underlie the potential injection zone. Furthermore, the waste stream to be injected could not be a hazardous waste. For this reason, an applicant would need to treat the wastewater to meet NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B to ensure that all toxic substances remain at concentrations less than the WDEQ class-of-use standards or any federal primary drinking water standards, whichever is more stringent (WDEQ, 2001). Similar to land application and surface discharge, the wastewater would be pretreated using ion-exchange columns, reverse osmosis, and barium/radium sulfate, and potentially radium-settling basins to decrease the levels of uranium, radium, and other contaminants in the wastewater. As a result, an applicant would need to address storage facilities (tanks, impoundments) or radium-settling basins and sludges as part of decommissioning the facility (NRC, 2003a). In addition, the UIC Class V permit would require an applicant to implement a monitoring plan to ensure wastes were confined to the authorized injection zone (WDEQ, 2008).

2.2.3 No-Action (Alternative 2)

Under the No-Action alternative, the NRC would not approve the license application for the proposed Nichols Ranch ISR Project. The No-Action alternative would result in Uranerz not constructing, operating, restoring the aquifer, or decommissioning the proposed Nichols Ranch ISR Project. No facilities, roads, or wellfields would be built and no pipeline would be laid, as described in Section 2.2.1.2 of the SEIS. No uranium would be recovered from the subsurface ore body; therefore, injection, production, and monitoring wells would not be installed to operate the facility. No lixiviant would be introduced in the subsurface, and no buildings would be constructed to process extracted uranium or store chemicals. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impacts of the other alternatives, including the proposed action.

2.2.4 Modified Action—No Hank Unit (Alternative 3)

Under this alternative, NRC would issue a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing for the Nichols Ranch Unit and not the Hank Unit. Thus, the project would consist of both extracting uranium and processing it at a central processing plant located at the Nichols Ranch Unit. The Hank Unit satellite facility, wellfields, access roads, and related infrastructure would not be

developed. Thus, the potentially affected land surface area would range from approximately 61 to 81 ha [150 to 200 ac] compared to the 120 ha [300 ac] that would be disturbed under the proposed action. The building and wellfield locations on the Nichols Ranch Unit and the access road connecting the buildings to existing ranch roads, described for the proposed action, would also be constructed under this alternative. Less land would be disturbed for wells, and less piping and associated structures would be needed for this alternative. The impacts from this alternative are further discussed in Chapter 4 of this SEIS.

2.3 Alternatives Eliminated from Detailed Analysis

As required by NRC regulations, the NRC staff considered other alternatives to the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project. The range of alternatives was determined by considering the purpose and need for the proposed action and the private party's objectives to extract uranium from a particular ore body. Reasonable alternatives considered in a site-specific environmental review depend on the proposed action and site conditions. This section describes alternatives to the proposed action that were considered but not carried forward for detailed analysis for reasons described in the following sections. Sections 2.3.1 and 2.3.2 describe different mining and associated milling alternatives for the proposed project site. Section 2.3.3 discusses the use of different lixiviant chemistry. Section 2.3.4 discusses the alternative where NRC would only issue Uranerz a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing for the Hank Unit but not the Nichols Ranch Unit.

2.3.1 Conventional Mining and Milling at the Nichols Ranch ISR Project Site

Uranium ore deposits at depth may be accessed either by open-pit (surface) mining or by underground mining techniques. Open-pit mining is used to exploit shallow ore deposits, which generally occur at depths of less than 170 m [550 ft] below ground surface (EPA, 2008a). To gain access to the deposit, the topsoil is first removed and may be stockpiled for later site reclamation, while the remainder of the material overlying the deposit (i.e., the overburden) can be removed via mechanical shovels and scrapers, trucks or loaders, or by blasting (EPA, 1995, 2008a). The depth to which an ore body is surface mined depends on the ore grade, the nature of the overburden, and the ratio of the amount of overburden to be removed per extracted ore unit (EPA, 1995).

Underground mining techniques vary depending on size, depth, orientation, grade of the ore body, stability of the subsurface strata, and economic factors (EPA, 1995, 2008a). In general, underground mining involves sinking a shaft near the ore body and then extending levels from the main shaft at different depths to access the ore. Ore and waste rock would be removed through shafts by elevators or by using trucks to carry these materials up inclines to the surface (EPA, 2008a).

In addition, when the open pit or underground workings are established, the mine may need to be dewatered so the uranium ore can be extracted. Dewatering can be accomplished either by pumping directly from the open pit or through pumping of interceptor wells to lower the water table (EPA, 1995). The mine water likely would require treatment prior to discharge, due to contamination from radioactive constituents, metals, and suspended and dissolved solids. Discharge of these mine waters may have subsequent impacts to surface water drainages and sediments, as well as to near-surface sources of groundwater (EPA, 1995).

Following the completion of mining, either by open-pit or underground techniques, the mine would be reclaimed. Stockpiled overburden can be reintroduced into the mine, either during extraction operations or following any topsoil reapplied to reestablish topography consistent with the surroundings. When dewatering ceases, the water table may rebound and fill portions of the open pit and underground workings. Historically, uranium mines have impacted local groundwater supplies and the waste materials from the mines have contaminated lands surrounding the mines (EPA, 2008b).

Ore extracted from the open-pit or underground mine would be processed in a conventional mill. As discussed in GEIS Appendix C (NRC, 2009), ore processing at a conventional mill involves a series of steps (handling and preparation, concentration, and product recovery). While the conventional milling techniques recover approximately 90 percent of the uranium content of the feed ore (NRC, 2009), the process generates substantial wastes (known as tailings) because roughly 95 percent of the ore rock is disposed of as waste (NRC, 2006). This process also can consume large amounts of water {e.g., approximately 534 Lpm [141 gpm] for the proposed Piñon Ridge Mill in Colorado (EFRC, 2009)}.

Tailings are disposed of in areally extensive lined impoundments; NRC reviews the design and construction of these to ensure the safe disposal of the tailings (NRC, 2009). Reclamation of the tailings pile generally involves evaporation of liquids in the tailings, settlement of the tailings over time, and covering the pile with a thick radon barrier and earthen material or rocks for erosion control. The area surrounding the reclaimed tailings piles would be transferred to either a State or Federal agency for long-term care (EIA, 1995). The costs associated with final mill decommissioning and tailings reclamation can run into the tens of millions of dollars (EIA, 1995).

NRC evaluated the potential environmental impacts of conventional uranium milling operations in a programmatic context, including the management of mill tailings in the final GEIS on uranium milling (NRC, 1980). This GEIS evaluated the nature and extent of conventional uranium milling to inform the regulatory requirements for management and disposal of mill tailings and for mill decommissioning. The impacts from operating a conventional mill are significantly greater than for operating an ISR facility. For example, at the proposed Nichols Ranch ISR Project, approximately 121 ha [300 ac] would be used for uranium extraction operations (e.g., wellfields, central processing plant, satellite plant, pipeline infrastructure). However, for a conventional mill, more land would be affected by construction {approximately 300 ha [741 ac]} and operations devoted to milling and allied activities {approximately 150 ha [370 ac]} (NRC, 1980). The deposition of windblown tailings could further restrict use of the land near the tailings. Levels of contamination extended several hundred meters beyond the model site boundary evaluated in the GEIS for conventional milling. Therefore, conventional milling was eliminated from detailed analysis in the SEIS.

2.3.2 Conventional Mining and Heap Leaching at the Nichols Ranch ISR Project Site

Heap leaching is discussed in GEIS Appendix C. For low-grade ores, heap leaching is a viable alternative. Low-grade ore removed from open-pit or underground mining operations undergoes further processing to remove and concentrate the uranium. Heap leaching is typically used when the ore body is small and situated far from the milling site. The low-grade ore is crushed to approximately 2.6 cm [1 in] in size and mounded above grade on a prepared pad. A sprinkler or drip system positioned over the top continually distributes leach solution over the mound. Depending on the lime content, an acid or alkaline solution can be used. The leach solution trickles through the ore and mobilizes the uranium, as well as other metals, into the solution.

The solution is collected at the base of the mound by a manifold and processed to extract the uranium. The uranium recovery from heap leaching is expected to range from 50 to 80 percent, resulting in a final tailings material of around 0.01 percent U_3O_8 content. When heap leaching is complete, the depleted materials are considered byproduct material that must be placed in a conventional mill tailings impoundment unless NRC grants an exemption for disposal in place. While the impacts from heap leaching may be less than those from conventional milling, the impacts from the associated open-pit or underground mining would still be substantial. For these reasons, similar to those listed in Section 2.3.1 in the SEIS, this alternative was eliminated from detailed analysis.

2.3.3 Alternate Lixiviants

Alternate lixiviant chemistry was also considered for the operations phase of the proposed action, including acid leach solutions and ammonia-based lixiviants. Acid-based lixiviants such as sulfuric acid dissolve heavy metals and other solids associated with uranium in the host rock and other chemical constituents that require additional remediation and have greater environmental impacts. At a small-scale research facility in Wyoming, test patterns were developed using acid-based lixiviants. During operations, two significant problems developed. First, the mineral gypsum precipitated on the well screens and in the aquifer, which plugged the wells and reduced the efficiency of the wellfield restoration. Aquifer restoration had limited success because of the gradual dissolution of the precipitated gypsum, which resulted in increased salinity and sulfate levels in the affected groundwater. Because it is technically more difficult to restore acid mine sites, the use of an acid-based lixiviant was eliminated from detailed analysis in the SEIS.

Ammonia-based lixiviants have been used at ISR operations in Wyoming. However, operational experience has shown that ammonia tends to adsorb onto clay minerals in the subsurface and then slowly desorb from the clay during restoration, therefore requiring a much larger volume of groundwater be removed and processed during aquifer restoration (Mudd, 2001). Because of the greater consumptive use of groundwater to meet groundwater restoration requirements, the use of an ammonia-based lixiviant was eliminated from detailed analysis.

2.3.4 Modified Action—No Nichols Ranch Unit

Under this alternative, NRC would issue the applicant a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing at the Hank Unit but not the Nichols Ranch Unit. Thus, all activities associated with the project would be confined to the Hank Unit, and the project would be wholly located in Campbell County. The Hank Unit would support the central processing plant, office buildings, and maintenance buildings, and there would not be a satellite facility. Approximately 61 to 81 ha [150 to 200 ac] of the Hank Unit would be affected under this alternative compared to an approximate area of 40 ha [100 ac] under the proposed action. The NRC staff considered this alternative but eliminated it from detailed analysis because of more severe potential impacts to ecological and cultural resources than the proposed action, as described in the following paragraphs.

First, impacts to Greater sage-grouse (*Centrocercus urophasianus*) would be greater under this alternative. Eight of the nine Greater sage-grouse leks within a 3.2-km [2-mi] radius of the Nichols Ranch ISR Project are within a 3.2-km [2-mi] radius of the Hank Unit, while only one of the nine leks is within a 3.2-km [2-mi] radius of the Nichols Ranch Unit. The Greater sage-grouse is federally listed as a candidate species and is state-listed as a species of special

concern. The Fish and Wildlife Service (FWS) added the species as a candidate for the federal List of Endangered and Threatened Wildlife and Plants in a rulemaking on March 5, 2010 (75 FR 13909). The Wyoming Game and Fish Department's (WGFD) most recent revision to its Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats was published in April 2010 (WGFD, 2010). Appendix B of the recommendations specifies best management practices (BMPs) to minimize impacts to sage-grouse. Some of the recommended BMPs that would apply to the Nichols Ranch ISR Project, which is not located in a core area, include

- Locating main haul roads used to transport production and/or waste products at a distance greater than 3.2 km [2.0 mi] from the perimeter of occupied leks
- Reducing the number and height of aboveground facilities within 1 km [0.6 mi] of the perimeter of leks
- Limiting human and vehicular traffic within 1 km [0.6 mi] of the perimeter of leks from 6:00 p.m. to 8:00 a.m. during the breeding season (March 15 through May 15)
- Maintaining no surface occupancy within 0.42 km [0.25 mi] of the perimeter of occupied leks

Because of the proximity of the eight leks to the Hank Unit the applicant would not be able to reasonably maintain BMPs such as those described previously if all activities associated with the Nichols Ranch ISR Project development were concentrated on the Hank Unit (which would involve more facilities on the Hank Unit than in the proposed action); therefore, the potential impacts to Greater sage-grouse would be more substantial than from either the proposed action, where the Hank Unit would be operated as a satellite facility, or the Modified Action (No Hank Unit), where the Hank Unit would not be developed.

Second, adverse impacts to the National Register of Historic Places (NRHP)-eligible Pumpkin Buttes (Site 48CA268) and four associated traditional cultural properties (TCPs) (sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753) would be greater under this alternative than under the Proposed Action or Modified Action (No Hank Unit). The western boundary of the Pumpkin Buttes TCP and the four additional TCPs are located within the proposed Hank Unit permit boundary. Concentrating all buildings and facilities associated with the Nichols Ranch ISR Project within the Hank Unit would result in greater impacts to the TCP viewshed.

Additionally, the 113 ha [280 ac] of BLM-owned land within the Hank Unit would be subject to the programmatic agreement between BLM and Wyoming SHPO for mitigation of adverse effects to the Pumpkin Buttes TCP (BLM, 2009). Stipulations in the PA (applicable to BLM administrated land and federal uranium leaseholders that plan to construct ISR facilities on federally-owned subsurface minerals overlain by private surface lands) would make construction of buildings and wellfield siting more difficult. If wellfields are assumed to be located in the same areas of the Hank Unit as in the Proposed Action (see Figure 2-8 in the SEIS), the central processing plant, office buildings, and maintenance buildings would have to be located east of the wellfield to avoid locating them over an ore zone and to minimize adverse effects to the viewshed of the five TCPs. However, locating these buildings east of the wellfield would adversely affect four Greater sage-grouse leks that lie within 3.2 km [2 mi] of the east boundary of the Hank Unit. Additionally, because buildings subject to safety requirements would not be painted to blend in with the environment, locating the proposed Nichols Ranch ISR

Project on the Hank Unit would result in more unpainted buildings, further obstructing the TCP viewshed. Thus, cultural resource impacts and visual resource impacts would be greater under this alternative than with either the Proposed Action or Modified Action (No Hank Unit). Because of the potential impacts on ecological and cultural resources, this alternative was eliminated from detailed analysis.

2.4 Comparison of the Predicted Environmental Impacts

NUREG–1748 (NRC, 2003b) categorizes the significance of potential environmental impacts as follows:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

Table 2-2 provides the potential environmental impacts (SMALL, MODERATE, or LARGE) of the proposed action. Impacts to each resource area for the proposed action can be found in the Executive Summary, and impacts are detailed in SEIS Chapter 4.

2.5 Final Recommendation

After weighing the impacts of the proposed action and comparing the alternatives, NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action. Unless safety issues mandate otherwise, the NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that the source material license be issued as requested. This recommendation is based upon (i) the license application, including the ER Uranerz submitted and applicant supplemental letters and responses to NRC staff RAIs; (ii) consultation with Federal, State, Tribal, and local agencies; (iii) NRC staff independent review; (iv) NRC staff consideration of comments received on the draft SEISs; and (v) the assessments summarized in this SEIS.

2.6 References

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Table 2-2. Impacts Summary for the Nichols Ranch ISR Project

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.2 Land Use Impacts			
Construction SMALL 4.2.1.1		NONE 4.2.2	SMALL 4.2.3.1
Operation SMALL 4.2.1.2		NONE 4.2.2	SMALL 4.2.3.2
Aquifer Restoration 4.2.1.3	SMALL	NONE 4.2.2	SMALL 4.2.3.3
Decommissioning SMALL 4.2.1.4		NONE 4.2.2	SMALL 4.2.3.4
4.3 Transportation Impacts			
Construction SMALL 4.3.1.1		NONE 4.3.2	SMALL 4.3.3.1
Operation SMALL 4.3.1.2		NONE 4.3.2	SMALL 4.3.3.2
Aquifer Restoration 4.3.1.3	SMALL	NONE 4.3.2	SMALL 4.3.3.3
Decommissioning SMALL 4.3.1.4		NONE 4.3.2	SMALL 4.3.3.4
4.4 Geology and Soils Impacts			
Construction SMALL 4.4.1.1		NONE 4.4.2	SMALL 4.4.3
Operation SMALL 4.4.1.2		NONE 4.4.2	SMALL 4.4.3
Aquifer Restoration 4.4.1.3	SMALL	NONE 4.4.2	SMALL 4.4.3
Decommissioning SMALL 4.4.1.4		NONE 4.4.2	SMALL 4.4.3
4.5 Water Resources Impacts (Surface Waters and Wetlands Impacts)			
Construction SMALL 4.5.1.1.1		NONE 4.5.1.2	SMALL 4.5.1.3
Operation SMALL 4.5.1.1.2		NONE 4.5.1.2	SMALL 4.5.1.3
Aquifer Restoration 4.5.1.1.3	SMALL	NONE 4.5.1.2	SMALL 4.5.1.3
Decommissioning SMALL 4.5.1.1.4		NONE 4.5.1.2	SMALL 4.5.1.3
4.5 Water Resources Impacts (Groundwater Impacts)			
Construction SMALL 4.5.2.1.1		NONE 4.5.2.2	SMALL 4.5.2.3.1
Operation SMALL 4.5.2.1.2		NONE 4.5.2.2	SMALL 4.5.2.3.2
Aquifer Restoration 4.5.2.1.3	SMALL	NONE 4.5.2.2	SMALL 4.5.2.3.3
Decommissioning SMALL 4.5.2.1.4		NONE 4.5.2.2	SMALL 4.5.2.3.4

Table 2-2. Impacts Summary for the Nichols Ranch ISR Project (continued)

Alternative	1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.6 Ecological Resources Impacts (Terrestrial)			
Construction SMALL 4.6.1.1.1		NONE 4.6.2	SMALL 4.6.3
Operation SMALL 4.6.1.2		NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration 4.6.1.3	SMALL	NONE 4.6.2	SMALL 4.6.3
Decommissioning SMALL 4.6.1.4		NONE 4.6.2	SMALL 4.6.3
4.6 Ecological Resources Impacts (Aquatic)			
Construction NONE 4.6.1.1.2		NONE 4.6.2	NONE 4.6.3
Operation NONE 4.6.1.1.2		NONE 4.6.2	NONE 4.6.3
Aquifer Restoration 4.6.1.3	NONE	NONE 4.6.2	NONE 4.6.3
Decommissioning NONE 4.6.1.4		NONE 4.6.2	NONE 4.6.3
4.6 Ecological Resources Impacts (Protected Species)			
Construction SMALL 4.6.1.1.3		NONE 4.6.2	SMALL 4.6.3
Operation SMALL 4.6.1.2		NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration 4.6.1.3	SMALL	NONE 4.6.2	SMALL 4.6.3
Decommissioning SMALL 4.6.1.4		NONE 4.6.2	SMALL 4.6.3
4.7 Air Quality Impacts			
Construction SMALL 4.7.1.1		NONE 4.7.2	SMALL 4.7.3.1
Operation SMALL 4.7.1.2		NONE 4.7.2	SMALL 4.7.3.2
Aquifer Restoration 4.7.1.3	SMALL	NONE 4.7.2	SMALL 4.7.3.3
Decommissioning SMALL 4.7.1.4		NONE 4.7.2	SMALL 4.7.3.4
4.8 Noise Impacts			
Construction SMALL 4.8.1.1		NONE 4.8.2	SMALL 4.8.3.1
Operation SMALL 4.8.1.2		NONE 4.8.2	SMALL 4.8.3.2
Aquifer Restoration 4.8.1.3	SMALL	NONE 4.8.2	SMALL 4.8.3.3
Decommissioning SMALL 4.8.1.4		NONE 4.8.2	SMALL 4.8.3.4

Table 2-2. Impacts Summary for the Nichols Ranch ISR Project (continued)

Alternative	1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.9 Historical, Cultural, and Paleontological Resources Impacts			
Construction	MODERATE	NONE	SMALL
4.9.1.1		4.9.2	4.9.3.1
Operation	SMALL	NONE	SMALL
4.9.1.2		4.9.2	4.9.3.2
Aquifer Restoration	SMALL	NONE	SMALL
4.9.1.3		4.9.2	4.9.3.3
Decommissioning	SMALL	NONE	SMALL
4.9.1.4		4.9.2	4.9.3.4
4.10 Visual and Scenic Resources Impacts			
Construction	MODERATE	NONE	SMALL
4.10.1.1		4.10.2	4.10.3.1
Operation	SMALL	NONE	SMALL
4.10.1.2		4.10.2	4.10.3.2
Aquifer Restoration	SMALL	NONE	SMALL
4.10.1.3		4.10.2	4.10.3.3
Decommissioning	SMALL	NONE	SMALL
4.10.1.4		4.10.2	4.10.3.4
4.11 Socioeconomics (Demographics)			
Construction	SMALL	NONE	SMALL
4.11.1.1.1		4.11.2	4.11.3
Operation	SMALL	NONE	SMALL to MODERATE
4.11.1.2.1		4.11.2	4.11.3
Aquifer Restoration	SMALL	NONE	SMALL
4.11.1.3		4.11.2	4.11.3
Decommissioning	SMALL	NONE	SMALL
4.11.1.4		4.11.2	4.11.3
4.11 Socioeconomics (Income)			
Construction	SMALL	NONE	SMALL
4.11.1.1.2		4.11.2	4.11.3
Operation	SMALL	NONE	SMALL to MODERATE
4.11.1.2.2		4.11.2	4.11.3
Aquifer Restoration	SMALL	NONE	SMALL
4.11.1.3		4.11.2	4.11.3
Decommissioning	SMALL	NONE	SMALL
4.11.1.4		4.11.2	4.11.3

Table 2-2. Impacts Summary for the Nichols Ranch ISR Project (continued)

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.11 Socioeconomics (Housing)			
Construction	SMALL	NONE	SMALL
4.11.1.1.3		4.11.2	4.11.3
Operation	SMALL to MODERATE	NONE SMALL	to MODERATE
4.11.1.2.3		4.11.2	4.11.3
Aquifer Restoration	SMALL	NONE	SMALL
4.11.1.3		4.11.2	4.11.3
Decommissioning	SMALL	NONE	SMALL
4.11.1.4		4.11.2	4.11.3
4.11 Socioeconomics (Employment Rate)			
Construction	SMALL	NONE	SMALL
4.11.1.1.4		4.11.2	4.11.3
Operation	NONE	NONE	SMALL to MODERATE
4.11.1.2.4		4.11.2	4.11.3
Aquifer Restoration	SMALL	NONE	SMALL
4.11.1.3		4.11.2	4.11.3
Decommissioning	SMALL	NONE	SMALL
4.11.1.4		4.11.2	4.11.3
4.11 Socioeconomics (Local Finance)			
Construction	SMALL	NONE	SMALL
4.11.1.1.5		4.11.2	4.11.3
Operation	SMALL	NONE	SMALL to MODERATE
4.11.1.2.5		4.11.2	4.11.3
Aquifer Restoration	SMALL	NONE	SMALL
4.11.1.3		4.11.2	4.11.3
Decommissioning	SMALL	NONE	SMALL
4.11.1.4		4.11.2	4.11.3
4.11 Socioeconomics (Education)			
Construction	NONE NON	E NON	E
4.11.1.1.6		4.11.2	4.11.3
Operation	SMALL	NONE	SMALL to MODERATE
4.11.1.2.6		4.11.2	4.11.3
Aquifer Restoration	SMALL	NONE	SMALL
4.11.1.3		4.11.2	4.11.3
Decommissioning	SMALL	NONE	SMALL
4.11.1.4		4.11.2	4.11.3
4.11 Socioeconomics (Health and Social Services)			
Construction	SMALL	NONE	SMALL
4.11.1.1.7		4.11.2	4.11.3
Operation	SMALL	NONE	SMALL to MODERATE
4.11.1.2.7		4.11.2	4.11.3
Aquifer Restoration	SMALL	NONE	SMALL
4.11.1.3		4.11.2	4.11.3
Decommissioning	SMALL	NONE	SMALL
4.11.1.4		4.11.2	4.11.3

Table 2-2. Impacts Summary for the Nichols Ranch ISR Project (continued)

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.12 Environmental Justice Impacts			
Construction NON	E	NONE	NONE
4.12.2		4.12.3	4.12.4
Operation NONE		NONE	NONE
4.12.2		4.12.3	4.12.4
Aquifer Restoration	NONE	NONE	NONE
4.12.2		4.12.3	4.12.4
Decommissioning NON	E	NONE	NONE
4.12.2		4.12.3	4.12.4
4.13 Public and Occupational Health and Safety Impacts			
Construction SMALL		NONE	SMALL
4.13.1.1		4.13.2	4.13.3.1
Operation SMALL		NONE	SMALL
4.13.1.2		4.13.2	4.13.3.2
Aquifer Restoration	SMALL	NONE	SMALL
4.13.1.3		4.13.2	4.13.3.3
Decommissioning SMALL		NONE	SMALL
4.13.1.4		4.13.2	4.13.3.4
4.14 Waste Management Impacts			
Construction SMALL		NONE	SMALL
4.14.1.1.1		4.14.2	4.14.3
Operation SMALL		NONE	SMALL
4.14.1.1.2		4.14.2	4.14.3
Aquifer Restoration	SMALL	NONE	SMALL
4.14.1.1.3		4.14.2	4.14.3
Decommissioning SMALL		NONE	SMALL
4.14.1.1.4		4.14.2	4.14.3

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Introduction

The proposed Nichols Ranch *In-situ* Recovery (ISR) Project is located in the Powder River Basin, in a rural area that bisects Johnson and Campbell Counties, Wyoming. The Powder River Basin is an energy-rich area that possesses some of the largest coal, coal bed methane (CBM), and natural gas deposits in the United States. The proposed project is approximately 74 km [46 mi] south-southwest of the city of Gillette and approximately 98 km [61 mi] north-northeast of the city of Casper (Figure 1-1). The proposed Nichols Ranch ISR Project includes approximately 1,365 ha [3,371 ac] of land. An estimated 120 ha [300 ac] of land surface could be directly disturbed by ISR construction and operations.

This chapter describes the existing site conditions of the proposed Nichols Ranch ISR Project. The resource areas described in this section include land use, transportation, geology and soils, water resources, ecology, noise, air quality, historic and cultural resources, visual and scenic resources, socioeconomics, public and occupational health, and current waste management practices. The description of the affected environment are based upon information provided in the applicant's environmental report (Uranerz, 2007, 2010) and supplemented by additional information identified by NRC and the public. The information in this chapter of the supplemental environmental impact statement (SEIS) forms the basis for assessing the potential impacts (see Chapter 4) of the proposed action and each alternative (Chapter 2).

3.2 Land Use

The proposed project area is located within the Powder River Basin, which holds the largest deposits of coal in the United States, as well as other minerals and oil and gas. As a result, various mining operations have been, and continue to be, prevalent in the area. The lands within the proposed Nichols Ranch ISR Project have historically been used for cattle grazing and wildlife habitat (Uranerz, 2007). Ranching was the first major industry in the proposed project area and remained the predominant industry until the 1970s. Railroads grew simultaneously with ranching as cattle were shipped from Campbell and Johnson Counties to markets in the east. The emergence of Wyoming's rich energy resources, including coal, oil and gas, natural gas, uranium, and wind, subsequently attracted energy-producing industries to the proposed project area. Presently, the lands within the proposed project area are used for a variety of purposes. Livestock grazing, oil and gas extraction, CBM extraction, and uranium recovery activities are all currently taking place on or near the proposed project area (Uranerz, 2007). The immediate future land use for the proposed project area and adjacent areas would be continued livestock grazing, ISR activities, CBM extraction, and oil and gas extraction.

The proposed Nichols Ranch ISR Project includes approximately 1,365 ha [3,371 ac] of land and is divided into two units: the Nichols Ranch and Hank Units. The Nichols Ranch Unit encompasses approximately 453 ha [1,120 ac] located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20. The Hank Unit encompasses approximately 911 ha [2,251 ac] located in Township 44 North, Range 75 West, Sections 30 and 31, and Township 43 North, Range 75 West, Sections 5, 6, 7, and 8. The main processing facility [central processing plant (CPP)], main office, and maintenance buildings would be located at the proposed Nichols Ranch facility. The Hank Unit would be a satellite operation, which would have a satellite ion-exchange plant, and office and maintenance buildings (Uranerz, 2007).

Section 3.1.2.2 Generic Environmental Impact Statement (GEIS) described the concept of split estate where different entities can own the land surface rights and mineral rights can be owned by different entities, and in particular, where the U.S. Bureau of Land Management (BLM) owns and leases the mineral rights (NRC, 2009a) and surface rights are privately owned. This situation occurs at the proposed Nichols Ranch ISR Project.

The current surface ownership of the proposed Nichols Ranch ISR Project includes approximately 1,251 ha [3,091 ac] of private ownership, mainly by the T-Chair Livestock Company, and approximately 113 ha [280 ac] of U.S. Government ownership administered BLM (Uranerz, 2007). The subsurface mineral ownership is divided among various private entities, including oil and gas and mineral extraction companies, and the U.S. Government, as administered BLM (Uranerz, 2007). Uranerz Energy Corporation (Uranerz) has formed surface use agreements with all of the proposed project area landowners. The applicant has obtained the rights to mine in certain areas of the proposed project area and has also identified the No Right to Mine lands within the proposed project area.

The town of Wright, located approximately 32 km [20 mi] east of the proposed Nichols Ranch ISR Project, is the closest major population center. The towns of Edgerton and Midwest are located approximately 40 km [25 mi] southwest of the proposed project area. No residential sites are located within the proposed Nichols Ranch ISR Project area. The two residences located within 2 km [1 mi] of the proposed project area are Pfister Ranch, approximately 1 km [0.6 mi] north of the Hank Unit, and Dry Fork Ranch, approximately 1.5 km [0.9 mi] west of the Nichols Ranch Unit (Figure 3-1). The 110 ha [280 ac] of BLM land near the Hank Unit is landlocked by private land and thus has limited access. BLM recognizes Pumpkin Buttes, which flank the northern and southeastern boundaries of the Hank Unit, as a Traditional Cultural Property (TCP) (Uranerz, 2007).

3.2.1 Rangeland

Livestock grazing is the main activity at the proposed Nichols Ranch ISR Project area and adjacent lands. Hay was grown in the past on approximately 52 ha [128 ac] of the southern part of the Nichols Ranch Unit, but ceased due to past drought conditions (Uranerz, 2007).

3.2.2 Hunting and Recreation

The proposed project area is within the Pumpkin Buttes Pronghorn Herd Unit and Hunt Area 23 and within portions of the Pumpkin Buttes Mule Deer Herd Unit, which comprises Hunt Areas 19, 20, 29, and 31 (WGFD, 2007). Hunting is limited to the allowable seasons set for the respective game, which are predominantly elk and deer.

Recreational activities within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project are mainly outdoor activities, such as camping, hiking, fishing, and hunting. Almost all of the land on and adjacent to the proposed Nichols Ranch ISR Project area is privately owned with limited access, but public lands such as the Thunder Basin National Grassland, located approximately 38 km [24 mi] east-southeast of the Hank Unit, and the Bighorn Mountains, approximately 43 km [27 mi] west of the proposed project area, are used for recreational activities. The Powder River, located approximately 14 km [9 mi] west of the proposed project area, also provides recreational opportunities for public users. Most recreational activities occur during the summer months when mild weather conditions grant easier and more diverse access. The historic Bozeman Trail, located approximately 3.2 km [2 mi] west of the proposed Nichols

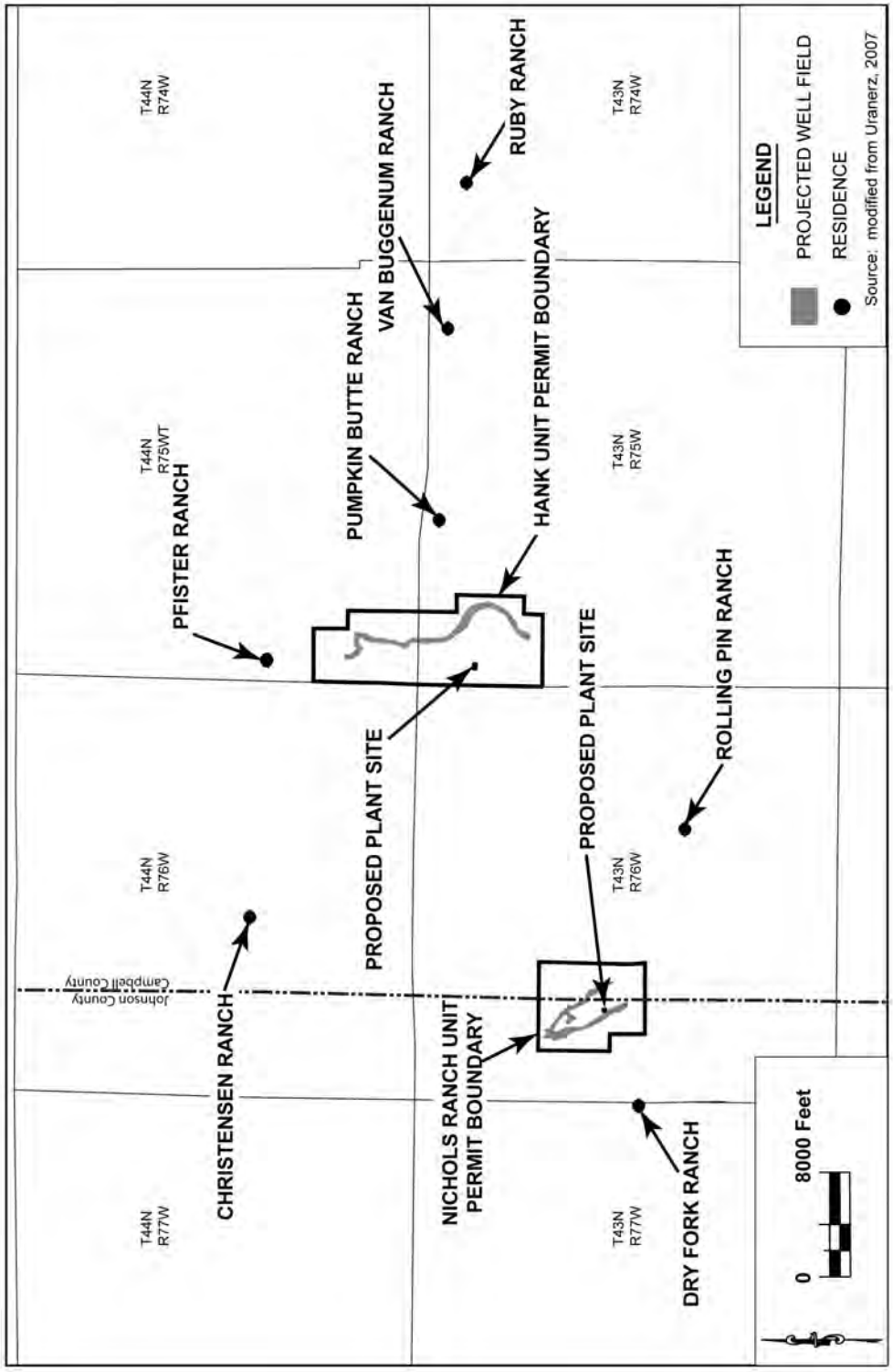


Figure 3-1. Nearest Residential Receptors to the Nichols Ranch ISR Project

Ranch ISR Project area, was a route used first by Native Americans and then later by traders and homesteaders moving west during the 19th century (Uranerz, 2007).

3.2.3 Minerals and Energy

CBM activity is widespread throughout the Powder River Basin. The methane is produced at a depth of approximately 300 m [1,000 ft] and deeper, which is approximately 120 m [400 ft] deeper than the uranium mineralization found in the Nichols Ranch and Hank Units (Uranerz, 2007). In comparison, the typical depth to oil and gas-bearing strata generally ranges from 1,220 to 4,116 m [4,000 to 13,500 ft], but some wells are as shallow as 76 m [250 ft] (BLM, 2005).

Currently, 24 permitted and completed CBM wells are located in or adjacent to the Nichols Ranch Unit, 6 of which are within the bounds of the Nichols Ranch Unit, and 33 permitted and completed CBM wells are located in or adjacent to the Hank Unit, 11 of which are within the bounds of the Hank Unit (Uranerz, 2007). There are approximately 472 oil and gas production units in the Powder River Basin in various stages of production. These are also evenly dispersed throughout the entire Powder River Basin. The Wyoming Oil and Gas Conservation Commission reported that, in 2003, the oil and gas wells in the Powder River Basin produced approximately 13 million barrels of oil and 1.2 billion m^3 [41 billion ft^3] of conventional gas (BLM, 2005). Six oil and gas wells are located on or adjacent to the Hank Unit, of which three are within the bounds of the Hank Unit; no oil and gas wells are located on or near the Nichols Ranch Unit (Uranerz, 2007). No CBM wells or oil and gas wells are located within a planned wellfield associated with the proposed Nichols Ranch ISR Project.

Table 3-1 summarizes the number of permitted or completed CBM wells and oil and gas wells within the Nichols Ranch and Hank Units and those within 4.8 km [3 mi] of the Nichols Ranch and Hank Units. Infrastructure such as pipes and pipelines are attendant structures associated with each energy extraction operation found within at least a 4.8-km [3-mi] radius of the Nichols Ranch and Hank Units. These infrastructure systems occupy vertical subsurface space for extraction purposes as well as horizontal surface area for pipelines that either transport fuel or wastewater to and from each facility.

Three Nuclear Regulatory Commission (NRC)-licensed ISR facilities are located within 80 km [50 mi] of the proposed Nichols Ranch ISR Project. The Uranium One, Inc. Irigaray/Christensen Ranch ISR facility is located approximately 6.4 km [4 mi] northwest of the Hank Unit. Power Resources, Inc. (PRI)-licensed North Butte amendment area is located approximately 3.2 km [2 mi] north of the Hank Unit. The PRI Smith Ranch-Highland ISR facility is located approximately 72 km [45 mi] southeast of the proposed Nichols Ranch ISR Project. Two of the licensed facilities, Irigaray/Christensen Ranch and Smith Ranch-Highland, currently have existing yellowcake processing plants with the latter in operation (Uranerz, 2007).

3.3 Transportation

The proposed Nichols Ranch ISR Project area lies within the Powder River Basin of Wyoming, wherein there are only two 4-lane interstate highways. Interstate 25 (I-25) extends north from Colorado, terminating where it merges with I-90 at Buffalo, Wyoming. I-90 enters northeastern Wyoming from South Dakota at Beulah, continues west through Gillette and turns north at Buffalo, exiting the state into Montana just beyond Sheridan (Figure 3-2). Primary two-lane highways within the Powder River Basin include U.S. 14 and U.S. 16. The paved roads closest to the proposed Nichols Ranch ISR Project area are State Route (SR) 387 and SR50. SR387

Table 3-1. CBM and Oil and Gas Wells on and Within 4.8 km [3 mi] of the Nichols Ranch ISR Project

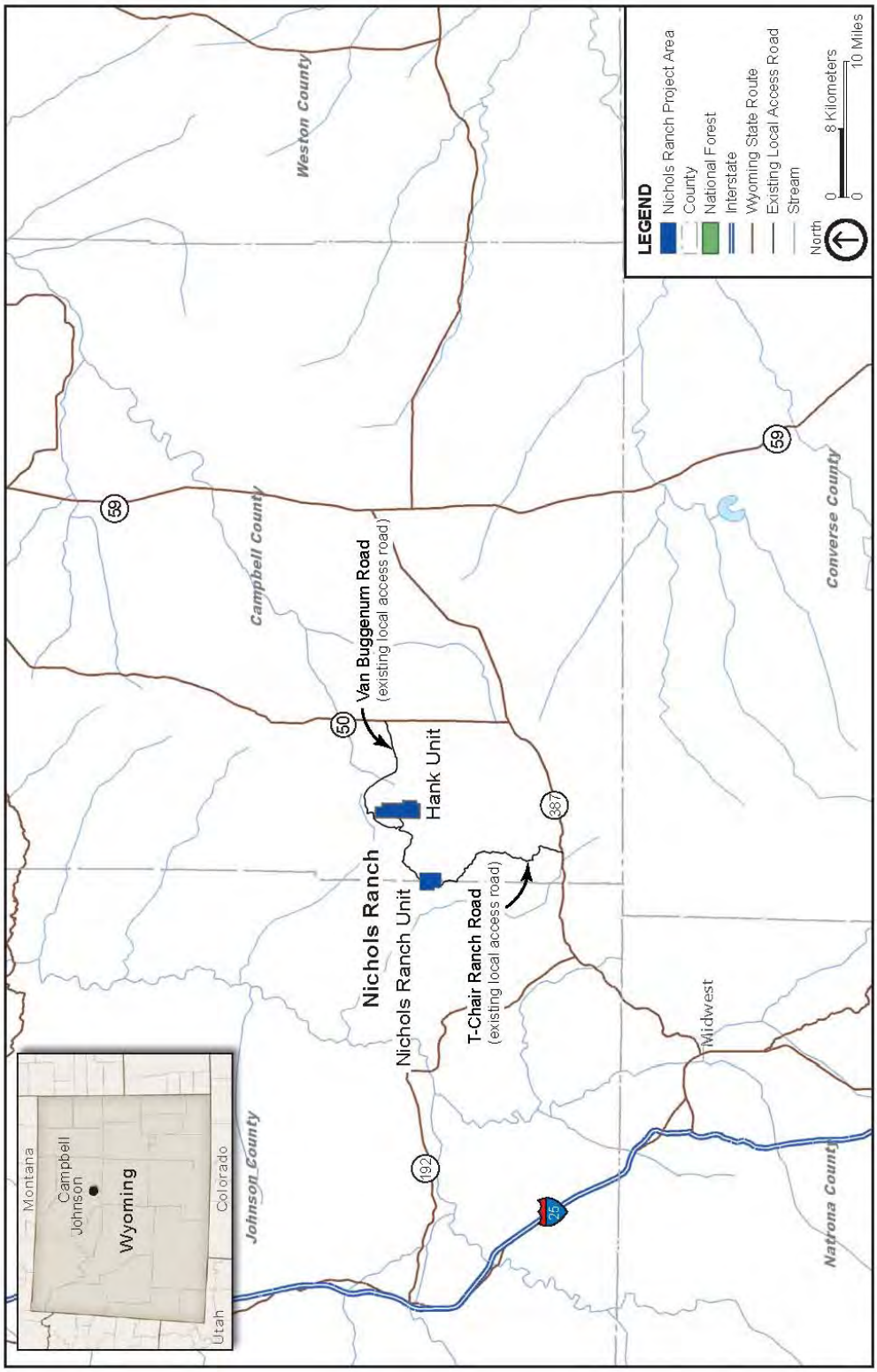
CBM Wells	Within Project Site	Within 4.8 km [3 mi]
Nichols Ranch Unit	6	200
Hank Unit	11	180
Oil and Gas Wells	Within Project Site	Within 4.8 km [3 mi]
Nichols Ranch Unit	0	1
Hank Unit	3	27
Source: Uranerz, 2007		

runs east-west from Wright to I-25 at Midwest. SR50 commences in Gillette and runs southerly, terminating at the intersection with SR387 (Figure 3-2). Numerous county roads provide access to public and private lands, many of which consist of maintained gravel surfaces. Unimproved or minimally improved private roads are also common in this area. The maximum posted speed limit for rural portions of interstate highways is 120 kilometers per hours (kph) [75 miles per hours (mph)], with urban settings being 97 kph [60 mph]. State highways have a maximum posted speed limit of 105 kph [65 mph].

The proposed Nichols Ranch ISR Project area can be accessed from the north via SR50 by travelling 13.7 km [8.5 mi] west along Van Buggenum Road and Christensen Road and continuing westerly for another 13.7 km [8.5 mi] on T-Chair Livestock Company ranch roads (Figure 2-6). Both Van Buggenum Road and Christensen Road are county-maintained gravel roads that provide access to several ranches located in the project region. These roads are 7.3 m [24 ft] wide, which allows for two tractor-trailers to pass one another, and are crowned and ditched. Both Van Buggenum Road and Christensen Road are currently being used as access routes for tractor-trailer traffic associated with CBM activities in the vicinity. The speed limit is posted at 72 kph [45 mph]. Access from the south can be gained by traveling north from SR387 on T-Chair Livestock Company ranch roads (Uranerz, 2007).

Ranch roads occurring on the T-Chair Livestock Company property are also crowned and ditched gravel roads. Recent CBM producer activities have improved the major ranch roads that the applicant would use. These roads range from 4.6 to 6.1 m [15 to 20 ft] wide and are constructed and maintained by the landowner and CBM producers. These roads would accommodate both passenger cars and tractor-trailers when traveling to and from the proposed Nichols Ranch ISR Project. The speed limit on these roads is 50 kph [30 mph].

The distance from the proposed Hank Unit satellite facility to the nearest major road (SR50), is approximately 16 km [10 mi]. The distance from the proposed Nichols Ranch Unit central processing plant to the nearest major road (SR387) is just over 19 km [12 mi]. In 2006, annual average daily traffic counts (AADTs) for trucks using SR387 in the vicinity of the proposed project ranged from 220 to 410 trucks and the AADT for all vehicle types combined was 970 to 3,130 per day (NRC, 2009a). The AADT for SR50 for all vehicles was 550 in 1999, based on most recent available data (BLM, 2003). However, this estimate is likely low because new CBM development has increased traffic on this road. No traffic count data are available for Van Buggenum Road or the T-Chair Livestock Company ranch roads. Table 3-2 provides traffic count data for the state routes surrounding the proposed Nichols Ranch ISR Project area. The expected route for yellowcake shipments from the proposed Nichols Ranch ISR Project are discussed in Section 2.2.1.3.1.7 in the SEIS.



Source: modified from Uranerz, 2007

Figure 3-2. Transportation Routes Near the Nichols Ranch ISR Project

Table 3-2. Traffic Counts for State Routes Near the Nichols Ranch ISR Project

Route Name	Description	All Vehicles				Trucks	
		1998	1999	2005	2006	2005	2006
SR 59	Gillette South of Urban Limits	18,690	17,760	—	—	—	—
SR 59	Johnson-Campbell County Line	1,110	1,210	—	—	—	—
SR 59	Wright	2,150	2,250	3,630	3,930	690	750
SR 59	Converse-Campbell County Line	1,350	1,450	—	—	—	—
SR 387	Johnson-Campbell County Line	1,110	1,210	—	—	—	—
SR 387	Between SR 50 and SR 59	—	—	970–3,130	970–3,130	210–410	220–410
Sources: NRC (2009a); BLM (2003)							

3.4 Geology and Soils

The proposed Nichols Ranch ISR Project would be located in the Pumpkin Buttes Uranium District of the Wyoming East Uranium Milling Region established in NUREG–1910, (NRC, 2009a). The Pumpkin Buttes Uranium District lies within the Powder River Basin. GEIS Section 3.3.3 provides a general description of the geology and soils of the Powder River Basin and Pumpkin Buttes Uranium District. The following is a discussion of the geology and soils of the region and, more specifically, the proposed Nichols Ranch ISR Project area based on the description provided in the GEIS and by the applicant.

3.4.1 Geology

The Powder River Basin is a large structural and topographic depression parallel to the Rocky Mountain range. The boundaries of the basin are the Hartville Uplift and the Laramie Range to the south, the Black Hills to the east, the Big Horn Mountains and Casper Arch to the west, and the Miles City Arch in southeastern Montana to the north. Overall, the Powder River Basin consists of approximately 5.6 million ha [14 million ac] in Wyoming. As indicated in the GEIS, the dominant source of sediment in the Powder River Basin was Precambrian[1] granitic rock of the Sweetwater Arch and northern Laramie Range. The Powder River Basin formed during the Laramide Orogeny (mountain-building era) during the Paleocene to early Eocene.[1] Rapidly subsiding portions of the basin received thick clastic wedges (i.e., made of fragments of other rocks) of predominantly arkosic sediment (i.e., sediments containing a significant fraction of feldspar), while large, more slowly subsiding portions of the basin received a greater proportion of paludal (marsh) and lacustrine (lake) sediments.

[1]The United States Geological Survey (USGS) defines the Precambrian Era to be between 544 million and 2.5 billion years ago; the Eocene Era to be between 33.7 and 55.5 million years ago and the Paleozoic Era to be between 248 and 544 million years ago. <http://geology.er.usgs.gov/paleo/glossary.shtml#p> (17 September 2009).

The Powder River Basin hosts a sedimentary rock sequence with sediments that range in age from recent (Holocene) to early Paleozoic[1] and overlie a basement complex of Precambrian-age igneous and metamorphic rocks (Figure 3-3). As noted in the GEIS, the upper part of the sedimentary sequence present in other portions of central Wyoming has been eroded away in the Powder River Basin, leaving only the Tertiary-aged White River, Wasatch, and Fort Union Formations. The White River Formation is of Oligocene age and is the shallowest Tertiary unit in the Powder River Basin. Underlying the White River Formation is the Wasatch Formation, which is of Eocene age. The Paleocene age Fort Union Formation directly underlies the Wasatch Formation, which directly overlies the Cretaceous Lance Formation.

The White River Formation is the youngest Tertiary unit that still exists in the Powder River Basin with remnants that can be found on top of the Pumpkin Buttes. A basal conglomerate forms the resistant cap rock of the Pumpkin Buttes. Elsewhere, the White River Formation consists of thick sequences of buff-colored tuffaceous sediments mixed with lenses of fine sand and siltstone. This formation is not known to contain significant uranium resources in this area. The next underlying unit, the Wasatch Formation, consists of interbedded mudstones, carbonaceous shales, silty sandstones, and relatively clean sandstones. In the vicinity of the Pumpkin Buttes, the Wasatch Formation is approximately 480 m [1,575 ft] thick. The interbedded mudstones, siltstones, and relatively clean sandstones in the Wasatch Formation contain varying degrees of lithification from uncemented to moderately well-cemented sandstones, and from weakly compacted and cemented mudstones to fissile shales. The Wasatch Formation contains significant uranium resources and hosts the ore bodies for which the applicant is proposing to conduct ISR operations. The Fort Union Formation in the Powder River Basin is lithologically similar to the Wasatch Formation. The Fort Union Formation includes interbedded silty claystones, sandy siltstones, relatively clean sandstones, claystones, and coal with varying degrees of lithification ranging from virtually uncemented sands to moderately well cemented siltstones and sandstones. The total thickness of the Fort Union Formation in this area is approximately 915 m [3,000 ft]. The Fort Union Formation contains significant uranium resources at various locations in the basin and is also the target formation for CBM extraction operations.

The uranium deposits for the proposed Nichols Ranch ISR Project site are located on the outcrop of the Wasatch Formation. With the exception of alluvial deposits overlying the Wasatch Formation along Cottonwood Creek, the Wasatch Formation comprises the most surficial deposits in the proposed project area. The stratigraphy of the Wasatch Formation in the proposed project area consists of alternating layers of sand and shale with lignite marker beds. The mineralized intervals are found in these sands. These mineralized sand horizons are in the lower part of the Wasatch Formation, at an approximate average depth of 168 m [550 ft] as depicted in Figure 3-4. These host sands are mostly arkosic in composition, friable, and have trace amounts of carbonaceous material and organic debris. There are locally sandy mudstone/siltstone intervals within the sands, which may thicken or thin to the point of removal in some areas.

The ore zones in the Wasatch Formation at the Nichols Ranch and Hank units are typical Powder River Basin roll front deposits. Where present, uranium ore is found at the naturally occurring chemical boundary between reduced and oxidized sandstone facies. The Nichols

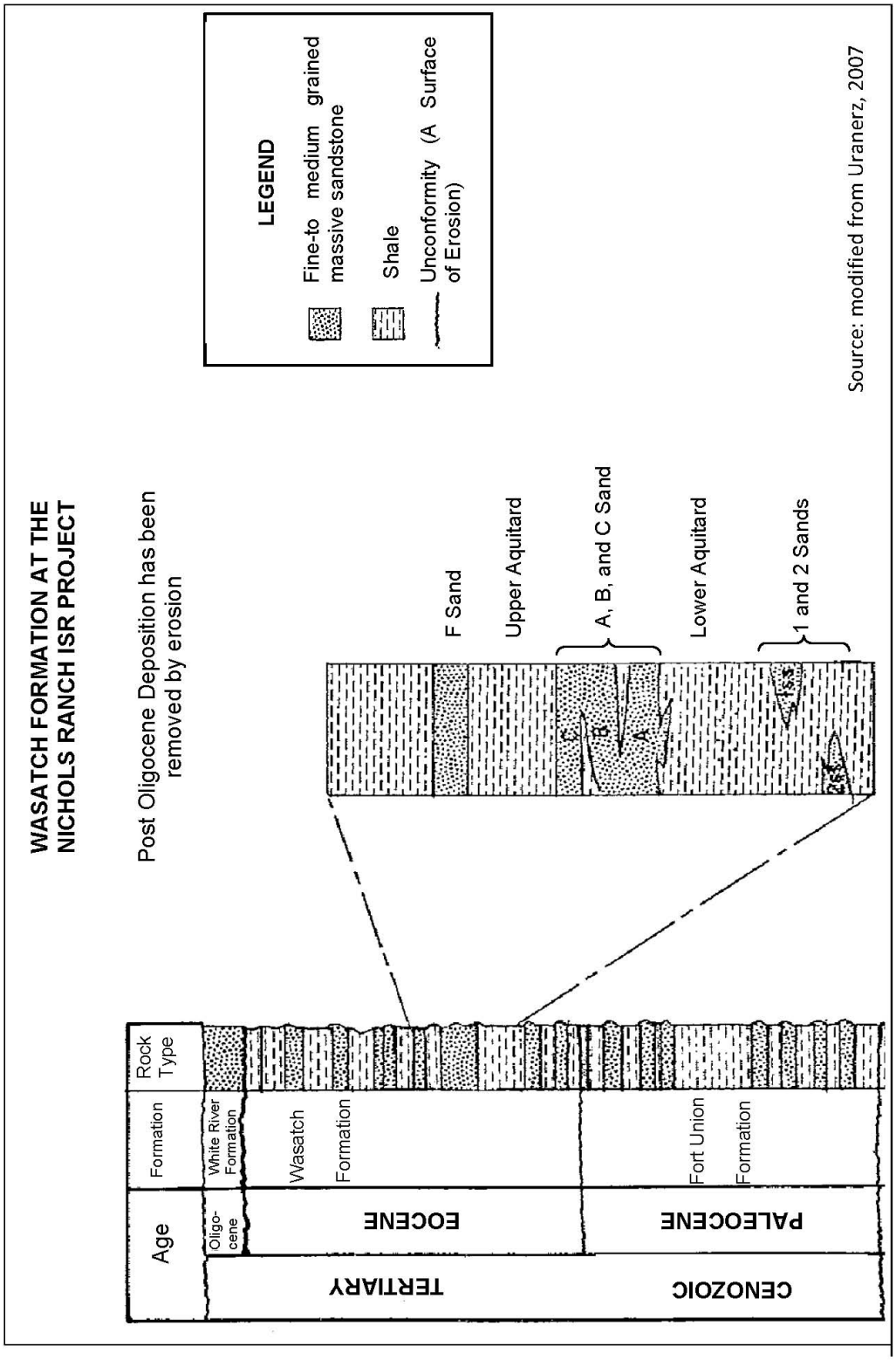


Figure 3-3. Geologic Composition at the Nichols Ranch ISR Project

Figure 3-4. Aquifers at the Nichols Ranch ISR Project

Source: (Uranerz, 2007)

Ranch and Hank Units ore zones have uranium mineralization comprising amorphous uranium oxide, sooty pitchblende, and coffinite. The uranium is deposited upon individual detrital sand grains and within authigenic clays in the void spaces. The host sandstones are made up of quartz, feldspar, accessory biotite and muscovite mica, and locally occurring carbon fragments. The sand grain sizes range from very fine-grained sand to conglomerate. The sandstones are weakly to moderately cemented and friable. The reduced facies are associated with pyrite and calcite, whereas the oxidized facies are associated with hematite or limonite stain from pyrite and montmorillonite and kaolinite clays from oxidized feldspars (Uranerz, 2007).

The applicant has identified a series of sand layers in the upper portion of Wasatch Formation present in the proposed project area and has labeled these layers from the shallowest to the deepest as the H, G, F, C, B, A, and 1 Sands (Figure 3-4). The intervening shales that separate these sands have been identified by the overlying and underlying sands (i.e., the shale separating the H and G Sands is the HG Shale or Aquitard). While generally present throughout the proposed project area, the nature and extent of these sands differ somewhat

across the proposed project area from the Nichols Ranch Unit to the Hank Unit. In addition, depth and expression of these sands at the ground surface is influenced by the topographical relief of the proposed project area. The sand layers have been observed to dip gently 0.5 to 1.0 degrees to the west. The following sections provide more information on the site-specific geology at each unit.

The applicant did not identify the proposed geologic formation for deep well disposal. At other NRC-licensed ISR operations in the Powder River Basin that are permitted by the Wyoming Department of Environmental Quality (WDEQ), deep well injection is typically into formations exceeding 1,130 m [3,700 ft] deep. If NRC approves the license, the licensee is required to obtain the WDEQ permits for the deep disposal wells and install the wells before ISR operations may begin.

3.4.1.1 Nichols Ranch Unit Geology

There are three primary Wasatch Formation sand members in the Nichols Ranch Unit and one minor sand unit. The primary sand members are the F, B, and A Sands, while the minor sand unit is the 1 Sand (Figure 3-4). The F Sand member is the shallowest, and the 1 Sand is the deepest. The main uranium ore zone sand member is the A Sand which is 12 to 30 m [40 to 100 ft] thick and is located 91 to 213 m [300 to 700 ft] below the surface. The A Sand is thickest to the northeast, thins to the southwest, and is fine to coarse grained. The A Sand is extensive and has been correlated across the site from the Nichols Ranch Unit to the Hank Unit.

Underlying the A Sand ore zone at the Nichols Ranch Unit are the A1 Aquitard and the 1 Sand. The A1 Aquitard comprises mudstones and carbonaceous shale with occasional thin lenses of poorly developed coal. This unit ranges in thickness from 6 to 24 m [20 to 80 ft].
The underlying 1 Sand is variable in thickness. The 1 Sand is missing or in a range of less than 1.5 m [5 ft] in thickness and occurs at depths of 171 to 216 m [560 to 710 ft] below ground surface (bgs). The sand is very fine to coarse grained.

Overlying the A Sand ore zone at the Nichols Ranch Unit are the BA Aquitard and the B Sand. In this portion of the unit, the BA Aquitard varies from 3 to 40 m [10 to 130 ft], thickening to the northwest and thinning to the southeast. The BA Aquitard consists of mudstones and thin discontinuous light gray siltstones. The B Sand ranges in thickness from 12 to 55 m [40 to 180 ft] at the Nichols Ranch Unit and is fine to coarse grained. The body of the B Sand is occasionally separated by lenses of mudstone, siltstone, and carbonaceous shale. Some of these mudstone lenses exceed 8 m [25 ft] in thickness and may extend for thousands of feet. The B Sand is very extensive and has been correlated across the gap between the Nichols Ranch and Hank Units.

3.4.1.2 Hank Unit Geology

There are four primary Wasatch Formation sand members and two minor sand units at the Hank Unit. The primary sand members at the Hank Unit are the F, C, B, and A Sands, and the minor sand units are the G and H Sand units (Figure 3-4). The main uranium ore zone sand member at the Hank Unit is the F Sand, which is approximately 6 to 37 m [20 to 120 ft] thick and 61 to 83 m [200 to 600 ft] bgs in this portion of the unit. At the Hank Unit, the F Sand is composed of fine- to coarse-grained sand.

Underlying the F Sand at the Hank Unit are the FC Aquitard and the C Sand. The C Sand at the Hank Unit is 3 to 18 m [10 to 60 ft] thick, discontinuous, and is composed of fine and

very fine-grained sand. The C Sand is not always present below the F Sand at the Hank Unit. When the C sand is not present, the B Sand underlies the production sand (F Sand). The FC Aquitard is composed of mudstones, siltstones, gray carbonaceous shales, and poorly developed coal. The Aquitard ranges in thickness from 14 to 24 m [45 to 110 ft] depending on the presence of the C Sand. Where the C Sand is not present, it merges with the CB Aquitard overlying the B Sand.

Overlying the F Sand at the Hank Unit are the GF Aquitard and the G Sand. At the Hank Unit, the G Sand comprises up to three individual sand units that are fine to very fine grained and 3 to 7.6 m [10 to 25 ft] thick. The entire G Sand sequence is up to 23 m [75 ft] thick with intersand zones composed of gray mudstone. The GF Aquitard at the Hank Unit is composed mostly of gray mudstones and is 9.1 to 17 m [30 to 55 ft] thick.

3.4.2 Soils

The applicant, inventoried and mapped soils based on National Cooperative Soil Survey Standards. Physical and chemical characteristics of the topsoil within the potential disturbance areas at both units and the depths of salvageable topsoil were also estimated (Uranerz, 2007). The soils occurring at the Nichols Ranch and Hank Units were found to be generally fine textured throughout. Patches of sandy loam were identified on upland areas and fine-textured soils occurred in or near drainages. The proposed project area was found to contain deep soils on the lower slopes and flat areas near drainages with shallow and moderately deep soils located on upland ridges and shoulder slopes (Uranerz, 2007). The applicant also conducted soil sampling, which indicated the topsoil is suitable for plant growth (in the case of reclamation) and that the soils had a clay texture. The Natural Resource Conservation Service (NRCS) conducted a reconnaissance survey, which indicated that no prime farmland[2] is present in the proposed project area.

3.5 Water Resources

3.5.1 Surface Waters and Wetlands

Surface water in the vicinity of the proposed Nichols Ranch ISR Project site includes CBM stock ponds and ephemeral streams that flow after snow melt or heavy storms. Generally, the ephemeral streams flow west to the Powder River, a tributary of the Yellowstone River in eastern Montana. The Powder River Basin, in which the proposed Nichols Ranch ISR Project is located, includes the Powder River, Little Powder River, Clear Creek, Piney Creek, Crazy Woman Creek, and eight major reservoirs. As discussed in GEIS Section 3.3.4.1, WDEQ classifies water bodies for designated uses. The channels within the Nichols Ranch and Hank Units are classified as Class 3B waters, which are generally intermittent, ephemeral, or isolated waters that support aquatic life other than fish and may include adjacent wetlands along stream channels (HKM, 2002).

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[2]Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. <http://www.nrcs.usda.gov/technical/

NRI/maps/meta/t5839.html> (16 September 2009).

3.5.1.1 Drainage Basins

Within the Powder River Basin, the Nichols Ranch Unit lies within the Cottonwood Creek drainage areas and the Hank Unit lies within the Willow Creek and Dry Willow Creek drainage areas (Figure 3-5).

Cottonwood Creek is a tributary that flows west from the proposed project site The Cottonwood Creek drainage area encompasses about 20,800 ha [51,300 ac] and has an elevation range of 1,400 to 1,820 m [4,590 to 5,974 ft] above mean sea level (AMSL) to the Dry Fork of the Powder River. The majority of the channels on the Nichols Ranch Unit drain to Cottonwood Creek, though channels in the northern portion of the site drain to Tex Draw, another tributary of the Dry Fork. The Tex Draw channel is located outside of the Nichols Ranch Unit.

The Willow Creek and Dry Willow Creek drainage areas encompass about 3,420 ha and 3,160 ha [8,450 ac and 7,800 ac] with elevation ranges of 1,529 to 1,536 m [5,015 to 5,040 ft] AMSL and 1,522 to 1,550 m [4,995 to 5,084 ft] above AMSL. Dry Willow Creek flows into Willow Creek, which is a tributary of the Powder River.

3.5.1.2 Surface Water Features

Approximately 6,020 m [21,722 ft] of ephemeral channels and washes occur within the Nichols Ranch Unit (Uranerz, 2007). Channels are moderately to deeply incised and have banks ranging from 0.3 to 4.5 m [1 to 15 ft] high and 0.3 to 4.5 m [1 to 15 ft] wide. Irrigation ditches used for hay production divert some ephemeral channel waters for agricultural use. Four emergent wetland areas, discussed further in Section 3.5.1.5 in this SEIS, were identified within the Nichols Ranch Unit.

Ephemeral channels and washes on the Hank Unit total 15,133 linear m [49,649 ft] (Uranerz, 2007). Channels are deeply incised at the western boundary of the Hank Unit and have banks ranging from 3.0 to 15 m [10 to 50 ft] high. Typical channel widths range from 6.1 to 9.1 m [20 to 30 ft] at the western boundary of the Hank Unit and 0.3 to 0.6 m [1 to 2 ft] over the remainder of the unit. The channels generally flow from east to west.

The CBM discharges are monitored through eight Wyoming Pollutant Discharge Elimination System (WYPDES) permits issued to CBM operators located within and adjacent to the proposed license area. These CBM discharges are further discussed in Section 3.5.1.3 of this SEIS.

3.5.1.3 Surface Water Flow

The channels within both the Nichols Ranch and Hank Units are ephemeral and remain dry during the majority of the year. These streams only flow in response to heavy snow melt and large rainfall events. The rolling terrain and deeply incised channels generally yield confined flow patterns without defined floodplains. Flood waters conveyed during storm events are expected to remain within the channel banks, with the exception of one stretch of Cottonwood Creek. The anticipated 25-year flood event on Cottonwood Creek showed water in its floodplain, which included the lower tip of the west limb of the Nichols Ranch Unit ore body.

This floodwater may inundate any wellfield in the lower portion of the proposed license area. The applicant predicted that flow in the smaller tributaries within the license area would be

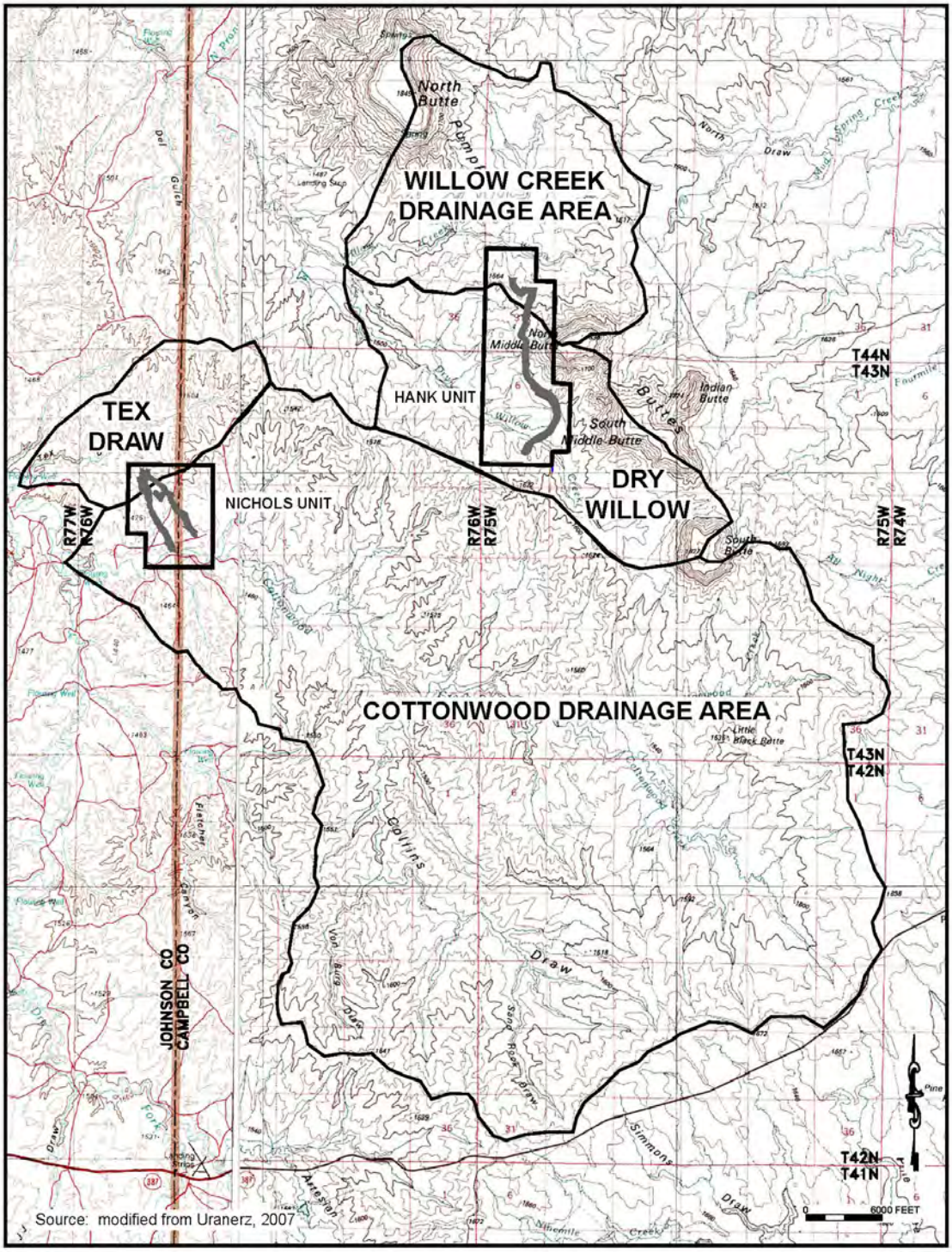

Figure 3-5. Drainage Basins at the Nichols Ranch ISR Project
Source: Modified from Uranerz (2007)

confined to the channels. The proposed location of the Nichols Ranch Unit central processing plant is north of the region, which is anticipated to be flooded by Cottonwood Creek. The applicant would install a ditch and berm on the upgradient side of the Nichols Ranch Unit central processing plant to convey waters from a 25-year flood event away from the plant (Uranerz, 2007). Peak flows and velocities for Cottonwood Creek, Tex Draw, Dry Willow Creek, and Willow Creek using the Lowham methodology (Lowham, 1976) are presented in Table 3-3.

For the Nichols Ranch Unit, there are 5 active CBM WYPDES permits containing 17 permitted outfalls for CBM-produced water within or adjacent to the proposed area. Discharge to surface water drainages has only occurred at 5 of the 17 permitted outfalls (Uranerz, 2007). Each of these active outfalls is currently located outside and hydrologically downgradient of the Nichols Ranch Unit and is therefore unlikely to have impacted the surface water quality at the site. The remaining permitted outfalls are associated with impoundments that are designed to infiltrate to groundwater and prohibited from direct discharge to surface water drainage. Two impoundment outfalls, which have not received discharge, are located upgradient of the site. These impoundments may impact surface water quality in Cottonwood Creek if they overflow during significant runoff events. Two other impoundment outfalls are located on drainages that discharge to Cottonwood Creek and are located upgradient and downgradient of the license area. If they overflow during significant rainfall events they may also enter Cottonwood Creek, but impacts to surface water quality from the CBM outfalls should be unlikely with the dilution from runoff. The applicant stated that the permit and freeboard requirements for the impoundments should prevent any impacts to surface water quality in the license area or on Cottonwood Creek (Uranerz, 2007).

For the Hank Unit, there are three active CBM WYPDES permits with five permitted outfalls for CBM-produced water within or adjacent to the proposed area. According to discharge monitoring reports submitted through June 30, 2008, no discharge has been made to any of these outfalls (Uranerz, 2007). One of the CBM operators at the Hank Unit will apparently not discharge any CBM water in the near future in the proposed license area but will instead pump it offsite for reinjection into the Madison Formation at a site 56 km [35 mi] west of the site. The applicant will notify NRC if any new CBM ponds or basins are installed within or adjacent to the Hank Unit.

3.5.1.4 Surface Water Quality

In its license application, the applicant presented surface water quality data from the historical investigation of the site in 1978 and 1979. The applicant also presented recent surface water quality from samples taken in June 2008. The June 2008 data included surface water samples both upstream and downstream of both units within channels with flowing water namely, Dry Willow Creek and Cottonwood Creek (Uranerz, 2007, 2010). The applicant provided results for four sampling locations within and adjacent to the Nichols Ranch Unit that NRC staff evaluated (Uranerz, 2007). The first sampling point was the Brown Water Pond located on a tributary of Cottonwood Creek 3.2 km [2 mi] upstream of the proposed license area. The second location was Cottonwood Creek at Brown Ranch, which is located approximately 3.2 km [2 mi] upstream of the proposed license area. A third sampling point was Cottonwood Upstream Nichols located immediately upstream of the proposed license area on the southern boundary. The last sampling point was Cottonwood Downstream Nichols located immediately downstream of the proposed license area on the southern boundary. The surface water quality measured at the Cottonwood Downstream location in 2008 exceeded the Wyoming Class I (domestic use) and Environmental Protection Agency (EPA) secondary drinking water standard for iron. The Cottonwood Upstream location exceeded Wyoming Class I and EPA primary and secondary

Table 3-3. Peak Flows of Major Drainages for the Nichols Ranch ISR Project

	Cottonwood Creek	Tex Draw	Dry Willow Creek	Willow Creek
Drainage Area in ha [ac]	20,800 [51,300]	1350 [3,330]	3160 [7,800]	3420 [8,450]
Estimated Peak Flows [m^3/s (cfs)] by Recurrence Interval				
2-Year	12.9 [454]	4.81 [170]	6.54 [231]	6.71 [237]
5-Year	34.5 [1220]	12.9 [456]	17.6 [620]	18.1 [638]
10-Year	60.1 [2150]	22.1 [782]	30.3 [1070]	31.1 [1100]
25-Year	106 [3760]	38.8 [1370]	52.9 [1870]	54.7 [1930]
50-Year	153 [5420]	55.8 [1970]	76.5 [2700]	78.7 [2780]
100-Year	212 [7500]	77.0 [2720]	106 [3730]	109 [3840]
Source: Uranerz (2007)				

drinking water standards for total dissolved solids (TDS) sulfate, uranium, and manganese in 2008. Cottonwood Creek at Brown Ranch exceeded Wyoming Class I and EPA secondary standards for TDS and sulfate in 1979. Lastly, the Brown Water Pond sample from 1979 did not exceed any drinking water standards.

The applicant provided results for two sample locations within and adjacent to the Hank Unit that NRC staff evaluated (Uranerz, 2007). The first sampling point was on Dry Willow Creek Reservoir, which is located upstream of the project boundary in the southern portion of the proposed license area. The second sampling point was on Dry Willow Creek, which is downstream of the proposed license area in the southern portion. Surface water quality measured at the Dry Willow Creek location downstream of the Hank Unit did not exceed any Wyoming Class of Use standards or EPA primary or drinking water standards in 2008. However, it did exceed the Wyoming Class I and EPA secondary drinking water standards for TDS, sulfate, and uranium in 1979. The Dry Willow Creek Reservoir sample did not exceed any drinking water standards in 1978. However, it did exceed the Wyoming Class I and EPA secondary drinking water standards for pH and iron in 1979.

3.5.1.5 Wetlands

A survey for wetlands and other waters of the U.S. (WUS) was performed on behalf of the applicant for the proposed Nichols Ranch ISR Project site in 2006 by a U.S. Army Corps of Engineers (USACE)-certified wetland delineator with TRC Environmental Corporation (Uranerz, 2007). The survey was conducted as a requirement of the WDEQ–Land Quality Division Permit to Mine application. Four potential jurisdictional emergent wetlands were identified in the southeastern portion of the Nichols Ranch Unit. Three of these are linear, palustrine depressions found within the Cottonwood Creek floodplain, which were created prior to 1950 due to excavation to the groundwater table. The fourth wetland is also in the Cottonwood Creek floodplain and occurs downstream of an overflowing stock tank associated with ranching operations. The total area of wetlands on the proposed Nichols Ranch Unit is 0.5 ha [1.2 ac]; because none of the individual wetlands delineated at the Nichols Ranch Unit exceed 0.2 ha [0.5 ac] in size, no Nationwide Permit 44 under Section 404 of the Clean Water Act was required.

The U.S. Fish and Wildlife Service (FWS) National Wetlands Inventory (NWI) indicates the potential for wetlands on the Hank Unit; however, the site-specific wetland survey concluded that no wetlands exist on the Hank Unit (Uranerz, 2007). The delineated wetlands in

Cottonwood Creek at the Nichols Ranch Unit are located south of the proposed extraction area, and the channel does not cross the area where extraction activities would occur.

3.5.2 Groundwater

3.5.2.1 Regional Groundwater Resources

As discussed in GEIS Section 3.3.4.3 the Northern Great Plains aquifer system is the major regional aquifer system in the Wyoming East Uranium Milling Region. This regional aquifer system has been subdivided into five major aquifers (Whitehead, 1996). These aquifers, from the shallowest to the deepest, are the Lower Tertiary, Upper Cretaceous, Lower Cretaceous, Upper Paleozoic, and Lower Paleozoic aquifers. The Lower Tertiary aquifers consist of the sandstone beds with the Wasatch Formation and the Fort Union Formation. Both formations consist of alternating sandstone, siltstone, and claystone beds and contain lignite and subbituminous coal. Most water is stored in and flows through the more permeable sandstone beds. In the Lower Tertiary aquifers, which include the ore horizons as described next, the regional flow direction is northward and northeastward from the recharge area in northeastern Wyoming. In Wyoming, the potentiometric surface of the Lower Tertiary aquifers is higher than the underlying Upper Cretaceous aquifers; consequently, groundwater moves vertically downward from the Lower Tertiary aquifers to the Upper Cretaceous units through the confining layer separating the two aquifers (NRC, 2009a).

The Upper Cretaceous aquifer consists of sandstone beds interbedded with siltstone and claystone in the Lance Formation and the Fox Hill Sandstone. The Fox Hills Sandstone is one of the most continuous water-yielding formations in the Northern Great Plains aquifer system. The Upper Cretaceous aquifers are separated from the Lower Cretaceous aquifers by several thick, confining units. The Pierre Shale, Lewis Shale, and Steele Shale are the thickest and most extensive confining units in the region. The Lower Cretaceous aquifers are the most widespread aquifers in the Northern Great Plain aquifer system and contain several sandstones. However, the Lower Cretaceous aquifers contain little fresh water. The water becomes saline in the deep parts of the Powder River Basin. The Paleozoic aquifers cover a larger area, but they are deeply buried in most places and contain little fresh water. An exception is the Madison Aquifer, which in some locales provides water with total dissolved solids below 10,000 mg/L [1.34 oz/gal].

As previously discussed in Section 3.4 of this SEIS, the Wasatch Formation outcrops in the study area and represents most of the surficial deposits in the area except for limited Quaternary deposits within surface drainages. Extensive alluvial deposits are present in the proposed project area along Cottonwood Creek. The sandstone beds within the Wasatch Formation comprise the shallowest aquifers within the proposed project area. There are commonly multiple water-bearing sands within the Wasatch Formation. Due to their higher permeability, these water-bearing sands provide the primary sources for groundwater withdrawal. Groundwater within the Wasatch Formation aquifers is typically under confined (artesian) conditions, although locally unconfined conditions exist. Well yields from the Wasatch Formation in the southern part of the Powder River Basin where the proposed site is located are reported to be as high as 1,900 Lpm [500 gpm]. In the vicinity of the Pumpkin Buttes, the Wasatch Formation is known to be 480 m [1,575 ft] thick (Sharp and Gibbons, 1964).

3.5.2.2 Local Groundwater Resources

As discussed in Section 3.4 of this SEIS, the applicant has identified a series of sand layers in the upper portion of Wasatch Formation, present in the proposed project area, and labeled these layers from the shallowest to the deepest as the H, G, F, C, B, A, and 1 Sands. The sands are considered aquifers in the proposed project area. The intervening shales that separate these sands are considered aquitards due to their hydraulic properties (i.e., low permeability) and have been identified by the overlying and underlying sands. For example, the shale separating the H and G Sands has been labeled the HG Aquitard. A schematic of the typical aquifer and aquitard sequence in the proposed project area is shown in Figure 3-4. While generally present throughout the proposed project area, the nature and extent of these sands differ somewhat across the proposed project area from the Nichols Ranch Unit to the Hank Unit. In addition, depth and expression of these sands at the ground surface are influenced by the topographical relief of the proposed project area. The production aquifer at the Nichols Ranch Unit is the A Sand, while the production aquifer at the Hank Unit is the F Sand. The geologic nature and extent of the specific sands and aquitards identified in the proposed project area are discussed further in Section 3.4.

The depth at which groundwater is first encountered across the site varies and depends on surface topography. The specific sand that acts as the surficial aquifer similarly varies across the proposed project area depending on the outcropping of these sands and the surface topography. Limited groundwater-level data are available to define depth to shallow groundwater across the Nichols Ranch Unit, and additional wells are planned to better define shallow groundwater levels in this area. In the southern portion of the Nichols Ranch Unit, shallow groundwater is first encountered in the Cottonwood alluvium and has been shown to come within 3 m [10 ft] of the ground surface. Moving north from the Cottonwood alluvium, shallow groundwater is first encountered in the F Sand aquifer at depths ranging from 15 to 30 m [50 to 100 ft]. However, in the northernmost portion of the Nichols Ranch Unit, the G Sand is likely to be the shallow aquifer, with depth to groundwater ranging between 15 and 30 m [50 and 100 ft] (Uranerz, 2007, 2010). Groundwater flow in the F and G Sands is projected to be in a westerly direction, most likely a result of the local topography.

Depth to shallow groundwater at the Hank Unit is similarly uncertain, and the installation of additional wells is planned to identify shallow water levels in the Hank Unit. However, the H Sand should be the surficial aquifer in this area with depth to groundwater ranging between 15 m [50 ft] in the low-lying areas west of the Hank Unit to 61 m [200 ft] along the eastern border of the Hank Unit (Uranerz, 2007). Groundwater flow in the H Sand at the Hank Unit is expected to be in a westerly direction. The Willow Creek and Dry Willow Creek alluvial materials in the Hank Unit are not expected to contain water except during short periods of time after runoff events.

Groundwater in the surficial aquifers is likely unconfined, although portions of these aquifers may be locally confined. Those sands that underlie the surficial aquifer, particularly at depth, are generally confined.

3.5.2.3 Uranium-Bearing Aquifer

The principal uranium-bearing aquifer at the Nichols Ranch Unit is the A Sand (Figure 3-4). As indicated in Section 3.4.2.1 of this SEIS, the A Sand is 12 to 30 m [40 to 100 ft] thick and is located 91 m to 213 m [300 to 700 ft] below the surface at the Nichols Ranch Unit. The A Sand is thickest to the northeast, thins to the southwest, and is fine to coarse grained. Groundwater

in the A Sand is confined. The A Sand is underlain by the A1 Aquitard and the 1 Sand. The 1 Sand has been identified as the underlying aquifer. The A1 Aquitard comprises mudstones and carbonaceous shale with occasional thin lenses of poorly developed coal. This unit ranges in thickness from 6 to 24 m [20 to 80 ft]. The underlying 1 Sand is missing or less than 1.5 m [5 ft] in thickness and occurs at depths of 171 to 216 m [560 to 710 ft] bgs. The sand is very fine- to coarse-grained.

The A Sand is overlain by the BA Aquitard and the B Sand. The B Sand has been identified as the aquifer overlying the production aquifer. The BA Aquitard varies from 3 to 40 m [10 to 130 ft] in this area, thickening to the northwest and thinning to the southeast. This unit consists of mudstones and thin discontinuous light gray siltstones. The BA Aquitard has been shown to extend across the site from the Nichols Ranch Unit to the Hank Unit, where it is 24 m [80 ft] thick and is composed mainly of mudstones. The B Sand ranges in thickness from 12 to 55 m [40 to 180 ft] at the Nichols Ranch Unit. This unit is fine to coarse grained. The body of the B Sand is occasionally separated by lenses of mudstone, siltstone, and carbonaceous shale. Some of these mudstone lenses exceed 8 m [25 ft] in thickness and may extend for thousands of feet. The B Sand is very extensive and has been correlated across the gap between the Nichols Ranch and Hank Units.

The principal uranium ore zone sand member at the Hank Unit is the F Sand, which is approximately 6 to 37 m [20 to 120 ft] thick and is 61 to 183 m [200 to 600 ft] bgs in this portion of the proposed project area. The water levels in the F Sand fall below the base of the overlying GF Aquitard in the northern portion of the Hank Unit and slightly above in the southern portion. The F sand is therefore both an unconfined and slightly confined aquifer across the Hank Unit. The F Sand is underlain by the FC Aquitard and the C Sand. The C Sand has been designated the aquifer underlying the production zone in areas where it is present. The C Sand at the Hank Unit is 3 to 18 m [10 to 60 ft] thick, discontinuous, and is composed of fine- and very fine-grained sand. The C Sand is not always present below the F Sand at the Hank Unit. At these locations, the B Sand is the sand unit underlying the production sand. The FC Aquitard is composed of mudstones, siltstones, gray carbonaceous shale, and poorly developed coal. The aquitard ranges in thickness from 14 to 24 m [45 to 110 ft], depending on the presence of the C Sand. Where the C Sand is not present, it merges with the CB Aquitard overlying the B Sand.

Water levels have been measured in wells installed in the proposed project area to define the direction and gradient of groundwater movement. The location of wells installed at the Nichols Ranch and Hank Units is shown in Figures 3-6 and 3-7. While wells have been installed in many of the identified sand aquifers, these wells have been concentrated in the production zones at the Nichols Ranch and Hank Units. Based on these water level measurements, a potentiometric map has been presented for the A Sand at the Nichols Ranch Unit (Uranerz, 2007, Figure 2-19). This potentiometric map indicates groundwater in the A Sand is flowing northwest with an average gradient of 0.0033. Based on this gradient, an effective porosity of 0.05, and an average hydraulic conductivity of 0.15 m/day [0.5 ft/day], the average rate of groundwater flow is estimated to be 0.01 m/day [0.033 ft/day]. A similar potentiometric map has been presented for the F Sand across both the Nichols Ranch and Hank Units (Uranerz, 2007, Figure 2-20). This map indicates water in the F Sand is flowing west with an average gradient of 0.005. Based on this gradient, an effective porosity of 0.05, and an average hydraulic conductivity of 0.18 m/day [0.6 ft/day], the average rate of groundwater flow in the F Sand aquifer across the proposed project area is estimated to be 0.018 m/day [0.06 ft/day]. Similar gradients and flow directions have been observed in the B and C Sand aquifers as in the A and F Sand aquifers. The shallow sands in the Hank Unit are more likely to be affected by

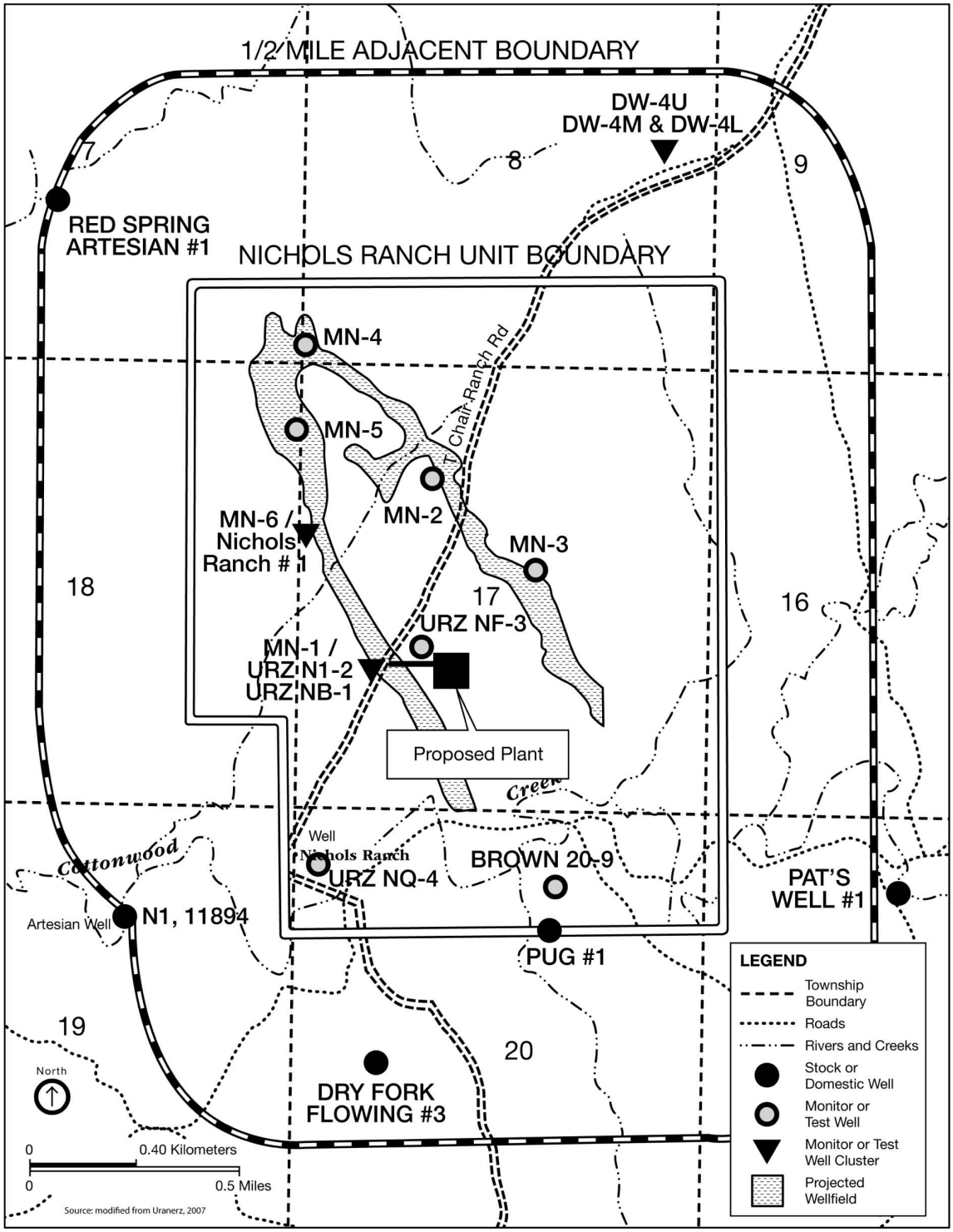

Figure 3-6. Nichols Ranch Unit Location of Existing Wells
Source: Modified from Uranerz (2007)

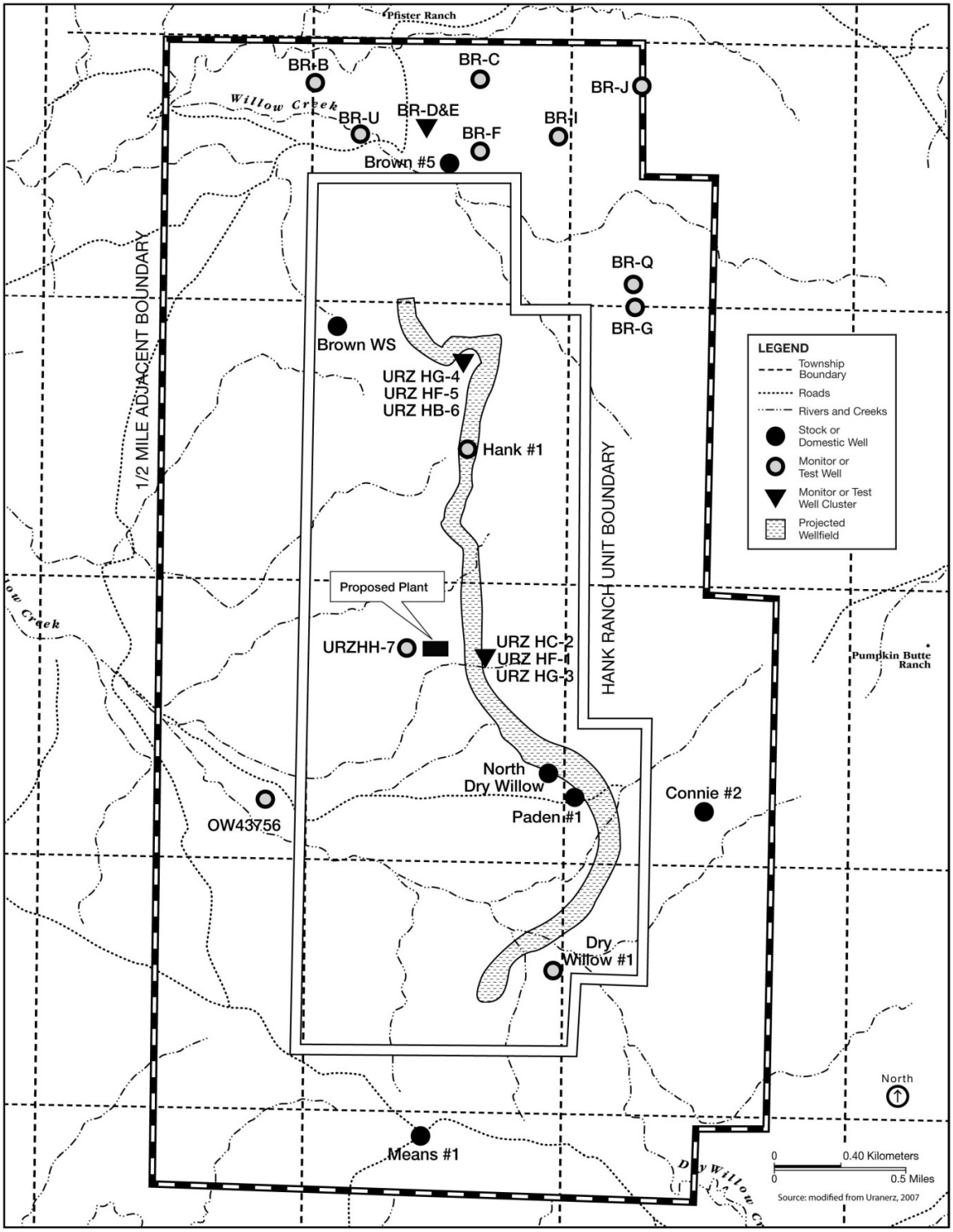

Figure 3-7. Hank Unit Location of Existing Wells
Source: Modified from Uranerz (2007)

local topographical changes than the deeper sands. Water level data for the G Sand in the Hank Unit show a much steeper groundwater gradient.

3.5.2.3.1 Hydrogeologic Characteristics

The hydraulic properties of the production aquifers, as well as the associated underlying and overlying aquifers, have been evaluated in the proposed project area using both multiwell pumping tests and single-well tests. Cleveland Cliffs[3] previously conducted aquifer testing 1978 and 1979. The applicant conducted additional aquifer testing in 2006 and 2007. The hydraulic conductivity of the A Sand at the Nichols Ranch Unit varied from approximately 0.55 to 21.3 cm/day [0.018 to 0.7 ft/day]. The applicant estimated hydraulic conductivity of 15.2 cm/day [0.5 ft/day] best represents the A Sand in this area. A single-well test for the B Sand aquifer indicated hydraulic conductivity of 11.3 cm/day [0.37 ft/day] for this sand. Two single-well tests for the 1 Sand resulted in hydraulic conductivities of 5.5 and 7.9 cm/day [0.18 and 0.26 ft/day] for this sand. A single-well test in the F Sand yielded a higher hydraulic conductivity of 110 cm/day [3.6 ft/day].

The hydraulic properties of the F Sand at the Hank Unit varied greatly from 4.3 to 287 cm/day [0.14 to 9.4 ft/day]. The applicant estimated hydraulic conductivity of 18.3 cm/day [0.6 ft/day] best represents the majority of the F Sand in this area. The water level in the ore zone at the Hank Unit is near the top of the sand; therefore, the F Sand is not fully saturated. Accordingly, the F Sand aquifer is an unconfined aquifer. The primary storage property for an unconfined aquifer is specific yield. The applicant estimated specific yield of 0.05 best represents the F Sand in this area. Test results from two G Sand wells yielded hydraulic conductivity measurements for this sand of 0.15 and 0.67 cm/day [0.005 and 0.022 ft/day]. A single measurement in the C Sand indicated a hydraulic conductivity value of 0.76 cm/day [0.025 ft/day]. Two single-well tests in the B Sand yielded hydraulic conductivity measurements of 11.6 and 67.1 cm/day [0.38 and 2.2 ft/day].

3.5.2.3.2 Level of Confinement

Vertical permeabilities of the aquitards in the Powder River Basin have been defined at numerous locations, including just north of the Hank Unit during the permitting of the PRI North Butte ISR Project. These permeabilities have been measured using multiwell pumping tests, a variety of analytical methods, and laboratory measurements. The applicant reported that data and analysis presented in the PRI North Butte ISR Project application indicate the vertical permeability for the aquitard separating the F and C Sands was 0.004 cm/day [1.1×10^{-4} ft/day]. A second multiwell test at the PRI North Butte ISR Project site indicated the aquitard permeability between the A Sand and the 1 Sand was 0.004 cm/day [1.2×10^{-4} ft/day]. Laboratory measurements of permeabilities of samples from two aquitards were submitted for the PRI North Butte ISR Project site. These permeabilities varied from 54.9 to 0.001 cm/day [1.8 to 3.7×10^{-5} ft/day]. NRC staff found these data sufficient to demonstrate the confinement of the uranium-bearing sands at the proposed project area. Aquifer confinement would be further verified by the applicant at each of the wellfields during the required wellfield multiwell pumping tests.

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[3] In the 1980s, Cleveland Cliffs Iron Company installed wells in the area when it was exploring the Pumpkin Buttes Uranium District.

3.5.2.3.3 Groundwater Quality

In Wyoming, the quality of groundwater is measured against either EPA Drinking Water Standards (40 CFR Parts 142 and 143), which establish Maximum Contaminant Levels (MCLs) for specific chemical constituents, or Wyoming Groundwater Quality standards. The Wyoming standards are based on ambient water quality and are divided into five classes (WDEQ, 2005):

- Class I is defined as suitable for domestic use
- Class II is defined as suitable for agriculture
- Class III is defined as suitable for livestock
- Class IV is defined as suitable for industrial use
- Class Special (A) is defined as suitable for fish and aquatic life.

For ISR operations to be conducted in a proposed ore-bearing aquifer within the permit boundaries of the proposed ISR Site, the aquifer must be declared as an exempted aquifer, in compliance with 40 CFR Part 146. The applicant is required to obtain a Class III underground injection control (UIC) exemption permit from the State. The state requests an aquifer exemption from the EPA for the proposed Class III UIC permit. The applicant must have both the UIC permit and the exemption before operations may begin.

The applicant evaluated the groundwater quality in the proposed project area by sampling numerous wells in many of the aquifers identified in the area. The resulting groundwater quality data are presented in Tables 3-4 and 3-5. The data in this summary have been grouped for the A Sand, the F Sand, the B and C Sands, the G and H Sands, and the 1 Sand. Included in this summary table are EPA Drinking Water Standards (40 CFR Parts 142 and 143) and Wyoming Class I, Domestic Ground Water Quality standards.

The groundwater quality summary data indicate the A Sand water has very low TDS [less than 500 mg/L [0.067 oz/gal], with major components being sodium, sulfate, and bicarbonate. Uranium concentrations in A Sand groundwater varied between detection and 0.027 mg/L [3.6×10^{-6} oz/gal]. Radium-226 concentrations varied between detection and 1,343 Bq/m^3 [36.3 pCi/L]. Typically, uranium-bearing aquifers, particularly in the ore zone, exhibit uranium and radium-226 levels exceeding their respective EPA MCLs (NRC, 2009a). The relatively low concentrations found in the A Sand in the area of Nichols Ranch and Hank Units appear to be related to the length of the well screens (ranging from 21 to 34 m [69 to 110 ft] in length), which extend over the entire A Sand and are not limited to the ore zone. This would lead to dilution of the samples with water from outside the ore zone.

Groundwater quality data for the F Sand indicate average TDS concentrations were greater than 1,000 mg/L [0.134 oz/gal]. Sodium, calcium, bicarbonate, and sulfate are the major dissolved constituents in this water. Uranium concentrations were measured in this ore-bearing sand at an average of 0.16 mg/L [2.1×10^{-5} oz/gal], with a maximum concentration of 5.25 mg/L [7.01×10^{-4} oz/gal]. Radium concentrations as high as 20,794 Bq/m^3 [562 pCi/L] were also measured, with an average value of 1,591 Bq/m^3 [43 pCi/L]. Consequently, the F Sand does not meet the Wyoming Class I, II, or III groundwater quality standards and exceeds the EPA MCL for uranium.

These B and C Sands lie between the two production zones and are connected in some areas. TDS in these aquifers averaged 793 mg/L [0.106 oz/gal] with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in these aquifers averaged 0.059 mg/L [7.9×10^{-6} oz/gal], with a maximum of 2.16 mg/L [2.88×10^{-4} oz/gal]. Radium

Table 3-4. Water Quality of Specific Aquifers in the Nichols Ranch Unit

Water Quality Parameter	B and C Sands Overlying Aquifer	A Sand Ore Zone Aquifer	1 Sand Underlying Aquifer	Water Quality Standards*
Bicarbonates as HCO_3 (mg/L)†	120.65	138.86	233.75	
Carbonates as CO_3 (mg/L)	3.43	4.41	15.75	
Chloride (mg/L)	53.22	8.06	5.00	250
Conductivity (umhos/cm)	1162.68	564.13	411.5	
Fluoride (mg/L)	0.174	0.24	0.65	2.0–4.0
pH (s.u.)	8.15	8.48	8.63	6.5–8.5
Total Dissolved Solids (mg/L)	797.11‡	333.14	232.0	500
Sulfate (mg/L)	466.24‡	135.05	1.5	250
Radium-226 (pCi/L)§	15.44‡†	5.02†	0.1	5.0
Nitrogen, Ammonia as N (mg/L)	0.627‡	0.09	0.07	0.5
Nitrogen, Nitrate+Nitrite as N (mg/L)	0.069	0.05	0.05	10
Aluminum (mg/L)	0.095	0.05	0.05	0.05 to 0.2
Arsenic (mg/L)	0.002	0.0	0.0005	0.01
Barium (mg/L)	0.052	0.05	0.05	2.0
Boron (mg/L)	0.110	0.08	0.05	
Cadmium (mg/L)	0.004	0.0	0.0025	0.005
Calcium (mg/L)	53.22	7.61	3.75	
Chromium (mg/L)	0.016	0.02	0.025	0.1 (total)
Copper (mg/L)	0.012	0.01	0.005	1.0
Iron (mg/L)	0.109	0.07	0.015	0.3
Lead (mg/L)	0.01	0.01	0.005	0.015
Magnesium (mg/L)	10.94	0.57	0.50	
Manganese (mg/L)	0.025	0.01	0.005	0.05
Mercury (mg/L)	0.001	0.0	0.0005	0.002
Molybdenum (mg/L)	0.069	0.07	0.05	
Nickel (mg/L)	0.02	0.02	0.025	0.1
Potassium (mg/L)	6.89	2.23	2.25	
Selenium (mg/l)	0.0	0.0	0.0005	0.05
Sodium (mg/l)	189.49	113.62	99.5	
Uranium (mg/L)	0.06‡	0.01	0.00015	0.03
Vanadium (mg/L)	0.05	0.05	0.05	
Zinc (mg/L)	0.23	0.01	0.005	5.0

*EPA Drinking Water Standards - 40 CFR Part 142 and 40 CFR Part 143, Wyoming Water Quality, Rules and Regulations, Chapter 8, Class I, Domestic Ground Water

†To convert mg/l to oz/ gal, multiply by 1.34×10^{-4}

‡Bolded values exceed either EPA or Wyoming Class I Groundwater Standards

§To convert pCi/L to Bq/m^3, multiply by 37

Table 3-5. Water Quality of Specific Aquifers in the Hank Unit

Water Quality Parameters	G Sand Overlying Aquifer	F Sand Ore Zone Aquifer	B and C Sand Underlying Aquifer	Water Quality Standards*
Bicarbonates as HCO_3 (mg/L)†	151.1	171.43	120.65	
Carbonates as CO_3(mg/L)	8.8	0.63	3.43	
Chloride (mg/L)	7.6	5.53	53.22	250
Conductivity (umhos/cm)	804.9	1426.96	1162.68	
Fluoride (mg/L)	0.2486	0.15	0.174	2.0–4.0
pH (s.u.)	8.4	7.82	8.15	6.5–8.5
Total Dissolved Solids (mg/L)	504.4‡	1020.95‡	797.11‡	500
Sulfate (mg/L)	243.1	597.33‡	466.24‡	250
Radium-226 (pCi/L)§	0.73	44.6‡	15.44‡	5.0
Nitrogen, Ammonia as N (mg/L)	0.103	0.05	0.627‡	0.5
Nitrogen, Nitrate+Nitrite as N (mg/L)	0.05	0.05	0.069	10
Aluminum (mg/L)	0.425‡	0.05‡	0.095	0.05 to 0.2
Arsenic (mg/L)	0.0033	0.0068	0.002	0.01
Barium (mg/L)	0.055357	0.05	0.052	2.0
Boron (mg/L)	0.24643	0.08	0.110	
Cadmium (mg/L)	0.00329	0.0034	0.004	0.005
Calcium (mg/L)	48.6	99.77	53.22	
Chromium (mg/L)	0.0221	0.02	0.016	0.1 (total)
Copper (mg/L)	0.00714	0.02	0.012	1.0
Iron (mg/L)	0.499‡	0.30‡	0.109	0.3
Lead (mg/L)	0.0231‡	0.01	0.01	0.015
Magnesium (mg/L)	9.8	24.37	10.94	
Manganese (mg/L)	0.051‡	0.07‡	0.025	0.05
Mercury (mg/L)	0.00047	0.0005	0.001	0.002
Molybdenum (mg/L)	0.05	0.05	0.069	
Nickel (mg/L)	0.0232	0.02	0.02	0.1
Potassium (mg/L)	6.0	7.12	6.89	
Selenium (mg/L)	0.0026	0.02	0.00	0.05
Sodium (mg/L)	110.9	185.73	189.49	
Uranium (mg/L)	0.009475	0.15‡	0.06‡	0.03
Vanadium (mg/L)	0.0363	0.05	0.05	
Zinc (mg/L)	0.021	0.02	0.23	5.0

*EPA Drinking Water Standards – 40 CFR Part 142 and 40 CFR Part 143, Wyoming Water Quality, Rules and Regulations, Chapter 8, Class I, Domestic Ground Water
†To convert mg/l to oz/gal, multiply by 1.34×10^{-4}
‡Bolded values exceed either EPA or Wyoming Class I Groundwater Standards
§To convert pCi/L to Bq/m^3, multiply by 37

concentrations in the B and C Sand aquifers average 592 Bq/m^3 [16 pCi/L] with a maximum measured concentration of 4,736 Bq/m^3 [128 pCi/L]. Consequently, the B and C Sands do not meet the Wyoming Class I, II, or III groundwater quality standards and exceed the EPA MCL for uranium. TDS in the H and G Sands averaged 427 mg/L [5.7 × 10^{-2} oz/gal] with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in these aquifers were generally low, averaging 0.004 mg/L [5.3 × 10^{-7} oz/gal]. Radium concentrations in the H and G Sand aquifers average 16 Bq/m^3 [0.44 pCi/L] with a maximum measured concentration of 70 Bq/m^3 [1.9 pCi/L]. Uranium concentrations averaged 0.059 mg/L [7.9 × 10^{-6} oz/gal]. As a result of the data presented, the H and G Sands would meet the Wyoming Class II groundwater quality standards and are suitable for agriculture.

TDS in the 1 Sand averaged 232 mg/L [3.09 × 10^{-2} oz/gal] with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in this aquifer were very low, averaging 0.00015 mg/L. Radium concentrations were on average 0.1 pCi/L. Consequently, the 1 Sand meets the Wyoming Class I groundwater quality standards.

3.5.2.3.4 Current Groundwater Uses

The applicant contacted the Wyoming State Engineer's Office (WSEO) to identify all permitted wells within each unit and within a 4.8-km [3-mi] radius of each unit. Numerous wells have been identified in these surveys, including wells associated with mining and aquifer monitoring, stock watering wells, and domestic wells. The survey indicates, excluding the monitoring and mining-related wells, most wells are used for livestock watering through the use of windmills or electric well pumps. The depth of these wells generally ranges between 30 and 305 m [100 and 1,000 ft]. A number of the identified wells have sufficient hydraulic heads so the wells can discharge to the surface without pumping (flowing wells). In the proposed project area, wells that are completed in the ore-bearing zone would be abandoned per Wyoming regulations or would be used as monitoring wells if deemed appropriate (i.e., proper screen interval).

Inspection of these data for wells identified within the Nichols Ranch Unit and within a 4.8-km [3-mi] radius of the unit with depths of between 91 and 210 m [300 and 700 ft] bgs (i.e., potentially screened within the A Sand) indicates available groundwater head averages around 136 m [446 ft]. The survey has identified nine existing wells within the Nichols Ranch Unit excluding aquifer testing or monitoring wells. All of these wells are used for stock watering. The applicant review conducted of these wells indicates several are completed in the ore-bearing sands and would need to be abandoned or converted to monitoring wells. The survey also indicates three domestic wells within 4.8 km [3 mi] of the Nichols Ranch Unit wellfields. Two of the wells (Doughstick and Garden Well) are approximately 3.62 km [2.25 mi] southeast and upgradient of the proposed wellfields, while Dry Fork #1 is about 2.01 km [1.25 mi] southwest and cross gradient from the proposed wellfields.

Inspection of these data for wells identified within the Hank Unit and within a 4.8-km [3-mi] radius of the unit with depths between 61 and 180 m [200 and 600 ft] bgs (i.e., potentially screened within the F Sand) indicates available groundwater head averages around 75 m [246 ft]. Six permitted wells were identified within 0.8 km [0.5 mi] of the Hank Unit. All of these are used for stock watering. Several of these wells appear to be completed in the F Sand, while other wells are screened through multiple sands including the C, B, and A Sands. Several of these wells would need to be abandoned or converted to monitoring wells. The survey also indicates three domestic wells within 4.8 km [3 mi] of the Hank Unit. A domestic well was identified 1 km [0.6 mi] north of the northern boundary of the Hank Unit. This well (BR-T) is reported to be completed in the B Sand below the westward-flowing production zone (F Sand)

at the Hank Unit. The other two domestic wells (Doughstick and Garden Well) are approximately 4.8 km [3 mi] southwest and cross gradient from the proposed wellfields.

For its safety review, NRC recommends groundwater samples should be collected quarterly from each well within 2 km [1.2 mi] of a proposed license area that is or could be used for drinking water, watering of livestock, or crop irrigation. Uranerz did not perform this sampling. NRC staff cannot conclude that the radiological sample results were provided for groundwater used for domestic water supplies and livestock watering to determine the background radiological characteristics. This situation is not consistent with the standard review plan recommendations; therefore, the staff is including a license condition, the wording of which is presented in SER Section 2.6.4. Staff based the license condition on NRC Regulatory Guide 4.14 that recommends groundwater sampling 2 km [1.2 mi] from a tailings impoundment for both domestic and livestock wells within 2 km [1.2 km] of the licensed ISR boundary. However, the staff will only require semiannual monitoring to determine background at these wells.

As a result of the NRC's safety review, a license condition will require the applicant will be required to submit to NRC by license condition monitoring well sampling results for domestic and livestock wells located within 1.2 mi [2 km] of the boundary of the proposed Nichols Ranch ISR Project before uranium recovery operations begin.

The applicant sampled two monitoring well locations in the surficial aquifers at both the proposed Nichols Ranch and Hank Units' proposed license area to assess surficial groundwater quality. NRC staff notes the surficial aquifer water quality may be impacted by spills; piping and casing leaks, which routinely occur at ISR operations; and potentially artificial connections between the surficial aquifer and other aquifers. Additionally, as mentioned in Section 3.5.1.3 of this SEIS, the applicant reported that CBM-produced water would be discharged at the surface into impoundments that are designed to infiltrate the surficial aquifers at both license areas. Therefore, CBM produced water is and will continue to be discharged to surface impoundments, which are designed to infiltrate the surficial aquifer near the Nichols Ranch Unit and potentially the Hank Unit.

During its safety review, NRC staff determined this number of monitoring well locations was insufficient to establish background ground water quality in the surficial aquifers at either the Nichols Ranch Unit or the Hank Unit. The NRC staff finds the lack of characterization of preoperational background ground water quality in the surficial aquifers of each license area will hinder the ability of the applicant to assess impacts to the surficial aquifer from ISR operations. NRC staff therefore found that the applicant should establish the preoperational water quality of surficial aquifers in the Nichols Ranch Unit and Hank Unit license area. This background is important to allow the applicant and NRC to distinguish between CBM-produced water infiltration to the surficial aquifer and impacts from surface spills, well and pipeline leaks, or excursions from ISR operations.

As a result of the NRC's safety review, a license condition will require the applicant will be required by a license condition to establish the average background water quality of the surficial aquifers at both the Nichols Ranch and Hank Unit before operations begin so that impacts to these aquifers from future CBM or ISR operations may be assessed.

3.5.2.4 Surrounding Aquifers

As indicated in GEIS Section 3.3.4.3.4, the Wasatch and Fort Union Formations are important aquifers for regional water supply. The Fox Hill Sandstone is one of the most continuous

water-yielding formations in the Northern Great Plains aquifer system. Except at outcrop areas, the Paleozoic aquifers are not usually used for water production, because they are either deeply buried or contain saline water.

Based on the survey of water wells within a 4.8-km [3-mi] radius of the proposed site, water supply wells are generally completed within 300 m [1,000 ft] of the ground surface in the sands of the Wasatch Formation. The Fort Union Formation is not extensively used, because sufficient yields of groundwater are available from the overlying Wasatch Formation.

Deep well injection has been proposed for the disposal of liquid effluent. Typically, deep well injection in the Powder River Basin occurs in the Upper Cretaceous Lance Formation (e.g., Irigaray/Christensen Ranch) several thousand feet below the Lower Tertiary production zones. The applicant has indicated it would apply for a UIC permit through WDEQ. The State and EPA would only grant such a permit if the applicant can demonstrate that liquid effluent could be safely isolated in a deep aquifer. As required by the WDEQ UIC permit, the deep disposal well would be completed (i.e., screened) in an approved subsurface formation and would be operated according to permit requirements.

3.6 Ecology

The Wyoming East Uranium Milling Region, as described in the GEIS, encompasses the Wyoming Basin, Northern Great Plains, Southern Rockies, and Western High Plains. The proposed Nichols Ranch ISR Project is located within the Powder River Basin of the Northwestern Great Plains ecoregion. GEIS Section 3.3.5.1 provides the following description of this region:

The Northwestern Great Plains encompass the Missouri Plateau section of the Great Plains. This area includes semiarid rolling plains of shale and sandstone derived soils punctuated by occasional buttes and badlands. For the most part, it has not been influenced by continental glaciation. Cattle grazing and agriculture with spring wheat and alfalfa farming are common land uses. Agriculture is affected by erratic precipitation and limited opportunities for irrigation. In Wyoming, mining for coal and coal-bed methane production is prevalent, with a large increase in the number of coal-bed methane wells drilled in recent years. Native grasslands and some woodlands persist, especially in areas of steep or broken topography (Chapman, et al., 2004).

GEIS Section 3.3.5.1 provides the following description of the Powder River Basin:

The Powder River Basin ecoregion of the Northwestern Great Plains covers rolling prairie and dissected river breaks surrounding the Powder, Cheyenne, and Upper North Platte Rivers. The Powder River Basin has less precipitation and less available water than the neighboring regions. Vegetation within this region is composed of sagebrush and mixed-grass prairie dominated by blue grama (*Bouteloua gracilis*), western wheatgrass (*Elymus smithii*), prairie junegrass (*Koeleria macrantha*), Sandberg Bluegrass (*Poa secunda*), needle-and-thread grass (*Stipa comata*), rabbitbrush (*Chrysothamnus nauseosus*), fringed sage (*Artemisia frigida*), and other forbs, shrubs, and grasses (Chapman, et al., 2004).

The Nichols Ranch Unit has elevations ranging from 1,423 to 1,494 m [4,670 to 4,900 ft] AMSL. Topography in this area is relatively flat with gently rolling hills and low ridges that drain south toward Cottonwood Creek, an intermittent stream that is located in the southern portion of the unit.

The Hank Unit is located approximately 6.7 km [4.2 mi] northeast of the Nichols Ranch Unit, with elevations ranging from 1,541 to 1,588 m [5,055 to 5,209 ft] AMSL. The topography includes gently rolling hills and low ridges, as well as steep terrain near North Middle Butte and some steeply eroded areas associated with Dry Willow Creek, an ephemeral stream that is located in the southern portion of this unit.

The applicant conducted a number of ecological studies at the proposed Nichols Ranch ISR Project to accomplish the objectives specified in NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications," (NRC, 2003) and to meet the applicable State of Wyoming requirements. These studies include vegetation and wildlife surveys, which are detailed in the following sections.

3.6.1 Terrestrial Ecology

The proposed project site comprises primarily sagebrush shrubland and mixed grasslands. Sagebrush shrubland dominates the Hank Unit, and mixed grasslands cover most of the Nichols Ranch Unit (Uranerz, 2007). No perennial streams or other permanent water bodies exist within either unit; however, four wetlands were found in the southeast corner of the Nichols Ranch Unit. These wetlands are detailed in Section 3.5.1.5 of this SEIS.

3.6.1.1 Vegetation

The proposed project area comprises eight vegetation/habitat types, with approximately 88 percent of the area represented by two vegetation communities: sagebrush shrubland and mixed grasslands. In June and July 2006, the applicant conducted vegetation studies in accordance with a study plan the WDEQ–Land Quality Division (LQD) approved for noncoal project areas (Uranerz, 2007).

Sagebrush shrublands are dominated by shrubs and also contain some grasses and forbs. The proposed Nichols Ranch ISR Project site contains 774.7 ha [1,914.4 ac] of sagebrush shrublands, which accounts for 56.8 percent of the site. The community is dominated by threadleaf sedge (*Carex filifolia*), a grasslike species. Other characteristic species include Wyoming sagebrush (*Artemisia tridentata wyomingensis*) and a number of perennial and annual grasses. Alyssum (*Alyssum parvifolia*) and wooly plantain (*Plantago patagonia*), both annual forbs, as well as several scattered plains cottonwood (*Populus deltoids*) and Rocky Mountain juniper (*Juniperus scopulorum*) trees, occur in this community and are generally found growing along the drainages.

Mixed grasslands are common across eastern Wyoming and generally receive more moisture and have greater species diversity than other types of prairie habitats (WGFD, 2006a). The proposed Nichols Ranch ISR Project site contains 428.3 ha [1,058.3 ac] of mixed grasslands, which accounts for 31.4 percent of the site. The community is composed of mainly perennial grasses such as needle-and-thread (*Stipa comata*), Sandberg bluegrass (*Poa secunda*), blue grama (*Bouteloua gracilis*), western wheatgrass (*Elymus smithii*), bluebunch wheatgrass (*Elymus spicatus*), and grasslike species such as threadleaf sedge. Some perennial forbs, annual forbs, and shrub species are scattered in low-density stands throughout this community. No trees occur in this plant community.

Other vegetative communities present on the project site include 60.0 ha [148.3 ac] of juniper outcrop (4.4 percent of the site), 50.4 ha [124.6 ac] of bottomland (3.7 percent), 25.9 ha [64.0 ac] of greasewood shrubland (1.9 percent), 0.5 ha [1.1 ac] of wetland

(less than 0.1 percent), 7.1 ha [17.5 ac] of rock outcrop (0.5 percent), and 17.1 ha [42.3 ac] of disturbed lands (1.2 percent). A full list of species identified in each plant community during the vegetation study is presented in Table 3-6.

No federal threatened, endangered, candidate, or proposed plant species are known to occur on or in the vicinity of the proposed Nichols Ranch ISR Project site. A number of state listed species are known to occur on and in the vicinity of the site and are detailed in Section 3.6.3 in the SEIS. One designated noxious weed species, Canada thistle (*Cirsium arvense*), was found during surveys Uranerz (2007) conducted in disturbed areas and in small numbers.

3.6.1.2 Wildlife

The applicant conducted wildlife inventories on the proposed project site and surrounding 3.2-km [2.0-mi] radius in April, May, June, and July 2006 and February 2007 (Uranerz, 2007). The wildlife inventories included a big game winter survey; Greater sage-grouse lek monitoring; raptor nest activity and productivity surveys; prairie dog colony mapping; federal threatened, endangered, candidate, or proposed species surveys; bald eagle winter roost and nesting surveys; surveys for sensitive species or their habitat; and incidental wildlife observations (big game, birds, mammalian predators, small mammals, reptiles, and amphibians).

The vegetative communities on the proposed Nichols Ranch ISR Project site, which the applicant identified through vegetation studies, have the potential to provide habitat for a great diversity of wildlife. Predominant species include mule deer (*Odocoileus hemionus*; pronghorn antelope (*Antilocapra Americana*); jackrabbit (*Lepus townsendii*); cottontail rabbit (*Sylvilagus audubonii*); coyote (*Canis latrans*); bobcat (*Lynx rufus*); Greater sage-grouse (*Centrocercus urophasianus*); gray partridge (*Perdix perdix*); and a number of small mammals, songbirds, and raptors. Most species are yearlong residents of Wyoming. However, during migration periods, some species such as elk, eagles, songbirds, and waterfowl are more abundant (Uranerz, 2007). Wildlife species identified during the wildlife inventories the applicant conducted are listed in Table 3-7. The characterization of the predominant wildlife species in the wildlife inventories is consistent with the Final Environmental Impact Statement (EIS) for the Wright Area Coal Lease Applications (BLM, 2009a), which analyzes lands in Campbell County.

3.6.1.2.1 Big Game

The applicant (Uranerz, 2007) conducted a formal big game winter survey in February 2007, which included the proposed project area and land within a 1.6-km [2-mi] radius. The survey was completed in accordance with WDEQ and Wyoming Game and Fish Department (WGFD) guidelines, and wildlife biologists recorded the number of individuals, sex, age composition, and habitat type for each group of big game observed within this area. Additionally, the applicant (Uranerz, 2007) conducted opportunistic big game surveys in conjunction with other wildlife surveys in 2006 and 2007. Two species of big game, pronghorn antelope and mule deer, were observed during the survey; a total of 460 and 322 individuals each were recorded. Pronghorn antelope were mainly observed in mixed grassland and sagebrush shrubland vegetation types. The proposed project area lies within habitat WGFD designated as winter/yearlong and yearlong range for pronghorn antelope. WGFD identified the pronghorn antelope herd in this area as the Pumpkin Buttes Antelope Herd Unit, which occupies a total of 2,485 km^2 [1,544 mi^2] and has exceeded the objective population size (18,000 individuals) since 1999 (WGFD, 2005a in Uranerz, 2007). There are no crucial pronghorn antelope ranges within the proposed project area. The nearest crucial range for pronghorn occurs approximately 63 km [39 mi] south of the proposed project area (University of Wyoming, 2008).

Table 3-6. Plant Species by Habitat Occurrence at the Nichols Ranch ISR Project

Scientific Name	Common Name	Sagebrush Shrubland	Mixed Grassland	Juniper Outcrop	Bottomland	Greasewood Shrubland
Perennial Grass						
Agropyron cristatum	Crested wheatgrass		X			
Aristida purpurea longiseta	Three-awn	X	X			
Bromus inermis	Smooth brome				X	
Bouteloua gracilis	Blue grama	X	X	X		X
Calamovilfa longifolia	Prairie sandreed	X	X	X		
Distichlis stricta	Inland saltgrass				X	X
Elymus cinereus	Basin wild rye			X		
Elymus intermedium	Intermediate wheatgrass				X	
Elymus spicatus	Bluebunch wheatgrass	X	X	X		X
Elymus smithii	Western wheatgrass	X	X		X	X
Hordeum jubatum	Foxtail barley		X		X	
Koeleria macrantha	Prairie junegrass	X	X	X	X	X
Poa secunda	Sandberg bluegrass	X	X	X	X	X
Poa spp.	Bluegrass species			X	X	
Oryzopsis hymenoides	Indian ricegrass	X	X	X		X
Sporobolus airoides	Alkali Sacaton				X	X
Stipa comata	Needle-and-thread	X	X	X		X
Stipa viridula	Green needlegrass	X	X			
Unknown perennial grass	—			X	X	
Annual Grasses						
Festuca octoflora	Six-week fescue	X	X			
Bromus japanicus	Japanese brome	X	X	X		X
Bromus tectorum	Cheatgrass (Downy brome)	X	X	X	X	X
Other Grasslike Species						
Carex filifolia	Threadleaf sedge	X	X	X	X	X
Carex praegracilis	Clustered field sedge				X	
Equisetum spp.	Scouring rush				X	
Juncus balticus	Baltic rush				X	
Perennial Forb						
Achillea millefolium	Yarrow			X	X	
Arenaria hookeri	Sandwort			X		
Asclepias specious	Milkweed			X	X	
Astralagus bisulcatus	Two-groove milkvetch	X	X	X	X	

Table 3-6. Plant Species by Habitat Occurrence at the Nichols Ranch ISR Project (continued)

Scientific Name	Common Name	Sagebrush Shrubland	Mixed Grassland	Juniper Outcrop	Bottomland	Greasewood Shrubland
Cirsium arvense	Canada thistle			X	X	
Chaenactis douglasii	Chaenactis			X		
Cryptantha flava	Cryptantha					
Eriogonium ovalifolium	Oval-leaf desert buckwheat	X				
Eriogonium spp.	Buckwheat		X			
Grindellia squarosa	Curlycup gumweed				X	
Haplopappus acaulis	Goldenweed		X	X		
Heterotheca villosa	Golden aster		X	X		
Iva axillaris	Poverty sumpweed	X			X	X
Lupinus spp.	Lupine	X		X		
Lygodesmia juncea	Skeletonweed	X	X			
Melilotus officinalis	Yellow sweetclover					
Phlox hoodii	Hood's phlox		X			X
Psoralea tenuiflora	Scurfpea	X	X	X		
Sphaeralcea coccinea	Globe mallow		X	X		X
Unknown forb	—				X	
Unknown aster	—				X	
Yucca glauca	Yucca		X			
Annual Forbs						
Alyssum parvifolia	Alyssum	X	X	X	X	X
Descurainia sophia	Flixweed tansymustard				X	
Kochia scoparia	Summer cypress				X	X
Lappula redowski	Blue-seed stickseed	X		X		
Madia glomerata	Tarweed				X	
Plantago patagonia	Wooley plantain	X	X		X	X
Unknown annual forb	—		X		X	
Subshrub						
Artemisia frigida	Fringed sage	X	X	X	X	
Artemisia pedatifida	Birdfoot sage					X
Leptodactylon pungens	Granite prickly gila	X	X	X		
Gutierrezia sarothrae	Broom snakeweed	X	X	X		
Succulent						
Opuntia polyacantha	Pricklypear cactus	X	X	X		X

Table 3-6. Plant Species by Habitat Occurrence at the Nichols Ranch ISR Project (continued)

Scientific Name	Common Name	Sagebrush Shrubland	Mixed Grassland	Juniper Outcrop	Bottomland	Greasewood Shrubland
Shrub						
Artemisia cana	Silver sagebrush	X	X	X	X	X
Artemisia tridentata wyomingensis	Wyoming big sagebrush	X	X	X		X
Atriplex gardneri	Gardner's saltbrush					X
Cercocarpus montanus	Mountain mahogany	X		X		
Chrysothamnus nauseosus	Rubber rabbitbrush		X	X		
Chrysothamnus viscidiflorus	Douglas rabbitbrush			X		X
Krascheninnikovia lanata	Winterfat	X	X	X	X	
Rhus tribolata	Skunkbrush			X		
Sarcobatus vermiculatus	Greasewood					
Symphoricarpos occidentalis	Snowberry			X		
Trees						
Juniperus scopulorum	Rocky Mountain juniper			X		
Pinus flexilis	Limber pine			X		
Populus deltoides	Plains cottonwood	X			X	

Source: Uranerz (2007)

Table 3-7. Wildlife Species Observed on or Near the Nichols Ranch ISR Project

Scientific Name	Common Name
Mammals	
Antilocapra americana	pronghorn antelope
Canis latrans	coyote
Cynomys ludovicianus	black-tailed prairie dog
Erethizon dorsatum	porcupine
Lepus townsendii	white-tailed jackrabbit
Lynx rufus	bobcat
Odocoileus hemionus	mule deer
Spermophilus tridecemlineatus	thirteen-lined ground squirrel
Sylvilagus auduboni	desert cottontail
Sylvilagus nutallil	mountain cottontail
Taxidea taxus	badger
Vulpes velox	swift fox
Birds	
Anas platyrhynchos	mallard
Aquila chrysaetos	golden eagle
Asio otus	long-eared owl
Bubo virginianus	great horned owl
Buteo jamacensis	red-tailed hawk
Buteo lagopus	rough-legged hawk
Centrocercus urophasianus	greater sage-grouse
Eremophila alpestris	horned lark
Falco mexicanus	prairie falcon
Falco sparverius	american kestrel
Haliaeetus leucocephalus	bald eagle
Perdix perdix	gray partridge
Pica pica	black-billed magpie
Spizella breweri	Brewer's sparrow
Reptiles	
Coluber constricter flaviventris	Eastern yellowbelly racer
Crotalus viridis viridis	Prairie rattlesnake
Pituophis melanoleucas sayi	Bullsnake
Source: Uranerz (2007)	

Mule deer were generally observed in mixed sagebrush grassland and juniper outcrop vegetation types. WGFD identified the mule deer population in this area as the Pumpkin Buttes Mule Deer Herd Unit, and it occupies 4,355 km^2 [2,706 mi^2] (WGFD, 2005a in Uranerz, 2007). This population was slightly below the objective population size of 11,000 individuals in 2005 and 2006 (WGFD, 2005a in Uranerz, 2007). The proposed project area lies within habitat designated as winter/yearlong and yearlong range for mule deer. There are no crucial mule deer ranges within the proposed project area. The nearest mule deer crucial winter range occurs approximately 77 km [48 mi] southwest of the proposed project area (University of Wyoming, 2008).

3.6.1.2.2 Upland Game Birds

During the wildlife inventories the applicant conducted, two species of upland game birds, the Greater sage-grouse and gray partridge, were recorded on the proposed Nichols Ranch ISR

Project site. While no sage-grouse leks are within the proposed project area, 10 occupied sage-grouse leks were reported within a 3.2-km [2-mi] radius of the proposed Nichols Ranch ISR Project during the applicant survey for Greater sage-grouse lek activity in April 2006 (Uranerz, 2007). In addition, the applicant gathered information from BLM and WGFD for previous monitoring events initiated by the development of CBM mining in the area (Uranerz, 2007). WGFD provided NRC staff with updated sage-grouse information in 2009 and 2010, which is presented on SEIS Figure 3-8 (WGFD, 2010). According to the most recent WGFD information, nine active leks are located within a 3.2-km [2-mi] radius of the proposed Nichols Ranch ISR Project (WGFD, 2010). The Greater sage-grouse is a candidate species for the federal list of endangered and threatened species, and is listed at the state level as a species of special concern, and is discussed in more detail in Section 3.6.3 in the SEIS. This information is further discussed in Section 3.6.3 in the SEIS.

The University of Wyoming (2006) Wyoming Natural Diversity Database (WYNDD) reports the applicant did not indicate the potential presence of any other species of upland game birds in the vicinity of the proposed site.

3.6.1.2.3 Raptors

The applicant (Uranerz, 2007) conducted raptor nesting surveys in April and May 2006 as part of the wildlife inventories. Follow-up productivity surveys for nests determined to be active were conducted in June 2006 (Uranerz, 2007). A winter bald eagle roost survey was conducted in January and February 2007, as detailed in SEIS Section 3.6.3. Additionally, incidental sightings of raptor species were recorded during other portions of the 2006 and 2007 wildlife inventories.

Six raptor species were observed during the wildlife inventories: the red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), long-eared owl (*Asio otus*), great horned owl (*Bubo virginianus*), and the rough-legged hawk (*Buteo lagopus*) (Uranerz, 2007). All but the rough-legged hawk were determined to have active nests in the area. A total of 40 raptor nests were identified within the 3.2-km [2.0-mi] radius. Ten of these nests were determined to be active, and the remaining 30 nests were inactive or abandoned by an undetermined species. Nine of the active nests (three red-tailed hawks, three long-eared owls, and three great horned owls) were located in the Hank Unit, and the remaining active nest (golden eagle) was located in the Nichols Ranch Unit. The red-tailed hawks nests were located in isolated cottonwood trees within drainages. The long-eared owls' nests were in juniper trees. The great horned owl nest was located in a cliff/bank of an incised drainage. The active golden eagle nest was observed in a cottonwood tree.

3.6.1.2.4 Waterfowl and Shorebirds

Limited habitat exists on or in the vicinity of the proposed Nichols Ranch ISR Project site for waterfowl and shorebirds (Uranerz, 2007). Four wetlands {totaling 0.5 ha [1.2 ac] in size} occur within the southeast portion of the Nichols Ranch Unit three are linear, palustrine depressions found within the Cottonwood Creek floodplain and one is also in the Cottonwood Creek floodplain and occurs downstream of an overflowing stock tank associated with ranching operations (Uranerz, 2007). These wetlands are detailed in Section 3.5.1.5 in the SEIS. A small pond on the Nichols Ranch Unit and small human-made stock ponds within the vicinity of the site provide seasonal sources of water (Uranerz, 2007). No open-water systems occur on the Hank Unit that waterfowl or shorebirds could use. Because such limited habitat occurs on or in the vicinity of the site, the applicant did not conduct formal surveys for waterfowl or shorebirds; however, incidental sightings were recorded during the course of the wildlife

inventories conducted in 2006 and 2007. Only one mallard duck (*Anas platyrhynchos*) was observed in a stock pond on the Nichols Ranch Unit (Uranerz, 2007).

WYNDD reports indicated the following additional waterfowl and shorebird species or populations may be found in the vicinity of the site: the sandhill crane (*Grus canadensis*), American avocet (*Recurvirostra americana*), black tern (*Chlidonias niger*) breeding colonies, and American dipper (*Cinclus mexicanus*). None of these species were recorded during the wildlife inventories the applicant conducted; however, this does not preclude their potential occurrence on or in the vicinity of the proposed site.

Sandhill cranes can be found throughout Wyoming in spring and summer months. Two distinct populations of sandhill cranes have been identified in Wyoming: the Rocky Mountain Population and the Mid-Continental Population (WGFD, 2005e). Any sandhill crane individuals seen on the proposed Nichols Ranch ISR Project site would most likely be from the Mid-Continental Population as this population occupies the eastern portion of the State. The WGFD issues 1-year limited-quota sandhill crane permits to hunters as an effort to regulate the state's population.

The American avocet is designated as a Level III, Local Interest species by the Wyoming Bird Conservation Plan (Nicholoff, 2003). The species is found throughout Wyoming in marshes, ponds, and wet meadows and feeds on aquatic invertebrates, small fish, insects, and seeds (Nicholoff, 2003). Because the wetland and open water areas on the proposed Nichols Ranch ISR Project site and surrounding vicinity are small in size and seasonal, they do not support aquatic life and would not, therefore, provide the diet necessary for this species. Though the American avocet is unlikely to inhabit the proposed Nichols Ranch ISR Project site, this species may migrate through the area.

The black tern is listed as a Level I, Conservation Action Species (also referred to as migratory bird species of management concern) by the Wyoming Bird Conservation Plan (Nicholoff, 2003). The black tern occurs across Wyoming in small, loose colonies and most commonly nests in emergent wetlands with cattail (*Typha* spp.) or bulrush (*Scirpus* spp.). The species prefers marshes or a series of marshes greater than 20 ha [50 ac] in size (Nicholoff, 2003); therefore, the proposed Nichols Ranch ISR Project site is unlikely to provide sufficient habitat for this species, though some individuals may migrate through the area.

The American dipper is listed as a Level II, Monitoring species by the Wyoming Bird Conservation Plan (Nicholoff, 2003). This species requires rapidly flowing mountain streams near coniferous forest and is unlikely to inhabit the proposed Nichols Ranch ISR Project site.

3.6.1.2.5 Nongame/Migratory Birds

The applicant recorded incidental sightings of nongame/migratory birds during 2006 and 2007 wildlife inventories but did not conduct any formal surveys specifically for these species (Uranerz, 2007). Three species were observed during the wildlife inventories: the horned lark (*Eremophila alpestris*), black-billed magpie (*Pica pica*), and Brewer's sparrow (*Spizella pusilla*). The Brewer's sparrow is a State of Wyoming species of concern and a BLM-designated sensitive species and is discussed in more detail in Section 3.6.3 in the SEIS.

WYNDD reports indicated the following additional nongame/migratory bird species may be found in the vicinity of the site: the Williamson's sapsucker (*Sphyrapicus thyroideus*), canyon wren (*Catherpes mexicanus*), and chimney swift (*Chaetura pelagica*). The Williamson's

sapsucker is designated as a Level II, Monitoring species by the Wyoming Bird Conservation Plan (Nicholoff, 2003). This species inhabits coniferous forests and aspen stands and is unlikely to occur within the vicinity of the proposed Nichols Ranch ISR Project site. The canyon wren is designated as a Level III, Local Interest species by the Wyoming Bird Conservation Plan (Nicholoff, 2003). The species generally inhabits cliffs, canyons, and rock outcrops in pine-juniper and woodland-chaparral habitat (Nicholoff, 2003). The chimney swift has no designation within the State of Wyoming.

Additional nongame/migratory birds with a protected status and the potential to occur on or in the vicinity of the site are listed in Section 3.6.3 in the SEIS.

3.6.1.2.6 Other Mammals

The applicant recorded incidental sightings of mammals during 2006 and 2007 wildlife inventories but did not conduct any specific formal surveys (Uranerz, 2007). Three species of mammalian predators were observed within a 3.2-km [2.0-mi] radius of the proposed Nichols Ranch ISR Project site: bobcat (*Lynx rufus*), badger (*Taxidea taxus*), and coyote (*Canis latrans*). In addition, a swift fox (*Vulpes velox*) was observed approximately 8 km [5 mi] east of the proposed site.

Desert cottontails (*Sylvilagus audubonii*) and white-tailed jackrabbits (*Lepus townsendii*) were observed in all types of vegetative communities; however, both species were observed in highest concentration near disturbed areas, which included existing CBM well pads, a CBM compression station, and along existing roads. During the wildlife inventories, an outbreak of tularemia, an infectious bacterial disease, was confirmed by a Wyoming State laboratory biologist to be present within the rabbit population. Outbreaks of this disease, caused by the bacterium *Francisella tularensis*, are found primarily in rodent populations, and documented cases occur in Wyoming nearly every year (WGFD, 2006b).

Additional mammal species observed within the vicinity of the site include ground squirrels (*Spermophilus tridecemlineatus*) and black-tailed prairie dogs (*Cynomys ludovicianus*) (Uranerz, 2007). A total of 381.1 ha [941.8 ac] of black-tailed prairie dog colonies occur on or within a 3.2-km [2-mi] radius of the proposed Nichols Ranch ISR Project site (Uranerz, 2007). Black-tailed prairie dogs are a State of Wyoming species of concern and are discussed in more detail below in Section 3.6.3 in the SEIS.

3.6.1.2.7 Reptiles and Amphibians

The applicant recorded incidental sightings of reptiles and amphibians during 2006 and 2007 wildlife inventories but did not conduct any specific formal surveys (Uranerz, 2007). Two species of reptiles were observed: the prairie rattlesnake (*Crotalus viridis*) and bullsnake (*Pituophis melanoleucas sayi*). Prairie rattlesnakes were observed in juniper outcrop and bottomland vegetation. One bullsnake was observed along a road in the northern portion of the Hank Unit.

Additional protected reptile and amphibian species that may occur in the vicinity of the proposed site are listed in Section 3.6.3 in the SEIS.

3.6.2 Aquatic Ecology

The majority of the surface water features on the proposed project area are ephemeral streams and washes that maintain flow during snow melt or major summer storms. Four small wetlands with human-made ponds are located within one of the channels in the southeast corner of the Nichols Ranch Unit. These wetlands and ponds are seasonal in nature, and thus do not provided a year-round source of surface water sufficient to maintain a population of aquatic species. The wetlands, specifically, are detailed in Section 3.5.1.5 in the SEIS.

3.6.3 Protected Species

Table 3-8 presents species that are federally listed under the Endangered Species Act (ESA), state-listed under the Final Comprehensive Wildlife Conservation Strategy for Wyoming, and/or BLM-listed as sensitive species and occur in Campbell and Johnson Counties. No federal candidate or proposed species, such as the Greater sage-grouse (*Centrocercus urophasianus*) and the mountain plover (*Charadrius montanus)*, are known to occur on or in the vicinity of the proposed Nichols Ranch ISR Project site. Of the state-listed species, the black-tailed prairie dog (*Cynomys ludovicianus*) and swift fox (*Vulpes velox*) are known to occur on or in the vicinity of the site and were observed during the wildlife inventories the applicant conducted (Uranerz, 2007). These species are detailed as follows.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*), which was delisted from the federal List of Endangered and Threatened Wildlife in July 2007 (72 FR 37346), is known to occur within the vicinity of the proposed project. Numerous bald eagles were observed during the wildlife inventories the applicant conducted (Uranerz, 2007). A raptor nest inventory was conducted in April and May 2006 to determine the presence of raptor nests onsite. Additionally, in January and February 2007, three specific bald eagle winter roost site surveys were conducted that included land within a 0.6-km [1-mi] radius of the proposed Nichols Ranch ISR Project site. One winter roost was identified from available BLM data and is located 7.2 km [4.5 mi] southwest of the Nichols Ranch Unit (Uranerz, 2007). The closest known nest is about 16 km [10 mi] west of the proposed site along the Powder River (Uranerz, 2007). In addition to the wildlife inventories the applicant conducted, a BLM Environmental Assessment (EA) for the Yates Petroleum

Corporation All Day Plan of Development (BLM, 2009c) identifies bald eagle roosts within the Hank Unit of the proposed Nichols Ranch ISR Project as the projects are located near one another. The Environmental Assessment (EA) documents the observation of 7 bald eagles on December 3, 2007, 5 bald eagles on December 16, 2008, 1 bald eagle on January 12, 2009, and 13 bald eagles on February 11, 2009, all within the Hank Unit (BLM, 2009c).

The species continues to be protected federally by the Bald and Golden Eagle Protection Act, as well as the Migratory Bird Treaty Act, and at the state level as a species of concern. FWS published its National Bald Eagle Management Guidelines in FWS (2007) to ensure the continued protection of the species. The bald eagle is a large raptor species with a white head and tail, and brown body feathers and is generally associated with lakes and other large, open bodies of water. Bald eagles prey on fish, small mammals, birds, and occasionally carrion.

Table 3-8. Federal-, State- and BLM-Listed Species That Occur in Johnson and Campbell Counties

Scientific Name	Common Name	Federal Status*	State Status†	County of Occurrence‡
Amphibians				
Ambystoma tigrinum	tiger salamander	—	SGCN	CAM; JOH
Bufo cognatus	Great Plains toad	—	SGCN	CAM
Rana pipiens	northern leopard frog	—	SGCN; BLM-SS	CAM; JOH
Rana pretiosa	spotted frog	—	BLM-SS	CAM; JOH
Rana sylvatica	wood frog	—	SGCN	JOH
Birds				
Accipiter gentilis	northern goshawk	—	SGCN; BLM-SS	JOH
Aegolius funereus	boreal owl	—	SGCN	JOH
Ammodramus bairdii	Baird's sparrow	—	BLM-SS	CAM; JOH
Ammondramus savannarum	grasshopper sparrow	—	SGCN	CAM; JOH
Amphispiza belli	sage sparrow	—	SGCN; BLM-SS	CAM; JOH
Asio flammeus	short-eared owl	—	SGCN	CAM; JOH
Athene cunicularia	burrowing owl	—	SGCN; BLM-SS	CAM; JOH
Buteo regalis	ferruginous hawk	—	SGCN; BLM-SS	CAM; JOH
Calcarius mccownii	McCown's longspur	—	SGCN	CAM; JOH
Calcarius ornatus	chestnut-collared longspur	—	SGCN	CAM
Centrocercus urophasianus	Greater sage-grouse	C	SGCN; BLM-SS	CAM; JOH
Charadrius montanus	mountain plover	—	SGCN	CAM; JOH
Coccyzus americanus	yellow-billed cuckoo	—	SGCN; BLM-SS	JOH
Cygnus buccinator	trumpeter swan	—	BLM-SS	CAM; JOH
Dolichonyx oryzivorus	boblink	—	SGCN	CAM
Egretta thalus	snowy egret	—	SGCN	JOH
Falco peregrinus anatum	American peregrine falcon	DL	SGCN; BLM-SS	CAM; JOH

Table 3-8. Federal-, State- and BLM-Listed Species That Occur in Johnson and Campbell Counties (continued)

Scientific Name	Common Name	Federal Status*	State Status†	County of Occurrence‡
Gaviea immer	common loon	—	SGCN	JOH
Haliaeetus leucocephalus	bald eagle	DL	SGCN	CAM; JOH
Lanius ludovicianus	loggerhead shrike	—	BML-SS	CAM; JOH
Numenius americanus	long-billed curlew	—	SGCN; BLM-SS	CAM
Nycticorax nycticorax	black-crowned night-heron	—	SGCN	CAM; JOH
Oreoscoptes montanus	sage thrasher	—	BLM-SS; SGCN	CAM; JOH
Plegadis chihi	white-faced ibis	—	BLM-SS	CAM; JOH
Rallus limicola	Virginia rail	—	SGCN	JOH
Sitta pygmaea	pygmy nuthatch	—	SGCN	CAM; JOH
Spizella breweri	Brewer's sparrow	—	BLM-SS; SGCN	CAM; JOH
Fish				
Hiodon alosoides	goldeye	—	SGCN	JOH
Hybognathus argyritis	western silvery minnow	—	SGCN	CAM; JOH
Macrhybopsis gelida	sturgeon chub	—	SGCN	CAM; JOH
Oncorhynchus clarki bouvieri	Yellowstone cutthroat trout	—	BLM-SS	CAM; JOH
Scaphirhynchus platorynchus	shovelnose sturgeon	—	SGCN	CAM; JOH
Stizostedion canadense	sauger	—	SGCN	CAM; JOH
Corynorhinus townsendii	Townsend's big-eared bat	–	BLM-SS; SGCN	CAM; JOH
Cynomys leucurus	white-tailed prairie dog	–	SGCN	JOH
Cynomys ludovicianus	black-tailed prairie dog	—	SGCN	JOH
Euderma maculatum	spotted bat	—	BLM-SS	CAM; JOH
Lasionycteris noctivagans	silver-haired bat	—	SGCN	CAM; JOH

Table 3-8. Federal-, State- and BLM-Listed Species That Occur in Johnson and Campbell Counties (continued)

Scientific Name	Common Name	Federal Status*	State Status†	County of Occurrence‡
Lasiurus cinereus	hoary bat	—	SGCN	CAM; JOH
Lontra canadensis	river otter	—	SGCN	JOH
Martes pennanti	fisher	—	SGCN	JOH
Microtus richardsoni	water vole	—	SGCN	JOH
Mustela nigripes	black-footed ferret	E	SGCN	CAM; JOH
Mustela nivalis	least weasel	—	SGCN	JOH
Mammals				
Myotis ciliolabrum	western small-footed myotis	—	SGCN	JOH
Myotis evotis	long-eared myotis	—	BLM-SS; SGCN	CAM; JOH
Myotis thysanodes	fringed myotis	—	BLM-SS; SGCN	JOH
Myotis volans	long-legged myotis	—	SGCN	JOH
Perognathus fasciatus	olive-backed pocket mouse	—	SGCN	CAM; JOH
Sorex haydeni	Hayden's shrew	—	SGCN	JOH
Sorex nanus	dwarf shrew	—	SGCN	CAM; JOH
Vulpes velox	swift fox	—	BLM-SS; SGCN	CAM; JOH
Reptiles				
Coluber constrictor flaviventris	eastern yellowbelly racer	—	SGCN	CAM; JOH
Plants				
Anemone narcissiflora ssp. zephyra	zephyr windflower	—	PSC	JOH
Arnica lonchophylla	northern arnica	—	PSC	JOH
Cymopterus williamsii	Williams' waferparsnip	—	BLM-SS; PSC	JOH
Cypripedium montanum	mountain lady-slipper	—	PSC	JOH
Draba fladnizensis var. pattersonii	white artiv whitlow grass	—	PSC	JOH
Festuca hallii	Hall's fescue	—	PSC	JOH
Juncus triglumis var. triglumis	three-flower rush	—	PSC	JOH

Table 3-8. Federal-, State- and BLM-Listed Species That Occur in Johnson and Campbell Counties (continued)

Scientific Name	Common Name	Federal Status*	State Status†	County of Occurrence‡
Papaver kluanense	alpine poppy	—	PSC	JOH
Parnassia kotzebuei	Kotzebuei's grass-of-parnassus	—		JOH
Pedicularis contorta var. ctenophore	coil-breaked lousewort	—	PSC	JOH
Penstemon haydenii	blowout penstemon	E	–	CAM; JOH
Physaria lanata	woolly twinpod	—	PSC	CAM; JOH
Polygala verticillata	whorled milkwort	—	PSC	CAM
Polygonum spergulariiforme	fall knotweed	—	PSC	JOH
Potamogeton amplifolius	large-leaved pondweed	—	PSC	JOH
Psilocarphus brevissimus	dwarf woolly-heads	—	PSC	CAM
Puccinellia cusickii	Cusick's alkali-grass	—	PSC	JOH
Pyrrocoma clementis var. villosa	hairy tranquil goldenweed	—	HCP	JOH
Rubus acaulis	northern blackberry	—	PSC	JOH
Schoenoplectus heterochaetus	slender bulrush	—	PSC	CAM
Sesuvium verrucosum	sea purslane	—	PSC	CAM
Spiranthes diluvialis	ute ladies'-tresses	T	–	CAM; JOH
Sporobolus compositus	longleaf dropseed	—	PSC	CAM
Triodanis leptocarpa	slim-pod Venus' looking-glass	—	PSC	CAM

*C = Candidate; DL = delisted; E = endangered; T = threatened; – = not listed

†BLM-SS = BLM Wyoming-designated Sensitive Species; PSC = plant species of concern, as designated by the WYNDD; SGCN = species of greatest conservation need, as designated by the WGFD

‡CAM = Campbell County, Wyoming; JOH = Johnson County, Wyoming

Sources: USDA, 2009; FWS, 2008b; WYNDD, 2007; WGFD, 2005b; WYNDD, 2003; BLM, 2002

Black-Footed Ferret

The black-footed ferret (*Mustela nigripes*) is federally listed as endangered. The species is endemic to North America and primarily inhabits the Great Plains region. It is the only species of ferret native to the Americas. The species was believed to be extinct by the late 1980s, but in 1981, a small relic population was discovered near Meeteetse, Wyoming (WGFD, 2005c). From this population, 18 individuals were captured to start a captive breeding program, which WGFD initiated (WGFD, 2005c). Nonessential experimental populations have been reintroduced to 18 locations in 8 states and Mexico (FWS, 2008a). Four of these reintroduced populations–those in Aubrey Valley, Arizona; Cheyenne River and Conata Basin, South Dakota; and Shirley Basin, Wyoming–have successfully stabilized and no longer require supplemental individuals from captive breeding (FWS, 2008a). Six additional locations are considered marginal to improving (FWS, 2008a).

The black-footed ferret is a small mammal in the weasel family with a natural to buff-colored body and black face, feet, and tail. Adults are 46 to 61 cm [18 to 24 in] long and weigh 0.7 to 1.1 kg [1.5 to 2.5 lb], with males generally larger than females (FWS, 2009). Generally, black-footed ferret occurrences coincide with prairie dog habitat [black-tailed (*Cynomys ludovicianus*), Gunnison's (*C. gunnisoni*), and white-tailed (*C. leucurus*)] because prairie dog is the main prey of the ferret and the ferret also uses prairie dog burrows for shelter (FWS, 2008a). Black-footed ferrets are more likely to occur in black-tailed prairie dog habitat than in other prairie dog species' habitat; historically, it is estimated that 85 percent of all black-tailed ferrets occurred in black-tailed prairie dog habitat, 8 percent in Gunnison's prairie dog habitat, and 7 percent in white-tailed prairie dog habitat (FWS, 2008a).

The applicant identified 11 black-tailed prairie dog colonies totaling 381.1 ha [941.8 ac] (discussed in more detail next) within and in the vicinity of the proposed Nichols Ranch ISR Project site during wildlife inventories conducted in 2006 and 2007 (Uranerz, 2007). In a 2004 letter (FWS, 2004a), FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations. FWS considered incidental takes of individual ferrets in black-tailed prairie dog habitat, which is "block cleared," to not be an issue and not to effect any wild population. However, this block clearance does not relieve Federal agencies of the need to assess a proposed action's effect on the species' survival and recovery. Further, FWS directs Federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret (FWS, 2004a).

No black-footed ferrets have been identified on the proposed Nichols Ranch ISR Project site (Uranerz, 2007). FWS has not designated any critical habitat for the species (FWS, 2009). However, due to the presence of black-tailed prairie dog habitat, the NRC initiated informal consultation with the FWS to ensure the provisions of the ESA are upheld regarding the black-footed ferret. This informal consultation is detailed in Section 4.6.1.1.3 in the SEIS.

Black-Tailed Prairie Dog

The black-tailed prairie dog (*Cynomys ludovicianus*) is a State of Wyoming species of concern. The species is a small, diurnal ground squirrel that is endemic to North America and occurs throughout the Great Plains region. In Wyoming, the black-tailed prairie dog inhabits dry, flat, open, short, and mixed-grass prairie within the eastern third of the state (WGFD, 2005d). Adults weigh 0.5 to 1.4 kg [1 to 3 lbs] and are 36 to 43 cm [14 to 17 in] long. Coloring can vary from a

mixture of brown, black, grey, and white, though the black-tipped tail is characteristic of the species. Black-tailed prairie dogs live in family groups within large colonies (FWS, 2000). The black-tailed prairie dog is preyed upon by a number of species, including the black-footed ferret, swift fox, ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*), all of which are federally or state listed species. The mountain plover (*Charadrius montanus*), a federal species proposed as threatened and Wyoming species of greatest conservation need, also relies on black-tailed prairie dog burrows for nesting areas.

Black-tailed prairie dog colony mapping completed as part of the wildlife inventory the applicant conducted indicates that a total of 381.1 ha [941.8 ac] of prairie dog colonies occur on or within a 3.2-km [2-mi] radius of the proposed Nichols Ranch ISR Project site, 144.3 ha [356.5 ac] of which are on the site itself (Uranerz, 2007). Eleven colonies were identified, the largest of which occurs within the Nichols Ranch Unit. One colony borders the western boundary of the Hank Unit and the rest of the colonies lie between the two units as well as to the west of the Nichols Ranch Unit. Within the State of Wyoming, the major threat to this species is habitat degradation, habitat loss, human conflict/disturbance, and unregulated take/mortality (WGFD, 2005d).

Mountain Plover

The mountain plover (*Charadrius montanus)* is federally proposed as threatened and a Wyoming species of greatest conservation need. This bird is a native of the short-grass prairie and is found in open, dry shrublands or agricultural fields with short vegetation and bare ground. Mountain plover breeding habitat includes the western Great Plains and Rocky Mountain states extending from the Canadian border to northern Mexico (75 FR 37353). The prime breeding and nesting period for the mountain plover is from April 10 through July 10 (BLM, 2007a). In Wyoming, the greatest concentration of mountain plovers is found in the south central part of the state, but, they can be found in every county (Andres, 2009; WYNDD, 2010). Prairie dogs and other burrowing animals provide highly suitable habitat for the mountain plover. The mountain plover is often found in areas with heavy grazing and landscapes with excessive surface disturbance (64 FR 7587). This species is a small bird about 17.5 cm [7 in] in height with light brown and white coloring. The FWS originally proposed this species as threatened on February 16, 1999 (64 FR 7587). The proposal was withdrawn on September 9, 2003, and was reinstated on June 29, 2010 (68 FR 53083; 75 FR 37353). This species was not observed during the 2006 applicant wildlife inventories (Uranerz, 2007). According to the WYNDD and BLM records, mountain plovers are known to reside in the area of the proposed site; however, no confirmed or unconfirmed observations have been recorded at the proposed site (WYNDD, 2010; BLM, 2007a).

Blowout Penstemon

The blowout penstemon (*Penstemon haydenii*) is federally listed as endangered. This perennial herb is endemic to the Nebraska Sandhills in north-central Nebraska and to the northeastern region of the Great Divide Basin in Carbon County, Wyoming (Fertig, 2008). The species is found exclusively in sparsely vegetated, early successional sand dunes or blowout areas at elevations of 1,790 to 2,270 m [5,860 to 7,440 ft] (Fertig, 2008). The proposed Nichols Ranch ISR Project does not have sand dune habitat and is outside of the elevation range in which this species is typically found. This species was not identified during vegetation inventories the applicant conducted and is not known to occur on or in the vicinity of the proposed site (Uranerz, 2007).

Brewer's Sparrow

The Brewer's sparrow (*Spizella breweri*) is a State of Wyoming species of concern and a BLM-designated sensitive species. During the wildlife inventories the applicant conducted, Brewer's sparrow was observed within a 3.2-km [2-mi] radius of the proposed Nichols Ranch ISR Project site (Uranerz, 2007). The species inhabits open sagebrush shrubland across Wyoming and migrates to southern California and south to central Mexico in winter months (Nicholoff, 2003). This species is the smallest of the North American sparrows and is brown to grey in color with a white eye ring (CDNR, 2005). The Brewer's sparrow builds its nest about 1.2 m [4 ft] off the ground at the base of live sagebrush and is commonly parasitized by the common cowbird (*Molothrus ater*) (Nicholoff, 2003). The species is territorial, and individual territories range from 0.1 to 2.36 ha [0.25 to 5.8 ac] in size (CDNR, 2005). Habitat fragmentation and sagebrush spraying/removal are the primary threats to this species (Nicholoff, 2003).

Greater Sage-Grouse

The Greater sage-grouse (*Centrocercus urophasianus*) is a federal candidate species, a State of Wyoming species of concern, and a BLM-designated sensitive species. On March 5, 2010, FWS published a finding in the Federal Register that listing of the species was warranted but precluded by higher priority listing actions (75 FR 13909). In effect, the species has been put on the federal list of candidate species, which contains plants and animals that are proposed for listing under ESA Section 4. FWS reevaluates the potential listing of candidate species every 12 months to determine whether the species' status should change to threatened or endangered at that time. WGFD published revisions to its Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats in November 2009 to be consistent with the Governor's Executive Order (EO). This guidance was updated again in April 2010 (WGFD, 2010b) in response to the FWS rule listing the sage-grouse as a candidate species. Also, in response to the species' listing as a candidate species, Wyoming BLM issued an instructional memorandum on March 5, 2010, which supplements BLM's previous National Sage-Grouse Habitat Conservation Strategy published in 2004 (BLM, 2004, 2010). The BLM guidance closely follows the recommendations WGFD put forth in its Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats (WGFD, 2010b). Finally, on August 18, 2010, the Governor signed EO 2010-4, updating the previous EO (2008-2) regarding the protection of sage-grouse (State of Wyoming, 2010). The most restrictive conservation measures and recommendations are for the sage-grouse core population areas (core areas), which are areas identified by the State of Wyoming as high quality habitat for sage-grouse nesting and brood-rearing and necessary to maintain sage-grouse populations.

The species inhabits open sagebrush plains in the western United States and is found at elevations of 1,200 to 2,700 m [4,000 to 9,000 ft], corresponding with the occurrence of sagebrush habitat (FWS, 2004b). The Greater sage-grouse is a mottled brown, black, and white ground-dwelling bird that can be up to 0.6 m [2 ft] tall and 76 cm [30 in] long (FWS, 2004b). Leks and stands of sagebrush surrounding leks are used in early spring and are particularly important habitat because birds often return to the same leks and nesting areas each year. Leks are generally in more sparsely vegetated areas such as ridgelines or disturbed areas adjacent to stands of sagebrush habitat. Threats to this species' survival include loss of habitat, agricultural practices, livestock grazing, hunting, and land disturbances from energy/mineral development and the oil and gas industry (Sage-grouse Working Group, 2006).

The Northeast Wyoming Sage-grouse Working Group oversees the conservation plan that includes the proposed Nichols Ranch ISR Project site and the Powder River Basin. The Northeast Wyoming Sage-grouse Working Group estimates Campbell and Johnson Counties contain 175 and 128 leks, respectively (Sage-grouse Working Group, 2006). According to information gathered from the applicant and WGFD, nine sage-grouse leks are located within a 3.2-km [2.0-mi] radius of the proposed Nichols Ranch ISR Project site (Uranerz, 2007; WGFD, 2010). Four of the leks averaged fewer than 15 birds, four of the leks averaged in the range of 15 to 25 birds, and one of the leks averaged more than 60 birds (Uranerz, 2007). None of these leks occur on the proposed project site. In July 2006, several females with young were observed in the Dry Willow Drainage north of the Hank Unit (Uranerz, 2007). No sage-grouse were observed during the winter survey in February 2007, which indicates that the population of sage-grouse in the vicinity of the proposed project site may be migratory and therefore only present near the site during the spring and summer months.

Swift Fox

The swift fox (*Vulpes velox*) is a State of Wyoming species of concern and a BLM-designated sensitive species. The species was removed from the ESA Candidate List in 2002 due to successful conservation measures and reintroduction efforts in western states. The species is native to the Great Plains region, and in Wyoming, the swift fox inhabits flat terrain east of the Continental Divide with shortgrass or mixed-grass prairie and is often associated with prairie dog colonies (WGFD, 2005f). Individuals are orange to tan in color with pale yellow to white on the throat, chest, and belly and black on the tail, muzzle, and ears. Adults are 2.3 to 3.2 kg [5 to 7 lb] in size with males generally larger than females. Its diet includes rabbit, prairie dog, and other small mammals, as well as some small reptiles, berries, and seeds (Defenders of Wildlife, 2009). Swift foxes are nocturnal and use underground dens year round. Threats to the species' continued survival include loss of prairie habitat, trapping and hunting, and predator control campaigns (WGFD, 2005f). During the wildlife inventories the applicant conducted, one swift fox was observed approximately 8 km [5 mi] east of the proposed Nichols Ranch ISR Project site (Uranerz, 2007). No swift foxes were observed on the proposed site; however, based on the observation of one individual near the proposed site and the presence of suitable short, mixed grassland habitat and prairie dog colonies on and in the vicinity of the proposed project site, the swift fox is likely to inhabit the proposed project site and surrounding area.

Ute Ladies'-Tresses Orchid

The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is federally listed as threatened. The species is a perennial, terrestrial orchid that occurs in Nebraska, Wyoming, Colorado, Utah, Idaho, Montana, and Washington. Within Wyoming, it inhabits moist meadows with moderately dense but short vegetative cover. The species is found at elevations of 1,280 to 2,130 m [4,200 to 7,000 ft], though no known populations occur in Wyoming above 1,680 m [5,500 ft] (FWS, 2008b). Generally, this orchid is found in low densities of four to eight flowering plants per square meter (Fertig, 2000). The species is likely to inhabit silt, sand, or gravely soils in areas with ample sunlight (FWS, 2008b). It is characterized by 12 to 50 cm [4.7 to 20 in] stems with linear basal leaves up to 28 cm [11 in] long and spikes of small white to ivory flowers that bloom between early August and early September (Fertig, 2000). Urbanization, livestock grazing, pesticide use, competition with noxious weeds, and loss of pollinators threaten this species, survival (Fertig, 2000). This species was not identified during vegetation inventories the applicant conducted and is not known to occur on or in the vicinity of the proposed site (Uranerz, 2007).

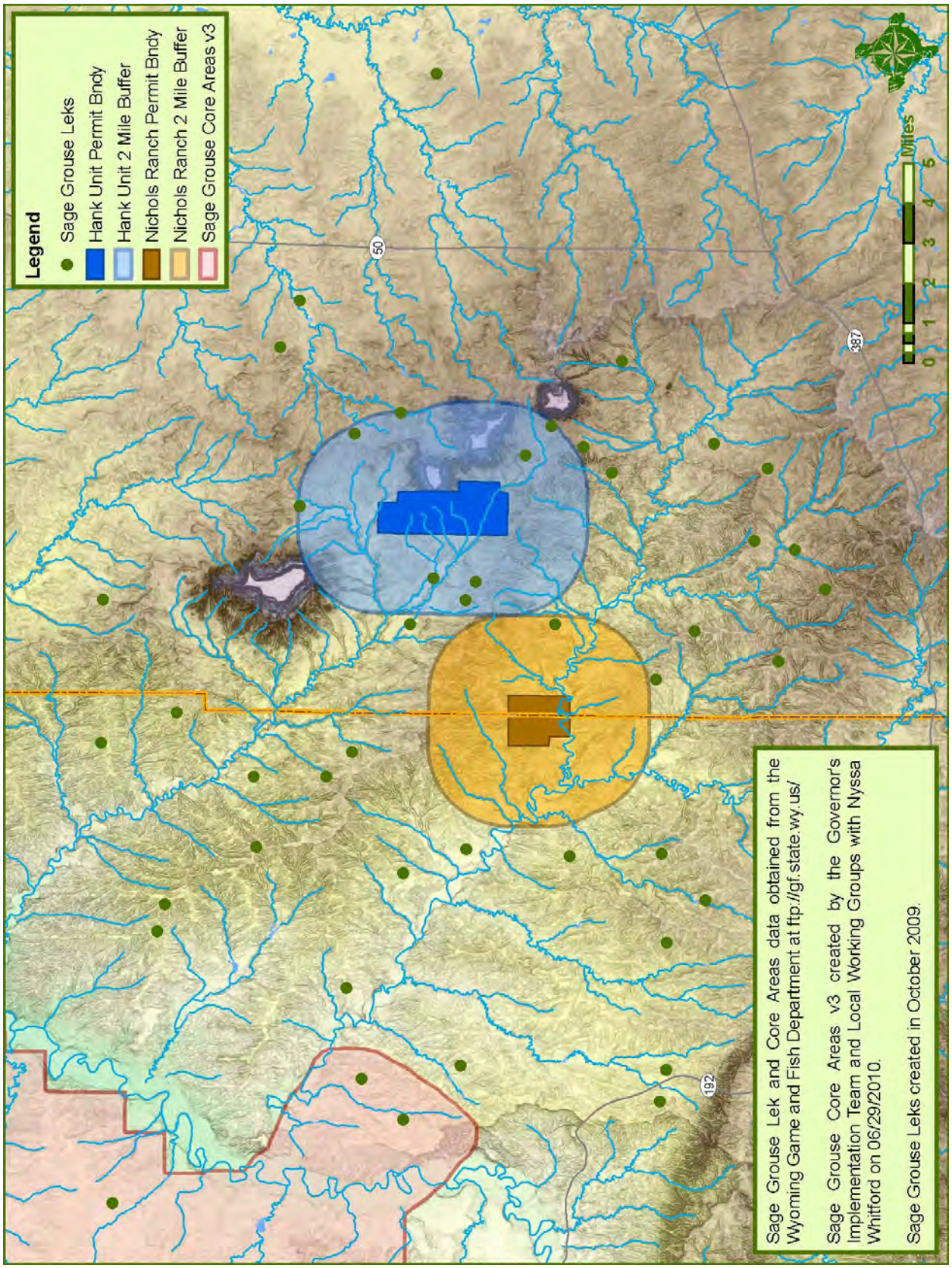

Figure 3-8. Sage-Grouse Lek and Core Areas
Source: WGFD (2010)

Additional Species

The following BLM-designated sensitive species and Wyoming species of concern have been recorded as occurring in the vicinity of the proposed site; however, none of these species were observed during the wildlife inventories the applicant conducted (Uranerz, 2007):

Burrowing owl (Athene cunicularia)

Ferruginous hawk (*Buteo regalis*)
Loggerhead shrike (*Lanius ludovicianus*)
Mountain plover (Charadrius montanus)
Sage sparrow (Amphispiza belli)
Sage thrasher (Oreoscoptes montanus)
Northern leopard frog (*Rana pipiens*).

3.7 Meteorology, Climatology, and Air Quality

The following sections discuss the meteorology, climatology, and air quality at the proposed project site. A discussion of climate change and greenhouse gases (GHGs) is also included in this section of the SEIS.

3.7.1 Meteorology and Climatology

The majority of Wyoming is dominated by mountain ranges and rangelands of the Rocky Mountains and high plains, which occupy the westernmost portion of the state and are generally oriented in a north-south direction. The Wyoming mountain ranges generally provide effective barriers to Pacific-generated weather systems because they are perpendicular to the prevailing westerly winds, as discussed in GEIS Section 3.3.6.1. Much of the moisture that moves in from the west is dropped along the western slopes, which creates semiarid conditions in the eastern portion of the state. The Wyoming mean elevation is 2,042 m [6,700 ft] AMSL with the highest point, Gannett Peak, at 4,201 m [13,785 ft] and the lowest point at 952 m [3,125 ft] in the northeastern corner of the state near the South Dakota state line. Generally, Wyoming elevation results in cool temperatures. The fall, winter, and spring months experience frequent variations with rapid change from cold to mild temperatures, and freezes in early fall and late spring create a short growing season (NRC, 2009a).

The proposed Nichols Ranch ISR Project is located at an elevation of 1,653 m [4,750 ft] AMSL and approximately 90 km [56 mi] southeast of the Big Horn Mountains within the Powder River Basin. This basin is characterized by semiarid plains with low hills and buttes, little vegetation, and few substantial topographical features. The Powder River Basin experiences diverse weather patterns that fluctuate throughout the year, due in large part to its proximity to the Rocky Mountain system and its relatively high elevation. Generally, weather patterns follow those described for the Wyoming East Uranium Milling Region in GEIS Section 3.3.6.1. The majority of precipitation occurs in the spring and summer months with occasional heavy rains or thunderstorms, which can create flash flooding. Table 3-9 is taken from the GEIS (Table 3.3-6) and includes mean temperatures at National Climate Data Center (NCDC) in Glenrock, about 120 km [75 mi] south of the proposed Nichols Ranch ISR Project, and Midwest, about 40 km [25 mi] southwest of the proposed Nichols Ranch ISR Project.

Because no onsite meteorological stations are within or adjacent to the proposed Nichols Ranch ISR Project area, data the applicant collected from seven meteorological stations surrounding

the proposed project area were used to describe the expected meteorological conditions at the site (Uranerz, 2007). These stations are the Antelope Mine {78 km [48.5 mi] to the southwest}, Buffalo {93 km [58 mi] to the northwest}, Casper Natrona County Airport {97 km [60 mi] to the south-southwest}, Dull Center 1 SE {87 km [54 mi] to the east-southeast}, Gillette 9 ESE {75 km [46.5 mi] to the north-northwest}, Glenrock 5 ESE {100 km [62 mi] to the south}, and Midwest {40 km [25 mi] to the southwest}. The NRC staff's safety review of potential air quality impacts included review and consideration of this local meteorological data provided by the applicant. During the review, the NRC staff concluded local topography at the Nichols Ranch ISR Project warrants onsite meteorological measurements as documented in SER Section 2.2.3.2. To address this concern, the NRC staff has added a license condition requiring the applicant to collect onsite meteorological data for a minimum of 1 year prior to operating as described in Section 2.2.4 of the SER. The condition requires the applicant to submit the data for NRC review.

3.7.1.1 Temperature

Temperatures fluctuate greatly throughout the year in the Powder River Basin. Located in a semiarid climate, summer temperatures at the proposed project site can be quite warm, while winters are commonly quite cold. The annual average temperature in the project area region is between 7 and 10 °C [45 and 50 °F]. The average maximum daily temperature is 32 °C [90 °F], with July yielding the warmest average temperatures. Monthly average temperatures range from a minimum of between -12.2 and -7.8 ^{o}C [10 and 18 ^{o}F] in January to a maximum of between 29.4 and 32.2 ^{o}C [85 and 90 ^{o}F] in July. Large, diurnal temperature variations occur in the region due to its high altitude and low humidity. Spring and summer daily variations are 11 to 14 ºC [20 to 25 ºF]. Less daily variation is observed during the cooler portions of the year; fall and winter have fluctuations of approximately 8 ºC [15 ºF] (Uranerz, 2007).

3.7.1.2 Wind

Winter winds in Wyoming may reach 48 to 64 kph [30 to 40 mph] with gusts to 80 to 97 kph [50 to 60 mph] (Uranerz, 2007). Prevailing wind directions vary from the west-southwest, west, and northwest. In many localities, winds are so strong and constant that trees (when present) show a definite lean toward the east or southeast.

Table 3-9. Climate Data for Stations in the Wyoming East Uranium Milling Region

		Glenrock 5 ESE	Midwest
Temperature (°C)*	Mean–Annual	8.8	7.5
	Low–Monthly Mean	−3.1	−5.7
	High–Monthly Mean	22.4	21.5
Precipitation (cm)†	Mean–Annual	31.0	35.0
	Low–Monthly Mean	0.90	1.4
	High–Monthly Mean	6.1	6.5
Snowfall (cm)	Mean–Annual	58.4	135
	Low–Monthly Mean	0	0
	High–Monthly Mean	13.5	22.6

*To convert Celsius (°C) to Fahrenheit (°F), multiply by 1.8 and add 32.
†To convert centimeters (cm) to inches (in), multiply by 0.3937.
Sources: NCDC, 2004; NRC, 2009a Table 3.3-6

Many wind farms have been established over southern Wyoming in places such as Arlington, Medicine Bow, Rock River, and just south of Cheyenne to take advantage of this renewable energy source.

The high plains area near the proposed Nichols Ranch ISR Project site experiences moderate westerly winds throughout the year. These prevailing winds are generated by high-pressure systems that originate in the north Pacific and Canadian Rocky Mountains. These systems move east across the mountainous western United States and Canada, where most of the precipitation is released, leaving fairly dry, steady winds that empty into the eastern foothills and plain regions such as the Powder River Basin.

The applicant did not collect onsite meteorological data at the Nichols Ranch ISR project. Instead, the applicant proposed to use the station operated by the Intermountain Laboratory (IML) at the Antelope Coal Company Mine (ACC) located 78 km [48.5 mi] east-southeast of the Nichols Ranch ISR Project area. The applicant provided Figure 2-10a in the application for the annual wind rose for the Antelope station (Figure 3-9 in this SEIS). The figure presents wind speed and wind direction data from 1987 through 2006. More detailed monthly wind rose data are provided in the applicant's technical report as Figures 2-10, 2-10a, and 2-10b in the application, respectively, but are not reproduced here. Average wind speed at the ACC station was 18 kmh [11 mph] with maximum wind speed averaging 76 kph [47 mph], and the wind direction from the ACC station shows a generally westerly pattern with a stronger west-southwestern component. Winds are the slowest in the predawn hours and strongest in the mid-afternoons, tapering off again at dusk. Seasonal variations indicated maximum and minimum wind speeds in the spring and fall, respectively (Uranerz, 2007).

3.7.1.3 Precipitation

The proposed Nichols Ranch ISR Project area receives relatively little rainfall due in large part to the Rocky Mountain range system, which effectively blocks moisture from regional weather systems that approach from the west, northwest, and southwest (Uranerz, 2007). Its unique location has helped shape the desert climate in the area. Annual precipitation ranged between 28 and 38 cm [11 and 15 in] with the greatest quantity occurring in late spring/early summer and the least amount occurring in the winter months (Curtis and Grimes, 2004). The most common severe storms consisted of thunderstorms and hailstorms.

3.7.1.4 Evaporation

As discussed in GEIS Section 3.3.6.1, the annual evaporation rates in the Wyoming East Uranium Milling Region range from about 102 to 127 cm [40 to 50 in] (NWS, 1982). The low humidity, sunshine, and high winds contribute to a high rate of evaporation. At the proposed Nichols Ranch ISR Project, the annual evaporation rate is approximately 102 to 114 cm [40 to 45 in] (Uranerz, 2007).

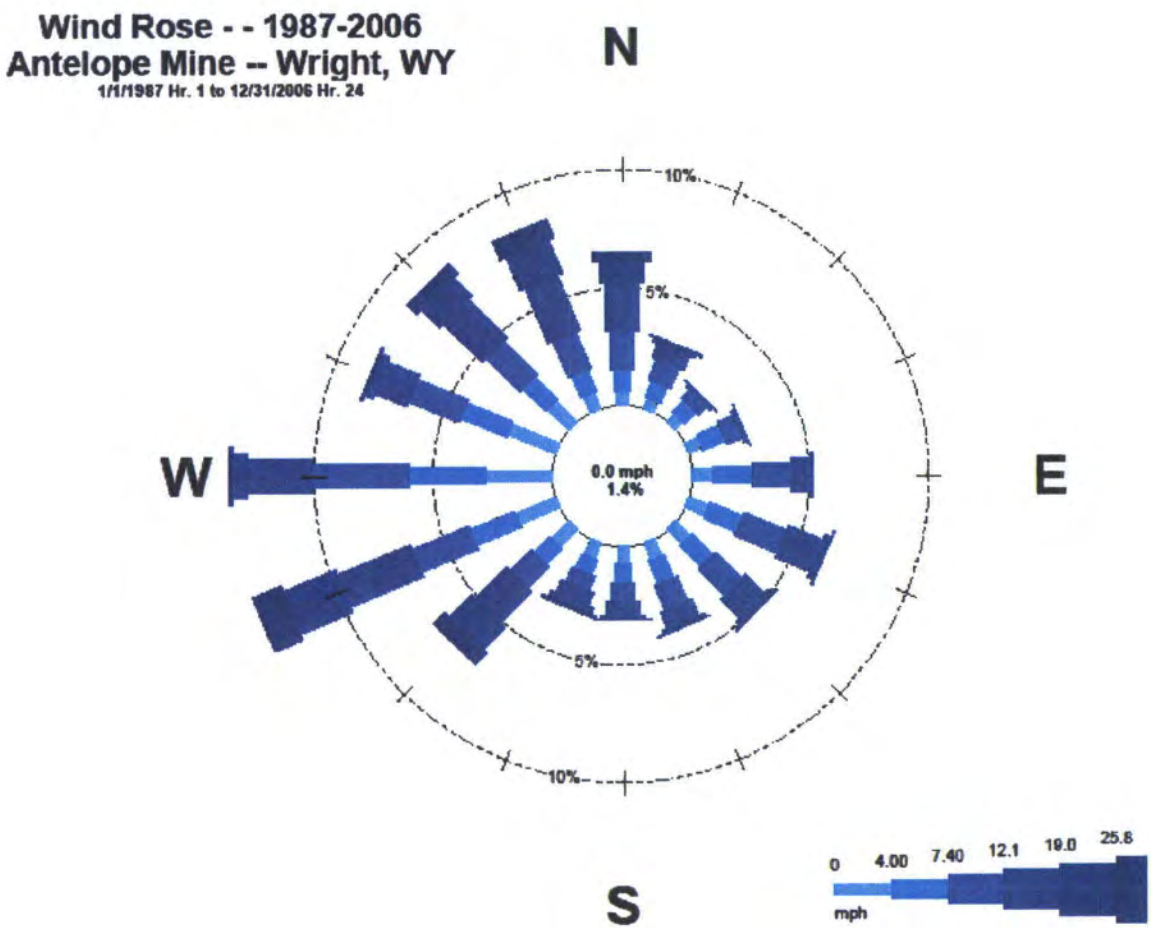

Figure 3-9. Annual Wind Rose for the Antelope Coal Company (Uranerz, 2008)

3.7.1.5 Climate Change and Greenhouse Gases

On a larger scale, climate change is a subject of national and international interest. The recent compilation of the state of knowledge in this area by the U.S. Global Change Research Program (GCRP), a Federal Advisory Committee (GCRP, 2009), has been considered in preparation of this SEIS. Average U.S. temperatures have risen more than 1.1 °C [2 °F] over the past 50 years and are projected to rise more in the future. In the period from 1993 to 2008, the average temperature in the Great Plains increased by approximately 0.9 °C [1.5 °F] from the 1961 to 1979 baseline (GCRP, 2009). The projected change in temperature (from the years 2000 to 2020) ranges from a decrease of approximately 0.3 °C [0.5 °F] to an increase of approximately 1.1 °C [2 °F]. This time period encompasses the 10-year licensing period for the proposed Nichols Ranch ISR Project. While GCRP has not incrementally forecasted the change in precipitation by decade, the projected change in spring precipitation from the 1961 to 1979 baseline to the period from 2080 to 2099 was presented. For the region of Wyoming where the Nichols Ranch ISR Project is proposed to be located, the GCRP report forecasts a 10 to 15 percent increase in spring precipitation (see Table 3-9)(GCRP, 2009).

The EPA determined that potential changes in climate caused by greenhouse gas (GHG) emissions endanger public health and welfare based on a body of scientific evidence assessed by the U.S. Global Climate Research Program, the Intergovernmental Panel on Climate Change, and then National Research Council (74 FR 66496). The Administrator issued an endangerment finding based on the technical support document compiled by the previously referenced scientific organizations, which indicates that, while ambient concentrations of GHG emissions do not cause direct adverse health effects (such as respiratory or toxic effects), public health risks and impacts can result indirectly from changes in climate. Based on EPA's determination, NRC recognizes that GHGs may have an effect on climate change. The Commission's Memorandum and Order CLI-09-21 provided guidance to NRC staff to consider carbon dioxide and other GHG emissions in its National Environmental Policy Act (NEPA) reviews. GHG emissions were considered an element of the existing air quality assessment. Relevant GHG emissions discussions are presented in Chapters 4 and 5 of this SEIS.

3.7.2 Air Quality

The proposed Nichols Ranch Project is located in and adjacent to counties that are designated as attainment with EPA National Ambient Air Quality Standards (NAAQS) for all criteria pollutants (EPA, 2010a). The nearest and only designated nonattainment area in Wyoming is the city of Sheridan, in Sheridan County (EPA, 2010a). The city of Sheridan is approximately 142 km [88 mi] northwest of the proposed Nichols Ranch Project. The terrain within the region where the proposed site is located, combined with windy conditions provides good conditions for dispersion of air pollutants (BLM, 2003). The nearest residence to the Nichols Ranch Unit is Dry Fork Ranch, approximately 1.5 km [0.9 mi] to the west. The nearest residence to the Hank Unit is Pfister Ranch, approximately 1.0 km [0.6 mi] to the north. The nearest residences along the path of the predominant wind direction (Figure 3-9) are approximately 3.0 km [1.9 mi] east of the proposed Nichols Ranch Unit (the T-Chair Ranch) and 1.8 km [1.1 mi] east of the proposed Hank Unit (the Pumpkin Buttes Ranch)(Uranerz, 2007). Air emissions for the proposed Nichols Ranch ISR Project are described in Section 2.2.1.6.1 of this SEIS.

As discussed in GEIS Section 3.3.6.2, the EPA has established air quality standards to promote and sustain healthy living conditions. These standards, known as NAAQS, address six pollutants EPA refers to as criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3), and sulfur dioxide (SO_2). EPA revised the NAAQS standards after the preparation of the GEIS. This includes a new rolling 3-month average standard for lead at 0.15 µg/m^3 and a new 1-hour nitrogen dioxide standard at 100 parts per billion. EPA revisions to SO_2 and O_3 standards are under consideration but are not finalized (EPA, 2010b). WDEQ adopted the EPA NAAQS, as summarized in the GEIS (NRC, 2009a, Table 3.2-8). States may develop standards that are stricter than, or that supplement, the NAAQS. Wyoming has a more restrictive standard for sulfur dioxide (annual at 60 µg/m^3 and 24-hour at 260 µg/m^3) and supplemental standards for particulate matter (annual PM_{10} at 50 µg/m^3 and 24 hour $PM_{2.5}$ at 65 µg/m^3) (WDEQ, 2008). The principal nonradiological emissions from activities at the proposed Nichols Ranch Project include diesel combustion engine emissions and fugitive road dust (particulate matter) described in Section 2.2.1.6.1.1.

Particulate matter (PM) refers to particles found in the air. Some particles are large enough to be seen as dust, soot, or smoke, while others are too small to be visible. As noted previously, NAAQS for PM_{10} and $PM_{2.5}$ limit the allowable concentration of PM particles to smaller than 10 and 2.5 µm. Emissions from highway and nonroad construction vehicles comprise approximately 28 percent of total PM_{10} and $PM_{2.5}$ emissions. The largest source of PM includes

fugitive dust from paved and unpaved roads, agricultural and forestry activities, wind erosion, wildfires, and managed burning.

The WDEQ Air Quality Division analyzes measurements from 26 stations located throughout Wyoming to ensure ambient air quality is maintained, in accordance with NAAQS. The results are synthesized into the Wyoming Ambient Air Monitoring Annual Network Plan (WDEQ, 2009). The baseline air quality conditions of the proposed Nichols Ranch Project were determined by evaluating data from four monitoring stations in the region to provide a reasonable representation of the air pollutant levels that could be expected to occur at the site. Monitoring data were reviewed for the Gillette, Campbell County South, Wright, and Antelope monitoring locations. Furthermore, the GEIS reported that all areas within the Wyoming East Uranium Milling Region were classified as being in attainment for NAAQS (NRC, 2009a).

WDEQ monitors air quality and annually reports the results to EPA. Table 3-10 presents the air quality monitoring data for all of the monitoring stations within an 80 km [50 mi] radius of the proposed Nichols Ranch project. These monitoring sites are located northeast, east, and southeast of the proposed project area in the general direction of the prevailing winds (Figure 3-9). The monitoring results for the 3 year period from 2006 through 2008 are consistent with the area's attainment status (WDEQ, 2009; EPA, 2010a). WDEQ uses the entire monitoring network to meet various objectives; therefore, all criteria pollutants are not monitored at each site and the data for monitoring sites in the vicinity of the proposed Nichols Ranch Project are limited.

As discussed in GEIS Section 3.3.6.2, of the Prevention of Significant Deterioration (PSD) requirements identify maximum allowable increases in concentrations for particulate matter, SO_2, and NO_2 for areas designated as attainment. There are several different classes of PSD areas, with Class I areas having the most stringent requirements. GEIS Table 3.4-9 identifies the Class I areas in Wyoming, South Dakota, Montana, and Nebraska. GEIS Figures 3.2-16 and 3.4-20 map the locations of Class I areas. Wind Cave National Park, the closest Class I area to the proposed action, is located about 185 km [115 mi] to the east of the Nichols Ranch site. Cloud Peak Wilderness Area, the closest Class II area to the proposed action, is located about 109 km [68 mi] to the northwest of the Nichols Ranch site.

3.8 Noise

As stated in GEIS Section 3.3.7, the estimated ambient noise levels in undeveloped rural and more urban areas of the Wyoming East Uranium Milling Region are 22 to 38 decibels (dBA) (NRC, 2009a). The proposed Nichols Ranch ISR Project area is located in rural Campbell and Johnson Counties, Wyoming. The known land uses within and adjacent to the Nichols Ranch ISR Project are grazing, wildlife habitat, recreation, oil and gas, and CBM recovery operations, none of which generate a significant amount of noise. Traffic along the roads leading to the site would generate some noise; however, almost all of the land on and adjacent to the proposed Nichols Ranch ISR Project is private with limited access. Sound levels from CBM operations would be expected to be unnoticeable from distances of 490 m [1,600 ft] and beyond (BLM, 2003). The nearest recreation area, the Powder River, is located approximately 14 km [9 mi] west of the proposed project area.

The applicant did not submit any ambient noise measurements as part of its license application. However, the applicant estimates the ambient noise levels at the proposed site are in the range reported for "farm in valley" sites by Wyle Laboratories (Wyle, 1971) where median noise levels are approximately 29 to 39 dBA. This range is similar to that stated in the GEIS. On occasion,

Table 3-10. Existing Conditions—Ambient Air Quality Monitoring Data (2006–2008)*

Pollutant†	Monitoring Station (Distance to Site)				Averaging Time (Standard)‡
	Gillette (46 mi)	Campbell (34 mi)	Wright (20 mi)	Antelope (36 mi)	
Nitrogen Dioxide	N/A	0.004 ppm	N/A	N/A	Annual (0.053 ppm)
Particulate Matter (PM_{10})	20	17	17	N/A	3 year annual (50 µg/m^3) (state limit)
	0	0	0	N/A	Number of exceedances in 3 year period (any 24-hour average, less than 150 µg/m^3)
Particulate Matter ($PM_{2.5}$)	N/A	N/A	N/A	4.1	3 year annual (15 µg/m^3)
	N/A	N/A	N/A	10	3 year average of the 98th percentile of 24 hr averages (35 µg/m^3)
Ozone	N/A	0.067 ppm	N/A	N/A	3 year average of the 4th highest 8-hour average for each year (0.075 ppm)

Source: WDEQ, 2009.
To convert miles to kilometers, divide by 0.621.
*Values reported are the 3 year average of annual averages unless otherwise specified
†Only those pollutants that were measured by WDEQ at monitoring stations within 80 km [50 mi] of the proposed site are listed. No measurements were taken for sulfur dioxide and carbon monoxide at these monitoring stations. Values are in units of µg/m^3 unless other units are specified.
‡Standards are federal NAAQS unless reported as state limit.

high winds and high truck traffic conditions may exist at the proposed project site, and the applicant estimates the noise levels in those situations to range from 50 to 60 dBA (Uranerz, 2007).

Noise is a concern to the areas surrounding the proposed project site because it can interfere with surrounding residential neighborhoods and wildlife activities. The nearest residential receptor (Pfister Ranch) is located approximately 0.95 km [0.6 mi] north of the proposed Hank Unit license area. The Dry Fork Ranch is located approximately 1.4 km [0.9 mi] west of the proposed Nichols Ranch Unit license area. With regard to onsite wildlife receptors, field observations suggest that noise from oil and gas and CBM operations could affect Greater sage-grouse lek activity (Braun, et al., 2002). The construction and operation of ISR facilities would involve similar activities. As discussed in Section 3.6.3 of this SEIS, sage-grouse leks have been identified within a 3.2-km [2.0-mi] radius of the proposed Nichols Ranch ISR Project site. None of these leks occur on the proposed project site.

The Federal Highway Administration (FHWA) and the Wyoming Department of Transportation (WYDOT) have noise impact assessment procedures and criteria to help protect the public health and welfare from excessive vehicular traffic noise. FHWA-established Noise Abatement Criteria (1-hour, a-weighted sound levels) are described according to land use, recognizing that different areas are sensitive to noise in different ways. The criteria as described in 23 CFR Part 772 are as follows:

Category A–Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes (exterior 57 dBA)

Category B–Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals (exterior 67 dBA)

Category C–Developed lands, properties, or activities not included in Categories A or B above (exterior 72 dBA)

Category D–Undeveloped lands

Category E–Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums (interior 52 dBA)

A person is considered to be impacted by noise, according to WYDOT procedures, when existing or expected future sound levels approach [within 1 decibel (dBA)] or exceed the Noise Abatement Criteria or when expected future sound levels exceed existing sound levels by a substantial amount (15 dBA). These criteria were used to assess impacts at the proposed Nichols Ranch ISR Project. T-Chair Livestock Company ranch roads, which cross the southwestern and northern portions of the Nichols Ranch Unit license area and are adjacent to the northwestern portion of the Hank Unit, are line sources of noise. Vehicular traffic sound 15 m [50 ft] from the receptor has been estimated at 54 to 62 dBA for passenger cars and 58 to 70 dBA for heavy trucks (NRC, 2009a). Because noise from line sources such as roads is reduced by approximately 3 dBA per doubling of distance (NRC, 2009a), the maximum truck sound level of 70 dBA on the shoulder of roads within the proposed project area would diminish to the level of a Category A Activity, approximately 480 m [1,575 ft] from the source, excluding the noise-dampening characteristics of topographic interference and vegetation. It was assumed that sound levels beyond a distance of 480 m [1,575 ft] from the T-Chair Livestock Company ranch roads would approximate 40 dBA, to conservatively overestimate a baseline that is consistent with the GEIS statement that existing ambient noise levels in this region would be 22 to 38 dBA (NRC, 2009a). GEIS Figure 3.2-17 provides examples of sound levels for common activities (NRC, 2009a).

3.9 Historical, Cultural, and Paleontological Resources

GEIS Section 3.3.8 (NRC, 2009b) provides a general overview of historic and cultural resources for the Wyoming East Uranium Milling Region. This section describes the site-specific historic and cultural resource investigations for the proposed Nichols Ranch ISR Project, including archaeological surveys, a paleontological survey, ethnographic review, and various government and tribal consultations. No standing structures were evaluated for the proposed project area; the only structures in the proposed project area are features associated with ranch operations including wells, stock ponds, reservoirs, existing two-track roads, and recently introduced energy development infrastructure.

The National Historic Preservation Act (NHPA) requires Federal agencies to consider the effects of their undertakings on historic properties. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places (NRHP). The criteria for eligibility are listed in 36 CFR Part 60.4 and include (i) association with significant events in history; (ii) association with the lives of persons significant in the past; (iii) embodiment of distinctive characteristics of type, period, or construction; and (iv) sites or places that have yielded or are likely to yield important information (ACHP, 2010). The historic preservation review process (NHPA Section 106) is outlined in regulations the Advisory Council on Historic Preservation (ACHP) issued in 36 CFR Part 800.

The issuance of a source materials license is a federal action (undertaking) that could possibly affect either known or undiscovered historic properties located on or near the Nichols Ranch ISR Project. In accordance with the provisions of the NHPA, NRC is required to make a reasonable effort to identify historic properties in the area of potential effect (APE). The APE for this review is area that may be impacted by construction, operation, aquifer restoration, and decommissioning activities associated with the proposed action. If no historic properties are present or affected, NRC is required to notify the Wyoming State Historic Preservation Office (WY SHPO) before proceeding. If it is determined that historic properties are present, NRC is required to assess and resolve possible adverse effects of the undertaking.

This cultural resources assessment also considers the Archaeological Resources Protection Act (ARPA) (16 United States Code 469-4689c-e) as amended, which covers permitting of archaeological investigations on public land such as that BLM manages. Finally, State of Wyoming laws dealing with protection of archaeological resources are also considered. These various laws and regulations were discussed in GEIS Appendix B.

As discussed in Section 1.7.2 of this SEIS, NRC initiated consultation with the WY SHPO, via a letter dated July 1, 2008 (NRC, 2008). A response from the WY SHPO, dated July 25, 2008, noted that the Pumpkin Buttes Traditional Cultural Property (TCP), a site eligible for listing in the NRHP, is of interest to numerous Native American tribes and that consultation with these tribes would be appropriate (WY SHPO, 2008). By letters dated July 8, 2010, and July 19, 2010, the WY SHPO concurred with NRC's determination of effect for most of the archaeological sites identified in the proposed project area (WY SHPO, 2010a, b). WY SHPO recommended that two of the sites remain unevaluated for the NRHP pending further testing, although neither site will be affected by the project as planned due to the use of protective fencing and avoidance measures. WY SHPO also recommended that five sites remain unevaluated for the NRHP pending Native American consultations, which have since been completed and are described in Section 3.9.3 of this SEIS. NRC is developing a Memorandum of Agreement (MOA) in consultation with BLM, WY SHPO, interested Native American tribes, and Uranerz for mitigation of potential adverse effects to the Pumpkin Buttes TCP and for four additional TCPs that were identified through tribal consultation.

3.9.1 Cultural History

The archaeological cultural sequence for the proposed project is unevenly divided between the prehistoric periods (Paleoindian, Archaic, and Late Prehistoric) and the recent protohistoric/historic era. The prehistoric periods encompass about 11,000 years between 12,000 B.P. (before present) and 250 B.P. (about A.D. 1700). The protohistoric/historic era extends from about A.D. 1700 to A.D. 1959.

3.9.1.1 Prehistoric Era

As mentioned previously, the prehistoric periods are divided into Paleoindian, Archaic, and Late Prehistoric. The hallmark artifact forms for the Paleoindian period (12,000 to 8,500 B.P.) in the region include, from oldest to youngest, Clovis, Folsom/Goshen, Agate Basin, Hell Gap, Eden, Scottsbluff, and Cody. Paleoindian sites in the region, yielding both Pleistocene megafauna and Paleoindian artifacts, include the James Allen site in southwestern Wyoming; Hell Gap and Agate Basin in eastern Wyoming, located east and southeast of the proposed project area; and Medicine Lodge Creek in central Wyoming. The Paleoindian period comes to a close in the terminal Pleistocene/early Holocene era. The Pleistocene megafauna (e.g., mammoth, muskox) are replaced by modern antelope, bison, deer, and elk. These smaller grazers were better adapted to the change from savannah to grassland communities that resulted from the onset of warmer and drier conditions in the Holocene era. The Archaic period (8,500 to 1,800 B.P.) in eastern and northeastern Wyoming is broken into three subperiods: Early (8,500 to 5,000 B.P.), Middle (5,000 to 3,000 B.P.), and Late (3,000 to 1,500 B.P).

In general, the regional Early Archaic sites are marked by the presence of various side and corner notched projectile points and side-notched knives. The subperiod is known for semi-subterranean houses that are usually marked by the presence of one or more hearths, fire pits, storage pits, and milling basins. The latter are of particular interest, as such features clearly indicate floral species played an important role in subsistence strategies. Middle Archaic site assemblages reflect a relatively broad spectrum of gathering and hunting responses, with an emphasis on bison procurement. By Late Archaic times, communal bison kills occur and recorded examples contain diagnostic Yonkee points (large corner-notched projectile points), which are the preferred method of felling the bison through the subperiod. Late Archaic faunal assemblages demonstrate the presence of smaller game animals and midsize ungulates (deer and antelope).

The Late Prehistoric period (1,500 to 300 B.P.) heralds the acceptance of new technologies such as smaller projectile points adapted to use with arrows. Prior to the Late Prehistoric period, the points were hafted on spears. Also introduced at this time is earthenware technology, which improves food preparation techniques. Stewing, braising, and boiling were now possible, which significantly broadened the number of floral and faunal species that could be used. Sometime between 1,000 and 600 B.P., there is considerable movement of people into Wyoming from several directions. The Kiowa-Apache and Shoshone-Comanche move into the region first, probably in response to several factors including population pressures from eastern sedentary groups who have partially adapted to horticultural regimes. Between about 600 B.P. (A.D. 1300) and A.D. 1700, the Crow, Cheyenne, and Arapaho all move into Wyoming to pursue their bison-oriented lifestyles.

3.9.1.2 Protohistoric/Historic Era

The Protohistoric period dates between about A.D. 1700 and 1840. This period includes the time when European goods and the domesticated horse are introduced into the region. There is no appreciable European presence in the region, with the exception of French fur traders moving up and down the Missouri River. Across the northern High Plains, there was active trading in European material goods, including metal knives, pots, and glass beads. Native American goods in similar styles also continued to be produced. The Native American tribes continued to pursue Native traditions into the 1900s in the region, though the majority of the tribal members were relocated to the Wind River Reservation.

The Historic era is subdivided into seven periods: Early Historic (A.D. 1801 to 1842), Preterritorial (A.D. 1843 to 1867), Territorial (A.D. 1868 to 1889), Expansion (A.D. 1890 to 1919), Depression (A.D. 1920 to 1939), World War II (A.D. 1940 to 1946), and Post-World War II (A.D. 1947 to 1959). European settlement in the Powder River Basin occurred after the close of the historic Bozeman Trail in the late 1800s (Uranerz, 2007). The Bozeman Trail is located approximately 3.2 km [2 mi] west of the proposed Nichols Ranch ISR Project area. It was a route used first by Native Americans and then later by traders and homesteaders moving west during the 19th century (Uranerz, 2007). Historically, the proposed project area was used for cattle ranching with limited oil and gas exploration in the nearby vicinity. There is no indication from the sites identified in the project area that there were earlier historic occupations of the area. Thus, at best, historic occupations are limited to the Expansion and post-Expansion periods.

3.9.2 Historic and Cultural Resources Identified and Places of Cultural Significance

NRC staff reviewed documentation related to past archaeological surveys conducted on behalf of the applicant for the proposed Nichols Ranch ISR Project and those conducted for CBM companies whose project areas overlap with the proposed project boundaries. These documents included survey reports with determinations of the potential for effects or adverse effects to properties listed on or eligible for listing in the NRHP. The following sections discuss the occurrence of cultural resources at each unit as well as consultation with Native American tribes that have a heritage interest on or in the vicinity of the proposed Nichols Ranch ISR Project site.

3.9.2.1 Nichols Ranch Unit

Within the Nichols Ranch Unit, Western Land Services conducted one Class III archaeological survey for the Tex Draw CBM Plan of Development (POD) project, which identified 13 archaeological sites. These included six prehistoric, two historic, and five prehistoric /historic sites. Based on the available data, the sites are mostly artifact scatters, though historic building remains are present at Site 48JO2953, which is not eligible for listing on the NRHP. Only 1 of the 13 sites is eligible for listing on the NRHP and is identified in Table 3-11.

3.9.2.2 Hank Unit

Within the Hank Unit, five archaeological Class III surveys have been completed, which identified 25 archaeological sites (Table 3-12). Of the 25 sites, 7 are eligible for listing on the NRHP, 16 are not eligible for listing, and 2 remain unevaluated for NRHP eligibility and are identified in Table 3-11. The past Class III surveys include two conducted by Frontier Archaeology and one by TRC Environmental Corporation for the proposed Nichols Ranch ISR Project on behalf of the applicant, one by SWCA Environmental Consultants for the Dry Willow I POD project, and one by ARCADIS, for the Dry Willow 4 POD project. Except for Sites 48CA268 and 48CA6147, all of the cultural resources identified in the Hank Unit are prehistoric or protohistoric. The single historic component at Site 48CA6147 is a very small debris scatter consisting of a fragmented clear glass bottle, two cans, and a handful of nails. The debris may have resulted from fence mending or other ranch activities.

Table 3-11. Nichols Ranch Unit Archaeological Sites

Site ID	Site Type	NRHP Finding and Comments/Stipulations
48JO2944	Prehistoric: lithic scatter Historic: debris scatter	Not eligible
48JO2946	Prehistoric: open camp	Not eligible
48JO2948	Prehistoric: lithic scatter	Not eligible
48JO2949	Historic: debris scatter	Not eligible
48JO2950	Historic: debris scatter	Not eligible
48JO2953	Prehistoric: lithic scatter Historic: building remains (razed Nichols Ranch)	Not eligible
48JO2957	Prehistoric: lithic scatter	Not eligible
48CA5386	Prehistoric: lithic scatter Historic: hunting blinds and wind breaks	Not eligible
48CA5390	Prehistoric: lithic scatter Historic: debris scatter	Not eligible
48CA5391	Prehistoric: lithic scatter with feature Historic: debris scatter	Eligible—site will not be affected by project as planned (fencing and avoidance)
48CA5392	Prehistoric: lithic scatter	Not eligible
48CA5393	Prehistoric: lithic scatter	Not eligible
48CA5406	Prehistoric: lithic scatter	Not eligible
Sources: WY SHPO, 2010a,b; Brunette, 2007		

The prehistoric sites are marked by the presence of fire-cracked rock (FCR), chipped stone tested cobbles, debris, and occasional tools; groundstone; and, at one site, minor amounts of bone. None of the prehistoric sites indicated the presence of temporally diagnostic items such as ceramics or projectile points. The reason for this absence of such sites is unclear, but the artifact assemblages from the sites are suggestive of seasonal processing locations. The presence of stone circles does not preclude seasonal use, and the stone circles, possible tepee loci, hint at Late Prehistoric or Protohistoric occupations. The absence of Euro-American goods at any of the sites argues against early Historic occupations by Native American peoples, though it is documented that the Pumpkin Buttes have been utilized by Native Americans into the Historic period.

3.9.2.3 Places of Cultural Significance

The Pumpkin Buttes (Site 48CA268), an NRHP-eligible TCP, is a place of cultural significance near or within the proposed Nichols Ranch ISR Project area, as shown in Figures 1-1 and 2-3. The Pumpkin Buttes comprise five individual buttes (North, North Middle, South Middle, Indian, and South) and have served as a landmark for peoples throughout the centuries. Native Americans first utilized the buttes for shelter, safety, and as a viewing point to watch for buffalo and other game (Uranerz, 2007). The western boundary of the North Middle Butte is located within the proposed Hank Unit permit boundary. The TCP boundary for the North Middle Butte is the area between 1,676 m [5,500 ft] AMSL and the top of the butte. The proposed Hank Unit permit area would be adjacent to the Pumpkin Buttes (Site 48CA268). Sites 48CA6748, 48CA6753, 48CA6751, and 48CA6148 are all within the proposed Hank Unit permit area. All of these sites have been determined through Native American tribal consultation to possess

Table 3-12. Hank Unit Archaeological Sites

Site ID	Site Type	NRHP Finding and Comments/Stipulations
48CA268	Prehistoric/Historic: TCP	Eligible—mitigation through MOA
48CA379	Prehistoric: lithic scatter	Not eligible
48CA6146/ 48CA6147	Prehistoric: lithic, groundstone, and Fire-cracked rock (FCR) scatter with stone circles Historic: debris scatter	Not eligible
48CA6148	Prehistoric: lithic scatter with stone circles: TCP	Eligible—mitigation through MOA (fencing and avoidance)
48CA6149	Prehistoric: lithic scatter	Not eligible
48CA6151	Prehistoric: lithic scatter	Not eligible
48CA6342	Prehistoric: lithic scatter with hearth	Not eligible
48CA6343	Prehistoric: lithic scatter with features	Not eligible
48CA6344	Prehistoric: lithic scatter with FCR	Not eligible
48CA6345	Prehistoric: lithic scatter with FCR	Not eligible
48CA6475	Prehistoric: open camp	Unevaluated for NRHP eligibility pending evaluative testing—site will not be affected by project as planned (fencing and avoidance)
48CA6490	Prehistoric: open camp	Eligible—site will not be affected by project as planned (fencing and avoidance)
48CA6491	Prehistoric: lithic scatter	Not eligible
48CA6498	Prehistoric: lithic scatter	Not eligible
48CA6499	Prehistoric: lithic scatter	Not eligible
48CA6748*	Prehistoric: lithic scatter with FCR and activity areas: TCP	Eligible—mitigation through MOA (fencing and avoidance)
48CA6749	Prehistoric: lithic scatter	Not eligible
48CA6750	Prehistoric: lithic scatter with groundstone	Not eligible
48CA6751*	Prehistoric: lithic scatter with activity areas and possible stone circle feature: TCP	Eligible—mitigation through MOA (fencing and avoidance)
48CA6752	Prehistoric: lithic and FCR scatter	Not eligible
48CA6753*	Prehistoric: lithic and FCR scatter: TCP	Eligible—mitigation through MOA (fencing and avoidance)
48CA6754	Prehistoric: lithic and FCR scatter with FCR concentration	Unevaluated for NRHP eligibility pending justification—site will not be affected by project (fencing and avoidance)
48CA6926	Prehistoric: lithic scatter	Not eligible
48CA6927	Prehistoric: lithic scatter with features	Eligible——site will not be affected by project as planned (fencing and avoidance)

Sources: WY SHPO, 2010a,b; Uranerz, 2010; TRC Solutions, 2010; Russell, 2009; Brunette, 2007, 2006; Hutchinson, 2006
*Not evaluated under all NRHP criteria (see 36 CFR 60.4).

traditional cultural and religious significance, are considered to be TCPs, and are eligible for listing on the NRHP for their religious and cultural significance.

During investigations unrelated to the proposed Nichols Ranch ISR Project, the Pumpkin Buttes were determined as eligible for the NRHP (Uranerz, 2007) under Criteria A, B, and D on the basis that their condition of integrity were considered intact (BLM, 2009b). Subsequent to the determination of eligibility, BLM entered into an MOA with the proponents of the Savageton 3/Savageton 4 Project (Lance Oil and Gas/Anadarko Petroleum Corporation) and Dry Willow Phase I and II projects (Anadarko Petroleum Corporation). Because of anticipated development within the viewshed of the Pumpkin Buttes, BLM entered into a Programmatic Agreement (PA) with the WY SHPO focused on mitigation of adverse effects for the Pumpkin Buttes TCP from anticipated federal minerals development (BLM, 2009b). Prior to entering into the PA, the BLM invited the Blackfeet, Cheyenne River Sioux, Crow, Eastern Shoshone, Fort Peck, Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nation), Northern Arapaho, Northern Cheyenne, and Oglala to participate in consultation and to be consulting parties to resolve adverse effects to the Pumpkin Buttes. Although the Northern Cheyenne participated in the consultation process for the Savageton 3/Savageton 4 MOA, it and the other tribes chose not to formally comment on the PA. In the PA, the signatory parties noted that “BLM has determined the development of oil, gas, and in-situ uranium well, infrastructure corridors, access roads, and other facilities are assumed to have an adverse effect to the contributing integrity of the setting, feeling, and association for the Pumpkin Buttes Traditional Cultural Property…” (BLM, 2009b). The PA outlines various measures that a project proponent (federal oil, gas, and uranium leaseholders) within a 3.2 km [2 mi] radius of the Pumpkin Buttes must take to mitigate the adverse effect of its proposed actions on the TCP. These measures are discussed in Chapter 4.

As discussed in Section 3.9.3, NRC is developing an MOA to address adverse impacts from the proposed Hank Unit to the viewshed of five TCPs eligible for listing on the NRHP [Sites 48CA268 (Pumpkin Buttes TCP), 48CA6148, 48CA6748, 48CA6751, and 48CA6753]. NRC sent its final determination of an adverse impact to the viewshed of the Pumpkin Buttes TCP in letters to the WY SHPO and ACHP dated August 9, 2010 (NRC, 2010c). NRC subsequently forwarded an additional letter to the WY SHPO on October 15, 2010, forwarding the determination of adverse viewshed impacts to the four additional TCPs identified through Tribal consultation (NRC, 2010d).

3.9.3 Tribal Consultation

The NRC has made a reasonable and good faith effort to identify Native American tribes that shall be consulted during the Section 106 consultation process and to provide the identified Native American tribes a reasonable opportunity to participate in the Section 106 consultation process, as is required by 36 CFR 800.2(c)(B)(ii)(A). As mentioned in Section 1.7.3.3 in the SEIS, NRC sent Section 106 consultation letters to the following tribes on December 24, 2008: Blackfeet, Cheyenne River Sioux, Crow, Eastern Shoshone, Fort Peck Assiniboine/Sioux, Northern Arapaho, Northern Cheyenne, Oglala Sioux, and Three Affiliated Tribes (the Mandan, Hidatsa, and Arikara Nation). By email dated February 12, 2009, the Northern Cheyenne Tribal Historic Preservation Office responded to the December 24, 2008 letter, and stated that the Pumpkin Buttes are considered spiritual and ceremonial areas and that contaminants related to uranium extraction, traffic, noise, and dust pollution may affect the overall condition of the area (NCTHPO, 2009). No other responses were received.

NRC contacted the nine tribes on April 23, 2010 (NRC, 2010a), to request information regarding cultural resources potentially affected by the proposed Nichols Ranch ISR Project and to invite the tribes to become signatories to an MOA among the NRC, BLM, WY SHPO, and Uranerz for mitigation of an adverse effect to the viewshed of the Pumpkin Buttes TCP. NRC followed up the letter with telephone calls to each tribe during May 2010. During these telephone calls, eight of the nine tribes (all but the Three Affiliated Tribes) expressed interest or potential interest in being a signatory to the MOA. Two tribes, the Fort Peck Assiniboine/Sioux Tribes and the Northern Cheyenne Tribe, requested a site visit. Uranerz hosted site visits with representatives from both tribes on July 7, 2010, and July 30, 2010. As a result of this consultation, the tribes agreed that Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 are considered to possess traditional cultural and religious significance and are considered to be eligible for listing on the NRHP (TRC Solutions, 2010). The applicant has committed to fence and avoid these sites. Mitigation of the adverse impacts to the viewshed of these eligible sites, including the viewshed of the Pumpkin Buttes TCP, will be addressed in the MOA.

NRC forwarded a draft MOA for comment to the eight interested tribes on July 22, 2010 (NRC, 2010b). NRC will continue to consult with interested tribes throughout the Section 106 process.

3.9.4 Paleontological Resources

A paleontological survey was conducted for the proposed project area for the applicant (Connely, 2007). The survey identified Quaternary sediments and exposed Eocene deposits of the Wasatch Formation. The deposits identified in the Nichols Ranch Unit and Hank Unit areas are fossil bearing yielding vertebrate, invertebrate, and petrified wood specimens. The survey results summarized the identification of unidentified mammal, gar, turtle, and petrified wood in the Nichols Ranch Unit. In the Hank Unit, fossil materials were recovered from the slope of the North Middle Butte and included unidentified bone, turtle, and petrified wood.

3.10 Visual and Scenic Resources

In general, this region of the Powder River Basin where the proposed Nichols Ranch ISR Project is located is characterized as basin and range country with prominent buttes and ridges interspersed by rolling grasslands. Semipermanent streams are fed by intermittent and ephemeral drainages, which seasonally drain the adjacent uplands. Past changes to land surfaces include those associated with human habitation; the development of stock ponds and reservoirs; access roads; and the introduction of gas, oil, and other energy development infrastructure.

BLM evaluates the scenic quality of the land it administers through a Visual Resource Inventory to ensure that the scenic (visual) value is preserved. As part of this inventory, the BLM completes a scenic quality evaluation, a sensitivity-level analysis, and a delineation of distance zones to group areas into one of four visual resource management (VRM) classes. Class I is the most protected of visual and scenic resources, and Class IV is the least restrictive. This type of inventory would apply to the 118 ha [280 ac] of BLM-owned land on the Hank Unit.

BLM has established VRM classifications and has resource management plans for all of the Wyoming East Uranium Milling Region, which includes the entire Nichols Ranch and Hank Units (NRC, 2009a). The VRM classifications for the region are shown in GEIS Figure 3.3-17 (NRC, 2009a). In the past, the landscape has been extensively modified in urban areas and in several rural areas by oil, natural gas, and coal production. The bulk of the Wyoming East

Uranium Milling Region is categorized as VRM Class III (along highways) and Class IV (open grassland, oil and natural gas, urban areas). The BLM resource management plans for this region do not identify any VRM Class I resources.

BLM recognizes the Pumpkin Buttes, which flank the northern and southeastern boundaries of the Hank Unit, as a TCP, which is discussed in more detail in Section 3.10.2 in the SEIS. In addition to the Pumpkin Buttes, four additional TCPs (Sites 48CA6748, 48CA6753, 48CA6751, and 48CA6148) were identified through Native American consultation. A portion of the Pumpkin Buttes TCP and the four additional TCPs are within the proposed Hank Unit permit area. The Pumpkin Buttes are discussed in more detail in SEIS Section 3.10.2. The area considered for visual resources associated with the proposed Nichols Ranch ISR Project includes the project site, access roads, and a 3.2-km [2-mi] buffer area outside the proposed project site. Beyond this distance, any changes to the landscape would be in the background distance zone and would be either unobtrusive or imperceptible to viewers. Areas and associated viewer types considered to be potentially sensitive to visual changes include park, recreation, and wilderness areas; major travel routes; and residential areas.

3.10.1 Nichols Ranch Unit

The Nichols Ranch Unit is located approximately 9.6 km [6 mi] southwest of the Hank Unit on the border between Johnson and Campbell Counties. Topography in this area is relatively flat with gently rolling hills and low ridges that drain south toward Cottonwood Creek (an intermittent stream) located in the southern portion of the unit. Elevations in the Nichols Ranch Unit range from 1,425 to 1,495 m [4,670 to 4,900 ft] AMSL (Uranerz, 2007).

The Nichols Ranch Unit is about 9.6 km [6 mi] west of the Pumpkin Buttes TCP and Sites 48CA6748, 48CA6753, 48CA6751, and 48CA6148. The proposed Nichols Ranch project area is separated from the five TCPs by hills and pronounced drainages. The mid to upper slopes and the tops of North Middle and South Middle Buttes can be seen from the Nichols Ranch Unit, but the butte bases are not visible.

As described in Section 3.2 of this SEIS, livestock grazing, oil and gas extraction, CBM extraction, and uranium recovery activities are all currently taking place on or near the proposed project area. The immediate future land use for the proposed project area and adjacent areas would be continued livestock grazing, ISR, CBM extraction, and oil and gas extraction. There are no parks, recreation areas, wilderness areas, or residential areas within the proposed project area. The historic Bozeman Trail, located approximately 3.2 km [2 mi] west of the proposed Nichols Ranch ISR Project area, was a route used first by Native Americans and then later by traders and homesteaders moving west during the 19th century (Uranerz, 2007). This trail is at the margin of the area considered for visual resources.

3.10.2 Hank Unit

The Hank Unit is located on the western flank of the North Middle Butte within the Pumpkin Buttes. Topography of the Hank Unit includes gently rolling hills and low ridges, as well as steep terrain near North Middle Butte. There are steeply eroded areas in the southern part of the Unit that have resulted from Dry Willow Creek (an ephemeral stream). Elevations in the Hank Unit range from 1,540 to 1,588 m [5,055 to 5,209 ft] AMSL, and the area is dissected by a series of unnamed and ephemeral drainages that generally drain west and southwest toward Dry Willow Creek (Uranerz, 2007).

The five buttes (collectively called the Pumpkin Buttes) are located north, east, and southeast of the Hank Unit. North Butte is located about 2.4 km [1.5 mi] northwest of the Hank Unit and 3.0 km [1.9 mi] from the existing T-Chair Livestock Company ranch road, which would serve as primary access to both the Nichols Ranch and Hank Units. Each of the buttes is a free-standing residual feature that clearly dominates its location. The buttes rise to elevations exceeding 1,830 m [6,000 ft] AMSL, and their bases lie at about 1,525 m [5,000 ft] AMSL. The flanks of the buttes are cut by intermittent drainages, which are effectively headwaters for local intermittent drainages. At present, water tanks are located within the Hank Unit on the base of North Middle Butte. South Middle Butte, outside the Hank Unit but within view of it, hosts four signal transmission towers on the butte top. These towers are visible from the Hank Unit and from North Middle Butte. The northeastern quadrant of the Hank Unit subsumes part of the western slope of North Middle Butte, which is an element of the Pumpkin Buttes TCP.

BLM recognizes the Pumpkin Buttes as a TCP. Visual concerns from CBM development in general were addressed in past EAs for Anadarko Petroleum Corporation Dry Willow Phase I and Dry Willow Phase II (BLM, 2007b). The Dry Willow Phase II EA (BLM, 2007b) noted that oil and gas facilities and related visual distractions, including oil and gas wells, well pads, pump jacks, pipeline scars, storage buildings, and vehicular traffic, were visible from the base of Pumpkin Buttes to approximately 24 km [15 mi] westward. A Pumpkin Buttes visual assessment completed in 2006 noted roads and trails, CBM-associated structures, reservoirs, and power lines were readily visible from the base of the buttes (Uranerz, 2007). Because of the anticipated development within the viewshed of Pumpkin Buttes, BLM entered into a PA with the WY SHPO focused on mitigation of adverse effects for the Pumpkin Buttes TCP from anticipated federal minerals development (BLM, 2009b).

During the NRC's environmental review, four additional TCPs were identified through Native American consultation and are within the proposed Hank Unit permit boundary. NRC is developing a MOA in consultation with BLM, WY SHPO, interested Native American Tribes, and Uranerz. The MOA would address mitigation of the adverse impacts to the viewshed of the five TCPs eligible for listing on the NRHP [Sites 48CA268 (Pumpkin Buttes TCP), 48CA6748, 48CA6753, 48CA6751, and 48CA6148].

3.11 Socioeconomics

This section of the SEIS describes current socioeconomic factors that have the potential to be directly or indirectly affected by the proposed Nichols Ranch ISR Project. The proposed project is located in the Wyoming East Uranium Milling Region, which is described in GEIS Section 3.3.10 (NRC, 2009a). The proposed ISR facility and the people and communities that would support it can be described as a dynamic socioeconomic system. The communities provide the people, goods, and services required to construct and operate the facility. The proposed ISR facility would, in turn, create the demand for people, goods, and services and pay for them in the form of wages, salaries, benefits, and payments for goods and services. Income from wages and salaries and payments for goods and services is then spent on other goods and services within the community, thus creating additional opportunities for employment and income.

The proposed Nichols Ranch ISR Project is located in a rural, resource-rich area of northeastern Wyoming that bisects Campbell and Johnson Counties in the Powder River Basin. Gillette, the largest town in the area with a population of approximately 25,000, is the center for mining and energy activity in this portion of Wyoming. Gillette is located 74 km [46 mi] from the proposed project site. The closest town to the proposed Nichols Ranch ISR Project is Wright,

located approximately 32 km [20 mi] to the east with 1,604 residents. The towns of Edgerton and Midwest are located approximately 40 km [25 mi] southwest of the proposed Nichols Ranch ISR Project and have populations of 176 and 435 people (USCB, 2008).

The socioeconomics region of influence (ROI) is defined by the area where employees and their families would reside, spend their income, and use their benefits, thereby affecting the economic conditions of the region. Given that most employees would reside near the ISR facility, the most significant impacts of plant construction and operations are likely to occur in Campbell and Johnson Counties. The SEIS analysis therefore focuses on the impacts of the proposed ISR facility in these counties. The following subsections describe the demographics, income, housing, employment structure, local finance, education, and public services in the ROI surrounding the proposed ISR facility.

The socioeconomic information presented in this SEIS for the proposed Nichols Ranch ISR Project ROI is based on a combination of 2000 U.S. Census Bureau data, U.S. Census Bureau 2005–2007 American Community Survey 3-Year Estimates, and U.S. Census Bureau 2009 State and County QuickFacts. Though specific numbers may differ, the characterization of socioeconomics presented in GEIS Section 3.3.10 remains valid for the proposed Nichols Ranch ISR Project.

3.11.1 Demographics

Campbell County has an estimated population of 43,967, and Johnson County has an estimated population of 8,531 (USCB, 2010). According to the 2000 Census, the population of Campbell and Johnson Counties is mostly White; Hispanic or Latino, American Indian, and other races comprise less than 6 percent of the population (USCB, 2000a,b,c).

Table 3-13 shows population projections and growth rates from 1980 to 2050 in Campbell County. The population in Campbell County has grown and is projected to continue to grow at a declining rate through 2050. The population in Johnson County had a slight decline in population from 1980 to 1990. From 2000 to 2030, the growth trend is at a declining rate.

Table 3-13. Population and Percent Growth in Campbell and Johnson Counties, Wyoming, From 1980 to 2050

Year	Campbell County		Johnson County	
	Population	Percent Growth*	Population	Percent Growth*
1980	24,367	—	6,700	—
1990	29,370	20.5	6,145	-8.3
2000	33,698	14.7	7,075	15.1
2009	43,967	30.5	8,531	20.6
2010	43,440	28.9	8,640	22.1
2020	52,130	20.0	9,990	15.6
2030	59,990	15.1	11,220	12.3
2040†	68,403	14.0	12,530	11.7
2050†	76,678	12.1	13,820	10.3

— = No data available

*Percent growth rate is calculated over the previous decade.

†2040 and 2050 population projections are calculated based on trends of demographic and economic variables.

Sources: USCB, 2010, 1995; WDAI-DEA, 2008, 2001

The 2000 demographic profiles for Campbell and Johnson Counties are presented in Table 3-14. Persons self-designated as minority individuals comprised about 6.0 and 4.2 percent of the total population in 2000 for Campbell and Johnson Counties. The minority population in both counties is composed largely of Hispanic or Latino residents.

According to American Community Survey 3-Year Census data estimates (2006–2008), minority populations in Campbell County were estimated to have increased by approximately 1,300 persons from 2000 and comprised 8.3 percent of the county population (see Table 3-15) (USCB, 2009a,b). Most of this increase was due to an estimated influx of Hispanic or Latin persons (approximately 800), which accounted for more than a 66 percent increase from the 2000 population. The next largest increase in minority population was for Black or African American, with an increase of approximately 140 persons from the 2000 population.

3.11.2 Income

Estimated income information for the ROI is presented in Table 3-16. According to American Community Survey 3-Year Census data estimates (2006–2008), median household and per capita income in Campbell County was above the Wyoming average, and an estimated 5.1 percent of the population and 4.2 percent of families in Campbell County were living below the official poverty level (USCB, 2009c). The median household income in Johnson County was below the Wyoming average; an estimated 8.3 percent of the population in Johnson County was living below the official poverty level (USCB, 2009d).

The annual unemployment average for Campbell County was 3.1 percent (USCB, 2009c). The unemployment rate in Johnson County was 3.2 (USCB, 2009d). Campbell and Johnson Counties were slightly lower than the annual unemployment average of 3.5 percent for Wyoming (USCB, 2009d).

3.11.3 Housing

Table 3-17 lists the total number of occupied housing units, vacancy rates, and house median value in Campbell County. According to American Community Survey 3-Year Census data estimates (2006 – 2008), there were more than 13,000 housing units in the ROI, of which approximately 12,000 were occupied. The median value of owner-occupied units was $102,900 (USCB, 2009d,e).

By 2008, the total number of housing units in Campbell County grew by almost 1,700 units to 14,959, while the total number of occupied units also grew by 1,700 units to 13,907. As a result, the number of available vacant housing units decreased slightly by almost 30 units to 1,052, or 7.0 percent of all housing units (USCB, 2009e). The total number of housing units in Johnson County grew by almost 280 units to 3,780 (USCB, 2009f).

3.11.4 Employment Structure

In 2007, the civilian labor force in Campbell County was 25,835 (FedStats, 2010a). The largest source of employment in Campbell County is the mining industry, which accounts for 27 percent of all jobs and 40 percent of all earnings in the county. Government-related jobs are the second largest source of employment in Campbell County, providing 13 percent of the total workforce, and retail trade accounts for 10 percent of the employment.

Table 3-14. Demographic Profile of the Population in Campbell and Johnson Counties in 2000

	Campbell County	Percent	Johnson County	Percent
Total Population	33,698	—	7,075	—
Race (Non-Hispanic or Latino)				
White	31,701	94.1	6,771	95.8
Black or African American	47	0.1	5	0.0
American Indian and Alaska Native	280	0.8	42	0.0
Asian	100	0.3	4	0.0
Native Hawaiian and Other Pacific Islander	28	0.1	0	0.0
Some other race	11	0.0	7	0.0
Two or more races	340	1.0	98	1.3
Ethnicity				
Hispanic or Latino	1,191	3.5	148	2.1
Minority Population (Including Hispanic or Latino ethnicity)				
Total minority population	1,997	5.9	304	4.2
Sources: USCB, 2000a; USCB, 2000b; USCB, 2000c				

Table 3-15. Demographic Profile of the Population in Campbell County (2006–2008 3-Year Estimate) and Johnson County (2008 Estimate)

	Campbell County	Percent	Johnson County	Percent
Total Population	40,121	—	8,464	—
Race (Non-Hispanic or Latino)				
White	36,805	91.7	8,043	95.0
Black or African American	189	0.5	7	0.1
American Indian and Alaska Native	380	0.9	52	0.6
Asian	204	0.5	5	0.1
Native Hawaiian and Other Pacific Islander	0	0.0	0	0.0
Some other race	82	0.2	0	0.0
Two or more races	481	1.2	94	1.1
Ethnicity				
Hispanic or Latino	1,980	4.9	263	3.1
Minority Population (Including Hispanic or Latino ethnicity)				
Total minority population	3,316	8.3	421	5.0
Sources: USCB, 2009a,b				

Table 3-16. Estimated Income for Campbell County (2006–2008) and Johnson County (2008)

	Campbell County	Johnson County	Wyoming
Median household income (dollars)	76,666*	51,162	53,096
Per capita income (dollars)	31,122*	36,074†	27,873
Percent of families below the poverty level	4.2	NA	5.5
Percent of persons below the poverty level	5.1	8.3	8.9

*In 2008 inflation-adjusted dollars
†In 2006
NA = Not available
Sources: USCB, 2009c,d

Table 3-17. Housing in Campbell and Johnson Counties, Wyoming In 2000 (Actual) and 2008 (Estimate)

	Campbell County	Johnson County
2000		
Total	13,288	3,503
Occupied housing units	12,207	2959
Vacant units	1,081	544
Vacancy rate (percent)	8.1	15.5
Median value (dollars)	102,900	115,500
2006–2008 (Estimated)		
Total	14,959	3,780
Occupied housing units	13,907	NA
Vacant units	1,052	NA
Vacancy rate (percent)	7.0	NA
Median value (dollars)	200,200	NA

NA = Not available
Sources: USCB, 2009e,f; USCB, 2000d,e

In 2007, the civilian labor force in Johnson County was 3,880 (FedStats, 2010b). The largest source of employment in Johnson County is the Federal government, which accounts for 17 percent of the county workforce. The health care and social assistance sector follows with 11 percent of the workforce (WBC, 2009).

3.11.5 Local Finance

Campbell County taxes commercial personal property. The county determines assessed valuation of commercial property at 11.5 percent of the market value and applies a mill levy of around 60 mills (WDOR, 2001). Johnson County imposes a 2 percent lodging tax (WDOR, 2007).

Wyoming has a 5 percent sales tax and allows counties to increase sales tax up to 4 percent above the state rate. Campbell County has an additional 0.25 percent sales and use tax for a total of 5.25 percent (Liu, 2008). The additional tax the county added comes back to the county. The average property tax rate in Campbell County is 6.25 percent. The average property tax rate in Johnson County is 7.13 percent (WDOR, 2007).

Finally, the state imposes an *ad valorem* tax on mineral extraction. In 2007, for uranium alone, the state collected $1.2 million from this tax (NRC, 2009a). Severance taxes associated with uranium extraction in Campbell County are levied by the Mineral Tax Division of the State of Wyoming Department of Revenue. This is a 4 percent uranium severance tax of taxable value coming from resource extraction operations (WDOR, 2009). Typical severance taxes collected in Wyoming from mineral development come from coal, trona, uranium, oil, and natural gas. Uranium had the lowest severance tax collected from all mineral types at well below 1 percent (WDOR, 2007).

3.11.6 Education

The Campbell County School District, which is the third largest school district in Wyoming, is composed of a total of 24 school facilities and currently enrolls approximately 7,500 students. Campbell County School District #1, which includes the Gillette area, had a student-to-teacher ratio of 12.98 in 2007 (WDE, 2007). By 2009, the student-to-teacher ratio had increased to 19.2 to 1, which is higher than the statewide ratio of 12.4 to 1 (CCESC, 2009; WDE, 2007). Johnson County has one school district that is composed of 5 school facilities and currently enrolls 1,261 students (JCSD, 2009).

3.11.7 Health and Social Services

The primary health care facility in Campbell County is the Campbell County Memorial Hospital located in Gillette, which provides emergency care, a cancer care center, and clinical outpatient operations. The hospital also has two branch clinics located in Gillette and the town of Wright. The closest medical center offering full service emergency services is the Wyoming Medical Center in Casper, located approximately 87 km [54 mi] southwest of the proposed Nichols Ranch ISR Project.

The primary health care facility in Johnson County is the Johnson County Health Center, located in Buffalo, which is a fully equipped hospital with an outpatient medical clinic. Emergency response services would also likely come from Buffalo (NRC, 2009b).

3.12 Public and Occupational Health and Safety

This section summarizes the natural background radiation levels in and around the proposed Nichols Ranch ISR Project area. Descriptions of these levels are known as “preoperational” or “baseline” radiological conditions, and they would be used for evaluating potential radiological impacts associated with the proposed Nichols Ranch ISR Project operations. This section also describes applicable safety criteria and radiation dose limits that have been established for protection of public and occupational health and safety.

Radiation dose is a measure of the amount of ionizing energy that is deposited in the body. Ionizing radiation is a natural component of the environment and ecosystem, and members of the public are exposed to natural radiation continuously. Radiation doses to the general public occur from radioactive materials found in the earth’s soils, rocks, and minerals. Radon-222 is a

radioactive gas that escapes into ambient air from the decay of uranium (and its progeny, radium-226) found in most soils and rocks. Naturally occurring low levels of uranium and radium are also found in drinking water and foods. Cosmic radiation from outer space is another natural source of exposure and ionizing radiation dose. In addition to natural sources of radiation, there are artificial or manmade sources that contribute to the dose the general public receives. Medical diagnostic procedures using radioisotopes and x-rays are a primary manmade radiation source. In NCRP (2009), estimates the annual average dose to the public from all natural background radiation sources (terrestrial and cosmic) as 3.1 millisieverts {mSv; 310 millirem [mrem]}. Due to the increase in medical imaging and nuclear medicine procedures, the annual average dose to the public from all sources (natural and human made) is 6.2 mSv [620 mrem] (NCRP, 2009).

3.12.1 Background Radiological Conditions

In accordance with NRC regulations contained in 10 CFR Part 40, Appendix A, Criterion 7, the applicant developed and implemented a preoperational monitoring program to establish site baseline conditions at the proposed site. Results of the baseline radiological environmental monitoring provided data on background levels that can be used for evaluating future impacts from routine facility operations or from accidental or unplanned releases. Regulatory Guide 4.14 (NRC, 1980) provides guidance on baseline radiological environmental monitoring. As a result of the NRC safety review, the applicant will be required by a license condition to collect additional baseline data related to groundwater sampling.

The applicant included the following sampling methods in its baseline radiological environmental monitoring program (Uranerz, 2007):

- Integrated gamma scan survey to map the ambient gamma radiation levels across the site
- Surface soil samples {to a depth of 15 cm [6 in]} in wellfields analyzed for radium-226 and a large percentage analyzed for uranium, thorium-230, and lead-210
- Eighteen subsurface samples {to a depth of 0.9 m [3 ft]} analyzed for radium-226, uranium, thorium-230, and lead-210
- Twenty-six sediment samples analyzed for radium-226, uranium, thorium-230, and lead-210
- Quarterly radon-222 sampling and ambient gamma measurements consistent with NRC Regulatory Guide 4.14
- Groundwater and surface water samples analyzed for radium-226, uranium, thorium-230, and lead-210
- Vegetation samples analyzed for radium-226, uranium, thorium-230, lead-210, arsenic, and selenium

Direct gamma surveys were conducted throughout the proposed production and processing areas as well as in drainages, at the nearest residence, and near the proposed license boundary. The intent of overland gamma surveys is to characterize and quantify natural

background or preoperational radiation levels and radionuclide concentrations in soils throughout the proposed site. Gamma measurements ranged between 11 and 18 microroentgen (μR) per hour. The Nichols Ranch Unit measurements ranged between 11 and 15 μR per hour and averaged 13 μR per hour. Measurements at the Hank Unit ranged from 11 to 18 μR per hour and also averaged 13 μR per hour. The results show that background within the survey areas is either within or somewhat higher than the average background of 15 μR per hour typical for Wyoming (Uranerz, 2007). The elevated gamma levels correlate in some locations with the elevated radium concentrations in soil.

Surface and subsurface soil samples were analyzed for radium-226 and, in most cases, uranium, thorium-230, and lead-210. The preoperational sampling program was designed to characterize radiological background conditions in areas that are most likely to experience potential impacts from the ISR process. Results for the majority of the Nichols Ranch Unit and Hank Unit surface soil samples were consistent with the average background radium range for Wyoming, which is approximately 0.018 to 0.074 Bq/g [0.5 to 2 pCi/g] (Uranerz, 2007). However, one surface soil sample (LAS-5) from the Nichols Ranch Unit had an elevated radium-226 concentration of 0.98 Bq/g [26.4 pCi/g], which would be well above the acceptable surface activity level of 0.18 Bq/g [5 pCi/g]. The applicant excluded this sample result from statistical analyses and indicated the elevated concentration may be due to previous exploration activities, which may have resulted in ore zone cuttings being left on the soil surface. At the Hank Unit, radionuclide concentrations measured at the LAS-2 surface sample site {8.4 mg/kg [1.3×10^{-4} oz/lb] uranium, 0.044 Bq/g [1.2 pCi/g] lead-210, 0.14 Bq/g [3.8 pCi/g] radium-226, and 0.093 Bq/g [2.5 pCi/g] thorium-230} were higher than concentrations for the other samples, though not abnormal for this region. All subsurface soil samples for both the Nichols Ranch and Hank Units exhibited typical background radiological characteristics (Uranerz, 2007).

Sediment samples were analyzed for radium-226, uranium, thorium-230, and lead-210. Approximately 40 percent of the Nichols Ranch Unit sediment samples were greater than background values for radium-226 {i.e., greater than approximately 0.037 Bq/g [1 pCi/g]}. The average concentration for radium was 0.35 Bq/g [9.6 pCi/g]. Sample SD-8 had the maximum radium concentration measured of 1.2 Bq/g [32.2 pCi/g]. At the Nichols Ranch Unit, of the uranium, thorium-230, and lead-210 samples collected, two lead-210 samples {0.074 Bq/g [2.0 pCi/g] and 0.067 Bq/g [1.8 pCi/g]} were higher than the typical background range. The applicant indicated these elevated concentrations may be due to previous exploration activities. At the Hank Unit, of the uranium, thorium-230, and lead-210 samples collected, two lead-210 samples {0.093 Bq/g [2.5 pCi/g] and 0.067 Bq/g [1.8 pCi/g]} were higher than the typical background range and the average and maximum radium concentrations measured were 0.044 and 0.081 Bq/g [1.2 and 2.2 pCi/g].

Following the monitoring procedure outlined in NRC Regulatory Guide 4.14, four radon detectors were placed at the location of the nearest residences, locations at or near the proposed license boundary, and at control points upwind of the site. The applicant documented four quarters of sampling results from October 2006 to October 2007. Reported quarterly site average radon-222 results for all sampling locations range between 22 and 70 Bq/m^3 [0.6 and 1.9 pCi/L] in air and are somewhat consistent with typical background levels {approximately 30 Bq/m^3 [0.8 pCi/L]} in this region of Wyoming (based on historic data from the PRI North Butte ISR Project), though higher than the U.S. average of 15 Bq/m^3 [0.4 pCi/L] (EPA, 2009). Gamma measurements for the same sampling locations range between 0.34 and 0.55 mSv [34 and 55 mrem] per quarter, which is consistent with typical background levels for the region (Uranerz, 2007).

Groundwater samples were taken from various wells located within the proposed Nichols Ranch ISR Project area. As expected, the concentrations of radionuclides in groundwater are strongly correlated with the location of the uranium mineralization. Excluding outliers, the concentration of uranium ranged from below detection levels to 5.25 mg/L [7.03×10^{-4} oz/gal], while the EPA drinking water MCL is 0.03 mg/L [4×10^{-6} oz/gal]. Radium concentrations ranged from below detection levels to 20,794 Bq/m^3 [562 pCi/L]. The MCL for radium-226 is 185 Bq/m^3 [5 pCi/L].

The applicant collected baseline surface water samples in June 2008 and analyzed them for numerous chemical and radiological constituents, including natural uranium and radium-226. The highest uranium concentration measured was 0.137 mg/L [1.83×10^{-5} oz/gal]. The 2008 data show radium-226 concentrations are less than 18.5 Bq/m^3 [0.5 pCi/L]. These values are consistent with typical background levels.

The applicant stated that no permanent surface water or fish were present at or immediately adjacent to the proposed project area. Agricultural activities are limited to cattle grazing, with no crop-growing areas identified at or near the Nichols Ranch ISR Project; thus no fish or crop samples were collected as part of the background radiological investigation. Vegetation and grazing samples were analyzed for radium-226, uranium, thorium-230, lead-210, arsenic, and selenium. All results are consistent with typical background levels for vegetation. Because baseline vegetation results are within background, the applicant chose not to sacrifice livestock (grazing cattle) to obtain samples (Uranerz, 2007).

3.12.2 Public Health and Safety

NRC has the statutory authority, under the Atomic Energy Act, to protect public health and safety and the environment. NRC regulations in 10 CFR Part 20 specify annual dose limits to members of the public of 1 mSv [100 mrem] total effective dose equivalent and 0.02 mSv [2 mrem] per hour from any external radiation sources. This public dose limit from NRC-licensed activities is a fraction of the background radiation dose as discussed in Section 3.12.1 of this SEIS.

A review of the surrounding area indicated there are several nuclear facilities within 80 km [50 mi] of the proposed Nichols Ranch ISR Project area (NRC, 2009a):

Smith Ranch-Highland — This operational ISR facility is located approximately 72 km [45 mi] southeast of the proposed Nichols Ranch ISR Project.

> Irigaray/Christensen Ranch — This ISR facility is located 6.4 km [4 mi] northwest of the Hank Unit. NRC recently granted a license amendment authorizing a restart of operations at the Irigaray/Christensen Ranch ISR facility.
>
> Moore Ranch —This proposed ISR facility would be located approximately 32 km [20 mi] southeast of the proposed Nichols Ranch ISR Project. NRC has completed its review of the license application for the Moore Ranch ISR Project.
>
> Several inactive and decommissioned conventional uranium mills are in the 80-km [50-mi] radius.

However, because of their relative distances, none of these projects are considered to represent an appreciable source of radiation exposure in and around the proposed Nichols Ranch ISR

Project area. Therefore, the natural background represents the only radiation exposure to individuals in the area surrounding the proposed Nichols Ranch ISR Project area.

Other than CBM activities, there are no major sources of nonradioactive, chemical releases to the atmosphere or water-receiving bodies in the immediate area surrounding the proposed project area.

3.12.3 Occupational Health and Safety

NRC regulates occupational health and safety risks to workers as a result of exposure to radiation mainly through the Radiation Protection Standards contained in 10 CFR Part 20. In addition to annual radiation dose limits, these regulations incorporate the principal of maintaining doses “as low as reasonably achievable” (ALARA), taking into consideration the purpose of the licensed activity and its benefits, technology for reducing doses, and the associated health and safety benefits. To comply with these standards, radiation safety measures are implemented for protecting workers at ISR facilities, ensuring radiation exposures and resulting doses are less than the occupational limits as well as ALARA.

Also of concern with respect to occupational health and safety are industrial hazards and exposure to nonradioactive pollutants, which for an ISR operation can include normal industrial airborne pollutants associated with service equipment (e.g., vehicles), fugitive dust from access roads and wellfield activities, and various chemicals used in the ISR process. Industrial safety aspects associated with the use of hazardous chemicals at the proposed Nichols Ranch ISR Project would be regulated under the State of Wyoming regulations and the Wyoming Occupational Safety and Health Administration. The type of chemicals and impacts are discussed in Section 4.13 in this SEIS.

3.13 Waste Management

Chapter 2 of this SEIS described the types and volumes of liquid and solid wastes that the operation of the proposed Nichols Ranch ISR Project would generate. The disposal options being considered include the use of a sanitary landfill for disposal of nonradioactive solid wastes, a licensed waste disposal site or mill tailings facility for byproduct material, deep disposal wells for liquid effluents, and onsite septic systems for sanitary waste. No mixed waste would be generated from implementing the alternatives. It is likely that operation of the Nichols Ranch ISR project would generate hazardous waste, such as used batteries, and could be considered as a Conditionally Exempt Small Quantity Generator under the Resource Conservation and Recovery Act (RCRA). Section 2.2.1.6. of this SEIS discusses the expected annual waste volumes that would be generated. This section describes the disposition of wastes the proposed Nichols Ranch ISR Project would generate.

3.13.1 Liquid Waste Disposal

Liquid wastes generated from operation of the proposed Nichols Ranch ISR Project would include sanitary wastewater, wastewater generated from well development and testing, and liquid effluent ISR process (liquid byproduct material) generated. Domestic wastewater from restrooms and lunchrooms would be disposed of in WDEQ-approved septic systems. Except for well development and well test waters (which would be uncontaminated and could be discharged to the surface), all remaining liquid effluent generated from production bleed and plant washdown water would be byproduct material to be disposed of via deep well injection, as described under the proposed action in Section 2.2.1.6.2 of this SEIS.

3.13.2 Solid Waste Disposal

Solid byproduct material (including radioactively contaminated soils or other media) that does not meet NRC unrestricted release criteria must be disposed of at a facility permitted to receive byproduct material. As discussed in Section 2.2.1.6.3 in this SEIS, the proposed action would generate approximately 46 to 69 m^3 [60 to 90 yd^3] of solid byproduct material (that does not meet NRC criteria for unrestricted release) from facility operations. Because the applicant is proposing to construct more than one wellfield, the cumulative estimate for byproduct material from decommissioning the plant facilities and all wellfields is 8,731 m^3 [11,410 yd^3] plus an additional 245 t [270 T] of concrete. As mentioned earlier, the applicant does not presently have an agreement in place with a licensed site to accept its solid byproduct material for disposal. Options the applicant considered include disposal at Pathfinder-Shirley Basin in Mills, Wyoming; Energy Solutions in Clive, Utah; or White Mesa in Blanding, Utah. By license condition, the applicant would need to enter into a written agreement with such a site prior to operations, which would ensure there was available capacity for byproduct material disposal.

As discussed in Section 2.2.1.6.3 of this SEIS, nonhazardous solid waste is material that is not hazardous and is either nonradioactive or complies with NRC unrestricted release limits. Nonhazardous solid waste the proposed Nichols Ranch ISR Project would generate includes general facility trash, septic system solids, construction/demolition debris, and any solid byproduct material (such as piping, valves, instrumentation, or equipment) that has been decontaminated to meet NRC criteria for unrestricted release. The proposed operations would annually generate approximately 540 to 770 m^3 [700 to 1,000 yd^3] (Uranerz, 2007), and decommissioning activities would cumulatively generate approximately 941 m^3 [1,230 yd^3] plus 2,074 t [2,288 T] of nonhazardous solid waste [i.e., nonradioactive solid waste (general trash), construction and demolition debris, or byproduct material that complies with NRC unrestricted release limits]. The applicant has proposed disposing of nonhazardous solid wastes (including construction/demolition debris) in a sanitary landfill located near Gillette, which is approximately 74 km [46 mi] north-northeast of the proposed project site. The Campbell County Landfill located in Gillette is well below capacity and can continue to receive waste at its current rate (more than 100 tons per day) for about 30 years (CCPW, 2009, 2010).

As discussed in Section 2.1.1.1.6.3 of this SEIS, it is likely that the applicant would generate small quantities of hazardous wastes as a result of its proposed activities. If small quantities of hazardous waste (e.g., used oil, spent batteries, waste solvents, waste chemicals) are generated, the Campbell County Landfill and the landfill's Recycling Center can accept these items for disposal or recycling.

3.14 References

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4 ENVIRONMENTAL IMPACTS OF CONSTRUCTION, OPERATION, AQUIFER RESTORATION, AND DECOMMISSIONING ACTIVITIES AND MITIGATIVE ACTIONS

4.1 Introduction

The Generic Environmental Impact Statement (GEIS) for *In-Situ* Leach Uranium Milling Facilities (NUREG–1910, NRC, 2009a) evaluated the potential environmental impact of implementing *in-situ* recovery (ISR) operations in four distinct geographic regions, including the Wyoming East Uranium Milling Region where the proposed Nichols Ranch ISR Project is located. This chapter evaluates the potential environmental impacts from Alternative 1 (implementing the proposed action, and alternative wastewater disposal options); Alternative 2 (the No-Action alternative); and Alternative 3 (Modified Action–No Hank Unit). Other reasonable alternatives considered at the Nichols Ranch ISR Project included a modification to the proposed action, alternative lixiviants, conventional mining and milling, and conventional mining and heap leach processing, all of which were eliminated from detailed analysis as described in Section 2.2.

This chapter analyzes the four lifecycle phases of ISR uranium extraction (construction, operations, aquifer restoration, and decommissioning) at the proposed Nichols Ranch ISR Project consistent with the analytical approach used in the GEIS (NRC, 2009a). The results of the GEIS impact analyses for the Wyoming East Uranium Milling Region, as summarized in Table 1-1 of the Supplemental Environmental Impact Statement (SEIS), were used to focus the site-specific environmental review at the proposed Nichols Ranch ISR Project. If the GEIS concluded there could be a range of impacts on a particular resource area (e.g., the impacts could range from SMALL to LARGE), then that resource area was evaluated in greater detail within this site-specific SEIS. The site-specific analyses in this chapter also note where (i) the U.S. Nuclear Regulatory Commission (NRC) staff obtained new information during its independent site-specific review and (ii) whether the potential impacts fit in the range of the GEIS analyses or whether the new information would be significant enough that it would change the expected impact beyond that discussed in the GEIS.

Sections 4.2 through 4.14 of the SEIS evaluate the impact from both the proposed action (which includes construction, operation, aquifer restoration, and decommissioning using a Class I injection well for management of process-related liquid waste streams) and the No-Action alternative (which means no ISR facilities would be built and operated at the proposed Nichols Ranch ISR Project). The No-Action alternative is assessed to provide a baseline to compare the potential impacts from the proposed action.

NRC established a standard of significance for assessing environmental impacts in the conduct of environmental reviews based on the Council of Environmental Quality (CEQ) regulations, as described in the NRC guidance in NUREG–1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (NRC, 2003a), and summarized as follows:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

4.2 Land Use Impacts

Potential environmental impacts to land use at the proposed Nichols Ranch ISR Project site may occur during all phases of the facility lifecycle. Impacts could include land disturbance from construction and decommissioning, grazing and access restrictions, and competing access for mineral rights. Potential impacts to land use may be greater in areas with higher percentages of private land ownership and lands held in trust for Native Americans or in areas with a complex patchwork of land ownership. Detailed discussion of the potential environmental impacts on land use from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.2.1 Proposed Action (Alternative 1)

4.2.1.1 Construction Impacts

GEIS Section 4.3.1.1 (NRC, 2009a) states that land use impacts during construction may occur from land disturbances and access restrictions that could limit other mineral extraction activities, grazing activities, or recreational activities. The GEIS concluded that land disturbances during construction would be temporary and limited to small areas within permitted boundaries, and that well sites, staging areas, and trenches would be reseeded and restored. The GEIS further noted that changes to land use access, including grazing restrictions and impacts on recreational activities, would be limited because of the small size of the restricted area. In addition, the nature of restrictions would be temporary and other land is available for these activities. As summarized in SEIS Table 1-1, the GEIS concluded that potential construction impacts on land use in the Wyoming East Uranium Milling Region could range from SMALL to LARGE, depending on the factors described previously (NRC, 2009a). The impact conclusions that contributed to a greater than SMALL impact in the GEIS finding addressed potential alterations to ecological, historic, and cultural resources that ranged from SMALL to LARGE. For this SEIS, the potential ecological impacts are evaluated in Section 4.6 and the potential historic and cultural resource impacts are evaluated in Section 4.9. Additionally, impacts to soil from surface disturbances are addressed in Section 4.4. Therefore, the following discussion assesses land use impacts at the proposed Nichols Ranch ISR Project considering the proposed land disturbances and associated access restrictions that could limit other mineral extraction, grazing, or recreational activities.

Disturbance from construction-related activities related to the proposed Nichols Ranch ISR Project (drilling, trenching, excavating, grading, construction of the central processing plant satellite facility, and auxiliary structures) would affect approximately 120 ha [300 ac] of the proposed project area. As stated in Section 2.2.1.2.1, approximately 24 to 32 ha [60 to 80 ac] would be fenced off to grazing activities at any given time during the proposed project life. The applicant estimated that construction of the wellfields and buildings would take approximately 9 months to a year. Construction of the processing facilities at both units would be limited to 0.81 to 1.6 ha [2 to 4 ac]. During construction of the proposed facilities, all topsoil will be removed and stockpiled in a designated area until reclamation activities commence. Open spaces for hunting and off-road vehicle access would be minimally impacted by the fencing associated with the proposed ISR facilities. Coal bed methane (CBM) wells located in and adjacent to the Nichols Ranch and Hank Units would not impact construction of the Nichols Ranch ISR Project, because neither the existing nor proposed CBM wells are located within the

applicant's proposed wellfield areas. The applicant indicated that close communication would be maintained with the CBM operators to avoid conflicts. (Uranerz, 2007)

The NRC staff concludes that the land use impacts for the proposed action would be SMALL. This conclusion is based on the following factors: the types of land use activities the applicant proposes are similar to those evaluated in the GEIS; the proposed action will disturb 120 ha [300 ac] of land, which is at the small end of the 50 to 750 ha [120 to 1,860 ac] range analyzed in the GEIS; and 24 to 32 ha [60 to 80 ac] of land would have restricted access during the construction phase, which would be small compared to the 150 ha [370 ac] analyzed in the GEIS.

4.2.1.2 Operations Impacts

As discussed in GEIS Section 4.3.1.2, the types of land use impacts from operational activities would be similar to the construction phase regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not occur from conducting operational activities described in GEIS Section 2.4. The primary changes to land use during this phase would be associated with development (sequencing) of wellfields from one area of the site to another. Because access restriction and land-disturbance-related impacts would be similar to, or less than, those for construction, the GEIS concluded that overall potential impacts on land use from operational activities would be SMALL.

Operations at the proposed Nichols Ranch ISR Project would take an estimated 1.25 to 2.5 years to extract the uranium from the production areas in each wellfield, as shown in Figure 2-1. As stated in SEIS section 2.2.1.2.4, the wellfields and associated disturbed area would cover approximately 46 ha [113 ac] at the Nichols Ranch Unit and approximately 63 ha [155 ac] at the Hank Unit. The wellfields at each unit would be developed in sequence, moving from one area of the site to another. Livestock grazing would continue to be restricted from the wellfields and the central processing plant during the operations phase. As discussed in SEIS Section 4.2.1.1, approximately 24 to 32 ha [60 to 80 ac] would be fenced to grazing activities. Since the land area to be restricted from grazing is small (24 to 32 ha [60 to 80 ac]) compared to that considered in the GEIS (150 ha [370 ac]) and because no additional land disturbance would occur from conducting operational activities, the NRC staff conclude that land use impacts would be SMALL.

4.2.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.1.3 discusses aquifer restoration impacts on land use. Because the same infrastructure would be used, land use impacts from aquifer restoration would either be similar to, or less than, those from operations. Activities during aquifer restoration would use the same infrastructure as the operations phase. As aquifer restoration proceeds and wellfields are closed, fewer wells and pump houses would be used. Onsite activities would diminish. The GEIS concluded that the overall potential impacts on land use during the aquifer restoration phase are comparable to those of the operations phase and would be SMALL.

Land use impacts from aquifer restoration at the proposed Nichols Ranch ISR Project would be similar to operation impacts. No additional land disturbances or withdrawals would occur during the restoration phase. Because the types of land use activities for the Nichols Ranch ISR Project are similar to those evaluated in the GEIS, the land surface area to be disturbed during the proposed action is small and at the low end of the range considered in the GEIS (see SEIS

Section 4.2.1.1), and the access restrictions would remain in place, the NRC staff conclude land use impacts from aquifer restoration would be SMALL.

4.2.1.4 Decommissioning Impacts

Decommissioning impacts to land use are discussed in GEIS Section 4.3.1.4. The GEIS concluded that land use impacts from decommissioning would be similar to those described for construction, with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, piping and excavated contaminated soils. Access restrictions may remain until decommissioning and reclamation are completed, although it is possible that a licensee could decommission and reclaim the site in stages. Reclamation of land to preexisting conditions and uses would help to mitigate long-term impacts. For lands the U.S. Bureau of Land Management (BLM) or other surface management agencies administer, other reclamation standards may also be applicable. The GEIS concluded impacts on land use during decommissioning would range from SMALL to MODERATE, and SMALL when decommissioning and reclamation are completed. (NRC, 2009a)

The dismantling of the proposed Nichols Ranch ISR Project facilities and roads, and reseeding and placement of soil as described in Section 2.2.1.5 in the SEIS would have impacts similar in scale to the construction phase. As stated in the license application, upon completion of well abandonment, the applicant would reseed soil and place it in stripped areas. This soil placement would occur primarily where the header houses and roads are removed, as well as in the Nichols Ranch Unit central processing plant and Hank Unit satellite facility areas (Uranerz, 2007). As decommissioning and reclamation progressed, the disturbed land area would decrease and the structures that would affect the viewshed of the Pumpkin Buttes Traditional Cultural Property (TCP) and associated TCPs (discussed in Section 4.9 of the SEIS) would be removed. NRC concludes that the land use impacts from decommissioning activities would be MODERATE until the reestablishment of vegetation in seeded areas. Once vegetation is reestablished in reclaimed areas, NRC staff concludes that the land use impacts would be SMALL because the reclaimed land could be released to support a variety of other uses such as wildlife habitat or livestock grazing.

4.2.2 No-Action (Alternative 2)

Under the No-Action alternative, the proposed Nichols Ranch ISR Project would not be licensed and the land would remain available for uses such as grazing, CBM, and oil and gas production. No construction, operation, aquifer restoration, or decommissioning activities would occur, and there would be no disruption to the land surface. No access restrictions would be in place to restrict wildlife usage. No wells would be drilled, no pipeline would be laid, and no access roads would be constructed.

4.2.3 Modified Action–No Hank Unit (Alternative 3)

4.2.3.1 Construction Impacts

Construction impacts under this alternative would be less than those resulting from the proposed action because ground-disturbing activities such as drilling, trenching, excavating, grading, and surface facility construction would be limited to an approximate 60 ha [150 ac] area for the Nichols Ranch Unit, compared to twice the land area if the Hank Unit were also developed. Approximately 12 to 16 ha [30 to 40 ac] would be fenced to grazing activities at any given time for the duration of this alternative. Because fewer wellfields would be developed and

no satellite facility would be constructed, the construction phase would take less time than for the proposed action (estimated 9 months to a year). Open spaces for hunting and off-road vehicle access and livestock grazing would be minimally impacted by the smaller fenced area under this alternative. CBM production in and adjacent to the Nichols Ranch Unit would not be impacted by construction, because no CBM wells exist or are planned within the proposed area. Based on the above factors, NRC staff concludes that the construction impacts discussed previously for this alternative would have a SMALL impact on land use.

4.2.3.2 Operations Impacts

Because the infrastructure would be in place, the land use access restrictions during operational activities would be similar to the construction phase and less than those associated with the proposed action. Operations would take an estimated 1.25 to 2.5 years to extract the uranium from each wellfield production area in the Nichols Ranch Unit (Figure 2-1). As stated earlier, at any given time approximately 12 to 16 ha [30 to 40 ac] of land would be fenced to grazing activities for the duration of the project. The NRC staff concludes that the potential impacts to land use from operational activities would be SMALL.

4.2.3.3 Aquifer Restoration Impacts

During aquifer restoration, land use impacts would be comparable to operations phase impacts. Activities during aquifer restoration would use the same infrastructure as activities during the operations phase. Impacts from Alternative 3 would be less than those for the proposed action less land would be disturbed because the Hank Unit would not be developed. The NRC staff concludes that impacts to land use from aquifer restoration for this alternative would be SMALL.

4.2.3.4 Decommissioning Impacts

Dismantling of project facilities and roads, as well as the reseeding and placement of soil, would have impacts similar in scale to the construction phase. As with the proposed action, upon completion of well abandonment, seeded soil would be placed in areas where it had been stripped. This would occur primarily where the header houses and roads had been removed and at the Nichols Ranch Unit central processing plant area. Impacts on land use from implementing this alternative would be less than those of the proposed action because the Hank Unit would not be developed. Therefore, no structures would affect the viewshed of the Pumpkin Buttes TCP and associated TCPs as in the proposed action. At the completion of decommissioning, the reclaimed land would be released for other uses and no longer restricted. The NRC concludes that land use impacts would be MODERATE until the reestablishment of vegetation. Once vegetation is established in reclaimed areas, the NRC staff conclude that the land would be returned to a condition that could support a variety of land uses and, therefore, land use impacts would be SMALL.

4.3 Transportation Impacts

Potential environmental impacts from transportation at the proposed Nichols Ranch ISR Project site may occur during all phases of the facility lifecycle. Impacts would be from workers commuting to and from the site and from the shipment of materials and chemicals on and off the site. Impacts could occur from fugitive dust, noise, incidental wildlife or livestock kills, increased traffic on local roads, and accidents. Fugitive dust emissions are evaluated as air quality impacts in Section 4.7, noise impacts are evaluated in Section 4.8, and the impact from wildlife kills is considered in ecological impacts in Section 4.6.1.1.1.2 in the SEIS. The potential

environmental impacts on transportation from construction, operation, aquifer restoration, and decommissioning are detailed in the following sections.

4.3.1 Proposed Action (Alternative 1)

4.3.1.1 Construction Impacts

GEIS Section 4.3.2.1 concluded that low levels of traffic generated by ISR construction activities (relative to local traffic counts) would not significantly increase traffic or accidents on many of the roads in the region. Roads that currently experience low traffic counts could be moderately impacted by the additional worker commuting traffic during periods of peak employment. Additionally, the NRC staff concluded that, depending on site-specific conditions, moderate dust, noise, and incidental wildlife or livestock kill impacts would be possible on or near site access roads. For these reasons, the GEIS concluded that construction impacts to transportation could range from SMALL to MODERATE.

As discussed in Section 2.2.1.2.3, the existing T-Chair Livestock Company ranch roads at the proposed Nichols Ranch ISR Project area are gravel crowned and ditched and have been constructed to accommodate tractor-trailer traffic used for CBM activities during the wet and dry seasons. The development of new access roads is addressed in Section 4.2.1.1 of the SEIS. The applicant has indicated all roads, except those the landowner has requested to remain, would be reclaimed.

The applicant has indicated the trip frequency to the proposed project area would be approximately eight passenger vehicles per day (standard, light-duty, and ¾-ton trucks; passenger vans; or personal cars) and six tractor trailers per week (Uranerz, 2007). Traffic volumes would be highest Monday through Friday during the beginning and end of regular working hours (8:00 am and 4:00 pm). The proposed commuter traffic was bound by the number of workers assumed in the GEIS. The aforementioned number of tractor-trailer shipments the applicant expected during the construction period for the proposed action is greater than the number of shipments evaluated in the GEIS but is still a low volume of trucking activity. Based on the annual average daily traffic (AADT) counts presented in Section 3.3 of the SEIS for State Route (SR) 50, the proposed project-related traffic would increase AADT counts on SR50 by roughly 3 percent. For SR387, AADT counts would increase an estimated 0.6 percent to 2 percent, depending on the road segment location between Interstate 25 and SR59. If the maximum estimated number of workers during the construction period (55 employees and 20 contractors)(Uranerz, 2007) were to commute to the site individually on the same road, the aforementioned estimated increases in traffic counts would be up to 28 percent above the current AADT for SR50 and between 4.5 and 16 percent above the AADT for SR387. The NRC staff considers this scenario unlikely but bounding relative to the applicant's proposal. The NRC staff expects commuting workers would come from a variety of locations and would not all commute on the same road; therefore, actual values would be lower than the bounding values.

To further evaluate the potential significance of the estimated project contributions to traffic, NRC considered another impact analysis of nearby coal mining activities conducted by BLM (BLM, 2010a). In that study, the BLM evaluated the impact of an estimated 48 percent increase in traffic for Campbell County roads by year 2020 based on high coal production population projections and concluded highways along major routes would not be affected but urban areas such as Gillette could experience additional traffic delays (BLM, 2010a). Because traffic counts on main roads in Gillette (a more urban area) are much higher (ranging from a few thousand to

more than 20,000 vehicles per day)(Gillette Department of Traffic Safety, 2010) than the traffic counts for the rural highways evaluated previously, the proposed Nichols Ranch ISR project contribution to Gillette traffic under the bounding assumptions (e.g., 152 one-way vehicle trips per day) would be a lower proportion of daily traffic than is indicated by the aforementioned project-specific estimates or the BLM study. The small increases in estimated traffic on the main arteries from the proposed project support the NRC staff conclusion (with ample margin should actual construction traffic exceed the applicant's planned volume) that usage of the regional road network or the gravel roads near the project area would not overtax existing road infrastructure and would therefore be a SMALL impact, although no traffic count data are available for Van Buggenum Road or the T-Chair Livestock Company ranch roads.

By permit condition (WDEQ, 2009), the applicant is required to treat the main plant access road and the haul road between the Nichols and Hank Units with water or chemical dust suppressants to control fugitive dust emissions from transportation activities. Because of the state-required dust mitigation measures and the low traffic volume during the construction phase, the NRC staff conclude that the impacts from transportation at the proposed Nichols Ranch ISR Project site would be SMALL. The NRC staff considered the GEIS factors which contributed to the MODERATE impact finding in the GEIS (e.g., road dust, livestock and wildlife kills) and concluded that these factors would occur less frequently at the Nichols Ranch ISR Project site because of the low traffic volumes and dust mitigation measures associated with the proposed Nichols Ranch ISR Project. SEIS Section 4.7 analyzes the impacts from potential fugitive dust emissions. Impacts to wildlife are addressed in SEIS Section 4.6.1.1.1.2.

4.3.1.2 Operations Impacts

As discussed in GEIS Section 4.3.2.2, during the operations phase, the facility-related traffic volume would remain at a low level and would not noticeably increase traffic or accidents, except that local, less traveled roads could be moderately impacted during periods of peak employment. Dust, noise, and possible incidental wildlife or livestock kill impacts on or near site access roads could continue to occur.

The GEIS also assessed the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. The GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area. The probability of such accidents occurring was determined to be low because of the small number of shipments, comprehensive regulatory controls, and the applicant's use of best management practices (BMPs). For radioactive material shipments (yellowcake product, ion-exchange resins, waste materials), compliance with transportation regulations was expected to limit radiological risk for normal operations. The use of emergency response protocols would also help to mitigate the consequences of severe accidents involving release of uranium. The GEIS concluded that the potential impacts from transportation during operations could range from SMALL to MODERATE (NRC, 2009a).

For the proposed Nichols Ranch ISR facility, the operational transportation activities discussed in Sections 2.2.1.3.1.6, 2.2.1.3.1.7, and 2.2.1.7 of this SEIS would occur over a planned 5-year period (Figure 2-1) and include the same activities evaluated in the GEIS, including truck shipments of yellowcake product, chemicals, and other supplies; satellite ion-exchange resins; and waste materials, which could result in potential environmental impacts from more traffic and the potential for an accident as discussed next.

The potential impacts from the proposed operational activities on local and regional traffic volumes would be low and are bound by the facility operational traffic evaluated in the GEIS. The GEIS assumed a workforce of 20 to 200 employees and operational trucking activity of approximately 2 trucks per day (NRC, 2009a). During the operations phase at the proposed Nichols Ranch ISR Project, the applicant's trip frequency to the proposed project area has been estimated at approximately eight passenger vehicles per day (standard, light-duty, and ¾-ton trucks; passenger vans; or personal cars) and six tractor trailers per week (Uranerz, 2007) or about one truck per day. The applicant has stated that the proposed operations would involve a workforce of 45 to 55 employees (Uranerz, 2007). Because the applicant's trip frequency is the same during operations and construction, the amount of traffic from the proposed action that would be added to existing AADT counts on local highways would also be the same as that described for the construction phase in Section 4.3.1.1 of the SEIS. The staff also evaluated the potential traffic impacts of each employee commuting in their own vehicle during operations. This would involve the aforementioned 55 employees making 2 trips per day or 110 one-way trips per day. When this traffic is compared to the AADT counts provided in Section 3.3, the additional contribution from these commuting employees would be approximately 11 percent or less of existing traffic on local roads and therefore would be a small addition to current traffic conditions. NRC staff considers this magnitude of change in existing traffic to be a small addition to existing traffic, and therefore impacts to traffic would be SMALL and bounded by traffic-related impacts evaluated in the GEIS based on adding a smaller commuting workforce under the proposed action to the same roads and existing traffic evaluated in the GEIS. Based on the aforementioned state-required dust mitigation measures and the low levels of traffic during operation phase activities, the NRC staff determined that the circumstances which contribute to a MODERATE impact conclusion in the GEIS (e.g., road dust, livestock and wildlife kills) would occur less frequently at the Nichols Ranch site because of the low traffic volume and dust mitigation measures associated with the proposed action. Therefore, the NRC staff concludes that transportation impacts during operations phase of the proposed action would be SMALL. SEIS Section 4.7 provides analysis of impacts from fugitive dust emissions, and impacts to wildlife impacts are addressed in SEIS Section 4.6.1.1.1.2.

The potential radiological accident risk associated with yellowcake product shipments was evaluated in GEIS Section 4.2.2.2. The yellowcake transportation analysis assumed shipment volumes that ranged from 34 to 145 yellowcake shipments per year, which could result in a risk of 0.04 and 0.003 latent cancer fatalities, respectively, considering accident probabilities and consequences (NRC, 2009a). The annual maximum production rate of yellowcake at the proposed Nichols Ranch ISR Project is estimated as 909,090 kg [2 million lb]. Given that each yellowcake shipment is 18,181 kg [40,000 lb] (Uranerz, 2007), approximately 50 shipments per year would be needed for the proposed action or an average of 1 shipment every week. Therefore, the radiological accident risk associated with shipment of yellowcake at the proposed Nichols Ranch ISR Project would be bounded by the GEIS analyses. The shipment volume would not significantly affect the project-related traffic relative to the expected commuting workforce.

The GEIS reported that accidents involving yellowcake releases result in up to 30 percent of shipment contents being released (NRC, 2009a). To minimize the risk of an accident involving resin or yellowcake transport, the GEIS reported that all such materials would be transported in accordance with U.S. Department of Transportation (USDOT) and NRC regulations, handled as low-specific-activity materials, and shipped using exclusive-use-only vehicles. The NRC staff concludes the consequences of such accidents would be limited because the applicant has proposed to develop an emergency response plan (Uranerz, 2007) for yellowcake and other transportation accidents that could occur during shipment to or from the proposed Nichols

Ranch ISR Project. The applicant would also ensure its personnel and the carrier receive training on these emergency response procedures (Uranerz, 2007). Therefore, the NRC staff concluded the impact from a potential accident involving yellowcake transportation during the operations phase of the proposed Nichols Ranch ISR Project would be SMALL.

The potential impacts from transportation of process chemical supplies were also evaluated in GEIS Section 4.2.2.2. The potential safety hazards associated with process chemicals the applicant intends to use for the proposed action (see Section 4.13.1.2.3 of the SEIS) were also evaluated in GEIS Section 4.2.11.2.4 (NRC, 2009a). These process chemicals are sodium chloride (NaCl), sodium bicarbonate ($NaHCO_3$), sodium hydroxide (NaOH), hydrochloric acid (HCl), hydrogen peroxide (H_2O_2), carbon dioxide (CO_2), oxygen (O_2), anhydrous ammonia (NH_3) diesel fuel, gasoline, and bottled gases (Uranerz, 2007).

Transportation risks associated with incoming, onsite, and outgoing shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and their transport would be made in accordance with the applicable USDOT hazardous materials shipping provisions. If an accident occurred, spill response would be handled via emergency response procedures, although a spill of nonradiological materials would be reportable to the appropriate State agency, the U.S. Environmental Protection Agency, and the USDOT (NRC, 2009a). Spill material would be recovered or removed and the affected areas reclaimed. The release of anhydrous ammonia, a compound that the applicant may use in the precipitation circuit (Uranerz, 2007), could be hazardous to the public if released near a populated area. However, the proposed Nichols Ranch ISR Project is not situated in a populated area and the likelihood of such an accident occurring is small, calculated as 3.0×10^{-7} accidents per km [4.8×10^{-7} accidents per mi] based on NUREG–0706 accident data (NRC, 1980) cited in the GEIS (NRC, 2009a).

The onsite transportation of ion-exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would traverse approximately 13.4 km [8.3 mi] of private road. The GEIS evaluated the potential impacts from similar ion-exchange shipments and concluded that the potential radiological impacts of these shipments would be bound by the risks from yellowcake shipments based on the less concentrated nature of the resins; the uranium being chemically bound to the resins, which would limit dispersion in the event of a spill; and the small shipment distance relative to yellowcake shipments (i.e., the likelihood of an accident increases with the distance traveled). Therefore, the NRC staff concludes the aforementioned SMALL potential radiological accident impacts from the proposed Nichols Ranch ISR facility yellowcake shipments bound the potential radiological accident impacts of the proposed ion-exchange resin shipments. The NRC basis for the conclusion that the resulting environmental impact from ion-exchange resin shipments would be SMALL is that the risk of ion-exchange resin accidents is low, a resulting spill would be properly removed and disposed of, and the affected area would be reclaimed in accordance with applicable NRC and state regulations.

The potential radiological accident risk associated with byproduct material shipments would be small based on the low number of annual shipments and the relative risk compared to the transportation of concentrated yellowcake product shipments discussed previously and in the GEIS. The applicant has estimated an annual production rate of up to 69 m^3 [90 yd^3] of byproduct material. Based on the use of roll-off containers with a nominal capacity of 15 m^3 [20 yd^3], there would be five shipments annually to a licensed disposal facility. According to its license application, the applicant would implement additional BMPs to reduce the risk of accidents, including (i) enforcing safe driving and emergency response training for personnel

and truck drivers, (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders, and (iii) posting speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game and other vehicles (Uranerz, 2007). The applicant would also maintain existing gravel ranch roads from the limits of county maintenance to the proposed project area during the life of the proposed Nichols Ranch ISR Project (Uranerz, 2007).

Based on the low volume of operational traffic, the required road dust mitigation, the low radiological risks from transportation accidents, and the implementation of the applicant's additional safety practices as previously discussed, NRC staff concludes that the overall impacts from transportation during the operations phase would be SMALL.

4.3.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.2.3 concluded that the magnitude of transportation activities during aquifer restoration would be lower than for the construction and operation phases. Aquifer restoration-related transportation activities would be primarily limited to supply shipments, waste shipments, onsite transportation, and employee commuting. The GEIS concluded transportation impacts from aquifer restoration would range from SMALL to MODERATE for the same reasons discussed previously for the operations phase.

The proposed aquifer restoration activities at the proposed Nichols Ranch ISR Project would be the same as those described and evaluated in the GEIS. The rate of uranium extraction would gradually decrease throughout the aquifer restoration phase, and incoming supply shipments of process chemicals would be reduced. The applicant has indicated that the trip frequency to the proposed project area would be less during aquifer restoration compared to the operations phase because the number of process chemicals and resin transfers from the Hank Unit to the Nichols Ranch Unit would be less than when project area was in production (Uranerz, 2007). This reduction in resin transfers between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would further reduce the risk of an accident. Fewer people (approximately 20) would be employed during this phase relative to the construction and operation phases (approximately 45 to 55 for each phase). Therefore, based on the above factors, NRC staff concludes that the impacts from transportation during aquifer restoration would be less than during the construction and operations phases which are SMALL.

4.3.1.4 Decommissioning Impacts

As discussed in GEIS Section 4.3.2.4, transportation activities during decommissioning, and therefore potential impacts, would be similar to those discussed for construction and operation, except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning would be lower than for the operations phase. The potential accident radiological risks from transportation during decommissioning would be bounded by the estimates of yellowcake transportation risk during operations based on the concentrated nature of the shipped yellowcake, the farther distance yellowcake is shipped compared to the waste destined for a licensed disposal facility, and the number of shipments for yellowcake relative to byproduct material. The GEIS concluded the potential transportation impacts during decommissioning would be SMALL because of the reduced levels of transportation activities.

Transportation activities during decommissioning (Section 2.2.1.5 of the SEIS) of the proposed Nichols Ranch ISR facility would be the same as those evaluated in the GEIS. These activities

would include transporting construction equipment, workers, and waste material shipments to offsite disposal facilities. The volume of onsite traffic at the proposed Nichols Ranch ISR Project would be related to the need for radiological surveys, infrastructure inspection and decontamination, extraction of buried pipelines, well abandonment, reclamation of disturbed areas, removal of contaminated materials, and monitoring of the restored site. The state-required road dust mitigation procedures to spray the main plant access road and the haul road between the Nichols Ranch and Hank Units to control fugitive dust emissions would remain in place; therefore, impact from fugitive dust emissions during transportation would be SMALL.

Waste materials generated during decommissioning would be segregated by type and transported offsite to approved disposal facilities. Nonhazardous solid waste would be shipped to the local landfill, and solid byproduct material would be shipped to those facilities authorized to accept byproduct material for disposal. Based on the applicant's decommissioning waste volume estimates provided in its surety calculation (Uranerz, 2007), roughly 50 percent of the decommissioning solid waste materials would be suitable for disposal as nonhazardous solid waste in a local, unrestricted landfill. The remaining 50 percent would be considered byproduct material that would be transported and disposed of at a licensed facility, such as the Pathfinder-Shirley Basin uranium mill site in Mills, Wyoming; EnergySolutions low-level radioactive waste disposal site in Clive, Utah; or White Mesa uranium mill site in Blanding, Utah (Uranerz, 2007). Because the trip distances to these facilities from the proposed site {161 km [100 mi], 934 km [580 mi], and 1,079 km [670 mi], respectively} are less than those for transporting yellowcake to the conversion facility in Metropolis, Illinois {approximately 2,250 km [1,400 mi]} and the transported yellowcake is concentrated, the inherent risks of an accident involving the release of uranium are lower than those discussed in Section 4.3.1.2 of the SEIS.

The landowner would determine the disposition of the access roads connecting T-Chair Livestock Company ranch roads with both the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant and those going to the wellfields. The applicant stated these roads would likely remain in use for some period after decommissioning to facilitate site monitoring. At the landowner's request, these access roads would be reclaimed at the applicant's expense. Such reclamation activities would include removing road bed materials, scarifying, or ripping the surface, and redressing with stockpiled topsoil and reseeding native vegetation or cover crops (Uranerz, 2007).

As described in Section 2.2.1.7 of this SEIS, the applicant has estimated that, during decommissioning, the trip frequency at the proposed project area would be the same as that during the construction and operations phases [eight passenger vehicles per day and six tractor trailers per week (Uranerz, 2007), or about one truck a day]. The applicant also plans to have fewer employees (approximately 20 people) commuting during the decommissioning phase, although the license application does not describe whether the reduced workforce was considered in its traffic projections.

To further evaluate the applicant's proposed truck traffic estimates, the NRC staff calculated waste volumes and the associated annual and daily truck shipments based on information provided in the applicant's surety estimate (Section 2.2.1.7 of the SEIS). Assuming the applicant decommissions a wellfield and plant facilities in a single year and waste shipments occur 5 days per week, the resulting frequency of round-trip waste shipments would be similar to the applicant's estimate of one truck per day or six trucks per week.

Using the aforementioned trip frequency information and assuming no carpooling, the NRC staff estimated that the project would generate approximately 42 one-way vehicle trips per day (i.e.,

20 workers and one truck traveling to and from the site). By comparison, the GEIS assumed a decommissioning trucking activity equivalent to approximately one truck every 2.5 days and a general range of commuting employees for all phases from 20 to 200 (NRC, 2009a). Therefore, the proposed truck traffic is approximately double the decommissioning truck traffic evaluated in the GEIS; however, the proposed number of commuting employees is at the low end of the range evaluated in the GEIS. Because the commuting employees contribute a greater proportion of the total potential traffic, both the NRC staff and the applicant's total decommissioning traffic estimates are less than the total traffic evaluated in the GEIS. Considering the applicant's and the NRC staff's estimated total decommissioning traffic for the proposed project, the traffic impacts would be less than or equal to the impacts evaluated in Section 4.3.1.1 for construction and therefore would be SMALL.

Another potential transportation impact from proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff considers the potential radiological accident risk associated with byproduct material shipments would be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in Section 4.3.1.2 and in the GEIS (Section 4.2.2.2). Analysis of the staff's annual waste volume estimate calculated from the applicant's surety (Section 2.2.1.6.3) indicates the majority (approximately 76 percent) of this material would be chipped wellfield piping. Relative to powdered yellowcake, this material is in a form that would be less dispersible (i.e., less likely to cause public exposure if released) and easier to clean up if an accident involving release were to occur. The applicant proposes to implement additional BMPs to reduce the risk of accidents including (i) enforcing safe driving and emergency response training for personnel and truck drivers, (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders, (iii) and posting speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game and other vehicles (Uranerz, 2007). The applicant would also maintain existing gravel ranch roads (at locations beyond the boundary of county maintenance) to the proposed project area during the life of the proposed Nichols Ranch ISR Project (Uranerz, 2007). All shipments would be required to comply with applicable U.S. Department of Transportation regulations governing the transportation of radioactive material (including quantity limits, packaging requirements, and conveyance dose rate limits). Based on the preceding analysis, the NRC staff concludes the potential radiological risks from the proposed transportation of decommissioning byproduct material would be low and therefore the potential environmental impacts from the proposed radioactive material transportation would be SMALL.

In conclusion, because of the low estimated traffic for the proposed Nichols Ranch Project relative to existing road traffic in the region surrounding the site, the NRC staff concludes the potential traffic related transportation impacts would be SMALL. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal would also be SMALL. Therefore, the NRC staff concludes the overall transportation impacts related to the decommissioning phase would be SMALL.

4.3.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in existing traffic flows, routings, service levels, or the integrity of the road surfaces and profiles associated with this proposed project. There would be no transportation of materials to and from the site to support licensed activities. There would be no transportation of either radioactive or solid waste attributable to

the proposed action because the facility would neither be licensed nor constructed and operated. Traffic volumes associated with current land use activities such as CBM extraction, oil and gas extraction, and cattle ranching would continue into the future. This alternative would have no additional impacts to transportation.

4.3.3 Modified Action–No Hank Unit (Alternative 3)

4.3.3.1 Construction Impacts

Construction activities under this alternative would be similar to construction activities for the proposed action, though construction would be restricted to only the Nichols Ranch Unit location. As with the proposed action, potential transportation impacts from the construction phase pertain to increased traffic from commuting workers and delivery of equipment and supplies. Other potential impacts include road dust from this additional traffic on or near site access roads. Because no Hank Unit would be constructed under this alternative, the total number of wellfields developed over the duration of the project would be halved and therefore the total amount of construction required for the project would be substantially reduced. Because many of the transportation impacts such as increased traffic and dust are dependent on the intensity of activities occurring at the same time, the NRC staff evaluated the schedule of planned activities for the proposed action (Figure 2-1). Considering the applicant's phased and partially overlapping approach to wellfield construction at the two units occurring within a 4-year period, if no Hank Unit were constructed, the NRC staff expects the projectwide intensity of construction during individual years under the alternative action would be different for each year that construction is planned. For example, during the 2 years where proposed construction overlaps among units, the alternative would reduce this planned construction by approximately 60 percent in 1 year and by 25 percent in the other year. For the 2 years where no overlap in construction is planned, under the alternative, 1 year would have the same duration of planned construction as the proposed action and in the other the construction would be reduced by 100 percent (i.e., no construction during that year). Therefore, transportation impacts at any given time may be similar to or much less than what was previously identified for the proposed action (Section 4.3.1.1). However, the overall projectwide duration of construction activities would be reduced by 60 percent under Alternative 3 (to 1.5 years of activities allocated over 3 calendar years).

The aforementioned reductions in construction activities under Alternative 3 would reduce the volume of construction-related traffic and associated road dust compared to the proposed action because fewer workers would be needed to construct the reduced number of wellfields. Based on the reduced traffic volume, the aforementioned state-required mitigation measures for access road dust control (Section 4.3.1.1), and the shorter construction period, the transportation impacts from the construction phase under Alternative 3 would be SMALL.

4.3.3.2 Operations Impacts

Operation impacts under this alternative would be less than during the proposed action because shipments of ion-exchange resin and other operational traffic between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would not occur. Furthermore, because only one ore body would be developed instead of the two for the proposed action, and the proposed operation schedule includes the Nichols Ranch and Hank Units operating during the same years (Figure 2-1), NRC staff assumes there would be approximately half of the uranium processing occurring under the alternative and therefore approximately half the incoming shipments of process chemicals and supplies and outgoing shipments of yellowcake,

byproduct material, and waste compared to the proposed action. Therefore, the potential transportation impacts for these activities would be approximately half of the magnitude associated with the proposed action activities that resulted in a SMALL impacts conclusion in Section 4.3.1.2. The number of workers would also be less than for the proposed action based on no operations at the Hank Unit, and this would reduce the amount of commuter traffic and associated road dust compared to the proposed action. Based on the lower traffic volume, the state-required mitigation measures for dust mitigation on access roads as described previously, and the lower radiological risk of vehicular-related accidents because of reduced traffic, the NRC staff concludes that the transportation impacts during the operational phase under Alternative 3 would be SMALL.

4.3.3.3 Aquifer Restoration Impacts

Impacts on transportation during the aquifer restoration phase of Alternative 3 would be less than those of the proposed action. Because only one ore body would be developed instead of the two for the proposed action, and the proposed aquifer restoration schedule includes the Nichols Ranch and Hank Units being restored during the same years for about half of the restoration period (Figure 2-1), NRC staff assumes there would be a reduction in the uranium processing occurring under the alternative and therefore a reduction in the incoming shipments of process chemicals, supplies and outgoing shipments of yellowcake, byproduct material, and waste compared to the proposed action. Fewer workers would be required than for the proposed action because no aquifer restoration at the Hank Unit would occur; therefore, there would be less commuter traffic. For these reasons, the NRC concludes that the transportation impacts during aquifer restoration would be less than during the construction and operation ISR phases and therefore would be SMALL.

4.3.3.4 Decommissioning Impacts

Impacts on transportation during the decommissioning phase under this alternative would be less compared to the proposed action because only one ore body would be developed and therefore half of the wellfields associated with the proposed action would be decommissioned. Because the applicant classified the majority of its estimated wellfield decommissioning waste as byproduct material (Uranerz, 2007), the staff estimates that reducing the number of wellfields at the facility by half under this alternative would also proportionately reduce the total number of outgoing shipments of byproduct material by half for the duration of the decommissioning phase. Therefore, the transportation impacts that would apply to the total duration of the decommissioning phase (accident risks, road wear) are assumed to decrease proportionately. Because the applicant has proposed a phased approach to decommissioning (Figure 2-1) over a 5-year period with little overlap among Nichols Ranch and Hank Unit decommissioning activities, the effect of eliminating the Hank Unit wellfields on annual transportation activities would be primarily to shorten the overall duration of the decommissioning phase to approximately 3 years. Because of the low overlap in activities, the NRC staff estimates the annual transportation traffic generated for each year under the alternative would be the same as the staff estimated for the proposed action (Section 2.2.1.7). The applicant's estimate is approximately nine vehicles per day (eight passenger vehicles and one truck or 18 one-way vehicle trips per day). Assuming no carpooling, the staff's estimate increases the daily vehicle one-way trips to 42 as described in Section 4.3.1.4). Therefore, the traffic- and dust-related impacts for the alternative are estimated to be the same as those described in Section 4.3.1.4 for the proposed action. Based on (i) the reduced number of wellfields that would need to be decommissioned under this alternative, (ii) the lower volumes of decommissioning wastes generated, and (iii) the shorter duration of the decommissioning phase but comparable annual

traffic generation to the proposed action, the NRC concludes that the transportation impacts during the decommissioning phase under this alternative would be SMALL.

4.4 Geology and Soils Impacts

Potential environmental impacts on geology and soils could occur during all phases of the proposed Nichols Ranch ISR Project lifecycle. However, these impacts would largely be concentrated during the construction phase of the proposed project.

4.4.1 Proposed Action (Alternative 1)

4.4.1.1 Construction Impacts

As described in GEIS Section 4.3.3.1, during construction of ISR facilities, the principal impacts on geology and soils would result from earthmoving activities associated with constructing surface facilities, access roads, wellfields, and pipelines. Earthmoving activities that could impact soils include the clearing of ground or topsoil and preparing surfaces for the central processing plant, satellite facility, header houses, access roads, drilling sites, and associated structures. Similarly, excavating and backfilling trenches for pipelines and cables may impact soils in the proposed project area. (NRC, 2009a)

The GEIS concluded that the impact of construction activities on geology and soils would depend on local topography, surface bedrock geology, and soil characteristics. The earthmoving activities are normally limited to only a small portion of the project. Consequently, earthmoving activities would result in SMALL and temporary (months) disturbance of soils, impacts that are commonly mitigated using accepted BMPs. Construction activities would also increase the potential for erosion from both wind and water due to the removal of vegetation and the physical disturbance from vehicle and heavy equipment traffic. However, these activities would result in SMALL impacts if equipment operators adopt construction BMPs that prevent or substantially reduce erosion.

Soil impacts would be limited to a total disturbed area of approximately 40 ha [100 ac] during the life of the project for the construction of plant facilities, wellfields, access roads, and pipelines based on information provided by the applicant (Uranerz, 2007). This disturbed area is at the low end of the range 50 to 70 ha [120 to 1,860 ac] evaluated in the GEIS (NRC, 2009a). The applicant's identification of the following BMPs would mitigate potential impacts to soils temporarily disturbed by construction and facility installation activities. The topsoil in the central processing plant area, satellite facility, and wellfield header houses would be stripped before facility construction. The applicant would store salvaged topsoil in designated topsoil stockpiles in accordance with WDEQ requirements (see Section 2.2.1.2 in the SEIS). The applicant would also remove topsoil to construct wellfield access roads and would adhere to landowner-preferred road construction practices. The stockpiles would be located onsite to minimize topsoil losses from wind erosion. Topsoil stockpiles would neither be located in drainage channels or at other locations that could result in material loss. The applicant would also construct berms around the base of the stockpiles and seed them with wheatgrass to reduce sediment runoff and wind erosion. As also identified in the application, temporarily disturbed areas would be reseeded as soon as possible following completion of the construction activity, and other soil protection measures would be used where appropriate, including proper grading and contouring, placement of hay bales, culvert installation, sedimentation breaks (e.g., sediment fencing), or placement of water contour bars (e.g., soil berms) (see SEIS Section 4.5.1.1.1). (Uranerz, 2007)

Construction of the wellfields, drilling activities, and the installation of piping could also impact soils. WDEQ issues Class III UIC permits for the installation of production and injection wells for uranium extraction. The construction of mud pits during drilling would also affect soils. During the excavation of mud pits, the applicant would first remove the topsoil and place it in a separate location. The applicant would then remove and deposit the subsoil next to the mud pit. When the mud pit use was complete (usually within 30 days of initial excavation), the subsoil would be redeposited in the mud pit followed by topsoil replacement. The applicant would follow a similar approach for pipeline ditch construction (Uranerz, 2007). WDEQ-LQD has established guidelines for topsoil and subsoil management at uranium ISR facilities (WDEQ, 2000).

Process-related liquid effluents would be disposed of in deep disposal wells. A UIC permit from WDEQ would be required for the applicant to use this method of waste disposal. WDEQ will evaluate the suitability of the formations proposed for deep well disposal and would only grant such a permit if the applicant can demonstrate that liquid effluent could be safely isolated in a deep aquifer. (Uranerz, 2007)

In summary, based on the information provided regarding the limited areal extent of the construction area, soil stockpiling procedures, BMPs (berms, seeding method) identified in the license application, the assumption that WDEQ would only permit proposed deep disposal wells based on the suitability of the proposed deep well injection zone, and the short duration for use of the mud pits and pipeline trenching activities, the NRC staff concludes that the potential environmental impact on geology and soils from the construction at the proposed Nichols Ranch ISR Project would be SMALL.

While the NRC staff concludes impacts to soils from construction would be SMALL, the staff recognizes that alternative methods to manage drilling fluids are available that the applicant could choose to implement to further limit the potential impacts from the use of mud pits during well drilling activities. Alternatives or mitigating measures to the use of mud pits during well drilling operations include, for example, lining the mud pits with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids.

4.4.1.2 Operations Impacts

As discussed in GEIS Section 4.3.3.2, during ISR operations, a non-uranium-bearing (barren) solution or lixiviant is injected through wells into the ore zone. The lixiviant moves through the pores in the host rock, dissolving uranium and other metals. Production wells withdraw the resulting “pregnant” lixiviant, which now contains uranium and other dissolved metals, and pump it to a central processing plant or to a satellite facility for further uranium recovery and purification (NRC, 2009a),

The removal of uranium from the target sandstones during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure, and therefore no significant matrix compression or ground subsidence would be expected. Therefore, the GEIS concluded the impacts on geology from ground subsidence at ISR projects would be SMALL (NRC, 2009a).

GEIS Section 4.3.3.2 discusses that potential soil impacts from ISR operations result from the need to transfer barren and pregnant uranium-bearing lixiviant to and from the central processing plant in above- and belowground pipelines. If a pipe ruptures or fails, lixiviant could

be released and (i) pond on the surface, (ii) run off into surface water bodies, (iii) infiltrate and adsorb in overlying soil and rock, or (iv) infiltrate and percolate to groundwater. In the case of spills from pipeline leaks and ruptures, licensees are expected to establish immediate spill responses through onsite standard operating procedures (Section 5.7) (NRC, 2003b). As part of the monitoring requirements at ISR facilities, licensees must report certain spills to NRC within 24 hours. Licensees in the State of Wyoming must also comply with applicable WDEQ requirements for spill response and reporting (NRC, 2009a).

If soil were contaminated by a spill, the applicant would remove the contaminated soil and dispose of it at a licensed disposal facility. After decontamination was complete, the applicant would conduct radiation surveys to confirm that soils had been cleaned up in accordance with applicable NRC standards for unrestricted use. The applicant has proposed a program to monitor wellfield and pipeline flow and pressure during the operations phase as discussed in SEIS Section 6.3.2. This monitoring would ensure timely detection of potential releases from pipeline breaks or ruptures and minimize the volume of such releases (Uranerz, 2007).

As noted in GEIS Section 4.3.3.2, short-term impacts to soils from spills during operation could range from SMALL to LARGE, depending on the volume of soil affected by the spill. However, because of the immediate response requirement to report spills at ISR facilities as described previously, coupled with the spill recovery actions, and the required routine monitoring programs, the impacts from spills would be temporary, and the overall long-term impacts to soils would be SMALL (NRC, 2009a).

As described in SEIS Section 2.2.1.3, the applicant proposed operations at the Nichols Ranch ISR Project that are similar to the operations analyzed in the GEIS. Operations would not remove rock matrix or structure as noted previously and analyzed in the GEIS. No significant matrix compression or ground subsidence would be expected because the net fluid withdrawal (bleed) would typically be 1 percent or less. At the depths at which the source uranium formations exist {91 to 213 m [300 to 700 ft] bgs for the Nichols Ranch Unit, 61 to 183 m [200 to 600 ft] bgs for the Hank Unit} and because rock matrix is not removed during the uranium mobilization and recovery process that would cause any void space in underground structures, the NRC staff concludes that no subsidence would be expected to occur from the collapse of overlying rock strata into the ore zone.

In summary, the projected small area of surface disturbance anticipated during operations, the applicant's proposed erosion control measures, and the operational measures that would be implemented to detect and respond to spills, NRC concludes that the potential environmental impact on geology and soil resources would be SMALL.

4.4.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.3.3 describes that aquifer restoration programs typically use a combination of (i) groundwater transfer; (ii) groundwater sweep; (iii) reverse osmosis, permeate injection, and recirculation; (iv) stabilization; and (v) water treatment and surface conveyance. The groundwater sweep and recirculation process does not remove rock matrix or structure; therefore, no significant matrix compression or ground subsidence would be expected. The aquifer water pressure is decreased during restoration by the maintenance of a negative water balance in the wellfield being restored; this ensures the direction of water flow is into the wellfield, thereby reducing the potential spread of contamination. However, the pressure change is limited by the recirculation of treated groundwater, and therefore the GEIS concluded that it would be unlikely that ISR operations could reactivate local faults and extremely unlikely

that ISR operations could cause earthquakes. Therefore, the GEIS concluded that in the Wyoming East Uranium Milling Region, the potential environmental impacts on geology from aquifer restoration would be SMALL (NRC, 2009a).

GEIS Section 4.3.3.3 also concluded impacts to soils from potential spills of contaminated groundwater resulting from pipeline leaks and ruptures could occur during aquifer restoration. NRC determined the impact from spills are temporary and therefore the long-term impact on soils would be SMALL because of the requirement for immediate response at ISR facilities, for spill recovery actions, and for routine monitoring programs.

The applicant would conduct the same spill and leak detection program described for the operations phase in SEIS Section 4.4.1.2. Therefore, the NRC staff concludes the potential impact on soils from spills and pipeline leaks during aquifer restoration would be similar to that described for the operations phase and would be SMALL because of the requirement for immediate response, for spill recovery actions, and for routine monitoring programs.

ISR activities during aquifer restoration at the proposed Nichols Ranch ISR Project site would neither remove rock matrix nor structure. At the depths at which the source uranium formations exist {91 to 213 m [300 to 700 ft] bgs for the Nichols Ranch Unit, 61 to 183 m [200 to 600 ft] bgs for the Hank Unit} and because no rock matrix would be removed during the uranium mobilization and recovery process, no significant matrix compression or ground subsidence would be expected; therefore, subsidence and collapse of overlying rock strata into the ore zone during the restoration phase would not be expected. Therefore, the impact on geology from subsidence during the aquifer restoration phase would be SMALL. Based on the above discussion, the NRC staff concludes the potential environmental impact on geology and soils during aquifer restoration would be SMALL.

The applicant would conduct the same spill and leak detection program described for the operations phase in SEIS Section 4.4.1.2. Therefore, the NRC staff concludes the potential impact on soils from spills and pipeline leaks during restoration would be similar to that described for the operations phase and would be SMALL because of the requirement for immediate response, for spill recovery actions, and for routine monitoring programs.

4.4.1.4 Decommissioning Impacts

GEIS Section 4.3.3.4 describes the decommissioning of ISR facilities, which includes the following activities: (i) dismantling process facilities and associated structures, (ii) removing buried piping, and (iii) plugging and abandoning wells in accordance with accepted practices. The main impacts on geology and soils during decommissioning would be from land reclamation activities and the cleanup of contaminated soils (NRC, 2009a).

As further discussed in the GEIS, before decommissioning and reclamation activities begin, the licensee is required to submit a decommissioning plan to NRC for review and approval. Any potentially impacted areas would be surveyed to ensure areas with elevated soil concentrations are identified and properly cleaned up in accordance with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6(6). An additional reclamation goal is to return the site to preproduction conditions and to reestablish native vegetative communities (NRC, 2009a).

The GEIS concluded most impacts to geology and soils from decommissioning would be detectable but SMALL. Disruption and/or displacement of existing soils would be relatively small. Changes in the area and location of impervious surfaces would be measurable, but

would not be at a scale large enough to noticeably alter existing natural conditions (NRC, 2009a).

The applicant would submit a final decommissioning plan to NRC for review and approval at least 12 months prior to the planned decommissioning of either a wellfield or portion of the project area (NRC, 2003b). During the reclamation process, the applicant would follow WDEQ guidelines; WDEQ would determine the success of final revegetation by comparing the revegetated area to a reference area (Uranerz, 2007).

As part of decommissioning, the applicant has proposed a reclamation plan that would reclaim (restore) lands disturbed by the proposed Nichols Ranch ISR Project to their prior land use of livestock grazing and wildlife habitat (see SEIS Section 2.2.1.5). Buildings or structures would be decontaminated to regulatory standards and either demolished and trucked to a disposal facility or turned over to the landowner, if desired. Background soils, vegetation, and radiological data will be used as criteria to evaluate the final reclamation (Uranerz, 2007).

Short-term impacts on geology and soils would occur as reclamation progressed; however, the outcome of these activities would be to return the project area to its prior use. Soil impacts during decommissioning would be limited to the area that had been disturbed (approximately 120 ha [300 ac]) over the life of the project based on information provided by the applicant (Uranerz, 2007). This disturbed area is at the low end of the range 50 to 70 ha [120 to 1,860 ac] evaluated in the GEIS (NRC, 2009a). Based on the temporary nature of the impacts, the applicant's goal to decommission and reclaim the site to preproduction conditions, and the magnitude of soil disturbance being within the range evaluated in GEIS, the NRC staff concludes the potential environmental impact on geology and soils from the decommissioning phase at the proposed Nichols Ranch ISR Project would be SMALL.

4.4.2 No-Action (Alternative 2)

Under the No-Action Alternative, no soils would be disturbed by earthmoving activities and no facility construction would occur associated with the proposed action, including buildings, roads, well installations, and pipelines. Site geology would be unaffected by the proposed action because no fluids would be injected into the subsurface and no license would be issued to authorize construction, operations, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project.

The current land uses on and near the proposed project area, which include grazing, natural resource extraction, and recreational activities, would continue, but there would be no impact from the proposed action.

4.4.3 Modified Action–No Hank Unit (Alternative 3)

Under Alternative 3, the Hank Unit would not be developed; therefore, the area potentially affected would be smaller compared to the proposed action in which both the Nichols Ranch and Hank Units would be developed. Under Alternative 3, approximately 20 ha [50 ac] of soil would be disturbed to construct a central processing plant, auxiliary facilities, wellfields on the Nichols Ranch Unit, and an access road; however, because no soil disturbance or well development would occur at the Hank Unit, the potential impact would be less than described for the proposed action. These impacts would be short term because disturbed areas from the proposed project would be restored and reclaimed after the project concluded. The applicant would take similar actions as described for the proposed action: topsoil would be stripped from

the area where the central processing plant and wellfield header houses would be constructed. The topsoil would be salvaged and stored in designated topsoil stockpiles in accordance with WDEQ requirements. During construction of the Nichols Ranch Unit wellfields, soils could be impacted by the drilling of wells, by other drilling activities, and by the installation of pipeline. Like the proposed action, the drilling activities would involve excavating mud pits following the same procedure described for the proposed action in Section 4.4.1. During both the operation and aquifer restoration phases, the applicant would implement the same monitoring program and spill procedures described for the proposed action. The applicant would also submit a decommissioning plan for NRC review prior to the decommissioning of either a wellfield or portion of the Nichols Ranch Unit project area. Because a smaller area would be affected under this alternative compared to the proposed action {20 ha [50 ac] vs. 120 ha [300 ac]} and the same monitoring and spill procedures described under the proposed action would be implemented, the NRC staff concludes the potential environmental impact on geology and soils for all ISR phases under Alternative 3 would be SMALL.

4.5 Water Resources Impacts

4.5.1 Surface Waters and Wetlands Impacts

Potential environmental impacts to surface water at the proposed Nichols Ranch ISR Project site could occur during all phases of the ISR facility lifecycle. Impacts can result from road construction and crossings, erosion runoff, spills or leaks of fuel and lubricants, discharges of storm water and potentially process-related fluids, CBM discharges, and discharges of wellfield fluids from pipeline or wellhead leaks.

The potential environmental impacts on surface water from construction, operation, aquifer restoration, and decommissioning are detailed in the following sections. No potential jurisdictional wetlands have been identified at the Hank Unit, but four potential jurisdictional wetlands occur on the Nichols Ranch Unit (Uranerz, 2007). The survey completed for these wetlands is described in SEIS Section 3.5.1.5. Nationwide Permit 44 under Section 404 of the Clean Water Act (CWA), issued by the U.S. Army Corps of Engineers (USACE), is required for discharges of dredged or fill material into a wetland or waters of the United States (WUS) exceeding 0.2 ha [0.5 ac] in area. However, none of the wetlands delineated at the Nichols Ranch Unit exceed 0.2 ha [0.5 ac] in size; therefore, no Nationwide Permit 44 would be required. Furthermore, because the wetlands were delineated on Cottonwood Creek south of the proposed ISR extraction activities and because the streambed does not flow through the area that would be impacted by activities in the extraction area, the NRC staff concludes impacts to wetlands would be SMALL. The following discussions focus on the occurrence of ephemeral channels and washes on and in the vicinity of the proposed site.

4.5.1.1 Proposed Action (Alternative 1)

4.5.1.1.1 Construction Impacts

As discussed in GEIS Section 4.3.4.1.1, impacts to surface waters and related habitats from construction could result from building road crossings, filling channels, surface erosion, surface water runoff, and spills or leaks of fuels and lubricants from construction equipment. These occurrences would be mitigated through proper planning and design, the use of proper construction methods, and the implementation of BMPs. Spills of petroleum products or hazardous chemicals into surface waters or related habitats must be reported to WDEQ. USACE permits could be required when filling and crossing wetlands. The GEIS concluded that

temporary changes to stream flow from grading and changes in topography and natural drainage patterns could either be mitigated or restored after the construction phase. The GEIS also noted that even though impacts could result from incidental spills of drilling fluids into local streams, these occurrences would be temporary because mitigation measures would be implemented. The GEIS also concluded that the impacts from surface water runoff from roads, parking areas, and buildings recharging shallow aquifers would be SMALL, because the potential license area would contain limited, impervious surface area. The GEIS concluded that construction impacts on surface water would be SMALL (NRC, 2009a).

During the construction phase of the proposed Nichols Ranch ISR Project, two new access roads, 0.32 km [0.2 mi] in length, would be constructed entirely in upland areas (Uranerz, 2007). The applicant would be required to develop a Storm Water Pollution Prevention Plan in accordance with WDEQ requirements to control storm water runoff during construction and to ensure that surface water runoff from disturbed areas met Wyoming Pollutant Discharge Elimination System (WYPDES) permit limits. The sedimentation- and erosion-control measures required in the WDEQ permit would minimize the potential for sediment transfer to surface water. Furthermore, the applicant would construct berms and recontour where possible to minimize potential erosion and sediment transfer to surface water (Uranerz, 2010). If surface water runoff was impeded by the presence of facilities, the applicant would install culverts and ditches to control runoff and to prevent excessive erosion (Uranerz, 2010).

Temporary wellfield access roads would also be constructed for equipment delivery and for truck access to install injection and production wells. These access roads would cross ephemeral channels at two locations on the Nichols Ranch Unit and at three locations on the Hank Unit. The applicant stated that the stream crossing locations would be at the natural streambed elevation in shallow water and that no fill material would be required at these locations. The applicant would grade steep and incised channel banks to produce a gentle slope on the approach to channel crossings. The applicant stated that (i) proper sedimentation and erosion control measures, such as riprap, hay bales, or both, would be used to armor erosion-prone areas to minimize channel sedimentation and (ii) disturbed soil would be reseeded to reduce surface water runoff (Uranerz, 2007).

The applicant would route overhead electric lines through both the Nichols Ranch and Hank Units on utility poles; however, poles are not typically installed in ephemeral streams, washes, or wetlands. Therefore, NRC concludes that there would be no impact on surface water from the construction of overhead lines.

The applicant would avoid constructing wells in channels and washes, if possible, to minimize damage from erosion and to avoid damage to wellfield infrastructure; however, these areas might not be able to be avoided depending on the location of the subsurface ore bodies, which guides the placement of the supporting infrastructure. The applicant has proposed to install approximately 15 wells (5 production and 10 injection) in the Nichols Ranch Unit and 22 wells (11 production and 11 injection) in the Hank Unit within ephemeral channels (Uranerz, 2007). The applicant acknowledges that the magnitude of the peak flows and surface water velocities in the tributaries that cross the wellfields in the proposed Nichols Ranch Unit may be an erosion risk and could damage wellfield infrastructure (Uranerz, 2010). The applicant stated that for any well placed near a stream or within the 25-year flood plain of Cottonwood Creek shown in Figure 2-15a (Uranerz, 2007), erosion protection controls such as grading and contouring, culvert installation, low-water crossing constructed of stone, water contour bars, and designated traffic routes would be implemented to minimize damage (Uranerz, 2007). If wells were placed in a stream, the applicant would use appropriate well and wellhead protection, such as cement

blocks, protective steel casing, and other measures (Uranerz, 2007), and apply best management practices, such as the use of riprap and rock to protect embankments, culverts, and drainage crossings, in accordance with Chapter 3 of WDEQ Land Quality Division (LQD) rules and regulations. The applicant also stated that these practices would be implemented for either wells or infrastructure located in the 25-year floodplain of Dry Willow Creek at the Hank Unit (Uranerz, 2010). For wells located in ephemeral channels, water pumped during well development would be directly released into ephemeral channels per permit discharge limits, to percolate into the soil. After well installation, the applicant would implement mitigation measures, such as reseeding and mulching, using standard erosion-control techniques to stabilize loose soil (Uranerz, 2007).

Pipeline connecting the injection and production wells with the Nichols Ranch Unit central processing plant and the Hank Unit satellite facility would be required to cross ephemeral channels at numerous locations. The applicant stated it would bury pipelines across ephemeral drainages and perform the work when the channels are dry using small-scale excavation equipment to create a narrow, shallow trench. The excavated soil to install the trench would be immediately reapplied after installation at the preexisting grade, and the applicant would reseed bare soil and mulch it for stability (Uranerz, 2007).

Temporary soil disturbances from vehicular passes during construction could also result in sediment transport during periods of surface water flow. To avoid impacts to the ephemeral drainages, the applicant would use existing roads within the proposed project area. The applicant would implement sedimentation and erosion-control measures, and in steep graded areas, disturbed soil would be reseeded to minimize surface water runoff into channels. The applicant would mitigate potential spills of petrochemicals, such as oil and gasoline, by conducting routine vehicle maintenance and inspection. The applicant would also develop and implement an emergency response plan (ERP) to address such occurrences. The applicant would train personnel to properly handle and transport hazardous materials to reduce the potential occurrence of spills. The applicant would also dispose of waste via properly installed septic systems, deep disposal wells, or offsite transport (Uranerz, 2007).

Because of the limited areal extent of construction, the limited occurrence of surface water and wetlands at the proposed Nichols Ranch ISR Project, and the applicant's commitment to implement BMPs, (e.g., the self-containment of the central processing plant and satellite facility buildings and secondary containment of exterior chemical and fuel tanks as discussed in Section 2.2.1.2.2 and the applicant's proposed mitigation measures described previously), the NRC staff concludes the potential impact from construction (including road construction, installation of electric lines, well construction, pipeline routing, building construction, and related vehicular traffic) would be SMALL.

4.5.1.1.2 Operations Impacts

GEIS Section 4.3.4.1.2 stated that through the permitting process, Federal and State agencies regulate the discharge of storm water runoff and the discharge of process-related water. Potential impacts from these discharges would be mitigated through permit conditions. The expansion of facilities or pipelines during operations could result in impacts comparable to those described for the construction phase. The potential impact from spills on surface water would depend on the size of the spill, the success of remediation, the use of the surface water, the proximity of the spill to surface water, and the volume of surficial aquifer discharge to the surface water. Because the potential impacts would be mitigated, the GEIS concluded that the potential impact on surface water during operations would be SMALL (NRC, 2009a).

No liquid effluent would be discharged to surface water as part of the proposed action. The applicant would develop a Storm Water Pollution Prevention Plan in accordance with WDEQ requirements for the management of storm water runoff. If WDEQ were to issue a WYPDES permit, the permit would establish discharge limits for releases to surface water. The Storm Water Pollution Prevention Plan would address compliance with WYPDES permit limits and discuss the diversion of storm water runoff from both the Nichols Ranch Unit and Hank Unit into soils, rather than into the ephemeral channels.

During routine well maintenance, vehicles would cross ephemeral channels to access the wellfields. Some channel crossings would occur at streambed locations that were unimproved. As discussed in Section 4.5.1.1.1, the applicant stated it would use appropriate erosion protection controls to minimize the impact to the drainage (Uranerz, 2007). Such controls could include crossing channels primarily during periods of low flow (Uranerz, 2010). Short-term soil disturbance from vehicular passes could result in limited downstream sediment transport. To avoid impacts to the ephemeral drainages, the applicant would use existing roads within the proposed project area (Uranerz, 2007). If an ephemeral drainage could be impacted by wellfield operations, the applicant would take appropriate measures to mitigate the impacts from erosion and sediment transport into the drainage as discussed in Section 4.5.1.1.1 (Uranerz, 2007).

The applicant would construct the Nichols Ranch Unit central processing plant and Hank Unit satellite facility on curbed concrete pads to contain spills and leaks. The applicant would also implement a storm water management plan in accordance with WDEQ requirements to retain or treat runoff from the facilities. Runoff would be diverted away from the facilities, where it would percolate into the soil. No wastewater discharge to surface water channels would occur. The applicant would also train personnel in proper handling and transport of hazardous materials to avoid spills. Piping connecting the wellfields to the central processing plant at the Nichols Ranch Unit and to the satellite facility at the Hank Unit would be equipped with high and low pressure alarms/shutdowns and flow meters to minimize the volume of fluid that could be released in the event of process pipeline failure (Uranerz, 2007).

NRC staff concludes that there would be no impact to surface water during operations of the proposed Nichols Ranch ISR Project because there would be no permitted discharge of wastewater to surface waters, the infrastructure would be in place to manage storm water discharge, and no large-scale earthmoving activities that could generate surface water runoff would occur. The occurrence of surface water within the proposed project area is limited, and there is intermittent surface water flow in the ephemeral channels. Lixiviant injection and subsequent extraction of the uranium-rich groundwater would occur within a closed and pressurized system of pipes at or near the ground surface. Processing of the uranium into yellowcake would be performed within the enclosed central processing plant and satellite facility. Accidental spills would be collected and disposed of in a Class I deep disposal well, and the applicant would be required to have a spill prevention and response plan.

Because of the limited occurrence of surface water at the proposed Nichols Ranch ISR Project, the self-contained design of the central processing plant and satellite facility, the WDEQ-required storm water permit and storm water management plan to meet WYPDES permit limits, the implementation of a site-specific emergency response plan to address accidental spills, and the applicant's commitment to conduct operations in accordance with standard operating procedures for spill prevention and control, the NRC staff concludes the potential impact on surface water from operations would be SMALL and further reduced by the applicant's proposed mitigation measures described in Section 4.5.1.1.1.

4.5.1.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.4.1.3 identified aquifer restoration activities that could impact surface water. These activities included management of produced water, storm water runoff, accidental spills, and management of brine reject from the reverse-osmosis system. The GEIS concluded that the impacts from these activities would be similar to the impact from operations, because the infrastructure would be in place and similar activities would be conducted (e.g., wellfield operation, transfer of fluids, water treatment, storm water runoff). For these reasons, the GEIS concluded that aquifer restoration impacts on surface water would be SMALL (NRC, 2009a).

Groundwater restoration at the proposed Nichols Ranch ISR Project would produce wastewater, primarily from groundwater sweep. The second wastewater source would be brine from the reverse-osmosis system. All wastewater would be disposed of in a Class I deep disposal well (Uranerz, 2007). The applicant would use automated sensors to monitor the injection process to detect leaks or pipe/well ruptures as described for operational monitoring. No wastewater would be discharged to surface water. The applicant would also be required to have an NRC-approved spill response plan (NRC, 2003b).

Impacts to surface water from stormwater runoff and accidental spills could occur as discussed in SEIS Section 4.5.1.1.2; however, because of the applicant's adherence to the mitigation measures described in SEIS Section 4.5.1.1.2 and its compliance with both NRC and WDEQ license and permit requirements, respectively, the NRC staff concludes the potential impact on surface water from aquifer restoration would be SMALL.

4.5.1.1.4 Decommissioning Impacts

As discussed in GEIS Section 4.3.4.1.4, impacts from decommissioning would be similar to the impacts from construction. The activities to clean up, recontour, and reclaim disturbed lands during decommissioning would mitigate long-term impacts to surface waters. The GEIS concluded potential impacts to surface water from decommissioning would be SMALL (NRC, 2009a).

During decommissioning of the proposed Nichols Ranch ISR Project, the applicant would remove buildings and pipelines, and plug and abandon wells (Uranerz, 2007). The potential impact from decommissioning would be similar to the impact from construction discussed in SEIS Section 4.5.1.1.1. Soil disturbances would occur during the removal of buildings and pipeline and could result in localized soil erosion and surface water runoff. However, the effects from these actions would be short term, occurring while the action was being implemented.

The applicant would replace stockpiled topsoil in previously disturbed areas, grade the surface to restore it to the predisturbance contours, and revegetate the affected area in accordance with WDEQ-LQD rules and regulations as part of a WDEQ-approved erosion and sedimentation control plan. Well and pipeline removal in ephemeral channels would temporarily disturb surface water in areas where a pipeline crossed the channels. Work would be performed during the dry season to minimize sedimentation. Surface soil would be returned to areas that had been excavated to remove pipeline such as at well head and trench locations. Restored trenches would be graded to preconstruction contours and seeded with a native seed mix in accordance with a WDEQ-approved restoration plan. The landowner would determine which access roads would be reclaimed; access roads would be restored following the same process described for trenches (Uranerz, 2007).

Because of the short-term, temporary nature of these activities, the applicant's commitment to implement the BMPs discussed in SEIS Section 4.5.1.1.1, and NRC license and WDEQ permit requirements, NRC staff concludes the potential impact on surface water from decommissioning the proposed Nichols Ranch ISR Project would be SMALL.

4.5.1.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no impact on either surface water or wetlands from the proposed Nichols Ranch ISR Project because the facility would not be licensed, no central processing plant at the Nichols Ranch Unit and no satellite facility at the Hank Unit with their associated infrastructure (i.e., access roads and piping) would be constructed, and no wellfields would be developed and operated.

The current land use on and near the proposed project area, which includes livestock grazing, natural resource extraction, and hunting and recreational activities as described in Section 3.2 of the SEIS, would continue. The 17 CBM wells and 3 oil and gas wells located within the proposed project area would continue to operate and could potentially discharge to surface water via outfalls permitted through the WYPDES program.

4.5.1.3 Modified Action–No Hank Unit (Alternative 3)

Under Alternative 3, the Hank Unit would not be constructed and operated and the proposed facilities would be located exclusively at the Nichols Ranch Unit. Similar to the proposed action, surface water could potentially be impacted by surface water runoff from well drilling, road and facility construction, and the installation of pipeline. However, only surface water located in the Tex Draw and Cottonwood drainage basins would be affected because the Hank Unit would not be constructed. Spills, leaks, and other inadvertent discharges into surface water could potentially occur during the operations phase at the Nichols Ranch Unit; however, as described in Section 4.5.1.1.1, the implementation of BMPs and adherence to the NRC license and WDEQ permit requirements would minimize the potential impact to surface water. None of the wetlands delineated at the Nichols Ranch Unit exceed 0.2 ha [0.5 ac] in size; therefore, no Nationwide Permit 44 would be required. Furthermore, because the wetlands were delineated on Cottonwood Creek south of the proposed ISR extraction activities and because the streambed does not flow through the area that would be impacted by activities in the extraction area, the NRC staff concludes impacts to wetlands would be SMALL.

4.5.2 Groundwater Impacts

Potential environmental impacts on groundwater at the proposed Nichols Ranch ISR Project site could occur during all phases of the ISR facility lifecycle, but primarily during operations and aquifer restoration.

ISR activities can impact aquifers located both above and below the uranium-bearing aquifer as well as adjacent aquifers. Surface or near-surface activities that could introduce contaminants into soils would be more likely to impact shallow aquifers, while ISR operations and aquifer restoration would impact the deeper uranium-bearing aquifer and could potentially impact aquifers above and below the uranium-bearing aquifer as well as adjacent aquifers.

ISR facility activities can impact groundwater resources from potential surface spills and leaks, from shallow surface piping releases, from consumptive water use, from potential horizontal and vertical leaching solution excursions from the production aquifer, by degrading water quality and

changing the water chemistry of the production aquifer, and from deep well injection of liquid effluent. Detailed discussion of the potential impact on groundwater resources from construction, operations, aquifer restoration, and decommissioning the proposed Nichols Ranch ISR Project is provided in the following sections.

4.5.2.1 Proposed Action (Alternative 1)

4.5.2.1.1 Construction Impacts

GEIS Section 4.3.4.2.1 concluded that the potential for groundwater impacts during construction of ISR facilities is primarily from consumptive groundwater use, the introduction of drilling fluids and muds during well installation, and potential spills of fuels and lubricants from construction equipment. The GEIS further noted that groundwater use during the construction phase would be limited and that groundwater would be protected by implementing BMPs such as spill prevention and cleanup. A limited volume of drilling fluids and muds would be introduced into the environment during well installation. Because of the limited nature of construction activities and the implementation of BMPs to protect shallow groundwater, the GEIS concluded that construction impacts on groundwater would be SMALL (NRC, 2009a).

Consumptive water use during the construction phase of the proposed Nichols Ranch ISR Project would be limited to dust control, drilling support, and cement mixing. The water source used for construction activities would be the surficial aquifer (Uranerz, 2007). The NRC staff concludes the consumptive water use during construction would be SMALL compared to consumptive water use during ISR operations and restoration.

The volume of drilling fluids and muds used during well installation would be limited; in addition, the WDEQ-LQD has guidelines on topsoil and subsoil management at Uranium ISR facilities that the applicant would be expected to follow (WDEQ, 2000). Attachment III to these guidelines identifies BMPs. The applicant proposes to use mudpits (Uranerz, 2007). Drilling fluids and muds would be stored in mud pits to manage the spread of fluids, to minimize the area of potential soil contamination, and to enhance evaporation. The NRC staff concludes the introduction of drilling fluids to the surficial aquifer could occur during well drilling, but the potential impact would be SMALL because drilling muds are designed to seal boreholes to set the casing.

After wells were installed, water may be pumped from the wells for well development or for hydrologic testing, such as pumping tests. This water would be discharged to the surface in accordance with the applicant's approved WYPDES permit. The surface discharge permits would protect near-surface aquifers by limiting the discharge volume and by prescribing concentration limits to discharged waters. Table 1-2 summarizes the status of the applicant's WYPDES permit application.

During the construction phase of the proposed Nichols Ranch ISR Project, the groundwater quality of near-surface aquifers would be protected by WDEQ-LQD and WQD permit requirements and BMPs that would include the applicant's implementation of a WDEQ-approved spill prevention and cleanup program to prevent soil contamination from construction equipment fuel and lubricant leaks (Uranerz, 2007). The potential volume of stored fuels and lubricants within the proposed project area would be small, and leaks or spills would result in an immediate cleanup response to prevent soil contamination or infiltration to groundwater.

The types of construction activities for the proposed Nichols Ranch ISR Project would have an anticipated SMALL impact on groundwater resources, applying GEIS criteria. Based on this analysis, consumptive groundwater use during the construction phase would be limited to routine activities, such as dust suppression, mixing cements, and drilling support, and have a SMALL and temporary impact. The impact to groundwater resources during wellfield and facility construction would be SMALL, based on the limited nature of construction activities and the applicant's implementation of WYPDES permit requirements and the BMPs described previously to protect soils and shallow groundwater.

4.5.2.1.2 Operations Impacts

GEIS Section 4.3.4.2.2 described impacts on shallow (near-surface) aquifers during ISR operations and concluded the environmental impacts are from leaks of lixiviant from pipelines, wells, or header houses. In addition, potential environmental impacts on groundwater resources in the production and adjacent aquifers could occur from consumptive water use and from water quality changes that result from normal operations in the production aquifer and from potential horizontal and vertical lixiviant excursions beyond the production zone. Disposal of liquid effluent by deep well injection during ISR operations could also potentially impact groundwater resources (NRC, 2009a).

4.5.2.1.2.1 Operation Impacts to Shallow (Near-Surface) Aquifers

GEIS Section 4.3.4.2.2.1 discusses the potential impacts on shallow aquifers during ISR operations. A network of buried pipelines is used during ISR operations to transport lixiviant between the pump house and the satellite facility or central processing plant and also to connect injection and extraction wells to manifolds inside the header houses. The failure of pipeline fittings or valves or failures of well mechanical integrity in wells in shallow aquifers could result in leaks and spills of pregnant and barren lixiviant, which could impact the water quality of the shallow aquifers. The potential environmental impact from such pipeline, valve, or well-integrity failure or pond leakage depends on several factors, including the depth-to-shallow groundwater, the use of shallow groundwater, and the degree of hydraulic connection between shallow aquifers and regionally important aquifers. Spills of either chemicals or petroleum products could also impact shallow groundwater quality and must be reported to WDEQ. The GEIS concluded that the potential environmental impact on shallow aquifers could range from MODERATE to LARGE if

- The groundwater in shallow aquifers is close to the ground surface
- The shallow aquifers are important sources for local domestic or agricultural water supplies
- Shallow aquifers are hydraulically connected to other locally or regionally important aquifers

The GEIS also concluded that the potential environmental impacts could be SMALL if shallow aquifers have poor water quality, well yields are not economically viable for production, and the shallow aquifers are hydraulically separated from other locally and regionally important aquifers. (NRC, 2009a)

Sections 3.4.1 and 3.5.2 of the SEIS described the Wasatch Formation, which outcrops in the proposed project area and is characterized by a series of sand layers separated by mudstones

and siltstones as shown in Figure 3-3. The applicant identified a series of sand layers in the upper portion of the Wasatch Formation and labeled them from the shallowest to the deepest as the H, G, F, C, B, A, and 1 Sands (Figure 3-4). The depth to groundwater across the Nichols Ranch Unit is variable and depends on surface topography. The surficial sand aquifer likewise varies across the proposed project area. In the southern portion of the Nichols Ranch Unit, where the proposed central processing plant would be located, shallow groundwater is first encountered in the Cottonwood Creek alluvium within 3 m [10 ft] bgs (Uranerz, 2007). In the middle portion of the Nichols Ranch Unit, shallow groundwater is first encountered in the F Sand aquifer at depths ranging from 15 to 30 m [50 to 100 ft] bgs. In the northernmost portion of the Nichols Ranch Unit, the G Sand is typically the shallow aquifer, with the depth to groundwater ranging from 15 to 30 m [50 to 100 ft] bgs. Groundwater flow in the F and G Sands is to the south (Uranerz, 2007, 2010).

The depth to groundwater in the proposed central processing plant area is approximately 15 m [50 ft] bgs based on well data. Portions of the proposed production zone to the south extend to the area overlying the Cottonwood Creek alluvium, where groundwater may occur at depths as shallow as 3 m [10 ft] bgs. The proximity of the groundwater to the ground surface in this area may increase the potential for a contaminant release at the ground surface to reach the surficial aquifer. The water level in the F Sand shallow aquifer is shown in Figure 2-20 of the applicant's technical report (Uranerz, 2010).

The groundwater quality data for the F Sand surface aquifer indicate relatively high total dissolved solids (TDS), but the groundwater would be suitable for livestock watering (Wyoming Class III groundwater). The applicant's well survey indicates six stock watering wells are located within a 0.8-km [0.5-mi] radius of the proposed project area. One well (N1, 11849) at the Nichols Ranch Unit is screened in (open to) the F Sand shallow aquifer and could potentially be impacted if a surface release migrated downgradient to the west. The location of this stock watering well is shown in Figure 3-6 (Uranerz, 2007).

The depth to shallow groundwater at the Hank Unit is deeper than at the Nichols Ranch Unit. The H Sand is the surficial aquifer in this area, and the depth to groundwater ranges between 15 m [50 ft] bgs at the low lying areas west of the Hank Unit and 61 m [200 ft] bgs along the eastern border of the Hank Unit. The average depth to groundwater is approximately 30 m [100 ft] bgs or more beneath most of the Hank Unit and the planned satellite facility. Groundwater flow in the H Sand at the Hank Unit is to the west. The Willow and Dry Willow Creek alluvium at the Hank Unit are mostly dry, except after surface water runoff events. (Uranerz, 2007)

Based on applicant-provided groundwater quality data from the H Sand aquifer, this aquifer is suitable for livestock use (Wyoming Class III groundwater). As noted previously, the applicant's well survey indicated six stock watering wells are located within a 0.8-km [0.5-mi] radius of the proposed project area. None of the stock wells at the Hank Unit are installed in the H Sand aquifer. However, three monitoring wells are screened in the surficial H Sand aquifer (i.e., BR-I, BR-K, URZHH-7) (Uranerz, 2007).

As discussed in the GEIS, NRC-required leak detection programs would greatly reduce the potential impact on shallow groundwater from surface releases. As described in SEIS Section 6.3.2, the applicant would be required to have leak detection, spill response, and cleanup programs (Uranerz, 2007). Furthermore, the NRC requirement for well mechanical integrity testing (NRC, 2003b) and similar requirements in the WDEQ UIC permit (Uranerz, 2007) would further reduce the potential for well integrity failure during operations.

In conclusion, shallow aquifers in the Nichols Ranch ISR Project area are not known to be hydraulically connected with more significant local and regional water supply aquifers. Only one well near the Nichols Ranch Unit is known to be in the shallow F Sand aquifer and is used by ranchers to water their stock. No other wells are known to be used for domestic or livestock water in the shallow aquifers in the Nichols Ranch ISR Project area. As discussed previously for the Nichols Ranch Unit, the surficial aquifer is 3 m [10 ft] bgs in the southern portion of the unit and, therefore, may be connected to the surface water in Cottonwood Creek. Therefore, in accordance with GEIS criteria, the NRC staff concludes the impact on the shallow aquifer system at the proposed Nichols Ranch ISR Project would be MODERATE. However, implementation of the leak detection and correction program and mechanical integrity testing could mitigate the potential impact (i.e., early detection and cleanup) and result in SMALL operational impacts on shallow (near-surface) aquifers for the Nichols Ranch and Hank Units.

4.5.2.1.2.2 Operations Impacts to Production and Surrounding Aquifers

The potential environmental impacts on groundwater supplies in the production and other surrounding aquifers are related to consumptive water use and groundwater quality.

Water Consumptive Use

As discussed in GEIS Section 4.3.4.2.2.2, groundwater is withdrawn and reinjected into the production zone during ISR operations. Most of the water withdrawn from the aquifer is returned to the aquifer. That portion of water not returned to the aquifer is referred to as consumptive use. Consumptive use is due primarily to production bleed but also includes other smaller losses. The production bleed is the net withdrawal maintained to ensure that groundwater flow is toward the production network (inward gradient) to minimize the potential movement of lixiviant and its associated hazardous constituents out of the wellfield (NRC, 2009a).

As discussed in GEIS Section 1.7.2.1, the U.S. Environmental Protection Agency (EPA) must designate the portion of an aquifer where the production occurs as an exempt aquifer pursuant to the federal underground injection control (UIC) regulations before any production begins. An exempt aquifer designation means the aquifer is not, nor would it ever be, a source of drinking water in the location the exemption covered (NRC, 2009a). The aquifer exemption criteria are described in 40 CFR 146.6. These criteria include whether the aquifer is currently a source of drinking water, whether the water quality is economically or technologically impractical to use for a public water system, whether the TDS content of the groundwater is more than 3,000 ppm and less than 10,000 ppm, and assurance that the aquifer is not reasonably expected to supply a public water system. Moreover, under the federal UIC regulation, the exempted aquifer would no longer be protected under the Safe Drinking Water Act (SDWA) as an Underground Source of Drinking Water (USDW). At the proposed Nichols Ranch ISR Project, portions of the A Sand at the Nichols Ranch Unit and the F Sand at the Hank Unit (both units in which production operations would occur) and typically a buffer zone would be sought to be declared as exempt by EPA. Groundwater in the aquifer outside the designated exempt zone would still be considered a possible source of drinking water, if of appropriate quality.

Consumptive water use during ISR operations could potentially impact a local water user who uses water from the production aquifer outside the exempted zone. This potential impact results from a lowering of the water levels in nearby wells in response to pumping within the production zone. This water level decrease, referred to as a drawdown, if significant enough relative to the original water level, can potentially reduce well yields. In addition, if the

production zone is hydraulically connected to other aquifers above and/or below, consumptive use may potentially impact the water levels in these overlying and underlying aquifers and cause a drawdown in water level, thus reducing the potential yield from nearby wells completed in these aquifers. Water consumptive use is described in GEIS Section 4.3.4.2.2.2 (NRC, 2009a).

The applicant provided a map of water wells within 0.81 km [0.5 mi] of the Nichols Ranch Unit project area. Completion data for these wells, including the aquifers in which they are screened (i.e., open to the environment), were provided. Based on a search of the Wyoming State Engineer's Office (WSEO) water permit database within this area, the NRC staff found the majority of wells are either stock or monitoring wells. No water wells permitted for domestic use are located within the 0.81 km [0.5 mi] boundary of the Nichols Ranch Unit. The applicant also provided a map of all permitted wells within a 4.8-km [3-mi] radius of the Nichols Ranch Unit. According to the summary table, the majority of wells within this radius were either stock or monitoring wells. Two domestic wells, Doughstick #3 and Garden Well, located approximately 3.2 km [2 mi] southeast of the proposed project area, are drilled to a depth of 168 and 159 m [550 and 520 ft] bgs, respectively. One other domestic well, Dry Fork #1, associated with a residence at Dry Fork Ranch, is located at a distance of a little over 0.6 km [1 mi] to the west of the proposed project area. The depth of this well could not be determined.

The applicant predicted drawdown from production bleed during operations (Uranerz, 2007) based on a simple analytical model and using aquifer properties determined from either aquifer testing or assumptions based on site-specific conditions. Assuming a production rate of 13,250 Lpm [3,500 gpm] and a 1 percent bleed rate, a groundwater withdrawal rate of 133 Lpm [35 gpm] was used to predict drawdown at the Nichols Ranch Unit. Based on these inputs, the potential drawdown from this pumping rate was predicted using the aquifer properties of 4,350 L/day/m [350 gal/day/ft] for transmissivity and a storage coefficient of 1.8×10^{-4}. The applicant conducted simulations to evaluate drawdown over the entire production area resulting from several extraction wells sited at various locations within the production area. These predictions show 9 m [30 ft] of drawdown from a combined 35 gpm rate would extend approximately 2,100 m [7,000 ft] outward from the center of the entire production area. The 1.5 m [5 ft] drawdown contour was projected to extend approximately 6,860 m [22,500 ft] or approximately 6.4 km [4 mi] beyond the Nichols Ranch Unit boundary.

The applicant stated the primary effect from the Nichols Ranch Unit bleed would be drawdown in those wells completed in the ore zone (i.e., the A Sand) (Uranerz, 2007). The applicant further stated the predicted drawdown would not greatly impact production from pumping wells because in the A Sand confined aquifer the available groundwater levels (hydraulic head) is sufficient to allow drawdown without impacting well yields. As discussed in SEIS Section 3.5.2.3.4, the applicant reviewed WSEO data for wells located within 4.8-km [3-mi] of the Nichols Ranch Unit, which showed there was an average hydraulic head (available groundwater level) in the wells of about 136 m [446 ft]. A decrease of 9 m [30 ft] in the water level in wells located approximately 2,134 m [7,000 ft] from the center of the production area would, therefore, represent less than 7 percent of the available water level in the aquifer. The NRC staff concludes this decrease would not significantly impact well yield.

Although the available hydraulic head is sufficient to prevent an impact on well yield in most of the private wells, there are naturally flowing wells (i.e., those wells with a water level above the ground surface) located in the vicinity of the Nichols Ranch Unit. The predicted drawdown could cause these wells to cease to flow naturally because it would drop their water level below ground surface. The applicant stated that flowing wells located within the 3 m [10 ft] drawdown

contour could be impacted and that within an 8 km [5 mi] radius, 10 flowing wells screened within the A Sand could be affected (Uranerz, 2007). The applicant also stated that if any of these wells stopped flowing, either a pump or other supplement to lift the water to the surface might need to be installed. The applicant stated "confidential surface use agreements (are) in place with the landowners" who own these free-flowing wells to address mitigation measures the applicant would implement should a free-flowing well be impacted by drawdown from the proposed Nichols Ranch ISR Project (Uranerz, 2007). These measures include either providing additional pumping capacity or replacing the well.

In addition to drawdown, production from the A Sand could induce water from the overlying and/or underlying aquifers to move across the aquitards (confining layers) into the production zone. This water movement is referred to as leakage. Leakage could potentially occur in areas where the intervening aquitards are not extensive, where the aquitard has been compromised by wells screened over multiple aquifers, or where inadequately sealed wells or boreholes are present. Leakage across confining beds could result in a drawdown in the overlying and underlying strata. Pumping tests conducted by the applicant at the Nichols Ranch Unit have not demonstrated leakage from either the overlying B Sand or the underlying 1 Sand into the A Sand. Based on the results from two multiwell pumping tests (MN–1 and MN–2) conducted by the applicant that evaluated pumping and monitoring the A Sand, the overlying B Sand aquifer, and the underlying 1 Sand aquifer (Uranerz, 2007), there is no hydraulic connection across the aquitards between the A Sand, and the B Sand or 1 Sand. Because of the large hydraulic head in the A Sand, which would only be reduced a small percentage by consumptive groundwater use, the mitigation measures the applicant would implement if a free-flowing well was impacted, and the results from the pumping test data that indicate no leakage from either overlying or underlying aquifers, the NRC staff concludes the short-term impact from consumptive groundwater use at the Nichols Ranch Unit during the production phase would be SMALL.

As shown by the Nichols Ranch Unit drawdown estimates, the net consumptive use of water at the Nichols Ranch Unit during the operational phase (production and restoration) would reduce groundwater levels in the A Sand by a small fraction of the existing groundwater levels in the Powder River Basin. After production and restoration are completed and groundwater withdrawals are terminated at the Nichols Ranch Unit, groundwater levels would recover with time. Thus, the NRC staff concludes the potential long-term environmental impact from consumptive groundwater use during the operations phase at the Nichols Ranch Unit would be SMALL.

As discussed in SEIS Section 3.5.2, the F Sand production zone at the Hank Unit is not completely saturated. Therefore, it is an unconfined aquifer. The unconfined conditions in the production zone reduce the potential impact from consumptive groundwater use during ISR operations. For a given net withdrawal in an unconfined aquifer, substantially less water level drawdown would occur over a smaller area compared to that in a confined aquifer. As shown in Figure 4-1, the water produced from a well in an unconfined aquifer (water level below overlying aquitard) comes from dewatering of the aquifer pore space in the production zone. However, the water moving to a well in a confined aquifer (water level above overlying aquitard) comes from the sediment compression and water expansion from the pressure drawdown in the production zone, but does not drain the pore spaces. Therefore, much more water is produced from dewatering drawdown over a small area of an unconfined aquifer to meet the well flow rate, whereas the pressure drawdown to produce water from a confined aquifer occurs over a larger area to meet the well flow rate.

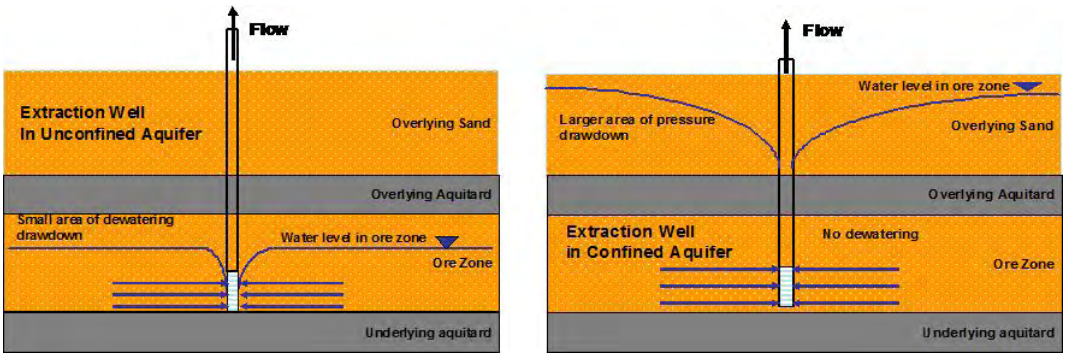

Figure 4-1. Drawdowns in an Unconfined Aquifer and Confined Aquifer from an Extraction Well Operating at Same Rate. Modified from Uranerz (2007).

The applicant provided a map of water wells within 0.81 m [0.5 mi] of the Hank Unit proposed project area. Completion data for these wells, including the aquifers in which they are screened, were provided. Based on a search of the Wyoming State Engineers Office database of groundwater permits and well descriptions within this area, the NRC staff found the majority of wells are stock wells or monitoring wells. No water wells permitted for domestic use were located within 0.81 km [0.5 mi] of the Hank Unit. The applicant also provided a map of all permitted wells within a 4.8 km [3 mi] radius and the associated groundwater permits, which indicated the majority of wells were either stock or monitoring wells.

For the Hank Unit, two domestic wells, Doughstick #3 and Garden Well, are located approximately 4.8 km [3 mi] southwest of the proposed project area and drilled to a depth of 168 and 159 m [550 and 520 ft] bgs, respectively. The applicant stated that a domestic well was located at a residence at Pfister Ranch, approximately 1 km [0.6 mi] north of the Hank Unit northern boundary. The only well shown at this location is BR-T. The applicant stated this well was located at a depth stratigraphically below the F Sand ore zone in the B Sand aquifer underlying the production zone. Completion information for BR-T was provided in Uranerz (2007,Table D6-3), but no permit for this well was identified in Uranerz (2007, Table D6G2-2). The NRC staff was unable to locate BR-T or any other domestic wells associated with this ranch from the Wyoming State Engineers Office water permit database. However, the staff accepts that the applicant has located and assessed this well location, well completion, and its use as a domestic well.

To evaluate production impacts, the applicant predicted the drawdown from production bleed in the F Sand at the Hank Unit assuming the following inputs: a production rate of 9,470 Lpm [2,500 gpm], a bleed rate of 3 percent, and a groundwater withdrawal rate of 284 Lpm [75 gpm]. The resulting drawdown calculation was based on the aquifer properties of a transmissivity of 4,968 L/day/m [400 gal/day/ft] and a storage value of 0.05 for the unconfined F Sand. The simulations assumed 284 Lpm [75 gpm] withdrawals at six locations in the northern wellfield for 1.5 years followed by a second set of six withdrawals in the southern wellfield for 1.5 years. The simulations predicted that the 3 m [10 ft] drawdown contour would extend out to the area immediately adjacent to the southern wellfield, while the drawdown contour of 1.5 m [5 ft] would extend approximately 270 m [900 ft] from the wellfield. The drawdown in the F Sand at the Hank Unit is lower compared to drawdown in the A Sand in the Nichols Ranch Unit because of the unconfined (unsaturated) nature of the F Sand aquifer.

Applicant-performed aquifer testing at the Hank Unit has not indicated leakage from either the overlying G Sand or the underlying B Sand into the production zone. Specifically, two applicant-

performed multiwell pumping tests (URZHF–1, URZHF–5) included pumping and monitoring the F Sand, monitoring the overlying G Sand aquifer, and monitoring the underlying B Sand aquifer (Uranerz, 2007). Neither test indicated a hydraulic connection (drawdown) between the F Sand and either the G Sand or B Sand. No flowing wells have been identified in the F Sand in the Hank Unit. In addition, the applicant stated that wells screened in the F Sand in the immediate area adjacent to the Hank Unit would either need to be abandoned using acceptable WDEQ methods or be used as monitoring wells (if not completed in multiple sands) because of their close proximity to the production zone (Uranerz, 2007). Given the anticipated groundwater flow behavior in the unconfined aquifer at the Hank Unit, the applicant will be required by license condition to provide to NRC after the wellfield production and monitoring wells have been installed, the wellfield data hydrologic package on the unconfined aquifer for at least one wellfield at the Hank Unit for NRC review and approval before operations are initiated. This package will contain the pumping test data and the applicant's analysis of the wellfield groundwater flow behavior.

As described previously, the applicant has predicted that the projected drawdown would not impact the yield at any private wells located outside the proposed Hank Unit. Private wells completed in the production zone within the Hank Unit project area would be plugged and abandoned. The applicant has also demonstrated through pumping tests that there is no hydraulic connection with either the overlying or underlying aquifers. The applicant will be required by license condition to submit information verifying these conditions in its wellfield hydrologic data package. The license condition will require NRC review and approval of at least one wellfield hydrologic package at the Hank Unit before operations begin. Based on the applicant's initial drawdown predictions and the wellfield testing and verification required by NRC license condition, the NRC staff concludes the environmental impact from consumptive groundwater use at the Hank Unit during the operations phase would be SMALL.

As shown by the Hank Unit drawdown estimates, the net consumptive use of water at the Hank Unit during the operational phase (production and restoration) is predicted to reduce groundwater levels by a small fraction of the groundwater levels currently in the F Sand in the Powder River Basin. After production and restoration are completed and groundwater withdrawals are terminated at the Hank Unit, the groundwater levels would recover with time. Thus, NRC staff concludes that the potential long-term environmental impact from consumptive groundwater use during the operational phase at the Hank Unit would be SMALL.

Excursions and Groundwater Quality

GEIS Section 4.3.4.2.2.2 discussed how groundwater quality in the production zone would be degraded as part of ISR operations. Excursions are defined as the movement of fluids away from the production zone aquifer during operations. NRC would require the applicant to take preventative measures to reduce the likelihood and consequences of potential excursions. These measures include conducting wellfield operations to ensure fluids stay within the wellfield and specific requirements for monitoring, reporting, and correcting excursions if they occur. (NRC, 2009a)

Horizontal excursions are defined as movement of production fluids into the aquifer surrounding the wellfield, which may be caused by an imbalance in injection and production rates in the wellfield. To prevent such an imbalance, a licensee is required to maintain an inward hydraulic gradient by extracting more fluid than is injected to create a wellfield bleed. This bleed ensures that groundwater is drawn into the wellfield to minimize the potential for production fluids to move out of the production zone. To detect a horizontal excursion, the licensee is also required

to install a ring of monitoring wells located within and encircling the production zone to detect horizontal excursions, as discussed in SEIS Chapter 6.

Vertical excursions are defined as movement of production fluids into aquifers overlying or underlying the production zone aquifer. The GEIS stated that the potential for leaching solution to migrate into an overlying or underlying aquifer would be small if the aquitard separating the production zone from the overlying and underlying aquifers is of sufficient thickness and has a low permeability. Steep hydraulic gradients in which the potentiometric head of the production zone is above that of the overlying or underlying aquifers could also result in a vertical excursion. Vertical excursions can also result from improperly sealed boreholes, from poorly completed wells that provide a pathway for vertical flow, or from a loss of mechanical integrity in the ISR injection and extraction wells. NRC requires monitoring of the overlying and underlying aquifers to detect vertical excursions using monitoring wells at a spacing of not less than one every 1.6 ha [4 ac]. The applicant would be required to take preventive measures against vertical excursions prior to operations, including well integrity tests (NUREG–1910, Section 1). The applicant would be required to conduct mechanical integrity testing of each well to check for leaks or cracks in the casing, in compliance with 40 CFR 146.8. The conduct of mechanical integrity testing reduces the likelihood of poor well integrity and potential excursions.

NRC requires the excursion monitoring wells surrounding, below, and above the production zone be sampled every 2 weeks for excursion indicators. At least three chemical indicators of horizontal and vertical excursions are required. These indicators must be conservative (i.e., nonreactive or unretarded) constituents of the lixiviant, such as alkalinity, conductivity, and chloride. If the value of any two of these constituents is elevated above certain values approved by NRC, it indicates that a potential excursion has occurred. If the excursion is confirmed by additional sampling, it must be reported to NRC within 24 hours. Corrective action would be required to either stop or reverse the fluid movement. The applicant would modify wellfield operations, as necessary, to correct the excursion. If a well remained on excursion for more than 60 days, the applicant would be required to provide NRC with a written report describing the excursion event, corrective actions, and results of the corrective actions. If the excursion was not corrected after 60 days, the applicant would be required to cease lixiviant injection or increase the financial surety bond to cover the cost of restoration from the excursion.

In GEIS Section 2.11.4, the NRC staff documented that, based on historical information, excursions have occurred at operating ISR facilities. Separately, NRC staff analyzed the environmental impacts from both horizontal and vertical excursions at three NRC-licensed ISR facilities. In that analysis, which involved 60 events at the three facilities, the NRC staff found that, for most of the events, the licensees were able to control and reverse the excursions through pumping and extraction at nearby wells. Most excursions were short lived, although a few continued for several years. In all cases, environmental impacts were SMALL and temporary (NRC, 2009b).

To examine the potential for excursions at the Nichols Ranch Project, the hydrogeology, ISR operating conditions, and potential to prevent and control excursions were evaluated by NRC staff for both the Nichols Ranch and Hank Units. Groundwater in the A Sand (the production zone) at the Nichols Ranch Unit is confined (saturated conditions), and the aquifer has sufficient hydraulic conductivity for ISR operations. The drawdown from pumping in the production zone would facilitate both lixiviant containment in the ore zone and the recovery of either a horizontal or vertical excursion. The A Sand is both overlain and underlain by thick extensive aquitards that are shown on the north-south and east-west cross sections at the Nichols Ranch Unit [exhibits D5-10 and D5-11, respectively, of Uranerz (2007)] and would isolate the lixiviant in the

A Sand. The results of the applicant's pumping tests conducted to date indicate no hydraulic connection between the A Sand to either the overlying or underlying sands. Before the initiation of ISR operations, extensive aquifer testing would be conducted in each production area. For the Nichols Ranch Unit ISR Project, the applicant demonstrated through modeling that a 1 percent production bleed would be maintained to ensure groundwater flow is toward the production zone (Uranerz, 2007). This inward groundwater flow toward the extraction wells minimizes the potential for horizontal excursions of leaching solutions away from the production zone. To ensure the hydrogeology and monitoring wells are sufficient to prevent and correct an excursion, the aquifer testing field results for at least the first wellfield package at the Nichols Ranch Unit would be provided in wellfield hydrologic data package submitted to NRC staff by license condition for review and approval before operations begin.

At the Hank Unit, the occurrence of unconfined aquifer (unsaturated) conditions in the production zone presents special considerations to maintain the necessary hydraulic control of the wellfield through an inward hydraulic gradient, to monitor the wellfield periphery, and to reverse a potential horizontal excursion by drawing lixiviant back to a producing well. The licensee must demonstrate that groundwater levels in the unconfined aquifer would be sufficient to support the extraction rate required to pull back a horizontal or vertical excursion without dewatering the ore zone. By license condition, NRC will require the applicant to conduct a hydrogeologic test at the Hank Unit using the proposed injection and production pattern to demonstrate that an inward gradient to the wellfield can be maintained in the unconfined aquifer given the planned production bleed during the operation and that an excursion could be corrected. The applicant has already performed several pumping tests at the Hank Unit, which indicate no hydraulic connection between the production zone and the overlying and underlying aquifers across the aquitards above and below the F Sand production aquifer. The applicant will also perform additional wellfield pumping tests before operations to verify this lack of vertical communication and to demonstrate the wellfield is in hydraulic communication with the monitoring ring wells. By license condition, NRC will require that the applicant provide detailed hydrologic test data packages for the first wellfield describing the wellfield pumping tests to demonstrate that all of these requirements are satisfied before the operations at the Hank Unit will be approved.

In addition, for both the Nichols Ranch and Hank Units, NRC will require by license condition that the applicant maintain an inward hydraulic gradient in the production aquifer within the perimeter monitoring ring wells during all phases of the ISR lifecycle to prevent horizontal excursions. NRC will require another license condition that if an excursion is detected and confirmed in a monitoring well, the excursion must be reported to NRC within 24 hours and the licensee must take corrective action. Because NRC would require the applicant to take preventative measures to reduce the likelihood and consequences of potential excursions, and impose several license conditions that would require extensive further testing to demonstrate hydraulic control to prevent and correct excursions, the NRC staff concludes the estimated environmental impact on groundwater quality from a potential excursion at the Nichols Ranch Project would be SMALL.

To prevent any impact to overlying, underlying, and surrounding groundwater after production operations are completed, the licensee would be required to return water-quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in 10 CFR Part 40, Appendix A, Criterion 5B(5), "at the point of compliance, the concentration of a hazardous constituent must not exceed (a) the Commission approved background concentration of that constituent in the groundwater; (b) the respective value given in the table if the constituent is listed in the table and the background level of the constituent is below the value listed; or (c) an

alternative concentration limit (ACL) established by the Commission." Only after demonstrating that it cannot restore a particular hazardous constituent to the background concentration or maximum contaminant level (MCL) can a licensee request a license amendment from NRC for an ACL for a particular hazardous constituent. Appendix C explains the process for granting an ACL. For ACLs to be approved, they must be shown to protect public health at the site. For these reasons, potential impacts to the aquifers surrounding the wellfield production zone aquifer after operations at the Nichols Ranch Project would be SMALL.

4.5.2.1.2.3 Operations Impacts to Deep Aquifers Below the Production Aquifers

Environmental impacts on confined deep aquifers located below the production aquifers could result from deep well injection of byproduct material. Under the Safe Drinking Water Act (SDWA), EPA has statutory authority to regulate injection well activities that may affect the environment. Underground injection of fluid requires a permit from EPA or from an authorized state UIC program under the SDWA. WDEQ has been authorized to administer the UIC program in Wyoming and is responsible for issuing permits for deep well disposal at the proposed Nichols Ranch ISR Project site. WDEQ would only permit Class I disposal wells if the groundwater quality in the injection zone would not be suitable for domestic or agricultural uses (e.g., high salinity), if the groundwater could not be designated as a USDW, and if the injection zone was confined above by sufficiently thick and continuous low-permeability layers. The GEIS concluded that the potential environmental impact of injecting byproduct material into deep aquifers below the ore-bearing aquifers would be SMALL if the aquifers were located below a USDW, if water production from deep aquifers was not economically feasible, or if the groundwater quality from these aquifers would not be suitable for domestic or agricultural uses (e.g., high salinity) and if they were confined above by sufficiently thick and continuous low permeability layers (NRC, 2009a).

GEIS Section 4.3.4.2.2.3 stated that in the Wyoming East Uranium Milling Region where the proposed Nichols Ranch ISR Project is located, the Paleozoic aquifers are hydraulically separated from the proposed aquifer sequence where ISR operations would occur (NRC, 2009a). The stratigraphic sequence, from shallowest to deepest, includes the Wasatch Formation, Fort Union Formation, Lance Formation, and the Fox Hills Formation. Thick, low-permeability confining layers separate the aquifer sequence, including the Pierre Shale, the Lewis Shale, and the Steele Shale (Whitehead, 1996). Hence, the nonkarstic Paleozoic aquifers (e.g., Tensleep Sandstone) can be investigated for their suitability for deep well disposal of liquid effluent. The GEIS concluded that in the Wyoming East Uranium Milling Region, because of the relative poor water quality in and the reduced water yields from nonkarstic Paleozoic aquifers and the occurrence of thick and regionally continuous aquitards confining them from above, the potential environmental impacts from deep well injection of liquid effluent into the nonkarstic Paleozoic aquifers could be SMALL (NRC, 2009a). Regionally, the Pierre Shale was reported to be fractured in some places (Whitehead, 1996). Because of potential heterogeneities in the hydrologic properties of the Pierre Shale, the potential impacts could range from SMALL to MODERATE at locations where the Pierre Shale is fractured.

WDEQ is reviewing a permit application for up to four Class I wells to be drilled in each the Nichols Ranch Unit and the Hank Unit, depending on the production rates and the capacity of each disposal well. The application states that the fluid would be injected in the Cretaceous Teckla, Teapot, and Parkman sandstones at depths of approximately 2,326 to 2,652 m [7,630 to 8,700 ft] bgs at the Nichols Ranch Unit and at depths of approximately 2,360 to 2,652 m [7,740 to 8,700 ft] bgs at the Hank Unit. This aquifer may be a candidate for exempt aquifer status if (i) it does not currently serve as a source of drinking water; (ii) it cannot now, or will not in the

future, serve as a source of drinking water because of contamination or economic or technical impracticability; and (iii) the TDS concentrations are greater than 3,000 ppm and less than 10,000 mg/L, and not reasonably expected to supply a public water system (40 CFR 146.4). WDEQ will evaluate the suitability of the formations the applicant has proposed for deep well injection and would only grant a permit if the applicant demonstrates that liquid effluent could be safely isolated in a deep aquifer. Consequently, the NRC staff concludes that if WDEQ were to issue a permit for these wells, the potential environmental impact on deep aquifers from deep well injection at the proposed Nichols Ranch ISR Project would be SMALL.

4.5.2.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.4.2.3 describes the potential environmental impact on groundwater resources during aquifer restoration and states the impact is from groundwater consumptive use and waste management practices, including the potential deep disposal of brine slurries from reverse osmosis (NRC, 2009a). The purpose of aquifer restoration is to return the groundwater quality in the production zone to groundwater protection standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards state the concentration of a hazardous constituent must not exceed (i) the Commission-approved background concentration of that constituent in groundwater, (ii) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed, or (iii) an alternative concentration limit the Commission establishes.

The applicant is planning three phases of aquifer restoration: groundwater sweep, groundwater transfer, and groundwater treatment. The actual restoration sequence would be based on operating conditions. The applicant stated that restoration would be sequenced with production, meaning that initially only production would occur. However, when production moved from one wellfield to another, restoration and production would occur simultaneously. After production was complete, only restoration would occur (Uranerz, 2007).

Hydraulic control of the former production zone during each restoration phase would be maintained by establishing an inward hydraulic gradient through production bleed (see SEIS Section 4.5.2.1.2.2). As discussed in the GEIS, the impact from groundwater consumptive use during aquifer restoration is generally greater than during ISR operations (NRC, 2009a). The applicant stated that aquifer restoration would consume additional water during the groundwater sweep phase because water would not be reinjected. During the groundwater treatment phase, approximately 20 to 25 percent of the groundwater treatment flow through the reverse-osmosis system would be disposed of as brine via deep well disposal. Based on the projected disposal rates for the deep disposal wells, net withdrawals from both the Nichols Ranch and Hank Units could approach 380 Lpm [100 gpm] during the combined production and restoration operations and during restoration alone (Uranerz, 2007).

The applicant's drawdown predictions (see SEIS Section 4.5.2.1.2.2) show that at a pumping rate of 133 Lpm [35 gpm], the potential drawdown from restoration of the Nichols Ranch Unit would affect an area within an 8-km [5-mi] radius. During Nichols Ranch Unit operations, restoration consumptive use could increase to 340 Lpm [90 gpm], which would increase the drawdown outside the proposed project area to much greater than the 9 m [30 ft] at 2,133 m [7,000 ft] from the center of the proposed project area, that was predicted for the production consumptive use at a pumping rate of 133 Lpm [35 gpm] (Uranerz, 2007). The NRC staff concludes the environmental impact from groundwater consumptive use during aquifer restoration of the Nichols Ranch Unit would therefore be MODERATE at private wells located just outside the Nichols Ranch Unit boundary. The applicant stated that it has confidential

agreements in place with private well owners to either provide the pumping capability or to replace wells if the water level drawdowns affect well yield. After production and aquifer restoration are completed and groundwater withdrawal ceased at the Nichols Ranch Unit, the groundwater levels would recover with time. Therefore, the NRC staff concludes the potential long-term environmental impact from consumptive groundwater use during the restoration phase at the Nichols Ranch Unit would be SMALL.

For the Hank Unit, the production drawdown predictions (see SEIS Section 4.5.2.1.2.2) show that at a production rate of 284 Lpm [75 gpm], limited, localized drawdowns would result because of the unconfined nature of the F Sand production aquifer at the Hank Unit (Uranerz, 2007). The additional pumping that could occur during aquifer restoration could increase the consumptive use to 340 Lpm [90 gpm], but given the unconfined aquifer setting, the NRC staff concluded this additional 15 gpm over the production consumptive use of 284 Lpm [75 gpm] would not likely significantly increase the drawdown. Therefore, the NRC staff concludes the potential environmental impact from consumptive groundwater use during aquifer restoration at the Hank Unit would be SMALL.

The process of aquifer restoration is described in GEIS Section 2.5 (NRC, 2009a). Restoration fluids would be transported via a network of buried pipelines between the pump house and the satellite facility or central processing plant; buried pipeline would also connect injection and extraction wells to manifolds inside the header houses. As lixiviant injection is terminated, fluids transported in the pipelines during aquifer restoration would have lower concentrations of hazardous constituents than production fluids. The potential failure of pipeline fittings or valves, or a failure of well mechanical integrity in shallow aquifers, could result in leaks and spills that could impact the water quality in shallow aquifers. However, as discussed in SEIS Section 4.5.2.1.2.1, the applicant has committed to implementing a leak-detection and spill-cleanup program (Uranerz, 2007), and NRC and the WDEQ UIC program would regulate well mechanical integrity testing. The NRC staff concludes the implementation of these mitigative measures would result in a SMALL impact on shallow (near-surface) aquifers at the Nichols Ranch and Hank Units.

The applicant has proposed to use deep well injection for disposal of liquid effluent during restoration and obtain Class I UIC permits from WDEQ for four disposal wells at each unit. By license condition, NRC will require the applicantto have enough disposal capacity to support operations. As discussed, the NRC staff concludes the potential environmental impact from deep well injection into deep aquifers located below the production aquifers would be SMALL because of WDEQ UIC permit requirements. The applicant also indicated (Uranerz, 2010) that if a disposal well became inoperable because of mechanical problems with pumps, piping, valves, or a mechanical integrity test failure, large tanks at each unit would provide surge capacity. This availability of water disposal capacity is critical to ensure that an inward gradient can be maintained during restoration through the wellfield consumptive water use. At the Nichols Ranch Unit, surge capacity would be provided by four tanks, each with a capacity of 64,350 L [17,000 gal]. At the Hank Unit, the applicant stated that surge capacity would be provided by six 64,350 L [17,000 gal] tanks. At the projected fill rates, the applicant estimated 22 to 24 hours of surge capacity would be provided by the tanks (Uranerz, 2010). In the case of emergency maintenance, the applicant also estimated the maximum down time for each deep disposal well as 5 days and proposed a plan to obtain readily available, large capacity bladder tanks with a volume of 63,600 L [16,800 gal] for additional surge capacity. The applicant committed to having two operational deep disposal wells and adequate availability of spare parts before commercial operations begin at the Nichols Ranch ISR Unit (Uranerz, 2010). The applicant also committed to other options to manage surge capacity in addition to the rental of

bladder tanks as discussed previously, which included hauling solution by tanker truck to the other unit and reducing production flow rates to minimize the tank fill rate. Because of the applicant's commitment to provide fixed surge capacity onsite, and the availability of different options to provide additional surge capacity, the NRC staff concludes the potential impact from the loss of disposal well availability would be SMALL.

The applicant also analyzed natural groundwater gradient recovery and lixiviant plume transport from shutting down an operational wellfield (in either the production or aquifer restoration phase) if all the deep disposal wells become inoperable and surge capacity exhausted. The applicant calculated that if the inward gradient was lost, the natural groundwater velocities of 3.7 m/yr [12 ft/yr] for the Nichols Ranch Unit and 5.4 m/yr [8 ft/yr] for the Hank Unit would result in migration of the lixiviant plume by about 0.6 m [2 ft] or less during 45 days of a nonoperating disposal well. The applicant's calculations demonstrated the plume could be recovered once the deep disposal wells became fully operational. The NRC staff concludes that the potential impact from this type of wellfield shut-in would be SMALL.

The applicant has proposed to dispose of liquid effluent during restoration using deep well disposal and has submitted a permit application to WDEQ for Class I injection wells. Each unit could have up to four deep injection wells. WDEQ would evaluate the suitability of the proposed deep disposal wells. WDEQ would only grant such a permit if the waste fluids can be suitably isolated in a deep aquifer. Consequently, the NRC staff concludes the estimated environmental impact on deep aquifers located below the production zone aquifers from deep well disposal would be SMALL.

4.5.2.1.4 Decommissioning Impacts

GEIS Section 4.3.4.2.4 describes the environmental impact on groundwater during the dismantling and decommissioning of ISR facilities and states the impact would primarily be from consumptive groundwater use, from potential spills of fuels and lubricants, and from improperly plugged and abandoned wells. Consumptive groundwater use could result from the use of water for dust suppression, revegetation, and reclaiming disturbed areas. The environmental impact during the decommissioning phase would be similar to potential impacts during the construction phase. Groundwater consumptive use during the decommissioning phase would be less than groundwater consumptive use during the ISR operation and groundwater restoration phases. Potential spills of fuels and lubricants during the decommissioning phase could impact shallow aquifers. Implementation of BMPs during decommissioning could reduce the likelihood and magnitude of such spills and facilitate cleanup (NRC, 2009a).

Before NRC terminates an ISR source material license, a licensee must demonstrate that there would be no long-term impacts to USDWs. NRC review and approval of the wellfield restoration would ensure that the restoration standards were met and were protective of public health and safety (NRC, 2009a).

After completion of ISR operations at the proposed Nichols Ranch ISR Project, improperly plugged and abandoned wells could potentially impact aquifers overlying the production zone by providing a hydrologic conduit between the aquifers. As part of the restoration and reclamation activities, the applicant would plug and abandon monitoring, injection, and production wells in accordance with Wyoming UIC requirements. The wells would be filled with cement and clay and the casing cut off below plow depth to ensure groundwater would not flow through abandoned wells (Uranerz, 2007). If wells were properly plugged, abandoned, and isolated

from the flow domain, the NRC staff concludes the potential environmental impact would be SMALL (NRC, 2009a).

4.5.2.2 No-Action (Alternative 2)

Under the No-Action alternative, no construction or operational activities would occur onsite that could impact shallow groundwater. No lixiviant would be injected into the production aquifer nor would consumptive groundwater use occur under this alternative. No disposal of liquid effluent and solid waste would occur from the proposed action; therefore, there would be no threat to groundwater quality from the proposed action. Impacts on groundwater from other activities in the area, such as CBM extraction, could occur.

4.5.2.3 Modified Action–No Hank Unit (Alternative 3)

Under Alternative 3, the applicant would construct, operate, perform aquifer restoration, and decommission facilities for ISR uranium milling and processing for only the Nichols Ranch Unit. ISR operations would not occur at the Hank Unit. Under Alternative 3, the same environmental impacts evaluated for the Nichols Ranch Unit under Alternative 1 (see Section 4.5.2.1 of the SEIS) would result; however, there would be no impact at the Hank Unit.

4.5.2.3.1 Construction Impacts

As shown for the evaluation of the environmental impacts at the Nichols Ranch Unit in SEIS Section 4.5.2.1.1, the estimated environmental impacts to groundwater resources during construction of the Nichols Ranch Unit would be SMALL, based on the limited nature of construction activities and implementation of BMPs to protect shallow groundwater.

4.5.2.3.2 Operations Impacts

As discussed in SEIS Section 4.5.2.1.2, during the operation phase, the estimated environmental impact on shallow groundwater quality at the Nichols Ranch Unit would be SMALL. Additionally, the short-term environmental impact from consumptive groundwater use during the operations phase at the Nichols Ranch Unit would be SMALL. After production and aquifer restoration were complete and groundwater withdrawals had ceased, the groundwater levels would recover with time. Thus, the estimated long-term impact from consumptive groundwater use during the operations phase at the Nichols Ranch Unit would be SMALL. The NRC staff concludes the environmental impact on groundwater quality in the production zone during operations would be SMALL at the Nichols Ranch Unit. During operations, the estimated environmental impact on deep aquifers below the production zone from deep well disposal of liquid effluent would be SMALL.

4.5.2.3.3 Aquifer Restoration Impacts

As discussed in SEIS Section 4.5.2.1.3, the short-term environmental impact from consumptive groundwater use during aquifer restoration at the Nichols Ranch Unit could be MODERATE. After production and aquifer restoration were completed and groundwater withdrawals ceased, the groundwater levels at the Nichols Ranch Unit would recover with time. Thus, the NRC staff concludes the estimated long-term environmental impact from consumptive groundwater use during the aquifer restoration phase at the Nichols Ranch Unit would be SMALL. The estimated impact on shallow groundwater during restoration at the Nichols Ranch Unit would be SMALL.

During aquifer restoration, the environmental impact on deep aquifers from disposal of liquid effluent below the production aquifers would be SMALL.

4.5.2.3.4 Decommissioning Impacts

During decommissioning, the environmental impact on groundwater resources in shallow aquifers at the Nichols Ranch Unit would be SMALL. As described in SEIS Section 4.5.2.1.4, before NRC terminates an ISR source material license, a licensee would need to demonstrate there would be no long-term impacts to USDWs. NRC approval after wellfield restoration completion would determine that the restoration standards had both been met and were protective of public health and safety.

4.6 Ecological Resources Impacts

Potential environmental impacts to ecological resources at the proposed Nichols Ranch ISR Project site may occur during all phases of the ISR facility lifecycle. Impacts may include removal of vegetation from the site (with the associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); modification of existing vegetative communities as a result of site activities; loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Impacts to wildlife could involve loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct or indirect mortalities. Disturbance of stream channels, increases in suspended sediments, fuel spills, and habitat reduction could affect aquatic species.

The potential environmental impacts to ecological resources from construction, operation, aquifer restoration, and decommissioning are detailed in the following sections.

4.6.1 Proposed Action (Alternative 1)

4.6.1.1 Construction Impacts

As discussed in GEIS Section 4.3.5.1, during construction, terrestrial vegetation may be affected through (i) the removal of vegetation from the milling site (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (ii) the modification of existing vegetative communities; (iii) the loss of sensitive plants and habitats as a result of clearing and grading; and (iv) the potential spread of invasive species and noxious weed populations. As further indicated in the GEIS, the percentage of vegetation removed and land disturbed by construction activities (from less than 1 percent and up to 20 percent of the permit area) would be a SMALL impact compared to the total permit area and surrounding plant communities. Additionally, the clearing of herbaceous vegetation in an open grassland or shrub steppe community would have a short-term SMALL impact, given the rapid colonization of annual and perennial species in the disturbed areas. The clearing of wooded areas may have a long-term impact given the pace of natural succession, and such impacts could range from SMALL to MODERATE, depending on the amount of the surrounding wooded area. Noxious weeds would be expected to be controlled with appropriate spraying techniques and therefore impacts would be SMALL.

Ecological resources could be affected by land disturbance during facility construction. The construction phase of the proposed Nichols Ranch ISR Project could potentially impact ecological resources from clearing vegetation; constructing the central processing plant and the

satellite facility; developing the wellfields, including drilling wells; building header houses; constructing access roads; and clearing field laydown areas

4.6.1.1.1 Terrestrial Ecology

The terrestrial ecology at the proposed Nichols Ranch ISR Project is discussed in the following sections. Potential impacts to vegetation and wildlife are described in Sections 4.6.1.1.1.1 and 4.6.1.1.1.2, respectively.

4.6.1.1.1.1 Vegetation

Because sagebrush shrublands and mixed grasslands cover 88 percent of the proposed Nichols Ranch ISR Project, these plant communities would be most affected by the proposed action (Uranerz, 2007). A total of 120 ha [300 ac] of land would be disturbed by the proposed Nichols Ranch ISR Project from construction of the central processing plant, satellite facility, main access roads, and wellfields. This disturbance would occur over an anticipated 10 year life of the project and would affect approximately 24 to 32 ha [60 to 80 ac] of land at any time. The majority of vegetation disturbance would result from wellfield development, and each wellfield area would be reclaimed and reseeded with native plants and grasses as soon as practicable following project completion in accordance with a reclamation plan that would consider WDEQ-LQD regulations and the requirements in the WDEQ mine permit. Some recruitment from native populations bordering disturbed areas can also be expected, which would facilitate the revegetation process.

Existing access roads would be used and possibly upgraded to minimize new disturbance of sagebrush habitat following BLM and Wyoming Game and Fish Department (WGFD) recommendations to minimize road width, revegetate road shoulders, and limit vehicle speeds.

Surface disturbance from the construction activity of the proposed Nichols Ranch ISR Project could result in the spread of invasive and noxious weeds. One noxious weed species, Canada thistle (*Cirsium arvense*), is found in the proposed project area. Canada thistle can crowd out native species and reduce crop and forage yields if not properly controlled. The applicant has committed to mitigation measures, which include washing, on an as needed basis, vehicles that come into the proposed Nichols Ranch ISR Project and herbicide application, as necessary, to control the spread of Canada thistle and prevent the introduction of any additional noxious weeds (Uranerz, 2007).

Because the disturbed land area of 120 ha [300 ac] would comprise less than 10 percent of the total proposed project site {1364 ha [3,371 ac]}, some vegetation would be affected. However, because construction activities would not affect 120 ha [200] contiguous acres and the predominant vegetation communities comprise 88 percent of the site, the potential impact would not affect a sizeable segment of any species' population. Furthermore, disturbed areas would be revegetated according to a reclamation plan, and the applicant would implement mitigative measures to minimize the spread of noxious weeds (Uranerz, 2007). Therefore, the potential impact on vegetation during the construction phase would be SMALL.

4.6.1.1.1.2 Wildlife

As discussed in GEIS Section 4.3.5.1, during construction, terrestrial wildlife may be affected through (i) habitat loss or alteration and incremental habitat fragmentation, (ii) displacement of wildlife from project construction, and (iii) direct or indirect mortalities from project construction

and operation. The GEIS also states that construction impacts to wildlife habitat would be minimized with the timely reseeding of disturbed areas following construction. In general, wildlife species could disperse from the project area as construction activities approach, although smaller, less mobile species may die during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities could occur, and thus construction impacts could be SMALL to MODERATE. If an applicant or licensee adhered to WGFD-recommended standard management practices, the potential impact to wildlife could be mitigated as discussed in the following sections. Furthermore, the BLM and WGFD published guidelines to mitigate potential impacts to Greater sage-grouse (*Centrocercus urophasianus)* and big game species that the applicant could also implement. Potential impacts to raptor species from power distribution lines could be mitigated by following the Avian Power Line Interaction Committee (APLIC) guidance and to avoid activities near active nests, especially prior to the fledgling of young (APLIC, 2006).

Big Game

Pronghorn antelope (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) are the most likely big game species to be impacted by construction of the proposed Nichols Ranch ISR Project. These species would be affected by reduction of available habitat due to fencing of primary facilities, disturbance of a portion of winter/yearlong range, loss of forage, and the potential for vehicular collision accidents. During baseline wildlife inventories the applicant conducted (Uranerz, 2007), pronghorn antelope were mainly observed in mixed grassland and sagebrush shrubland vegetative communities, which are the vegetative communities most likely to be disturbed during construction. Mule deer were generally observed in mixed sagebrush grassland and juniper outcrop vegetative communities. Juniper outcrop would likely continue to be available for foraging throughout the life of the proposed project.

An estimated 120 ha [300 ac] would be disturbed during the approximate 10-year life of the ISR facility with 24 to 32 ha [60 to 80 ac] disturbed at a time. Winter/yearlong range carrying capacity for big game species could be reduced during the life of the proposed Nichols Ranch ISR Project and for several years thereafter until vegetative growth in restored areas becomes productive enough to support big game. However, the proposed Nichols Ranch ISR Project site covers an area of 13 km^2 [5 mi^2], which is a small fraction (0.003 percent) of the 2,485 km^2 [1,544 mi^2] area covered by the Pumpkin Buttes Antelope Herd Unit; therefore, the proposed action would have a negligible effect on the pronghorn antelope population either during the construction phase or over the 10-year lifespan of the proposed project. Likewise, the Pumpkin Buttes Mule Deer Herd Unit also occupies a large area {4,355 km^2 [2,706 mi^2]} compared to the 13 km^2 [5 mi^2] area comprising the proposed Nichols Ranch ISR Project; therefore, the proposed action would have a negligible effect on the mule deer population.

The potential for vehicular collisions with big game species would not significantly increase in the area, because of the short distance of the access roads {approximately 0.32 km [0.20 mi] in length}. The applicant's mitigative actions such as the enforcement of speed limits {32 to 48 kph [20 to 30 mph]} on the access roads would further reduce big game conflicts. Direct impacts to the pronghorn antelope and mule deer would be SMALL because a few animals could be affected and the continued existence of the species would not be threatened.

Big game species could be indirectly affected during construction by noise, (including generator noise), lighting, and human presence, which could cause these species to avoid habitat adjacent to disturbed areas. However, the construction phase of the proposed Nichols Ranch ISR Project has been projected at 9 months to 1 year in duration and adequate habitat for both

pronghorn antelope and mule deer exists in the surrounding areas; therefore, displaced populations could return to affected areas after the construction phase was complete. Furthermore, the applicant committed to implement mitigation measures, such as reduced speed limits and the use of fencing over the lifespan of the proposed project, to reduce the risk of vehicular collision (Uranerz, 2007). Therefore, the potential impact on big game species during the construction phase would be SMALL.

Upland Game Birds

Greater sage-grouse and gray partridge (*Perdix perdix*) are the most likely upland game bird species to be potentially impacted by construction of the proposed Nichols Ranch ISR Project. Sage-grouse is a federal candidate species, a State of Wyoming species of concern, and a BLM-designated sensitive species and is discussed in more detail in Section 4.6.1.1.3 of the SEIS. Direct impacts to upland birds from proposed project activities would include habitat loss and fragmentation from wellfield, road, pipeline, and power line construction; alteration of plant and animal communities; increased human activity or noise (including generator noise), that could cause the birds to avoid a specific area or reduce breeding efficiency; increased motorized access to the public, which could lead to harvesting of individuals (legal and illegal); greater risk of mortality from vehicular collisions; and an increase in mortality from raptors if power poles or tall buildings are placed in occupied habitat.

Because only 24 to 32 ha [60 to 80 ac] of the proposed Nichols Ranch ISR Project site would be disturbed at any given time, some individuals would be displaced and temporary habitat loss would occur over the life of the proposed project as development progressed. The applicant would minimize the removal and disturbance of vegetation, where possible, through the use of existing ranch roads for travel and for the placement of pipelines (Uranerz, 2007). The land disturbed by the proposed project would be revegetated following the reclamation process that would be described in the applicant's final decommissioning plan. The plan which would be submitted to the NRC for review and approval at least 12 months prior to the planned decommissioning of either a project area or wellfield (Uranerz, 2007). The applicant's commitment to implement mitigative measures, such as minimizing noise, vehicular traffic, and human proximity, near Greater sage-grouse leks (discussed in detail in Section 4.6.1.1.3 of the SEIS) would also benefit gray partridge and other upland bird species and nests within the vicinity of the leks. Therefore, the potential impact to upland game birds during the construction phase would be SMALL.

Raptors

The red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), prairie falcon (*Falco mexicanus*), long-eared owl (*Asio otus*), great horned owl (*Bubo virginianus*), and the rough-legged hawk (*Buteo lagopus*) occur on or in the vicinity of the proposed Nichols Ranch ISR Project site based on raptor surveys the applicant during conducted 2006 and 2007 as discussed in Section 3.6.1.2.3 of the SEIS. These would be the primary raptor species potentially impacted by the proposed action. Raptors are particularly sensitive to noise and the presence of human activity, which would be heightened during the construction period. Direct impacts to raptor species include displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbance, and the potential reduction in prey populations within the proposed project site.

The applicant would follow an annual raptor monitoring and mitigative plan to minimize conflicts between active nest sites and project-related activities (Uranerz, 2007). Mitigative measures, such as minimizing noise, vehicular traffic, and human proximity, taken near the Greater sage-grouse leks (discussed in detail in Section 4.6.1.1.3 of the SEIS), would also benefit raptor species and nests within the vicinity of the leks. Additional seasonal guidelines with respect to noise (including generator noise),, vehicular traffic, and human proximity for wildlife have been established by the WGFD (WGFD, 2010) and BLM (BLM, 2008). Based on the applicant's implementation of the mitigative measures described previously, the potential impact to raptor species during the construction phase would be SMALL.

Waterfowl and Shorebirds

Only limited, seasonal wetland habitat exists on the proposed Nichols Ranch ISR Project site for waterfowl and shorebirds; therefore, construction would not be expected to disrupt any breeding or nesting habitat. The wetland areas would not be disturbed by construction and would be avoided by project-related vehicles (discussed in more detail in Section 4.5.1 of the SEIS); therefore, there would be no impact to the limited existing habitat. The impact to waterfowl and shorebirds during the construction phase would be SMALL.

Nongame/Migratory Birds

Impacts to nongame/migratory birds would be similar to those discussed for upland game birds (Section 4.6.1.1.1.2 of the SEIS). Some habitat loss and potential reduction in the carrying capacity for nongame/migratory birds within the proposed project area would occur; however, because only 10 percent of the proposed project area would be affected by the proposed action and at any given time activities would be occurring over less than 1 percent of the area, the potential habitat loss would be minor. Direct impacts to nongame/migratory birds could include habitat loss and fragmentation, alteration of plant and animal communities, and increased human activity or noise that could cause the birds to either avoid a specific area or to reduce their breeding efficiency. Nongame/migratory birds would benefit from the implementation of mitigation measures near Greater sage-grouse leks (discussed in detail in Section 4.6.1.1.3 of the SEIS) because these measure would limit noise, vehicular traffic, and other human disturbances near these areas. Therefore, the potential impact to nongame/migratory birds during the construction phase would be SMALL.

Other Mammals

Mammalian predators such as the bobcat (*Lynx rufus*), badger (*Taxidea taxus*), coyote (*Canis transens*), and swift fox (*Vulpes velox*) would experience habitat loss and fragmentation and potential range reduction. Displacement of prey species may reduce food availability within the area; however, the outbreak of tularemia in the vicinity of the proposed site during the 2006 and 2007 wildlife inventories may have affected the rodent prey base and caused a shift of predators to neighboring areas. Predator species are more sensitive to noise and the presence of human activity, which would be heightened during the construction phase, though the species documented onsite are nocturnal; therefore, construction that occurred during daylight hours would not be expected to noticeably alter these species' patterns or behavior. Impacts to the swift fox (*Vulpes velox*), specifically, are discussed in more detail in Section 4.6.1.1.3 of the SEIS.

Desert cottontails (*Sylvilagus audubonii*), white-tailed jackrabbits (*Lepus townsendii*), ground squirrels (*Spermophilus tridecemlineatus*), black-tailed prairie dogs (*Cynomys ludovicianus*),

and other rodents would experience habitat loss or displacement. Because these species build dens, loss of habitat from construction activities on or near dens would have a greater effect on these species compared to the mammalian predator species discussed previously. Other potential impacts would include the increased potential for vehicular collision. Because small mammals are relatively abundant in the proposed project area and generally show a preference for disturbed areas, construction impacts would not impact the population size of any small-mammal species within the area. Impacts to black-tailed prairie dogs are discussed in detail in Section 4.6.1.1.3 of the SEIS.

Because only a few individuals would be affected and most mammal species would likely travel to suitable habitat adjacent to construction areas, the potential impact to other mammals from construction of the proposed Nichols Ranch ISR Project would be SMALL.

Reptiles and Amphibians

Prairie rattlesnake (*Crotalus viridis*) and bullsnake (*Pituophis melanoleucas sayi*) were the only species observed during the applicant's 2006 and 2007 wildlife inventories (Uranerz, 2007). During the construction phase, the potential impact to reptile and amphibian species would be similar to that described for mammal species (Section 4.6.1.1.1.2 of the SEIS), which includes loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of vehicular collision. Because of the small amount of land {i.e., 24 to 32 ha [60 to 80 ac]} that would be disturbed at any given time during the life of the proposed project and the limited occurrence of habitat to support amphibians and reptiles within the proposed project area, the potential impact on either reptile or amphibian species' population during the construction phase would be SMALL.

Summary of Wildlife Impacts

As described previously, crucial habitat and mating areas are neither present within the proposed Nichols Ranch ISR Project area nor would the small disturbed area affect a large proportion of a species habitat. Furthermore, the applicant has committed to mitigate the potential impact to wildlife through the implementation of reduced speed limits, limited hours for construction, and fencing to further reduce the potential impact to wildlife. For these reasons, the NRC staff concluded the potential impact to wildlife during the construction phase would be SMALL.

4.6.1.1.2 Aquatic Ecology

GEIS Section 4.3.5.1 discussed impacts to aquatic species that could be temporarily disturbed by in-stream channel activities and concluded the potential impact would be SMALL. Sediment loads in streams would be expected to taper off quickly both in time and distance, and long-term impacts would be SMALL. Additionally, standard management practices WGFD issues would help to limit impacts to aquatic life.

Because of the limited occurrence of surface water at the proposed Nichols Ranch ISR Project, the occurrence of aquatic species is also limited. As described in Section 3.6.2 of the SEIS, surface water at the proposed project site is ephemeral and seasonal in nature; thus, the site does not provide a year round source of surface water sufficient to maintain a population of aquatic species. Therefore, the potential impact on aquatic species from implementing the proposed Nichols Ranch ISR Project site would be SMALL.

4.6.1.1.3 Protected Species

As discussed in GEIS Section 4.3.5.1, if threatened or endangered species are identified on the proposed project site, the potential impact could range from SMALL to LARGE, depending on site conditions. Mitigation plans to avoid and reduce impacts to potentially affected species would be developed.

One federal candidate species, the Greater sage-grouse, is known to occur in the vicinity of the proposed Nichols Ranch ISR Project site. There are eight known leks within a 3.2-km [2-mi] radius of the Hank Unit, and one lek within a 3.2-km [2-mi] radius of the Nichols Ranch Unit. No suitable habitat for the blowout penstemon (*Penstemon haydenii*) or Ute ladies'-tresses orchid (*Spiranthes diluvialis*) exists on the proposed site.

Potential suitable habitat {a black-tailed prairie dog complex totaling 381.1 ha [941.8 ac]} for the black-footed ferret (*Mustela nigripes*) exists; however, no black-footed ferret population occurs near the proposed site. The closest successfully reintroduced population of black-footed ferrets is in Shirley Basin, Wyoming, approximately 160 km [100 mi] south of the proposed Nichols Ranch ISR Project site (FWS, 2008). As discussed in Chapter 3, the U.S. Fish and Wildlife Service (FWS) (FWS, 2004) relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations; therefore, no specific surveys were conducted during the applicant's 2006 and 2007 wildlife inventories on the proposed Nichols Ranch ISR Project site. However, FWS continues to direct Federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret (FWS, 2004). Because of the presence of black-tailed prairie dog habitat, NRC conducted informal consultation with FWS to ensure the provisions of the Endangered Species Act (ESA) are upheld regarding the black-footed ferret for the proposed project. FWS concluded no adverse impacts to the species would be likely as a result of the proposed action (NRC, 2009c).

Several Wyoming species of concern and BLM-designated sensitive species are known to occur on and in the vicinity of the site. The bald eagle (*Haliaeetus leucocephalus*), black-tailed prairie dog (*Cynomys ludovicianus*), and swift fox (*Vulpes velox*) were recorded during wildlife inventories the applicant conducted (Uranerz, 2007) in 2006 and 2007.

No known bald eagle nests or roosts would be displaced during the construction phase. During its raptor nesting survey, the applicant identified the nearest nest 16 km [10 mi] west of the proposed site and winter roost 7.2 km [4.5 mi] southwest of the Nichols Ranch Unit. An additional winter roost was identified from information in the BLM (2009b). Construction would not directly impact any of these nests or roosts. However, individuals nesting nearby or migrating through the area could use the proposed Nichols Ranch ISR Project site and surrounding lands for foraging during winter months; these lands would be unavailable during construction until the disturbed areas were reclaimed and prey species returned. Because only 24 to 32 ha [60 to 80 ac] of land would be disturbed at any given time over the life of the proposed Nichols Ranch ISR Project, this disturbance would not significantly reduce the available foraging habitat on the proposed 1,365 ha [3,371 ac] site (Uranerz, 2007). Additionally, bald eagles prefer to nest and hunt near large lakes, rivers, and other open bodies of water near forested habitat (WGFD, 2005a); therefore, the proposed Nichols Ranch ISR Project site does not represent optimal or preferred habitat for the species.

On September 11, 2009, FWS published a rule concerning eagle take permits (74 FR 46836). NRC contacted FWS on March 15, 2010, to discuss whether the applicant would be required to obtain an eagle permit for the proposed Nichols Ranch ISR Project per this rulemaking. FWS concluded NRC does not need to further pursue consultation nor does the applicant need to obtain an eagle take permit for the proposed Nichols Ranch ISR Project, because no trees with nests would be disturbed (NRC, 2010).

A black-tailed prairie dog complex, consisting of 11 black-tailed prairie dog colonies and totaling 381.1 ha [941.8 ac], exists on or within a 3.2-km [2-mi] radius of the proposed Nichols Ranch ISR Project site. The largest of the colonies is located on the Nichols Ranch Unit. The applicant (Uranerz, 2007) stated it "will take steps to minimize disturbance to known small mammal habitat such as black-tailed prairie dog towns, but some disturbance will be unavoidable." Because slightly more than one-third {1,443 ha [356.5 ac]} of the prairie dog habitat is onsite, construction activities could significantly reduce available habitat to this species. Because construction would only disturb small areas of land at a time, the species would be displaced and could adapt to small losses of habitat over the course of the 10-year project lifespan. This species is also prey to a number of species, including the black-footed ferret, swift fox, mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*), all of which are federally or state-listed species. The mountain plover, a federal species proposed as threatened also relies on black-tailed prairie dog burrows for nesting areas. Therefore, destruction of prairie dog habitat could affect these species as well and reduce the amount of mountain plover breeding habitat within the Nichols Ranch Unit, forcing the mountain plover into poor quality habitat.

No BLM or Wyoming Natural Diversity Database (WYNDD) records suggest that mountain plovers have been observed within the proposed project area. The applicant Environmental Report (Uranerz, 2007, Section 3.5.3.3) states that the closest reported BLM sighting of mountain plover as of 2006 was approximately 6.4 km [4.0 mi] from the proposed project area. Only the Nichols Unit contains prairie dog colonies where project activities are planned. NRC staff confirmed that although most of Wyoming is part of the plover's breeding range including the proposed site, no confirmed or unconfirmed observations have been recorded at the proposed site (WYNDD, 2010; BLM, 2007). The highest populations of mountain plovers in Wyoming are found in the Shirley and Laramie Basins in the southern half of the state. Although overall impacts on mountain plovers from oil-and-gas type activities are relatively unknown, individual mountain plovers adapt well to human disturbances and could respond to proposed project activities by nesting in pipeline corridors, on roads, and in cleared areas (Andres, 2009). Conversely, human proximity could be disruptive. Because no mountain plovers have been observed at the proposed project site, mountain plovers are known to tolerate human disturbances, and because phased construction activities are planned over the life of the proposed Nichols Ranch ISR Project, the NRC staff concluded the potential impact to mountain plovers would be SMALL.

WGFD (2005b) contains management objectives for grassland and sagebrush shrubland habitat, which supports a number of Wyoming species of concern, including the black-tailed prairie dog. The objectives focus on working with private landowners and cooperatives with FWS, BLM, and the U.S. Forest Service (USFS) (WGFD, 2005b). WGFD aims to preserve 88,600 ha [219,000 ac] of black-tailed prairie dog habitat across the state. However, WGFD gives priority management attention to black-tailed prairie dog complexes that cover an area of at least 2,000 ha [5,000 ac] because WGFD considers conserving these to be "integral to the black-tailed prairie dog's ecology" and "important habitat for many associated or dependent species" (WGFD, 2005b). The black-tailed prairie dog habitat on and in the vicinity of the

proposed Nichols Ranch ISR Project site is not large enough to be considered a management priority; however, the applicant should strive to both avoid and to minimize noise, including generator noise, and traffic surrounding these areas during construction.

Eight Greater sage-grouse leks were identified within a 3.2-km [2.0-mi] radius of the Hank Unit and one lek within a 3.2-km [2.0-mi] radius of the Nichols Ranch Unit of the proposed Nichols Ranch ISR Project site, according to data provided by WGFD and reviewed by the Governor's Sage Grouse Implementation Team (Figure 3-8). None of these leks occur within the proposed project site; however, construction would result in habitat loss and fragmentation to the species, as well as alteration of the plant and animal communities in disturbed areas and increased noise and human activity, which could cause sage-grouse to avoid previously used habitat. In its license application (Uranerz, 2007), the applicant committed to implementing the following mitigative measures during construction to minimize potential impacts to the Greater sage-grouse:

- Minimize or delay project activity and vehicular traffic within 0.15 km [0.25 mi] of active leks between the hours of 8:00 p.m. and 8:00 a.m. during the March 1 to May 15 strutting period
- Minimize or delay project activity within 1.6 km [2.0 mi] of active leks between March 15 and July 15
- Avoid constructing overhead power lines or high-profile structures within 0.15 km [0.25 mi] of leks to minimize raptor predation
- Minimize removal of vegetation, where possible, and revegetate disturbed areas as soon as practicable following project completion

WGFD (2010) and BLM (2008b, 2010) established seasonal guidelines for Greater sage-grouse with respect to noise, vehicular traffic, and human proximity. The previously mentioned mitigation measures are consistent with these guidelines.

Swift fox (*Vulpes velox*) is also known to occur within the vicinity of the proposed site (Uranerz, 2007). No family groups or dens have been identified on the proposed site; however, construction could decrease the range of individuals and shift prey availability. Heightened noise and the presence of human activity during the construction phase could cause the species to avoid habitat located adjacent to the proposed site. However, because the swift fox is nocturnal and the species would likely avoid habitat near construction areas, the construction phase of the proposed Nichols Ranch ISR Project would not noticeably alter these species' patterns or behavior. WGFD considers the swift fox habitat vulnerable, but not in a state of ongoing significant loss (WGFD, 2005c); therefore, the small amount of land disturbed at one time over the life of the proposed Nichols Ranch ISR Project is unlikely to affect the local population of the swift fox.

Additional BLM-designated sensitive species and Wyoming species of concern may occur on or in the vicinity of the site but were not documented during the 2006 and 2007 wildlife inventories the applicant conducted (Uranerz, 2007). Some BLM-designated sensitive species and Wyoming species of concern are likely to be impacted by habitat loss or displacement. Additionally, behavioral changes may occur due to noise, lighting, and human proximity. Impacts to protected species would be minimized because only small areas of land would be disturbed at any given time during the life of the proposed project. Because potential black-

footed ferret habitat exists on and in the vicinity of the proposed site, NRC conducted informal consultation with FWS on November 6, 2009 (NRC, 2009c), to ensure the provisions of the ESA are upheld for this species. During the teleconference, NRC updated FWS on the status of the Nichols Ranch ISR Project environmental review and described the black-tailed prairie dog habitat on and in the vicinity of the proposed site. FWS indicated that because the habitat for the black-tailed prairie dog complex on the proposed project covers less than 400 ha [1,000 ac] [the minimum required for block-clearing the State of Wyoming (FWS, 2004)], the black-tailed prairie dog habitat on the proposed Nichols Ranch ISR Project site did not need to be surveyed. FWS also concluded NRC did not need to initiate formal consultation or submit a biological assessment (BA) for the black-footed ferret for the proposed Nichols Ranch ISR Project.

Because only 24 to 32 ha [60 to 80 ac] of the site would be disturbed at any given time over the life of the proposed project, no sensitive vegetation species occur on the proposed site, the proposed construction activities would not noticeably alter wildlife behaviors because of the limited disturbed area, and the applicant committed to implement sage-grouse guidelines the NRC staff concludes that the impact to protected species from construction activities would be SMALL.

4.6.1.2 Operations Impacts

As discussed in Section 4.3.5.2 of the GEIS, wildlife habitats could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. However, WGFD specifies fencing construction techniques to minimize impediments to big game movement.

As further indicated in GEIS Section 4.3.5.2, temporary contamination or alteration of soils could occur from operational leaks and spills and possibly from transportation or land application of treated wastewater. However, the detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soil would limit the magnitude of impacts to terrestrial ecology. The implementation of spill detection and response plans would also mitigate impacts to aquatic species from spills around well heads and from pipeline leaks. Mitigation measures such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys would limit the potential impact, and the GEIS concluded the impact to wildlife would be SMALL.

The potential impact to ecological resources during the proposed Nichols Ranch ISR Project operations would be consistent with the findings described in the GEIS because the same activities described in the GEIS would also be implemented at the proposed Nichols Ranch ISR Project. There would be less noise and less traffic during the operations phase compared to the construction phase; therefore, the potential to disrupt wildlife populations would be reduced along with a decrease in the probability of vehicular collisions. Only minor impacts to vegetative communities would occur because most of the clearing for the ISR facility would have occurred during the construction phase. Wildlife use of areas adjacent to ISR operations would be expected to increase as animals became habituated to site activities. Invasive and noxious weeds could potentially colonize disturbed areas, but would be monitored by the applicant. Disturbed areas would be reseeded with a WDEQ- and BLM-approved seed mixture to prevent the establishment of competitive weeds and restore habitat to native species. If noxious weeds continued to be a concern, other alternatives, such as herbicide application, could be considered.

The applicant's continued adherence to WGFD (2010) and BLM (2010) seasonal guidelines for noise, vehicular traffic, and human proximity for active sage-grouse leks would reduce the potential impact to these species. Potential conflicts between active raptor nest sites and project-related activities would be mitigated by the applicant's annual raptor monitoring and mitigation plans.

Therefore, the NRC staff concludes that the impact on ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during the operations phase would be SMALL and less than that experienced during the construction phase. Because of the limited occurrence and ephemeral nature of surface water located on the proposed Nichols Ranch ISR Project site, there would be no impact to aquatic species.

4.6.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.5.3 describes the potential impacts to ecological resources during the aquifer restoration phase. These impacts could include habitat disruption, but because existing (in-place) infrastructure would be used during aquifer restoration, little additional ground disturbance during aquifer restoration would occur.

The GEIS also indicated soil and surface water could be contaminated by leaks and spills. However, a licensee's use of detection and response techniques and eventual survey and decommissioning of potentially impacted soils and sediments would limit the magnitude of impacts to terrestrial and aquatic ecology. The use of mitigation measures such as perimeter fencing, netting, and leak detection and spill response plans would reduce the potential impact to SMALL. There would be no expected impacts to threatened and endangered species beyond those that occurred during the construction phase because the existing infrastructure from the operations phase described in Section 4.6.1.2 would continue to be used.

Impacts to ecological resources during the proposed Nichols Ranch ISR Project aquifer restoration phase would be consistent with the impact conclusions described in the GEIS because the site-specific actions fell within the bounds considered in the GEIS. Because the existing infrastructure from the operations phase would continue to be used during aquifer restoration and the applicant would continue to apply the mitigation measures described previously, the potential impact to ecological resources would be similar to that described for the operations phase. The potential Impact to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during aquifer restoration would be SMALL. No impact to aquatic species would be expected because of the limited occurrence and ephemeral nature of surface water located on the proposed Nichols Ranch ISR Project site.

4.6.1.4 Decommissioning Impacts

As described in GEIS Section 4.3.5.4, during decommissioning and reclamation, there would be temporary land disturbances to land as soils was excavated, buried piping was recovered and removed, and structures were demolished and removed. However, revegetation and recontouring would restore habitat previously altered by construction and operations. Wildlife would be temporarily displaced, but could be expected to return after decommissioning and reclamation were completed and vegetation and habitat had been reestablished. Decommissioning and reclamation activities could also result in temporary increases in

sediment load in local streams from surface water runoff, but aquatic species would recover quickly as the sediment load decreased. For these reasons, the GEIS concluded the potential impact from decommissioning would be expected to be SMALL.

As noted in the GEIS, potential impacts to threatened and endangered species could result from individual takes from conflicts with decommissioning activities (equipment, traffic). Temporary impacts from land disturbance could occur as structures were demolished and removed and ground surface recontoured. A threatened or endangered species inventory would be developed during the site-specific environmental review of the detailed decommissioning plan to identify unique or special habitats, and ESA consultations with the FWS would reduce the potential impact to threatened and endangered species. At the completion of decommissioning, revegetation, and recontouring, habitat would be reestablished and therefore, the impacts would be limited. The GEIS concluded the potential impact to threatened and endangered species could range from SMALL to LARGE, depending on site conditions. The activities resulting in impacts to ecological resources during the proposed Nichols Ranch ISR Project decommissioning activities are consistent with the activities described in the GEIS.

Revegetation of native grasses and plants would occur during the decommissioning stage. Sagebrush shrubland, which is the dominant vegetative community on the proposed site, is difficult to successfully reestablish, though refined techniques in seeding sagebrush have shown significant improvements in successful establishment of the species (Lambert, 2005). These improved methods include the use of cased-hole punched seeding with polypropylene casings as described by Booth (2005). For areas previously dominated by sagebrush, trained biologists could reestablish sagebrush using such techniques which could increase the success rate of sagebrush habitat restoration. As required for decommissioning, the applicant would submit an updated reclamation plan for review and approval by NRC and the appropriate state agencies.

Potential impacts to wildlife would be similar to those discussed for the construction phase in Section 4.6.1.1. Populations of small mammals and birds that reinhabited the project site after cessation of the ISR construction phase could be displaced during the decommissioning phase. Noise, lighting, and human proximity could cause wildlife avoidance of the proposed project site and adjacent habitat.

Decommissioning would involve abandoning of the central processing plant at the Nichols Ranch Unit and the satellite facility at the Hank Unit, the wellfields, and surface equipment including injection and production feed lines and buried wellfield piping. Stockpiled topsoil would be used to regrade the land to preconstruction contours. The applicant would conduct revegetation practices in accordance with WDEQ-LQD regulations and in accordance with the WDEQ mine permit (Uranerz, 2007). Final revegetation of the affected areas would use a final reclamation seed mix developed through discussions with the landowner and approved by the WDEQ-LQD (Uranerz, 2007).

The potential impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during decommissioning would be SMALL and comparable to that described for the construction phase. Because of the limited occurrence and ephemeral nature of surface water on the proposed Nichols Ranch ISR Project site, there would be no impact to aquatic species.

4.6.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no ISR facility construction, operation, aquifer restoration, or decommissioning associated with the proposed project; therefore, there would be no land disturbance from the proposed action that could impact either vegetation or wildlife populations. The area would continue to sustain vegetation communities and wildlife habitat typical of the region, as characterized in Section 3.6 of the SEIS. Land would continue to be used for pastureland and extraction activities. CBM and oil and gas operations in the proposed project area would continue as well as grazing of existing vegetation, particularly in grassland areas. Wildlife within the proposed project area could be affected by ongoing grazing if it destroyed wildlife habitat or if species were displaced by cattle populations from a lack of forage and cover; however, there would be no impact to ecological resources from the proposed Nichols Ranch ISR Project under Alternative 2.

4.6.3 Modified Action–No Hank Unit (Alternative 3)

Under Alternative 3, the potential impact on ecological resources during all ISR phases of the project would be similar in nature to those described for the proposed action, but only about 60 ha [150 ac] on the Nichols Ranch Unit would be affected because the Hank Unit would not be developed. The potential impact on raptor species would be less than under the proposed action because 9 of the 10 active raptor nests that have been identified on the proposed Nichols Ranch ISR Project are located on the Hank Unit. The majority of the black-tailed prairie dog colonies are located on the Nichols Ranch Unit, and these could be affected as described for the proposed action in Section 4.6.1. No other unique habitats, protected species, or ecological resources exist on the Hank Unit. Based on the information above, the NRC staff concludes that the l impact on ecological resources for construction, operation, aquifer restoration, and decommissioning under Alternative 3 would be SMALL. Because no aquatic species exist in the project area, there would be no impact.

4.7 Air Quality Impacts

Potential environmental impacts to air quality from the proposed Nichols Ranch ISR Project could occur during all phases of the ISR facility lifecycle. Nonradiological air emission impacts primarily involve fugitive road dust from vehicles used throughout the facility lifecycle and combustion engine emissions from diesel equipment from construction, operation, and decommissioning activities. Other air emissions may be associated with the radon releases from well system relief valves and resin transfer or elution. Potential radiological air impacts including radon release impacts are addressed in the Public and Occupational Health and Safety Impacts analyses in Section 4.13 of the SEIS.

The NRC staff's review of potential air quality impacts included review and consideration of local meteorological data the applicant provided based on existing sampling stations in the region of the proposed Nichols Ranch ISR Project site. During the review, the NRC staff concluded local topography at the Nichols Ranch ISR Project warrants onsite meteorological measurements as documented in SER Section 2.2.3.2. To address this concern, the NRC staff has added a license condition requiring the applicant to collect onsite meteorological data for at least 1 year prior to operating as described in Section 2.2.4 of the SER. The condition requires the applicant to submit the data for NRC review and approval. The following review of air quality impacts assumes the applicant's regional meteorological data are representative of site meteorological conditions. When the applicant submits its onsite data for NRC review, the NRC staff will

evaluate whether the conclusions of the following analysis would change based on the additional information and issue a supplement if changes are warranted.

Factors the NRC staff used in determining the significance of the potential air quality impacts are described in GEIS Section 1.7.2 and include (i) whether the air quality for the site region of influence (ROI) is in compliance with the National Ambient Air Quality Standards (NAAQS) and (ii) whether the facility can be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs. An additional concern would be the presence of Prevention of Significant Deterioration (PSD) Class I areas within the region that could be impacted by emissions from the proposed action. As discussed in the following paragraphs, the proposed Nichols Ranch ISR Project would not be classified as a major source under New Source Review or Title V of the Clean Air Act, would be located within the attainment area for all NAAQS primary pollutants, and is not likely to affect the closest PSD Class I area.

Air emissions from the proposed Nichols Ranch ISR Project would be expected to comply with the conditions of the WDEQ-approved construction air permit (WDEQ, 2009) and the required WDEQ minor source operating permit. In addition, all of the nonradiological emissions estimate the NRC staff evaluated (Section 2.2.1.6.1 of the SEIS), with the exception of fugitive road dust, support the conclusion that the proposed action would not be comparable to, nor considered, a major source of emissions. The NRC staff considers such emissions (i.e., well below the major source thresholds) in an area with meteorology that is often favorable for dispersion (Section 3.7.1.2 of the SEIS) would not impact attainment with ambient air quality standards in the region surrounding the proposed site areas nor in the nearest Class I or Class II areas closest to the proposed Nichols Ranch ISR Project areas. The NRC staff expects that emissions at levels well below the major source thresholds would not destabilize local air quality, although localized short-term and intermittent visible air emissions would be possible in the surrounding area (i.e., when vehicles travel on unpaved roads). While the applicant estimates of fugitive road dust exceeded 90.7 t/yr [100 T/yr], the estimate assumed no dust controls would be applied. The applicant proposed road dust controls, which are also required by the WDEQ-approved construction air quality permit (WDEQ, 2009). The application of dust controls is expected to reduce the fugitive dust emissions to levels that would not destabilize the air quality of the local area nor change the current attainment status of the air quality surrounding the proposed site areas.

As described in Section 3.7.2 of the SEIS, the air quality of Johnson and Campbell Counties, where the proposed Nichols Ranch ISR Project site is located, is classified as being in attainment for all the NAAQS primary pollutants. The nearest PSD Class I area, Wind Cave National Park, is located about 185 km [115 mi] east of the proposed Nichols Ranch ISR Project site. Cloud Peak Wilderness Area, the closest Class II area to the proposed action, is located about 109 km [68 mi] northwest of the proposed Nichols Ranch ISR Project site. Both areas are classified as being in attainment. The attainment status of the air quality surrounding the proposed site provides a measure of current air quality conditions and affects considerations for allowing new sources of emissions.

The proposed ISR facility is not considered a major source of emissions based on a condition in the WDEQ-approved construction air permit (WDEQ, 2009) that requires the applicant to obtain a minor source operation permit pursuant to Wyoming Air Quality Standards and Regulations Chapter 6, Section 2(a)(iii). In addition, NRC staff calculated mobile nonroad emissions from construction equipment (Section 2.2.1.6.1 of the SEIS) that are not addressed by WDEQ air permitting, and these emissions were also found to be well below major source threshold levels. The low magnitude of emissions directly affects the potential for air quality impacts, and

therefore the level of detailed NRC review is considered necessary to adequately evaluate potential impacts.

All phases of the proposed Nichols Ranch ISR Project would also result in greenhouse gas emissions, principally carbon dioxide (CO_2); however, the majority of these emissions would be from the use of diesel-powered equipment (including well drilling rigs) during the construction and decommissioning phases (Section 2.2.1.6.1 and Appendix D). Based on methods described in detail in Appendix D, the NRC staff calculated a maximum annual CO_2 emission from this diesel-powered equipment of 2,810 t/yr [3,100 T/yr] and cumulative CO_2 emissions (total proposed facility lifecycle emissions) as 5,712 t/yr [6,300 T/yr]. For comparison, these calculated emissions from the proposed action are a small fraction of the net total of greenhouse gases produced annually in Wyoming at 20 million t [22 million T] (Center for Climate Strategies, 2007) and for the United States at 6 billion t [6 billion T] (EPA, 2009). Based on its assessment of the relatively small carbon footprint of the proposed facility as compared to the annual CO_2 emissions in both the State of Wyoming and the United States, the NRC staff concluded that the atmospheric impacts of greenhouse gases from the proposed facility lifecycle would not be noticeable and additional mitigation would not be warranted.

Air quality during construction, operation, aquifer restoration, and decommissioning phases of the proposed Nichols Ranch ISR Project is described in the following sections. See Chapter 5 for a discussion of climate change at the proposed site.

4.7.1 Proposed Action (Alternative 1)

4.7.1.1 Construction Impacts

As discussed in GEIS Section 4.3.6.1, fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities from construction would be short term and reduced through BMPs (e.g., wetting of roads and cleared land areas to reduce dust emissions). The GEIS also estimated fugitive dust emissions during ISR construction would likely be well below the NAAQS for particulate matter ($PM_{2.5}$ and PM_{10}). Additionally, the GEIS concluded particulate, sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) emissions from ISR facilities would be a small percentage (1 to 9 percent) of the PSD Class II allowable increments. For NAAQS attainment areas, the GEIS concluded nonradiological air quality impacts would be SMALL.

The proposed Nichols Ranch ISR Project would meet the conditions pertaining to air quality specified in the GEIS as discussed in Section 4.7, and therefore, NRC staff concludes that the impacts would be SMALL. The applicant proposes to implement BMPs to limit air emissions during the construction phase. These BMPs include ensuring the construction air quality control equipment would be maintained to mitigate fugitive dust emissions; treating unpaved roads and disturbed land to suppress dust generation; and scheduling construction activities to limit the amount and duration of exposed earth (Uranerz, 2007). The applicant also proposes to limit wind erosion by reclaiming disturbed soil and using a vegetative cover on soil stockpiles (Uranerz, 2007). Despite the use of controls, short-term and intermittent visible air emissions are possible to the local area surrounding the proposed project site when vehicles travel on unpaved roads. Therefore, short-term and intermittent MODERATE impacts from fugitive road dust are possible; however, the average air quality is expected to remain in compliance with ambient standards and the NRC staff concludes the overall impacts would be SMALL.

NRC staff calculated emissions from diesel combustion engines in drilling rigs and construction equipment used during the construction phase, as discussed in Section 2.2.1.6.1.1 and Appendix D of the SEIS. These calculations addressed emissions of nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), particulate matter (PM_{10}), formaldehyde, volatile organic compounds (VOC), and carbon dioxide (CO_2). The results show that NO_x and CO are the highest emissions of the criteria pollutants evaluated. Estimated emissions of these pollutants are well below major source threshold levels. The calculated annual pollutant emissions for NO_x are 31 t/yr [34 T/yr], assuming four of the maximum of eight proposed deep disposal wells were drilled in the same year as the first wellfield. If the NRC staff assumed all eight deep disposal wells were drilled in the same year as the first wellfield, the annual NO_x emission result increases to 53 t/yr [58 T/yr]. This higher level of calculated emissions is still less than the 91 t/yr [100 T/yr] major source threshold and is considered by the NRC staff to represent a single-year peak because all proposed deep wells would be completed in that year.

The diesel combustion engine emissions the NRC staff calculated for the proposed action are below those reported in the GEIS from a prior NRC Environmental Impact Statement (EIS) (NRC, 1997) for a proposed ISR facility in Crownpoint, New Mexico, and therefore the potential impacts to air quality from the proposed action would be less than those reported in the GEIS. The NRC staff considered the emissions and associated potential air impacts from constructing the Crownpoint facility to bound the emissions from constructing the proposed Nichols Ranch ISR Project based on the following considerations. First, the Crownpoint facility proposed a higher maximum annual production rate than the proposed Nichols Ranch ISR Project. The ore deposits at the Crownpoint facility are at a much greater depth and therefore would require longer drilling times per well during wellfield construction. For example, the Crownpoint ISR facility has ore at approximately 561 m [1,840 ft] bgs, whereas the proposed Nichols Ranch ISR Project has ore occurring at depths that range from 91.5 to 183 m [300 to 600 ft] bgs (Uranerz, 2007).

Second, the meteorology used at the Crownpoint site to estimate average annual air concentrations of emitted pollutants is also more stable than at the proposed Nichols Ranch ISR Project site, based on the NRC staff review of available joint frequency data for each site (NRC, 1997; Uranerz, 2007), which indicated winds that fall within stability classes E and F occur about two times more frequently at the Crownpoint site than in the region surrounding the proposed Nichols Ranch ISR Project. The annual average air concentrations for the Crownpoint site emissions are also based on a mixing height of 1 km [1.6 mi] (NRC, 1997), which is within the range of mixing heights reported for the proposed Nichols Ranch ISR Project facility of 659 m [718 yd] (morning average) and 4,074 m [4,440 yd] (afternoon average) (Uranerz, 2007). Based on the information reviewed, the NRC staff expects the dispersion conditions at the Crownpoint site would be less favorable than at the proposed Nichols Ranch ISR Project. Therefore, based on the combination of dispersion conditions and higher emissions estimates for the Crownpoint facility, the NRC staff concluded that the calculated annual average air concentration values for the emissions reported in the GEIS are conservative and therefore applicable to the proposed Nichols Ranch ISR Project. As a result, the GEIS conclusions that particulate, SO_2, and NO_2 emissions from ISR facilities would be well below the major source threshold for NAAQS attainment areas and account for a small percentage (1 to 9 percent) of the PSD Class II allowable increments would also be applicable to the proposed Nichols Ranch ISR Project.

The NRC staff considered the calculated magnitude of construction emissions in an area that meets current air quality standards was not sufficient to justify conducting additional detailed quantitative air quality modeling analysis of potential consequences. Considering (i) the

aforementioned analyses provided in the GEIS, (ii) the minor classification of emissions the WDEQ construction air quality permit indicated (WDEQ, 2009), and (iii) the conditions of the site area and region, the NRC staff concludes that such emissions (i.e., well below the major source thresholds) in an area with meteorology favorable for dispersion would not impact attainment with ambient air quality standards in the region surrounding the proposed site areas. The Class I area, Wind Cave National Park, is located about 185 km [115 mi] east of the Nichols Ranch ISR Project site. While the prevailing wind directions of west-southwest and west (Section 3.7.1.2 of the SEIS) could transport pollutants in the direction of the Class I area, the long distance is expected to be sufficient to adequately disperse the proposed emissions. Cloud Peak Wilderness Area is the closest Class II area to the proposed action, located about 109 km [68 mi] northwest of the Nichols Ranch ISR Project site. In addition to the low magnitude of emissions and distance, the prevailing winds would carry emissions to the northeast and east, away from this Class II area.

The NRC staff concludes that the site-specific conditions at the proposed Nichols Ranch ISR Project are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS conclusions that the impacts to air quality during construction would be SMALL. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that discussed in the GEIS.

4.7.1.2 Operations Impacts

GEIS Section 4.3.6.2 states that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting program. Additionally, although excess vapor pressure in pipelines could be vented throughout the system, such emissions would be rapidly dispersed into the atmosphere and so potential impacts would be SMALL, due in part to the expected low volume of effluent produced. The GEIS also states that other potential nonradiological emissions during operations include fugitive road dust and diesel combustion engine emissions from equipment, transport trucks, and other vehicles. For NAAQS attainment areas, the GEIS concludes nonradiological air quality impacts would be SMALL.

During operations of the proposed Nichols Ranch ISR Project, the NRC staff concludes nonradiological impacts to air quality would be less than the impacts from construction because the use of diesel-powered construction equipment would be reduced and therefore criteria pollutant levels would remain below the NAAQS; impacts to air quality during operation would be SMALL. The mitigation measures described under Section 4.7.1.1 of the SEIS would also pertain to the operations phase and would continue to limit potential impacts.

The NRC staff concludes that the site-specific conditions at the proposed Nichols Ranch ISR Project are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS conclusions that the impacts to air quality during operations would be SMALL. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that described in the GEIS.

4.7.1.3 Aquifer Restoration Impacts

As discussed in GEIS Section 4.3.6.3, because the same infrastructure is used during aquifer restoration as during operations, air quality impacts from aquifer restoration would be similar to,

or less than, those during operations. Additionally, fugitive dust and combustion-engine emissions from vehicles and equipment during aquifer restoration would be similar to, or less than, the dust- and combustion-engine emissions during operations. For NAAQS attainment areas, nonradiological air quality impacts would be SMALL.

This phase of the proposed Nichols Ranch ISR Project would use existing infrastructure and equipment similar to that employed during the operations phase but would require less vehicular traffic since fewer workers would be employed (Uranerz, 2007). The applicant's proposed BMPs described under Section 4.7.1.1 would also pertain to the aquifer restoration phase and would continue to limit impacts. Accordingly, the NRC staff concludes that the impacts would be smaller than during the operation phase. The NRC staff concludes that the site-specific conditions at the proposed Nichols Ranch ISR Project are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS conclusions that the impacts to air quality during aquifer restoration would be SMALL. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that discussed in the GEIS.

4.7.1.4 Decommissioning Impacts

GEIS Section 4.3.6.4 noted that fugitive dust, vehicle emissions, and diesel emissions during land-disturbing activities from decommissioning would come from many of the same sources used during construction. In the short-term, emission levels would increase given the activity (demolishing of process and administrative buildings, excavating and removing contaminated soils, grading of disturbed areas). However, such emissions would decrease as decommissioning proceeds, and therefore, overall, impacts would be similar to, or less than, those associated with construction, would be short term, and would be reduced through BMPs (e.g., dust suppression). Based on the NRC staff calculated emission estimates discussed in Section 2.2.1.6.1.1 and Appendix D of this SEIS, the highest emissions from diesel-powered construction equipment during the decommissioning phase for the proposed Nichols Ranch ISR Project would be less than diesel emissions generated during the construction phase. As discussed in Section 4.7.1.1 of the SEIS, considering the minor source classification of emissions the WDEQ construction air quality permit indicated (WDEQ, 2009) and the conditions of the proposed site area and region, the NRC staff conclude that such emissions (i.e., well below the major source thresholds) in an area with meteorology that is often favorable for dispersion would not impact attainment with ambient air quality standards in the region surrounding the proposed site areas. Therefore, for NAAQS attainment areas, NRC staff conclude that nonradiological air quality impacts of the decommissioning phase would be SMALL. The BMPs described under Section 4.7.1.1 of the SEIS would also be implemented during the decommissioning phase.

The NRC staff concludes that the site-specific conditions at the proposed Nichols Ranch ISR Project are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS conclusions that the impacts to air quality during decommissioning would be SMALL. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that disclosed in the GEIS.

4.7.2 No-Action (Alternative 2)

Under the No-Action alternative, in the next few years, there would be no change in air quality at the proposed Nichols Ranch ISR Project or at any surrounding receptors. While oil and gas

extraction activities would continue and perhaps expand in the future (along with CBM operations), these activities have been shown to have a small impact—direct, indirect, or cumulative—on air quality, regardless of geographic scale (BLM, 2003). The generation of fugitive dust is currently limited by the fact that existing roads are shared and maintained by the natural resource extraction and ranching operations that occur in the area. Roads are also maintained in good repair by these entities and restricted from unpermitted uses.

This area currently meets the NAAQS for attainment status (Section 3.7.2), and because there are no significant air pollution sources at the proposed site, it is expected that this area would continue to meet the NAAQS. Current projections of air quality for the broader Powder River Basin area and the surrounding region over the next decade are discussed in Section 5.7 of this SEIS.

4.7.3 Modified Action–No Hank Unit (Alternative 3)

4.7.3.1 Construction Impacts

For the Modified Action–No Hank Unit (Alternative 3), the NRC staff concludes the nonradiological impacts to air quality would be the same as those evaluated for the proposed action; however, because the number of wellfields the applicant constructed would be halved under this alternative, the NRC staff estimates both annual and facility lifecyle air emissions would be reduced compared to the proposed action. Because the applicant would not construct the Hank Unit, fugitive dust and diesel emissions from well drilling and construction equipment from the Hank Unit would not occur. Considering the applicant's proposed schedule (Uranerz, 2007), the degree of overlap in construction activities for the proposed action would occur for only a quarter of a year; therefore, NRC staff estimates the reduction in annual diesel emission estimates for NO_x, for example, from not constructing the Hank Unit wellfields would be only 1.8 t/yr [2 T/yr] relative to the proposed action, resulting in a total of 29 t/yr [32 T/yr] NO_x (for constructing one wellfield and four deep disposal wells) and 51 t/yr [56 T/yr] NO_x (for constructing one wellfield and eight deep disposal wells) under this alternative. Furthermore, the NRC staff estimates overall traffic counts and therefore the magnitude of fugitive road dust generation along the main T-Chair Livestock Company ranch road would likely decrease relative to the proposed action because fewer construction supply shipments would be required. The NRC staff concludes both of these outcomes would reduce the potential for impacts at nearby and downwind (easterly) receptors.

Therefore, because (i) the NRC staff concluded that air quality impacts during the construction phase of the proposed action were SMALL (Section 4.7.2.1), (ii) the NRC staff's review found the magnitude of construction activities under the alternative would be less than the proposed action, and (iii) the NRC staff assumed the applicant would implement BMPs described for the proposed action for Alternative 3 that limit air emissions from proposed construction activities, the NRC staff concludes the Nichols Ranch ISR Project under Alternative 3 would be SMALL. Based on this analysis, relative to the proposed action, the NRC staff concludes the potential impacts to air quality during the construction phase of Alternative 3 would be less than the impacts evaluated for the proposed action but would still be characterized as SMALL.

4.7.3.2 Operations Impacts

For the Modified Action–No Hank Unit (Alternative 3), the NRC staff concludes the nonradiological impacts to air quality during the operations phase would be less than the impacts from construction because the use of diesel-powered construction equipment would be

reduced and therefore criteria pollutant levels would remain below the NAAQS. Impacts to air quality during operation would be SMALL. The applicant's BMPs described under Section 4.7.1.1 of the SEIS would also pertain to the operations phase under Alternative 3 and would continue to limit potential impacts to air quality during the operation phase. Because the applicant would not operate the Hank Unit under this alternative, the NRC staff estimates the applicant's stationary emissions (e.g., generators and compressors) and proposed traffic volumes (Section 2.2.1.7) would be reduced during years of overlapping wellfield operations relative to the proposed action (Figure 2-1). Therefore, during the overlapping operational periods under this alternative where only two wellfields operations overlap, in any year, the NRC staff estimates the incoming shipments of process chemicals would be reduced by about half, onsite shipments of ion-exchange resins between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would not occur, and outgoing shipments of yellowcake and waste materials would also be reduced by about half. As a result of these expected reductions in traffic, the NRC staff estimates the fugitive road dust from these activities would be reduced by approximately half of the applicant's estimates for the proposed action. For those time periods where wellfield production operations do not overlap the NRC staff expects the emissions would be similar to those previously discussed for the proposed action. Based on this analysis, the NRC staff concludes the potential impacts to air quality during the operations phase of Alternative 3 would be less than the impacts evaluated for the proposed action and would still be characterized as SMALL.

4.7.3.3 Aquifer Restoration Impacts

For the Modified Action–No Hank Unit (Alternative 3), during the aquifer restoration phase of the proposed Nichols Ranch ISR Project the NRC staff expects the applicant would use existing infrastructure and equipment similar to those employed during the operation phase. However, aquifer restoration would require less vehicular traffic and would take less time to complete than under the proposed action. Accordingly, the NRC staff concludes impacts would be smaller than during the operation phase and thus the impacts would be SMALL. The NRC staff considered that the same activities would occur under Alternative 3, but would be limited to the Nichols Ranch Unit. Therefore, the magnitude of impacts would be reduced approximately 75 percent with no aquifer restoration at the Hank Unit wellfields (refer to SEIS Figure 2-1). For years where wellfield restoration activities of the Nichols Ranch and Hank Units overlap, the reduction in activities would be approximately half that of the proposed action, and NRC staff expects annual air emissions associated with these activities to be proportionately reduced. The BMPs proposed by the applicant and described in SEIS Section 4.7.1.1 would also apply to the aquifer restoration phase and would continue to limit the impact. Except for passing traffic along the gravel T-Chair Livestock Company ranch road, emission sources would not be present in the vicinity of the Hank Unit. Based on this analysis, the NRC staff concludes the impacts to air quality during the aquifer restoration phase under Alternative 3 would be less than the impacts evaluated for the proposed action and would be characterized as SMALL.

4.7.3.4 Decommissioning Impacts

For the Modified Action–No Hank Unit (Alternative 3), the NRC staff concludes the decommissioning phase of the proposed Nichols Ranch ISR Project would generate the same nonradiological air impacts as those stated for the proposed action; however, the magnitude of emissions would be lower because the applicant would need to decommission and reclaim half the number of wellfields. The NRC staff estimates this would reduce the operating hours for construction equipment and proportionally decrease in emissions from that equipment. Based on the NRC staff calculated emission estimates discussed in Section 2.2.1.6.1.1 and Appendix

D of this SEIS, the highest annual emissions from diesel-powered construction equipment during the decommissioning phase would be less than the comparable emissions during the construction phase. Because the applicant would not have constructed the Hank Unit, the NRC staff concludes fugitive dust and diesel emissions from decommissioning and reclamation equipment at the Hank Unit would not occur. Because the degree of overlap in decommissioning activities between the two units for the proposed action occurs for only one-half of a year (Figure 2-1), the NRC staff estimates the reduction in annual diesel emissions estimates for NO_x, for example, from not decommissioning the Hank Unit wellfields under the alternative would reduce the emissions for the proposed action provided in Table D3–7 of 18.1 t/yr [20 T/yr] by 3.6 to 14.5 t/yr [4 to 16 T/yr] NO_x (for decommissioning one wellfield and facilities in one year). Because the planned decommissioning of the Nichols Ranch Unit wellfields do not overlap in the schedule with the Hank Unit activities (Figure 2-1), the full set of estimated annual emissions in Appendix D that would be applicable to Alternative 3 (i.e., decommissioning one wellfield and facilities in 1 year) is shown in Table D3–6. The NRC staff expects the annual fugitive dust emissions during decommissioning would be similarly reduced and would occur for a shorter 3-year decommissioning phase under the alternative relative to the 5-year decommissioning phase planned for the proposed action (Figure 2-1).

Therefore, because (i) the NRC staff concluded that air quality impacts during the decommissioning phase of the proposed action would be SMALL (Section 4.7.2.1), (ii) the NRC staff's review found the magnitude of decommissioning activities under the alternative would be less than the proposed action decommissioning activities, and (iii) the NRC staff assumed the applicant would implement BMPs described for the proposed action that limit air emissions from proposed construction activities under this alternative, the NRC staff concludes the potential impacts on air quality during the decommissioning phase of Alternative 3 would be less than the impacts the NRC staff evaluated for the proposed action and would be characterized as SMALL.

4.8 Noise Impacts

Potential environmental impacts from noise at the proposed Nichols Ranch ISR Project site could occur during all phases of the ISR facility lifecycle. The GEIS described these impacts as occurring from the operation of equipment such as trucks, bulldozers, and compressors; from either commuting worker traffic or material/waste shipments; and from the operation of the wellfields, central processing plant, satellite facility, and associated equipment. Noise could affect both humans and wildlife in the vicinity of the site (NRC, 2009a).

As stated in the GEIS, the Occupational Safety and Health Administration (OSHA) has set permissible exposure limits for workplace noise levels (NRC, 2009a). The proposed Nichols Ranch ISR Project would be required to limit worker exposure in accordance with these regulations; therefore, occupational noise exposure is not described in this section but rather in Section 4.13. This section describes the potential propagation of noise to offsite receptors described in Section 3.8.

The following sections evaluated both mobile and stationary noise sources to assess the potential to create noise adjacent to the proposed Nichols Ranch ISR Project and to determine the site-specific impact. The GEIS concluded the noise impact at an ISR facility could range from SMALL to MODERATE during all four phases of an ISR project, depending on the distance between the nearest resident and the activities occurring at the ISR facility (NRC, 2009a). The potential site-specific environmental impacts from noise during construction, operation, aquifer restoration, and decommissioning are described in the following sections.

4.8.1 Proposed Action (Alternative 1)

4.8.1.1 Construction Impacts

GEIS Section 4.3.7.1 described the potential noise impacts as being greatest during construction of the ISR facility, due to the heavy equipment involved and given the likelihood that these facilities would be built in a rural, previously undeveloped area where background noise levels are lower. The use of drill rigs, heavy trucks, bulldozers, and other equipment to construct and operate the wellfields, drill the wells, develop the necessary access roads, and build the production facilities would generate audible noise exceeding undisturbed background levels. Noise levels are expected to be higher during daylight hours when construction is more likely to occur and more noticeable in proximity to the operating equipment. For individuals living in the vicinity of the site, ambient noise levels would return to background at distances more than 300 m [1,000 ft] from the construction activities. Wildlife would be expected to avoid areas where noise-generating activities were occurring; although for certain wildlife (e.g., sage-grouse) continuous elevated noise levels could reduce their breeding success. Overall, these types of noise impacts would be SMALL, given the use of hearing controls for workers and the expected distance of nearest residents from the site (NRC, 2009a).

The GEIS also concluded traffic noise during construction (commuting workers, truck shipments to and from the facility; and construction equipment such as trucks, bulldozers, and compressors) is expected to be localized and limited to highways in the vicinity of the site, access roads within the site, and roads in the wellfields. The relative short-term increase in noise levels from passing traffic would be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through smaller communities (NRC, 2009a).

The proposed Nichols Ranch ISR Project is located in a rural area, and the closest resident is located at Pfister Ranch, about 960 m [0.6 mi] north of the Hank Unit, greater than the 300-m [1,000-ft] radius evaluated in the GEIS; therefore, the NRC staff concludes the potential impact from noise to a person at the nearest resident location would be SMALL. Noise impacts from traffic would be transient and SMALL because of the limited traffic volume associated with the proposed project (see SEIS Section 4.3). As described in Section 4.6.1.1.3, the applicant has identified nine Greater sage-grouse leks within 3.2 km [2.0 mi] of the proposed Nichols Ranch ISR Project site (Figure 3-8). Although none of these leks occur within the project site, the applicant has committed to implement mitigation measures, which include delaying or minimizing project activities and vehicle traffic avoidance near active leks during key mating periods and following seasonal WGFD guidelines (WGFD, 2010) to reduce the noise impacts on the Greater sage-grouse (Uranerz, 2007). Therefore, the NRC staff concludes the potential impacts from noise during construction would be SMALL.

4.8.1.2 Operations Impacts

As described in GEIS Section 4.3.7.2, noise-generating activities in the central processing plant would occur indoors, thus offsite sound levels would be reduced. Wellfield equipment (e.g., pumps, compressors) would also be contained within structures (e.g., header houses, satellite facilities), thus limiting the propagation of noise to offsite individuals. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be localized and limited to highways in the vicinity of the proposed site, access roads on the proposed site, and roads in wellfields. Relative short-term increases in noise from traffic would be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through

smaller communities. Thus, the potential impact from noise during operations could range from SMALL to MODERATE (NRC, 2009a).

During the operations phase, a variety of mechanical equipment, such as generators; pumps; air compressors; and heating, ventilation, and air conditioning systems at the proposed Nichols Ranch ISR Project, would generate noise. The potential Impact from noise onsite during the operations phase would be less than during the construction phase because fewer pieces of heavy machinery would be in use and, therefore the NRC staff concludes the potential impact would be SMALL. Impacts from traffic-related noise would be similar to those during construction and would be SMALL. The applicant's implementation of mitigation measures to reduce the potential noise impact on the Greater sage-grouse discussed in SEIS Section 4.8.1.1 also supports the NRC staff conclusion that the potential impact from noise during the operations phase would be SMALL.

4.8.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.7.3 concluded that general noise levels during aquifer restoration would be either be similar to, or less than, the noise generated during operations. Workplace noise exposure would be managed using the same administrative and engineering controls implemented during operations. The noise from pumps and other wellfield equipment contained within buildings would reduce the noise impact to offsite receptors. The existing operational infrastructure would be used, and the traffic volume would be less than during the construction and operation phases. The GEIS concluded the potential impact could range from SMALL to MODERATE (NRC, 2009a).

Noise generated during the proposed Nichols Ranch ISR Project aquifer restoration phase would either be similar to, or less than, noise generated during the operations phase as described in SEIS Section 4.7.1.3. Noise from traffic would be limited to delivery of supplies and staff traveling to the site; therefore, there would be fewer vehicular trips than during the operations phase. Because the amount of equipment used and the volume of traffic would be less than during the operations phase, NRC staff concludes that noise impacts during aquifer restoration would remain SMALL. The applicant's adherence to the stipulated noise mitigation measures (EO 2010-4) described in Section 4.6.1.1.3 also supports the NRC staff conclusion that there would be a SMALL impact on the Greater sage-grouse populations located in the vicinity of the proposed project site during the aquifer restoration phase.

4.8.1.4 Decommissioning Impacts

GEIS Section 4.3.7.4 described the potential noise impacts during decommissioning. General noise levels during decommissioning and reclamation would be similar to the noise generated during construction. Equipment used to dismantle buildings and milling equipment, remove contaminated soils, or grade the surface as part of reclamation activities would generate audible noise at above-background levels. This noise would be temporary, and when decommissioning and reclamation activities were completed, noise levels would return to baseline, with occasional noise from longer term monitoring activities. Like the construction phase, the noise level would be greater during daylight hours when decommissioning and reclamation would be more likely to occur and most noticeable in proximity to operating equipment. Given the distance to nearby residents is greater than 300 m [1,000 ft], the GEIS concluded that noise could not be discernable to offsite residents or communities at this distance. Therefore, the GEIS concluded that the impact from noise generated during decommissioning could range from SMALL to MODERATE (NRC, 2009a).

The noise generated at the proposed Nichols Ranch ISR Project site during the decommissioning phase would be similar to or less than that generated during the construction phase. The sources of noise would include earthmoving, excavation, and building demolition. Fewer shipments to and from the proposed site would occur as decommissioning progressed resulting in less noise from traffic. Because the nearest resident is located beyond the 300 m [1,000 ft] radius evaluated in the GEIS, the NRC staff concludes the estimated impact on the nearest resident during decommissioning would be SMALL. The applicant's adherence to the stipulated noise mitigation measures (EO 2010-4) described in Section 4.6.1.1.3 would result in a SMALL impact on Greater sage-grouse populations in the vicinity of the proposed project during decommissioning.

4.8.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no change in the sound levels within the proposed project area or to surrounding receptors. While natural resource exploration activities would continue and could potentially expand in the future, they would typically be of short duration and would involve few vehicles and no permanent, noise-emitting infrastructure. The rural setting of the proposed project area and the continuation of ongoing natural resources exploration activities would result in sound levels remaining at ambient levels.

4.8.3 Modified Action–No Hank Unit (Alternative 3)

4.8.3.1 Construction Impacts

Under Alternative 3, no construction activities would occur at the Hank Unit; therefore, no noise generated by construction-related activities would occur. Traffic would continue to pass through the area on the main T-Chair Livestock Company ranch road en route to the Nichols Ranch Unit. The overall traffic volume along this road would decrease relative to the proposed action because less construction materials would be required. The lack of construction activities and less traffic would reduce the potential noise impact for offsite receptors. In addition, because the nearest resident to the Nichols Ranch Unit is located approximately 1.4 km [0.9 mi] north of the unit, a location that is greater than the 300-m [1,000-ft] radius evaluated in the GEIS, the NRC staff concludes the potential noise impact from the construction activities under Alternative 3 would be SMALL. The applicant's adherence to the required mitigation measures described in Section 4.6.1.1.3 would result in a SMALL impact on Greater sage-grouse populations in the vicinity of the project site during construction.

4.8.3.2 Operations Impacts

Because the Hank Unit would not be constructed, stationary noise sources (e.g., generators and compressors, idling vehicles) would not be present. In addition, traffic noise along the 13.4 km [8.3 mi] gravel ranch road generated from the transfer of ion-exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would not occur. The absence of wellfields at the Hank Unit would also result in less generated noise. Therefore, the NRC staff concludes the potential noise impact from the operation activities under Alternative 3 would be SMALL. The applicant's adherence to the required mitigation measures described in Section 4.6.1.1.3 would result in a SMALL impact to Greater sage-grouse populations in the vicinity of the project site during operations because the eight leks located within the 3.2 km [2.0 mi] radius of the Hank Unit boundary would not be affected.

4.8.3.3 Aquifer Restoration Impacts

No noise-generating sources would exist in the vicinity of the Hank Unit except for passing vehicular traffic along the gravel ranch road. Noise generated during the aquifer restoration phase would either be similar to or less than that generated during the operations phase. Vehicular traffic would be limited to supply delivery and staff accessing the site. The traffic volume would be less than for the proposed action. Therefore, the NRC staff concludes the potential noise impact from aquifer restoration activities under Alternative 3 would be SMALL. The applicant's adherence to the required mitigation measures described in Section 4.6.1.1.3 would result in a SMALL impact to Greater sage-grouse populations in the vicinity of the project site during aquifer restoration.

4.8.3.4 Decommissioning Impacts

Under Alternative 3, even though soil and road reclamation and infrastructure demolition would result in heavy equipment usage that would generate more noise than during the operation and aquifer restoration phases, the noise generated during decommissioning would be at a level similar to that during the construction phase, but occur only at the Nichols Ranch Unit. There would be less noise from vehicular traffic shipments to and from the site as decommissioning progressed. Because the nearest resident is located beyond the 300-m [1,000-ft] radius evaluated in the GEIS, the NRC staff concludes the potential noise impact from the decommissioning phase under Alternative 3 would be SMALL. The applicant's adherence to the required mitigation measures described in Section 4.6.1.1.3 would result in a SMALL impact on Greater sage-grouse populations during decommissioning because the eight leks located within the 3.2 km [2.0 mi] radius of the Hank Unit boundary would not be affected.

4.9 Historical, Cultural, and Paleontological Resources Impacts

Potential environmental impacts to historic, cultural, and paleontological resources at the proposed Nichols Ranch ISR Project site may occur during all phases of the facility lifecycle. Predominantly, these impacts could result from the loss of or damage to historic, cultural, and archaeological resources, as well as temporary restrictions on access to these resources. Detailed discussion of the potential environmental impacts to historic, cultural, and paleontological resources from construction, operation, aquifer restoration, and decommissioning is provided in the following sections.

4.9.1 Proposed Action (Alternative 1)

4.9.1.1 Construction Impacts

As discussed in Section 4.3.8.1 of the GEIS, the potential impacts during ISR facility construction could include loss of or damage to historic and cultural resources due to excavation activities as a part of construction. Additionally, access to historic, cultural, and archaeological resources could be temporarily restricted during construction.

As stated in the GEIS, NRC expects the applicant to conduct the appropriate historic and cultural resource surveys as part of prelicense application activities. Further, it is anticipated that the eligibility evaluation of historic properties for listing in the National Register of Historic Places (NRHP) or as a traditional cultural property (TCP) under criteria in 36 CFR 60.4(a)–(d) would be conducted as part of the site-specific environmental review. Most TCPs are identified through consultation. Consultation and mitigation of adverse effects would occur during the

site-specific environmental review process. To determine whether significant historic and cultural resources would be avoided or mitigated, consultations involving NRC, the applicant, WY SHPO, other government agencies (e.g., FWS and state environmental departments), and Native American tribes would occur as part of the site-specific review. Additionally, as discussed in the GEIS, during construction activities, discovery of previously undocumented historic or cultural resources would require the licensee to stop work and notify the appropriate Federal, Tribal, and State agencies with regard to appropriate mitigation measures. The GEIS concluded that potential impacts to historic and cultural resources from construction could be SMALL to LARGE, depending on the presence or absence of historic and cultural resources on the site.

For the proposed action, archaeological sites and isolated finds identified within the Nichols Ranch and Hank Unit project areas would be directly affected during construction. Activities would include the construction of wellfields and access roads. Only one archaeological site at the Nichols Ranch Unit is eligible for listing on the NRHP. Site 48CA5391 at the Nichols Ranch Unit is located within or near a proposed wellfield. However, the applicant has committed to avoid this site through the use of protective fencing (Uranerz, 2010).

At the Hank Unit, seven archaeological sites are eligible for listing on the NRHP; two archaeological sites remain unevaluated for NRHP eligibility pending evaluative testing. Of the seven eligible sites at the Hank Unit, there would be an adverse effect to the visual setting of five TCPs [Sites 48CA268 (Pumpkin Buttes), 48CA6148, 48CA6748, 48CA6751, and 48CA6753]. With the exception of the Pumpkin Buttes, all TCPs are within the proposed Hank Unit permit area. One TCP (Site 48CA6148) is adjacent to the proposed wellfield. The remaining TCPs are located outside of the outer extent of the monitoring well locations. Because the Hank Unit falls within the 3.2 km [2 mi] radius of the Pumpkin Buttes, the applicant must follow the stipulations listed in BLM's Programmatic Agreement (PA) with the WY SHPO for mitigation of adverse effects for the Pumpkin Buttes TCP (BLM, 2009b). In its license application, Uranerz committed to protect all cultural properties that have been determined NRHP-eligible or unevaluated sites within the proposed permit area from ground-disturbing activities. The NRC staff continues to consult with WY SHPO regarding the development of a Memorandum of Agreement (MOA) among NRC, BLM, WY SHPO, interested Native American tribes, and Uranerz for mitigation of adverse effects to the five TCPs. Sites 48CA6927 (NRHP-eligible) and 48CA6754 (unevaluated pending justification) could be impacted during construction because of its location near proposed monitoring wells. However, the applicant has committed to avoid this site and to use protective fencing. Sites 48CA6490 (NRHP-eligible) and 48CA6475 (unevaluated pending further evaluative testing) are located outside of the proposed construction area and would not be adversely affected by the proposed action. (Uranerz, 2010)

The applicant committed to the following cultural resource mitigation measures in the Mine Plan for the Nichols Ranch ISR Project for the NRC and WDEQ/LQD permit applications. These commitments are contained in a revision to the license application's Technical Report (Uranerz, 2007).

- Uranerz (the applicant) would not conduct any ground-disturbing work in areas that have not been previously inventoried and cleared for cultural resources.

- The applicant would protect all NRHP-eligible cultural properties within the proposed permit area from ground-disturbing activities. To protect those eligible sites located within or near the projected wellfield (specifically, Sites 48CA5391, 48CA6148, and

48CA6927), the applicant would delineate these sites and would mark them with green-colored plastic snow fence material. The fencing material would not be highly visible and no signs would be installed, but the fencing material would protect these sites from inadvertent disturbance. The applicant would also provide small openings 1.8 to 2.4 m [6 to 8 ft] in the fencing to allow livestock and wildlife to move freely in, out, and through the site.

- If the applicant determined that it must conduct ground-disturbing activities within the boundaries of an eligible site, the applicant would notify NRC, WY SHPO, and WDEQ-LQD and the applicant would prepare an appropriate cultural resource mitigation plan and submit the plan to NRC and WY SHPO for review and approval. Once approved, the mitigation plan would be implemented before any ground-disturbing activities are undertaken. Any approved mitigation plan(s) would be subsequently incorporated into the permit document (if issued, the NRC license and WDEQ-LQD permit).

- If cultural resources are discovered during operations, the applicant would immediately stop ground-disturbing activities in the area of the discovery and would immediately notify WDEQ-LQD, NRC, and WY SHPO. Within 2 working days of the notification, WDEQ-LQD, NRC, and WY SHPO would evaluate or have evaluated any discovered cultural resources and would determine whether any action may be required to protect or preserve such discoveries.

- All cultural resources would remain under the jurisdiction of the private landowner or the U.S. Government depending on the where the cultural resource(s) were discovered.

- The applicant would instruct all employees, contractors, subcontractors, and any additional parties involved in the project not to search for archaeological materials (i.e., arrowhead hunting).

- If Native American human remains, funerary objects, or objects of cultural patrimony are encountered, the applicant would stop all work in the immediate area and would immediately notify NRC and WDEQ-LQD. If Native American human remains, funerary objects, or objects of cultural patrimony are encountered as a result of an NRC undertaking on a private surface, the remains would be evaluated as a historic property and procedures relating to identification and effect will be determined in consultation with NRC and WY SHPO. Existing state and local laws would be followed pertaining to discovery of Native American human remains, funerary objects, or objects of cultural patrimony on a private surface.

The applicant also committed to following the cultural resource mitigation measures identified in the PA between BLM and WY SHPO (BLM, 2009a) for the Pumpkin Buttes TCP (Site 48CA268) at the Hank Unit. These measures were documented in a revision to the NRC license application (Uranerz, 2010). Because the Hank Unit falls within the 3.2 km [2 mi] radius of the Pumpkin Buttes, the applicant must follow the stipulations listed in PA (BLM, 2009b). Some of these measures are summarized below.

- The applicant would instruct all employees, contractors, subcontractors, and any additional parties involved in the project to avoid the Pumpkin Buttes TCP.

- No ground-disturbing activities would occur on the tops and sides of the Pumpkin Buttes. The tops and bases of the buttes are defined as follows, based on 1:24,000 U.S. Geological Survey (USGS) topographic quadrangles for the area:

  (1) North Middle Butte: Top = 1,829-m [6,000-ft] contour line; Base = 1,676-m [5,500-ft] contour line

  (2) South Middle Butte: Top = 1,804-m [5,920-ft] contour line; Base = 1,676-m [5,500-ft] contour line

- For all activities associated with any future project modification, the applicant would obtain NRC and WY SHPO authorization before conducting ground-disturbing activities. The applicant and NRC would implement measures to reduce the visual contrast for any changes to the project.

- Prior to the NRC and WDEQ-LQD authorization of additional construction activities, the applicant would

  (1) Perform a Class III cultural resource inventory, biological, or other inventories as required

  (2) Submit detailed construction plans

  (3) Participate in an onsite evaluation (if necessary)

- The gravel surface of resource roads and new roads would be a color that does not create a visual contrast to the surrounding topography.

- All gathering pipelines would be corridored next to or within roads, wherever possible. Existing disturbed areas would be used for pipeline corridors where practicable.

- Wherever practicable, areas of existing disturbance would be used. To minimize visual contrast, well locations would not be placed in areas of dense sagebrush or other vegetation unless absolutely necessary. Brush hogging or other vegetation removal on drilling locations within areas of dense sagebrush or other vegetation would be feathered to reduce visual contrast and would be limited to 9 m [30 ft] in diameter. All aboveground infrastructure related to well production would be painted a color that best blends in with the surrounding topography. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon (Munsell Soil Color 2.5Y 6/2). Different colors maybe required on a site-specific determination based on visual assessment.

- Wherever practicable, well power lines would be buried and buried power lines would be placed inside or within 9 m [5 ft] of the trench utilized for pipelines. Construction of overhead power lines within 3.2 km [2 mi] from the base elevation of the Pumpkin Buttes would be designed to reduce visual contrast.

- All permanent aboveground structures (e.g., production equipment, tanks) not subject to safety requirements would be painted to blend in with the natural color of the landscape. The color would simulate the standard environmental colors BLM established for visual resource management. These colors are typically Covert Green (PANTONE for

Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon (Munsell Soil Color 2.5Y 6/2). Different colors may be required on a site-specific determination based on visual assessment.

No sites will be directly affected by construction activities, because sites located near proposed construction areas will be marked, fenced, and avoided. However, there will be an adverse effect to the visual setting of five TCPs. Additionally, the license application contains mitigation measures to address adverse effects to the visual setting of the five TCPs. NRC, WY SHPO, BLM, Uranerz, and interested Native American tribes are consulting to develop an MOA to address the mitigation of adverse effects to the five TCPs. Originally, a draft MOA for the impacts to the Pumpkin Buttes TCP was forwarded to consulting parties by letter dated July 22, 2010, for review and comment. Because four additional TCPs have been identified through consultation with Native American Tribes, a revised draft MOA will be developed with consulting parties that addresses impacts to the visual setting of the five identified TCPs.

Based on the review of archaeological surveys, consultation with WY SHPO and with Native American tribes, applicant-committed mitigation measures (see SEIS Section 4.9.1.1), and other information, the NRC staff concludes the impacts to historic and cultural resources at the proposed Nichols Ranch ISR project would be MODERATE. NRC staff concludes that most impacts would be the result of an adverse effect to the visual setting of five TCPs. This MODERATE impact would be mitigated by implementing the applicant-committed measures listed in Section 4.9.1.1. If issued, the license would contain license conditions that incorporate any mitigation measures in the license application and any agreements that address historic and cultural resources.

Paleontological specimens are present in both proposed project areas. Construction would impact both geological units including the surficial Quaternary deposits and near-surface Wasatch Formation deposits. However, based on the geology of the site and the poor exposure of fossil-bearing sediment, the NRC staff concludes that the proposed Nichols Ranch ISR Project would not significantly impact any fossil remains. The applicant would have a monitor present during construction activities involving depths in excess of a few feet (Uranerz, 2007). If fossil remains are discovered during construction, the applicant would stop work and contact the appropriate State and Federal agencies. Therefore, the NRC staff concludes the impact from construction on paleontological resources would be SMALL.

4.9.1.2 Operations Impacts

In GEIS Section 4.3.8.2, potential impacts to historic, cultural, and archaeological resources from operations would be less than during construction because less land is disturbed. Conditions in the NRC license typically require the licensee to stop work upon discovery of previously undocumented historic or cultural resources and to notify the appropriate Federal, Tribal, and State agencies with regard to mitigation measures. For these reasons, the GEIS concluded that ISR operations impacts to historic and cultural resources would be SMALL.

There would be minimal impacts from operations on NRHP-eligible sites at the proposed Nichols Ranch ISR Project. No sites will be directly affected by operations, because sites will be marked, fenced, and avoided. However, there will be an adverse effect to the visual setting of five TCPs. The applicant committed to a number of mitigation measures (Uranerz, 2007, 2010), which are listed in Section 4.9.1.1 of the SEIS and are specific to reducing impacts. These mitigation measures to which the applicant committed would remain in effect. There are no historic and cultural resources in the proposed project area that would be affected by facility

operation or maintenance. Should resources be encountered during routine maintenance activities, per site procedures, the applicant would stop work and notify NRC, WY SHPO, and other appropriate agencies (Uranerz, 2007). Therefore, NRC staff concludes that impacts to historic and cultural resources during operations would be SMALL.

Regarding the Pumpkin Buttes TCP, the Northern Cheyenne expressed concern that traffic, noise, dust, and extraction in general during operations may affect the integrity of the setting of Pumpkin Buttes. The applicant committed to a number of mitigation measures specific to reducing impacts on the Pumpkin Buttes TCP in its license application. These measures are described in SEIS Section 4.9.1.1.

In the case of paleontological resources, routine maintenance during operations could require ground-disturbing activities, which may impact fossil-bearing deposits. However, maintenance actions are usually near the surface and would likely be limited to predisturbed areas. Should ground-disturbing activities occur at depths in excess of a few feet, the applicant would have a monitor in place and its procedures would cover inadvertent discovery (Uranerz, 2007Taking into consideration the factors discussed above, NRC staff concludes that any impact from operations on paleontological resources would be SMALL.

4.9.1.3 Aquifer Restoration Impacts

In GEIS Section 4.3.8.3, aquifer restoration impacts to historic and cultural resources are expected to be similar to, or less than, potential impacts from operations. This is because aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing plant). For these reasons, the GEIS concluded the potential impacts from aquifer restoration to historic and cultural resources would be SMALL.

There would be minimal aquifer restoration impacts on NRHP-eligible sites and TCPs at the proposed Nichols Ranch ISR Project. No sites will be directly affected by aquifer restoration activities, because sites will be marked, fenced, and avoided. However, there would continue to be an adverse effect to the visual setting of five TCPs. As stated in Section 4.9.1.1, applicant-committed mitigation measures (Uranerz, 2007, 2010) would remain in effect. Should resources be encountered during restoration activities, per site procedures, the applicant would stop work and notify NRC, WY SHPO, and other appropriate agencies (Uranerz, 2007). Therefore, NRC staff concludes that impacts to cultural resources would be SMALL.

Regarding paleontological resources, should aquifer restoration activities involve ground disturbance in excess of a few feet, the applicant would have a monitor in place and its procedures would cover any inadvertent discoveries. Therefore, NRC staff concludes that the impact from aquifer restoration on paleontological resources would be SMALL.

4.9.1.4 Decommissioning Impacts

GEIS Section 4.3.8.4 discusses potential impacts from decommissioning to historic and cultural resources. It is expected that decommissioning and reclamation activities would focus on previously disturbed areas and historic and cultural resources within the potential area of effect would already be known. As a result, the GEIS concluded potential impacts to historic, cultural, and archaeological resources during decommissioning and reclamation would be SMALL. (NRC, 2009a)

There would be minimal decommissioning impacts on NRHP-eligible sites at the proposed Nichols Ranch ISR Project. No cultural sites would be directly affected during the decommissioning phase. No sites would be directly affected by decommissioning activities because sites will be marked, fenced, and avoided. If any unidentified cultural resources were encountered during decommissioning activities, the applicant would stop work and contact the appropriate State and Federal agencies. If ground-disturbing activities occur outside of previously surveyed areas during the decommissioning phase, then archaeological surveys would be conducted prior to the activity and appropriate mitigation responses would be identified at that time. Due to the adverse effect to the visual setting of five TCPs, applicant-committed mitigation measures identified in SEIS Section 4.9.1.1 would remain in effect during decommissioning activities (Uranerz, 2007, 2010). As buildings are dismantled and lands are reclaimed, there would be less visual impacts to the TCPs over time. After mining activities are completed, the land would be returned to preextraction use of wildlife habitat and grazing (Uranerz, 2007), Therefore, NRC staff concludes that the impacts to cultural resources would be SMALL.

With respect to paleontological resources, should decommissioning activities involve ground disturbance in excess of a few feet, the applicant would have a monitor in place and its procedures would cover any inadvertent discoveries. Therefore, NRC staff concludes that the impact from decommissioning on paleontological resources would be SMALL.

4.9.2 No-Action (Alternative 2)

Under the No-Action alternative, no ISR facility would be constructed or operated at the proposed Nichols Ranch ISR Project. No archaeological sites, isolated cultural resources, TCPs, or paleontological resources would be affected by the proposed action. The cultural impacts from current land activities, such as CBM extraction, oil and gas extraction, and cattle ranching, would continue.

4.9.3 Modified Action–No Hank Unit (Alternative 3)

4.9.3.1 Construction Impacts

Implementation of Alterative 3 would result in the construction of the Nichols Ranch Unit, but no construction at the Hank Unit. Selecting this alternative would avoid adverse impacts to the seven identified historic properties (including five TCPs) from construction, operation, aquifer restoration, and decommissioning of the Hank Unit. One NRHP-eligible site (48CA5391) is located near a projected wellfield on the Nichols Ranch Unit. This site would be avoided during construction and therefore would not be impacted by construction. The applicant would delineate the site and mark it with protective fencing to ensure it was not disturbed during construction. Fencing would not be visible from a distance and would include 1.8 to 2.4 m [6 to 8 ft] openings to allow livestock and wildlife movement (Uranerz, 2010). Because the Nichols Ranch Unit is located 9.6 km [6 mi] west of Pumpkin Buttes, there would be negligible effects on the Pumpkin Buttes TCP from construction of the Nichols Ranch Unit. Additionally, the applicant committed to a number of mitigation measures (Uranerz, 2007, 2010), which are listed in Section 4.9.1.1 of the SEIS and are specific to reducing impacts; therefore, NRC staff concludes that impact to historic and cultural resources would be SMALL.

Paleontological specimens are present at the Nichols Ranch Unit. Construction would impact both surficial Quaternary deposits and near-surface Eocene Wasatch Formation deposits. However, based on the geology of the site and the poor exposure of fossil-bearing sediment,

activities associated with this alternative would not significantly impact identified fossil remains. The applicant would have a monitor present during construction activities involving depths in excess of a few feet; therefore, NRC staff concludes the impact would be SMALL. If paleontological resources are discovered during construction, work would cease and the monitor would immediately contact the appropriate State and Federal agencies.

4.9.3.2 Operations Impacts

There would be minimal impacts from plant operations on one NRHP-eligible site at the Nichols Ranch Unit, because this site would be marked, fenced, and avoided. As stated in Section 4.9.1.1, applicant-committed mitigation measures (Uranerz, 2007, 2010) would remain in effect. There are no cultural resources known in the proposed project area that would be affected by facility operation or maintenance; however, the applicant procedures include inadvertent-discovery provisions. Should resources be encountered during routine operation or maintenance activities, work would be halted and the appropriate State and Federal agencies would be contacted. Therefore, NRC staff concludes the impact on cultural resources would be SMALL.

Because operational activities would occur only at the Nichols Ranch Unit, the impact on the five identified TCPs would be less compared to the proposed action. Therefore, NRC staff concludes the impact from plant operations on the Pumpkin Buttes and the four associated TCPs would be SMALL.

Paleontological resources could be impacted by routine maintenance during operations. However, most impacts would occur during initial plant construction. Should paleontological resources be encountered during routine operation or maintenance activities, work would be halted and the appropriate State and Federal agencies would be contacted. Therefore, NRC staff concludes the impact from operations on paleontological resources would be SMALL.

4.9.3.3 Aquifer Restoration Impacts

There would be minimal to no aquifer restoration impacts on the NRHP-eligible site at the Nichols Ranch Unit. This site would be marked, fenced, and avoided. As stated in Section 4.9.1.1, applicant-committed mitigation measures (Uranerz, 2007, 2010) would remain in effect. Applicant procedures include inadvertent-discovery provisions. Should resources be encountered during aquifer restoration, work would be halted and the appropriate State and Federal agencies would be contacted. Therefore, NRC staff concludes the impacts to cultural resources would be SMALL.

Because activities would be limited to the Nichols Ranch Unit, impacts to the five TCPs would be less compared to the proposed action and SMALL.

With respect to paleontological resources, should aquifer restoration activities involve ground disturbance depths in excess of a few feet, the applicant would have a monitor in place and its procedures would cover inadvertent discovery. Therefore, the impact from aquifer restoration on paleontological resources would be SMALL.

4.9.3.4 Decommissioning Impacts

There would be no decommissioning impacts on the NRHP-eligible site at the Nichols Ranch Unit. This site would be marked, fenced, and avoided. As stated in Section 4.9.1.1, applicant-

committed mitigation measures (Uranerz, 2007, 2010) would remain in effect. If ground-disturbing activities were to occur outside of previously surveyed areas, then the applicant would conduct cultural resource surveys prior to the project activity taking place.

Because activities would be limited to the Nichols Ranch Unit, impacts to the fiveTCPs would be less than for the proposed action and would be SMALL.

Regarding paleontological resources, should decommissioning activities involve ground disturbance depths in excess of a few feet, the applicant would have a monitor in place and its procedures would cover inadvertent discovery. Therefore, NRC staff concludes the impact on paleontological resources from decommissioning would be SMALL.

4.10 Visual and Scenic Resources Impacts

Potential visual and scenic impacts from the proposed Nichols Ranch ISR Project may occur during all phases of the ISR facility lifecycle. These impacts would come primarily from the use of equipment such as drill rigs; dust and other emissions from such equipment; the construction of facility buildings, other structures, and site and wellfield access roads; land clearing and grading activities; and lighting for nighttime operations. Such impacts could be mitigated by the rolling topography, the use of color considerations for structures, and dust-suppression techniques.

BLM Visual Resource Management (VRM) classification of landscapes was also considered in assessing the significance of these potential visual impacts. Most of the landscape in the Wyoming East Uranium Milling Region identified in the GEIS is VRM Class III or Class IV. These classes are based on a combination of scenic quality, sensitivity levels, and distance zones (BLM, 2007). This classification allows for an activity to contrast with basic elements of the characteristic landscape to a limited extent for a Class III designation and to a much greater degree for a Class IV designation.

4.10.1 Proposed Action (Alternative 1)

The Nichols Ranch and Hank Units are separated from one another by about 9.6 km [6 mi], and their settings are topographically different (Section 3.10). The effects of construction, operations, aquifer restoration, and decommissioning on the two units may differ because of the considerations that must be taken regarding the Pumpkin Buttes TCP, located immediately adjacent to and partially overlapped by the Hank Unit. An overall impact assessment for each issue is provided next, followed by a separate discussion of the impacts at the Nichols Ranch and Hank Units with respect to the Pumpkin Buttes TCP.

The BLM Buffalo Field Office identified the potential for a visual impact from the proposed development in the Hank Unit, which could affect the Pumpkin Buttes TCP's setting, feeling, and association (BLM, 2009c). A PA (BLM, 2009a) between WY SHPO and BLM for the Pumpkin Buttes TCP requires developers within 3.2 km [2 mi] radius of the Pumpkin Buttes to complete a Class III survey of any proposed project within the area, submit detailed construction plans, and participate in an onsite evaluation with BLM (BLM, 2009a). In addition to the Pumpkin Buttes, four additional TCPs (Sites 48CA6748, 48CA6753, 48CA6751, and 48CA6148) were identified through Native American consultation during the NRC's environmental review. Because the Hank Unit falls within the 3.2 km [2 mi] radius of the Pumpkin Buttes, the applicant must follow the stipulations listed in BLM's Programmatic Agreement (PA) with WY SHPO for mitigation of

adverse effects for the Pumpkin Buttes TCP (BLM, 2009b). This process ensures the effects of both units at the proposed Nichols Ranch ISR Project on visual resources would be mitigated.

4.10.1.1 Construction Impacts

As described in GEIS Section 4.3.9.1, visual impacts during construction can result from the presence of equipment (e.g., drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Depending on the location of an ISR facility relative to viewpoints such as highways, process facility construction and the presence of drill rigs could be visible. For nighttime operation, the drill rigs would be lighted, thus creating a visual impact on elevated areas. Most impacts would be temporary as equipment is moved and would be mitigated by BMPs (e.g., dust suppression). Additionally, because these sites are located in sparsely populated areas with rolling topography, most visual impacts during construction would not be visible from more than about 1 km [0.6 mi]. As previously described, PSD Class I areas require more stringent air quality standards that can affect visual impacts. However, there are no PSD Class I areas in the Wyoming East Uranium Milling Region. Finally, because proposed ISR facilities are expected to be located more than 16 km [10 mi] from the closest VRM Class II area and the visual impacts from ISR construction would be consistent with the predominant VRM Class III and IV classification in the region, the visual impact from ISR construction would be SMALL (NRC, 2009a). The following is a site-specific discussion of visual impacts from construction at both units at the proposed Nichols Ranch ISR with respect to the Pumpkin Buttes TCP.

4.10.1.1.1 Nichols Ranch Unit

Visual impacts from construction of the Nichols Ranch Unit would be consistent with impacts described in Section 4.10.1.1. No visual contrast during construction would affect any Class II areas. The two closest residences are the Pfister and Dry Fork Ranches (Uranerz, 2007). The Pfister Ranch is located approximately 0.9 km [0.6 mi] to the north of the Hank Unit's northernmost boundary, and the Dry Fork Ranch is located 1.4 km [0.9 mi] to the west of the Nichols Ranch Unit western boundary. Because there would be little to no visual contrast during construction, the NRC concludes that the impact would be SMALL. With respect to the Pumpkin Buttes TCP, Nichols Ranch Unit is outside the 3.2-km [2-mi] radius for potential impact on a TCP element. As a result, the applicant is not required to comply with mitigative measures stipulated in the BLM/SHPO PA for actions within the Nichols Ranch Unit. However, BLM has not yet developed mitigation responses for actions outside the 3.2-km [2-mi] radius of a TCP within BLM lands. BLM completed a scenic quality field inventory in the summer of 2009, the first step in a contrast rating evaluation. Because the Nichols Ranch Unit does not contain any BLM lands, the applicant would not be required to comply with any future BLM mitigative stipulations that apply beyond the 3.2-km [2 mi] radius of the Pumpkin Buttes TCP identified in the PA between BLM and WY SHPO (BLM, 2009a). Therefore, NRC staff concludes that the visual impact would be SMALL. Results of Section 106 consultation under the NHPA, which could further reduce the SMALL visual impact from the Nichols Ranch Unit, are presented in Section 4.9. Documentation related to the Section 106 consultation process is provided in Appendix A.

4.10.1.1.2 Hank Unit

Since the Hank Unit overlaps with and lies inside the 3.2-km [2.0-mi] radius of the Pumpkin Buttes TCP, mitigation measures identified in the BLM/SHPO PA for the Pumpkin Buttes TCP would apply to construction activities in the Hank Unit on the 113-ha [280-ac] portion of land the

BLM administers. In addition to the Pumpkin Buttes, four additional TCPs (Sites 48CA6748, 48CA6753, 48CA6751, and 48CA6148) were identified through Native American consultation during the NRC's environmental review. The applicant has committed to following a number of mitigation measures outlined in the BLM/SHPO PA for the entire portion of the proposed Nichols Ranch ISR Project within 3.2 km [2.0 mi] of the base elevation of the Pumpkin Buttes TCP (Uranerz, 2010). These measures, listed in Section 4.9.1.1 of the SEIS, would apply to all of the Hank Unit.

Additionally, as described in Sections 1.7 and 4.9, NRC staff is consulting with BLM Buffalo Field Office, WY SHPO, interested Native American tribes, and the applicant to develop an MOA to address mitigation of the adverse effects on the Pumpkin Buttes TCP and the four other identified TCPs. However, because of the proximity of the Hank Unit to the Pumpkin Buttes TCP and the presence of construction machinery in plain view, some visual and scenic effects from construction would occur, and therefore, NRC staff concludes that the impacts would be MODERATE.

Based on the review of the applicant-committed mitigation measures the environmental report; the staff's site visit; meetings with Federal, State, local, and Tribal officials and other stakeholders; and the evaluation of other available information, the NRC staff concluded that the site-specific conditions at the Hank Unit differ from those described in the GEIS for visual and scenic resources. The GEIS concludes that the impacts to visual and scenic resources in the Wyoming East Uranium Milling Region during construction of an ISR facility would be SMALL. However, the proximity of the Hank Unit to the Pumpkin Buttes TCP is unique to the proposed Nichols Ranch ISR Project site. For the reasons described in the previous section, the NRC staff concluded that the impacts to visual and scenic resources at the Hank Unit during the construction phase would be MODERATE. This MODERATE impact would be mitigated by implementing the applicant-committed measures listed in Section 4.9.1.1.

4.10.1.2 Operations Impacts

GEIS Section 4.3.9.2 states visual impacts during operations would be less than those from construction because the wellfield surface infrastructure would have a low profile and most piping and cables would be buried. The tallest structures would be expected to include the central processing plant, 10 m [30 ft] in height, and power lines, 6 m [20 ft] in height. Because ISR sites are typically located in sparsely populated areas with generally rolling topography, most visual impacts during operations would be limited to a distance of not more than about 1 km [0.6 mi]. The irregular layout of wellfield surface structures, such as wellhead protection and header houses, would further reduce visual contrast. BMPs, design (e.g., painting buildings), and landscaping techniques would be used to mitigate potential visual impact. The Wyoming East Uranium Milling Region defined in the GEIS is located more than 16 km [10 mi] from the closest VRM Class II region, and the visual impacts from ISR construction would be consistent with the predominant VRM Classes III and IV of the region. Therefore, the GEIS concluded that visual and scenic impacts from operations would be SMALL (NRC, 2009).

The Nichols Ranch ISR Project operations are proposed for an area where extensive CBM development has already occurred and where additional CBM development is planned. CBM installations include networks of wells, underground piping, pump structures, and overhead power lines, which are much larger and more extensive than ISR facilities. Despite the existing visual impacts from CBM development, the applicant intends to implement measures to lessen the visual impact from the proposed Nichols Ranch ISR Project. Buildings and other structures would be painted so they blend in to the natural landscape, and power lines and pipelines would

be buried where appropriate. The Hank Unit, located at the base of the Pumpkin Buttes, would be a satellite to the Nichols Ranch Unit, where the central processing plant would be located. As a satellite facility, the number and size of structures and supporting facilities would be smaller than at the central processing plant (Uranerz, 2007, 2010).

Implementation of the mitigation measures identified in Section 4.9.1.1 of the SEIS would reduce visual impacts on the five TCPs, including the Pumpkin Buttes TCP; therefore, NRC concludes the operational impacts on visual and scenic resources would be SMALL.

4.10.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.9.3 addresses visual and scenic impacts from aquifer restoration. The GEIS states that aquifer restoration activities would be expected to take place some years after the facility had been in operation and restoration activities would use in-place infrastructure. As a result, potential visual impacts would be similar to those experienced during operations. Mitigation measures (e.g., dust suppression) could be used to further reduce visual and scenic impacts. In addition, implementing the mitigation measures described in Section 4.9.1.1 would further reduce the potential for visual impacts on all five TCPs, including the Pumpkin Buttes TCP; therefore, NRC staff concludes the potential impacts from aquifer restoration would be SMALL.

4.10.1.4 Decommissioning Impacts

As described in GEIS Section 4.3.9.4, because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be similar to those experienced during construction. The greatest potential for visual impacts during decommissioning would only be temporary as equipment is moved from place to place and mitigated by BMPs (e.g., dust suppression). Additionally, visual impacts would be low, because these sites are expected to be located in sparsely populated areas of the Wyoming East Uranium Milling Region, and the impacts would diminish as decommissioning activities decrease. By regulation (10 CFR 40.42), NRC licensees are required to conduct final site decommissioning and reclamation under an approved site reclamation plan, with the goal of returning the landscape to preconstruction conditions. While some roadside cuts and hill slope modifications may persist beyond decommissioning and reclamation, the GEIS concluded that visual and scenic impacts from decommissioning would be SMALL. Mitigation through BMPs (e.g., dust suppression) would further reduce the SMALL visual and scenic impacts from decommissioning (NRC, 2009).

The applicant would implement dust suppression to reduce visual and scenic impacts, a BLM and WDEQ requirement (Uranerz, 2007). The GEIS assumptions regarding decommissioning are the same as those proposed for the Nichols Ranch ISR Project (e.g., dust suppression). Mitigation measures specified in Section 4.9.1.1 of the SEIS for the Hank Unit would further minimize the impacts on the five TCPs, including the Pumpkin Buttes TCP. Therefore, NRC staff concludes the visual and scenic impacts from decommissioning would be SMALL.

4.10.2 No-Action (Alternative 2)

Under the No-Action alternative, no ISR facility would be constructed and there would be no change to the existing visual and scenic resources. The existing pipelines, wellfields, and utility lines within the proposed project area from CBM and gas extraction activities would remain. No additional structures or uses associated with the proposed Nichols Ranch ISR Project would be

introduced from the proposed action to affect the existing viewscapes, and the existing scenic quality would remain unchanged (BLM Class IV, as defined in Section 3.10).

Because there would be no ISR facility construction under the No-Action alternative, the other phases of the ISR lifecycle would not occur. There would be no impact to visual and scenic resources. Natural resource exploration activities and cattle grazing would continue in the area.

4.10.3 Modified Action–No Hank Unit (Alternative 3)

Under this alternative, the Hank Unit would not be developed and all proposed activities would be confined to the Nichols Ranch Unit. As noted in the discussion of the proposed action, the applicant's coordination with BLM and WY SHPO would determine the extent to which the actions at the proposed Nichols Ranch ISR Project site would be visible from the five identified TCPs, including the Pumpkin Buttes TCP, and would help identify appropriate mitigation strategies. Because of the distance between the Nichols Ranch Unit and the five TCPs, impacts from this alternative under all phases would be less than the proposed action and supports the NRC conclusion of a SMALL impact.

4.10.3.1 Construction Impacts

Under this alternative, construction activity at the Hank Unit would not occur. There would be no land clearing, wellfield development, road construction, or building construction to impact visual and scenic resources at the Hank Unit. Dust and diesel emissions from vehicles and construction equipment would not impair visibilities surrounding the Pumpkin Buttes TCP. The use of BMPs (Uranerz, 2007, 2010) at the Nichols Ranch Unit would still be implemented under this alternative, but the overall impacts on visual and scenic resources from the construction phase would be greatly reduced. Therefore, NRC staff concludes the impact from this phase would be SMALL.

4.10.3.2 Operations Impacts

The operation impacts from this alternative would be similar to those stated for the proposed action. However, because the Hank Unit would not be constructed, header houses and well covers would not be present. More importantly, diesel emissions and dust from trucks transferring ion-exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant that could impair visual and scenic resources would not occur. BMPs (Uranerz, 2007, 2010) would still be implemented at the proposed Nichols Ranch ISR Project site under this alternative, but NRC staff concludes the overall impacts on visual and scenic resources during the operation phase under this alternative would remain SMALL.

4.10.3.3 Aquifer Restoration Impacts

The impacts from aquifer restoration for this alternative would be similar to those stated for the proposed action, but without the Hank Unit, the potential impacts would be even less. BMPs would still be implemented for the Nichols Ranch Unit under this alternative; however, NRC staff concludes the impacts on visual and scenic resources during the aquifer restoration phase of this alternative would be SMALL.

4.10.3.4 Decommissioning Impacts

The potential impacts from decommissioning under this alternative would be similar to those stated for the proposed action, but less because the Hank Unit would not be constructed. Half the number of wellfields would need to be decommissioned and reclaimed, along with header houses and other appurtenant structures. Soil and road reclamation and infrastructure demolition would not affect scenic resources through visual impairment under this alternative. The levels of pollutants generated would be similar to the construction phase of the proposed action, but diminished because the Hank Unit would not be present. BMPs (Uranerz, 2007, 2010) would still be implemented at the Nichols Ranch Unit under this alternative, but NRC staff concludes the overall impacts on visual and scenic resources during the decommissioning phase of this alternative would be SMALL.

4.11 Socioeconomic Impacts

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the proposed action could affect regional employment, income, and expenditures. Job creation is characterized by two types: (i) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact on the region, and (ii) operation-related jobs in support of facility operations, which have the greater potential for permanent, long-term socioeconomic impacts in the region.

The socioeconomic ROI represents a geographic area where the proposed Nichols Ranch ISR Project employees and their families would reside, spend their income, and use their benefits, thereby affecting the economic conditions of the region. As previously discussed, the focus of the analysis in the SEIS is on the impacts of constructing and operating the proposed ISR facility in Campbell and Johnson Counties.

Detailed discussion of the potential environmental impacts to socioeconomics from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

The GEIS socioeconomic analysis is based on 2000 U.S. Census Bureau (USCB) data. The socioeconomic analysis presented in this SEIS for the proposed Nichols Ranch ISR Project ROI is based on a combination of 2000 USCB data, USCB 2005–2007 American Community Survey 3-Year Estimates, and USCB 2009 State and County QuickFacts (USCB, 2009). Though specific numbers may differ, the analysis of socioeconomics presented in GEIS Section 4.3.10 remains valid for the proposed Nichols Ranch ISR Project as explained in the following sections.

4.11.1 Proposed Action (Alternative 1)

4.11.1.1 Construction Impacts

GEIS Section 4.3.10.1 discusses the potential impacts to socioeconomics from construction of an ISR facility. These impacts would result predominantly from employment at an ISR facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local workforce. The GEIS estimated total peak construction employment to be about 200 people. The GEIS also estimated an additional 140 jobs could be created from the construction of the ISR facility. During construction of surface facilities and wellfields, it is expected that a general practice would be to use local

contractors (e.g., drillers, construction workers), as available, and local building materials and building supplies would be used to the extent practical.

The GEIS assumed that most construction workers would choose to live in larger communities with access to more services. However, the GEIS expected that some construction workers would commute from outside the county to the construction site and that skilled employees (e.g., engineers, accountants, managers) would come from outside the local workforce. The potential also exists that some of these employees would temporarily relocate to the proposed project area and contribute to the local economy through purchasing goods and services and paying taxes. After review of the applicant's ER (Uranerz, 2007); the site visit; meeting with Federal, State, local, and Tribal officials and other stakeholders; and the evaluation of other available information, the NRC staff concludes that the site-specific impacts of constructing the proposed Nichols Ranch ISR Project would be bounded by the impacts described in the GEIS, based on the smaller number of required workers [200 estimated in the GEIS versus 45 to 55 estimated by the applicant (Uranerz, 2007)] for the proposed Nichols Ranch ISR Project site. Furthermore, the NRC staff did not identify any new and significant information during its independent review that would change the conclusions summarized in the GEIS.

Because a smaller number of workers would be required to construct the proposed Nichols Ranch ISR Project, the overall potential for socioeconomic impacts would be SMALL. The following subsections describe the effects of ISR facility construction on demographic conditions, income, housing, employment rate, local finance, education, and health and social services.

4.11.1.1.1 Demographics

Because of the short duration of construction (1 year) and small size of the construction workforce (45 to 55 workers), the impacts of construction on demographic conditions would be limited. It is assumed that the applicant would employ workers from the surrounding area, which would reduce demands for public services. Also, due to the short duration of the construction phase, workers would not likely relocate their families to the region. Therefore, demographic impacts from the proposed action would be SMALL.

4.11.1.1.2 Income

No changes to income levels in the region would be anticipated as a result of ISR facility construction activities. It is expected workers would be paid the regional rates typical of the area. Therefore, impacts from the proposed action would be SMALL.

4.11.1.1.3 Housing

Construction workers relocating to the area would cause a short-term increase in the demand for temporary (rental) housing units in Campbell and Johnson Counties. However, the number of available housing units in Campbell County has kept pace with the population increase in the county (see SEIS Sections 3.11.1, Demographics, and 3.11.3, Housing). Any changes in employment would have little to no noticeable effect on the availability of housing in Campbell and Johnson Counties. Due to the short duration of the construction phase and the availability of housing in the region, there would be little or no employment-related housing impacts. In addition, it is assumed the applicant would employ workers from the surrounding area, thereby reducing some of the need for additional housing. Therefore, housing impacts from the proposed action would be SMALL.

4.11.1.1.4 Employment Rate

Construction of the proposed Nichols Ranch ISR Project would create employment opportunities for 45 to 55 construction workers with the potential of up to 30 to 40 additional jobs being generated to support this activity in the local economy. Because of the short duration (1 year) and small number of jobs generated by the construction of the proposed Nichols Ranch ISR Project, the overall effect on employment in the region would be SMALL.

4.11.1.1.5 Local Finance

Construction of the proposed Nichols Ranch ISR Project would generate some tax revenue in the local economy through the purchase of goods and services as well as contributing to county and state tax revenues. Because of the short duration (1 year) and small size of the construction workforce (45 to 55 workers), construction of the proposed Nichols Ranch ISR Project would have a SMALL impact on local finances.

4.11.1.1.6 Education

Because of the short duration of construction (1 year; the GEIS assumed 12 to 18 months), workers would not be expected to bring families and school-aged children with them, and therefore, there would be no impact on educational services during construction of the proposed Nichols Ranch ISR Project.

4.11.1.1.7 Health and Social Services

The number of construction workers would cause a short-term increase in the demand for health and social services in Campbell and Johnson Counties. However, due to the short duration of the ISR construction phase and the small size of the construction workforce (45 to 55 workers), there would be little or no impact on health and social services. Therefore, it is anticipated that impacts on health and social services would be SMALL.

4.11.1.2 Operations Impacts

Operation of the proposed Nichols Ranch ISR Project is expected to last 9 years and employ from 45 to 55 workers (Uranerz, 2007). GEIS Section 4.3.10.2 discussed employment levels during ISR facility operations and assumed 50 to 80 workers would support this phase of the ISR lifecycle (NRC, 2009a). The complexity of ISR facility operations would require technically skilled workers who would not be available locally. The majority of the operational workforce would be staffed from outside the region, particularly during initial operations.

According to the GEIS, the effects on community services (e.g., education, healthcare, utilities, shopping, and recreation) during operation are expected to be similar to effects during construction, but longer in duration.

The operations phase of the proposed Nichols Ranch ISR Project is expected to last for approximately 9 years. The operations workforce would impact the local economy through the creation of jobs, the purchasing of local goods and services, and the increase in county and state tax revenues. Severance tax on the uranium extracted would also be collected at the state level and would contribute to the State of Wyoming general fund.

Because of the small relative size of the ISR operational workforce at the proposed Nichols Ranch ISR Project, the overall potential impacts to socioeconomics from construction would be SMALL. The following subsections describe the operation impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services.

4.11.1.2.1 Demographics

According to the applicant, the number of operations workers would be equal to the number of construction workers [45 to 55 workers (Uranerz, 2007)] with the potential of up to 30 to 40 additional jobs being generated to support this activity in the local economy; however, operations workers would stay in the area for approximately 9 years. ISR facility operations require a number of specialized workers, such as plant managers, technical professionals, and skilled tradespeople who would relocate from outside the area. Assuming the entire direct and indirect workforce comes from outside the region of influence, the combined effect of 85 to 95 new persons in the region would constitute 1 percent or less of the current civilian labor force in Campbell and Johnson Counties. Demographic conditions in Campbell and Johnson Counties would not likely change. The impact on demographic conditions would be SMALL.

4.11.1.2.2 Income

The average annual salary for all full-time employees would be roughly $50,000 (Uranerz, 2007). This slightly exceeds the Wyoming average of $48,205 (USCB, 2008). The impacts on income during operations would be SMALL.

4.11.1.2.3 Housing

Demand for permanent housing is anticipated to increase in the communities surrounding the proposed Nichols Ranch ISR Project site leading up to the startup of ISR facility operations. The surrounding towns of Wright, Edgerton, and Midwest, as well as larger cities such as Gillette and Casper, are within commuting distance to the proposed project area. Although there are more than 1,500 vacant units in Campbell and Johnson Counties (see Table 3-16), vacancy rates are currently low in some of the nearby towns and cities, and the additional demand for housing could have an impact in these communities. Because of the small size of the operations workforce (45 to 55 workers) and the potential addition of 30 to 40 (indirect) workers in support of facility operations, impacts to housing during ISR facility operations could range from SMALL for the region to MODERATE for nearby communities.

4.11.1.2.4 Employment Rate

As previously discussed, the proposed ISR facility operations at Nichols Ranch would generate 45 to 55 new jobs, such as project managers, plant operators, lab technicians, and drill contractors. Some skilled positions would likely be filled by people moving into the area rather than providing employment opportunities for people living in nearby communities. ISR facility operations could provide some jobs in the local economy. However, because it is likely that most skilled workers would be drawn from areas outside of the ROI, the proposed ISR facility operations at Nichols Ranch would not noticeably affect employment rates in Campbell and Johnson Counties.

4.11.1.2.5 Local Finance

Campbell and Johnson Counties would receive some tax revenue during ISR facility operations. Personal property tax would be applied to the value of all equipment used by the proposed project. In addition, a state mineral severance tax would be applied to the extracted uranium; however, this tax would not be directly returned to Campbell and Johnson Counties. A county *ad valorem* tax for production would also contribute to local government revenue. Indirectly, the counties would benefit from increased sales tax revenue from the increased number of workers relocating to the ROI and from increased demand for goods and services. The tax-revenue-related impact from ISR facility operations on local taxing jurisdictions in Campbell and Johnson Counties would be SMALL.

4.11.1.2.6 Education

The number of school-aged children could increase because 45 to 55 workers and their families could relocate to Campbell and Johnson Counties during ISR facility operations, impacting local public schools and education-related services. The average family size in Wyoming is 2.97 (USCB, 2005–2007); therefore, a conservative estimate for the number of school-aged children that could relocate to the ROI would be 45 to 55 children. Comprising various ages and spread across schools and classrooms in both counties (kindergarten and grades 1 through 12), this small number of children would not likely have a noticeable effect on student-to-teacher ratios. County planners indicated schools could accommodate a small increase in the number of students. Schools and education-related service impacts during the ISR facility operations would be SMALL.

4.11.1.2.7 Health and Social Services

There would be a small increase in the demand for health and social services during ISR facility operations from workers and their families relocating to the ROI. Operational impacts would not be expected to differ significantly from those during the construction phase of the ISR facility. Impacts to health and social services during operations would remain SMALL.

4.11.1.3 Aquifer Restoration Impacts

As discussed in GEIS Section 4.3.10.3, socioeconomic impacts from aquifer restoration were expected to be similar to impacts experienced during facility operations, because the number of workers at the ISR facility and demand for services in the region would not change. The conclusion in the GEIS was impacts would be SMALL.

However, aquifer restoration at the Nichols Ranch site would require fewer workers than ISR facility operations. According to the applicant, approximately 20 workers would be needed (Uranerz, 2009). Because the restoration would be short term and would not require any specialized skills, it is expected that some ISR facility operations workers would remain to assist in the aquifer restoration with the remainder drawn from the local labor pool. Based on this information, overall socioeconomic impacts during aquifer restoration would be less than those experienced during ISR facility operations due to the smaller number of workers required during this phase. Therefore, overall socioeconomic impacts from aquifer restoration would be SMALL.

4.11.1.4 Decommissioning Impacts

NRC has regulations and guidance for decommissioning. These regulations are found in 10 CFR 40.42. Additional guidance on how to decommission a nuclear facility is provided in the Consolidated NMSS Decommissioning Guidance, NUREG–1757. Decommissioning of the proposed ISR facility would be subject to a separate safety and environmental review. The decommissioning process would commence when the licensee informs NRC that it intends to decommission the facility or has ceased principal activities at the entire site or in any building or outdoor area. The licensee would prepare a decommissioning plan and submit it to NRC for review. Upon approval of the decommissioning plan, NRC would amend the license to allow decommissioning to proceed. At the completion of decommissioning, the licensee would conduct a final status survey to demonstrate compliance with criteria established in the decommissioning plan. After NRC had confirmed that the criteria in the decommissioning plan to release the site or portion of the site have been met, NRC would either terminate or amend the license, depending on the intended use of the site.

Socioeconomic impacts during the decommissioning of the ISR facility at Nichols Ranch would require fewer workers than ISR facility construction and operations. According to the applicant, approximately 20 workers would be required to support decommissioning activities (Uranerz, 2009). Based on this information, overall socioeconomic impacts during the decommissioning of the proposed ISR facility would be SMALL.

4.11.2 No-Action (Alternative 2)

Under the No-Action alternative, the ISR facility would not be constructed and operated at Nichols Ranch. Socioeconomic conditions in Campbell and Johnson Counties would remain unchanged.

4.11.3 Modified Action–No Hank Unit (Alternative 3)

Under Alternative 3, the Hank Unit would not be constructed and operated. All proposed facilities would be located at the Nichols Ranch Unit. A fewer number of workers would be required to construct, operate, perform aquifer restoration, and decommission the ISR facility at the Nichols Ranch Unit; therefore, the potential impact would be less than described for the proposed action. The socioeconomic impact from ISR facility construction would be SMALL, the impact from operations could range from regionally SMALL to locally MODERATE, and the impact from aquifer restoration and decommissioning would be SMALL.

4.12 Environmental Justice Impacts

Under Executive Order (EO) 12898 (59 FR 7629), Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations, Federal agencies are required to identify and address, as appropriate, disproportionately high or adverse human health or environmental effects of their programs, policies, and activities on minority populations and low income populations. A specific consideration of equity and fairness in resource decisionmaking is encompassed in the issue of environmental justice. As required by law and Title VI, all federal actions would consider potentially disproportionately negative impacts on minority or low income communities.

In 2004, in response to EO 12898, the Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040),

which states, "The Commission is committed to the general goals set forth in EO 12898, and strives to meet those goals as part of its NEPA review process."

The Council of Environmental Quality (CEQ) provided the following information in CEQ (1997):

> Disproportionately High and Adverse Human Health Effects. Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as employed by NEPA) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group.
>
> Disproportionately High and Adverse Environmental Effects. A disproportionately high environmental impact that is significant (as employed by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as defined by NEPA). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered.

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from the construction and operation of the proposed Nichols Ranch ISR Project. In assessing the impacts, the following CEQ (1997) definitions of minority individuals and populations and low-income population were used:

> Minority individuals. Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.
>
> Minority populations. Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
>
> Low-income population. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

4.12.1 Analysis of Impacts

Methodology

NRC addresses environmental justice matters for license reviews through (i) identifying of minority and low income populations that may be affected by the proposed construction and

operation of the proposed Nichols Ranch ISR Project and (ii) examining any potential human health or environmental effects on these populations to determine whether these effects may be disproportionately high and adverse.

The 2000 Census provides race and poverty characteristics for census tracts and block groups in Campbell and Johnson Counties. The proposed Nichols Ranch ISR Project and a 1.6-km [2-mi] perimeter are contained within two block groups that encompass portions of Campbell and Johnson Counties.

Campbell County was selected as the geographic area for comparison of demographic data for the affected census tract populations. This comparison was made to determine the concentration of minority or low-income populations in the affected census tracts relative to the state.

Census Block Group data are available from the 2000 Census. Table 4-1 shows the percentage of people living in poverty and the minority population in the United States, Wyoming, Campbell and Johnson Counties, and the block groups closest to the proposed Nichols Ranch ISR Project.

Analysis

According to the 2000 Census, the populations of Campbell and Johnson Counties were 33,698 and 7,075 (USCB, 2009). Approximately 11 percent of the Wyoming population (493,783) was classified as minority (Table 4-1). The minority populations in the Census Block Groups containing the proposed Nichols Ranch ISR Project ranged from 3.3 to 4.0 percent, which are both well below the state average of 11 percent (USCB, 2009).

According to American Community Survey 3-Year Census data estimates (2006–2008), the populations in the two counties increased to 40,121 (Campbell) and 8,464 (Johnson). Minority populations are estimated to have increased since 2000 by approximately 1,300 and 140 persons, respectively. The estimated percentage of minorities in Campbell County rose to 8.3 percent and Johnson County 5.0 percent. Most of this increase was due to an estimated influx of Hispanics or Latinos (more than 900 persons), an increase in population of 67.5 percent from 2000 (USCB, 2009).

Table 4-1. Percent of Population Living in Poverty and Percent Minority Population in 2000

Geographic Unit	Percent of Population Living in Poverty	Percent Minority Population
U.S.	13.0	30.9
Wyoming	11.4	11.2
Campbell County	7.6	6.5
Campbell County Project Block Group 1-1	12.4	3.3
Johnson County	10.1	3.8
Johnson County Project Block Group 9551-1	12.5	4.0
Source: USCB, 2009		

According to the 2000 Census, the U.S. population living below the poverty level was determined as 13 percent, and 11.4 percent of the population in Wyoming was determined to be living below the poverty level (the 1999 Federal poverty threshold was $17,029 for a family of four). The percentage of people living below the poverty level within the Census Block Groups surrounding the proposed Nichols Ranch ISR Project ranged from 7.6 to 12.5 percent. In the 2000 Census, 8.0 percent of families and 11.4 percent of individuals in Wyoming were living below the Federal poverty threshold in 1999 (USCB, 2009).

According to American Community Survey 3-Year Census data estimates, the median household income for Wyoming for the years 2006-2008 was $53,096, with 8.9 percent of the state population and 5.5 percent of families living below the Federal poverty threshold. Campbell County had a much higher estimated median household income average ($76,666) and lower percentages of individuals (5.1 percent) and families (4.2 percent) living below the poverty level when compared to the state average. Johnson County had the lowest median household income ($51,162) and higher percentages of individuals (8.3 percent) living below the poverty level when compared to Campbell County (USCB, 2009).

The percentage of minority populations living in the affected block groups is similar to the Johnson County percentage and very small when compared to the percentage of minority populations recorded at the state level and much less than the national level. No minority populations were identified as residing near the proposed Nichols Ranch ISR Project site. Therefore, there would be no disproportionately high and adverse impact to minority populations from the proposed Nichols Ranch ISR Project.

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of the proposed Nichols Ranch ISR Project. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impacts on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts (CEQ, 1997). Some of these potential effects have been identified in the resource areas discussed in Chapter 4 of the SEIS. For example, increased demand for rental housing during the construction of the ISR facility could disproportionately affect low-income populations. Minority and low-income populations are subsets of the general public residing around the proposed Nichols Ranch ISR Project site, and all would be exposed to the same health and environmental effects generated from construction, operations, aquifer restoration, and decommissioning activities.

4.12.2 Proposed Action (Alternative 1)

Potential impacts to minority and low-income populations due to the construction, operation, and decommissioning of the proposed ISR facility and aquifer restoration at Nichols Ranch would mostly consist of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction activities would be short-term and limited to onsite activities. Minority and low-income populations residing along site access roads could experience increased commuter vehicle traffic during construction

and operational shift changes. As construction and operations employment increases at the proposed Nichols Ranch ISR Project site, employment opportunities for minority and low-income populations may also increase. Increased demand for rental housing during peak construction could disproportionately affect low-income populations. However, according to the latest census information, there were more than 1,000 vacant housing units in Campbell County (see Section 3.11.3 of the SEIS). Based on this information and the analysis of human health and environmental impacts presented in Chapter 4, there would be no disproportionately high and adverse impacts to minority and low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project.

As part of addressing environmental justice associated with license reviews, NRC also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

Subsistence Consumption of Fish and Wildlife

Section 4-4 of EO 12898 (59 FR 7629) directs Federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who rely principally on fish and wildlife for subsistence and to communicate the risks of these consumption patterns to the public. In this SEIS, NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors. Special pathways that took into account the potential levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the proposed Nichols Ranch ISR Project site were considered.

Potential impacts to minority and low-income populations would mostly consist of radiological effects; however, radiation doses from ISR facility operations would be expected to be well below regulatory limits as described in Section 4.13. Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the proposed construction, operation, aquifer restoration, and decommissioning of the Nichols Ranch ISR Project would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations residing in the vicinity of the proposed Nichols Ranch ISR Project.

4.12.3 No-Action (Alternative 2)

Under Alternative 3, the impact on minority and low-income populations from the construction and operation of the proposed Nichols Ranch ISR Project, aquifer restoration, and decommissioning would be the same as described for the proposed action. There would be no disproportionately high and adverse impacts to minority or low-income populations from this alternative.

4.12.4 Modified Action–No Hank Unit (Alternative 3)

Under this alternative, impacts to minority and low-income populations during the construction and operation of the proposed Nichols Ranch ISR Project, aquifer restoration, and decommissioning would be the same as stated for the proposed action. There would be no

disproportionately high and adverse impacts to minority or low-income populations from this alternative.

4.13 Public and Occupational Health and Safety Impacts

Potential radiological and nonradiological impacts to public and occupational health and safety from ISR activities at the proposed Nichols Ranch ISR Project could occur during all phases of the ISR facility lifecycle. Such impacts could occur from normal operations or from accidents.

Detailed discussion of the potential environmental impacts to public and occupational health and safety from construction, operation, aquifer restoration, and decommissioning the proposed Nichols Ranch ISR Project are provided in the following sections.

4.13.1 Proposed Action (Alternative 1)

4.13.1.1 Construction Impacts

GEIS Section 4.3.11.1 discussed construction activities at an ISR facility, which would include installation of wellfields (and associated piping) and construction of surface-processing structures, access roads, and supporting utilities. Fugitive dust generated from construction and vehicle traffic is expected but would likely be of short duration. The construction phase at the proposed Nichols Ranch ISR Project has been estimated to last 9 months. Radiological environmental monitoring data from the one-year monitoring program showed that annualized average background gamma exposure rates at the Nichols Ranch and Hank Units are 42.5 and 45.4 mrem, respectively. These values are within the range of typical background exposure rates in the Western United States, and no significantly elevated levels of radioactive materials in soils beyond natural background levels have been identified (Uranerz, 2007). Therefore, inhalation of fugitive dust with these background levels does not pose a radiological dose significantly different than that from natural background exposure (NRC, 2009a).

Construction equipment would likely be diesel powered and would result in diesel exhaust that includes small particles. The impacts and potential human exposures from these emissions would be SMALL because the releases are usually of short duration and are readily dispersed into the atmosphere (NRC, 2009a). Appendix D of the final SEIS describes the emissions inventory evaluated for the proposed Nichols Ranch ISR Project.

The NRC staff has not identified any new and significant information during its independent review of the proposed Nichols Ranch ISR Project Environmental Report, the site visit, or evaluation of other available information. Therefore, the NRC staff has determined that there would be no significant impacts to public and occupational health and safety from construction beyond those discussed in the GEIS. The construction phase of the proposed Nichols Ranch ISR Project would have a SMALL impact on workers and the general public.

4.13.1.2 Operations Impacts

GEIS Section 4.3.11.2 discussed potential occupational radiological impacts from normal operations that could result from (i) exposure to radon gas from the wellfields, (i) ion-exchange resin transfer operations, and (iii) venting during processing activities. Workers could also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation could occur from radon releases from the wellfields and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker

and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20, which requires licensees to implement an NRC-approved radiation protection program. Measured and calculated doses for workers and the public are commonly only a fraction of regulated limits. For these reasons, the GEIS concluded that potential radiological impacts to workers and the public would be SMALL (NRC, 2009a).

Nonradiological worker safety would be addressed through occupational health and safety regulations and practices.

Radiological accident risks could involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. The GEIS concluded the consequences of these accidents to workers and the public would generally be low, except for a dryer explosion, which could result in a worker dose exceeding NRC limits. The likelihood of such an accident would be expected to be low, due to design considerations and operational monitoring, and therefore the GEIS concluded the risk would also be low.

The potential impact from nonradiological accidents includes high consequence chemical release events (e.g., of ammonia) that could expose workers and nearby populations. However, the GEIS concluded that the likelihood of such a release would be low, based on historical operating experience at NRC-licensed facilities, primarily because operators follow chemical safety and handling protocols. Therefore, the GEIS concluded that radiological and nonradiological impacts from accidents during operations could range from SMALL to MODERATE.

4.13.1.2.1 Radiological Impacts From Normal Operations

As discussed in the GEIS, some amount of radioactive materials would be released to the environment during ISR operations. The potential impact for these releases can be evaluated by the MILDOS-AREA computer code (MILDOS), which was developed by Argonne National Laboratory (Argonne, 1989) for calculating radiation doses to individuals and populations from releases that occur at uranium recovery facilities. MILDOS uses a multipathway analysis for determining external dose; inhalation dose; and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. The primary radionuclide of interest at an ISR facility is radon-222; other key radionuclides that may also be released, which are also in the uranium decay scheme, include uranium, thorium-230, radium-226, and lead-210. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

The GEIS presented historical data for ISR operations, providing a range of estimated offsite doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure (human receptor) locations range between 0.004 mSv [0.4 mrem] per year for the Crow Butte facility located in Nebraska and 0.32 mSv [32 mrem] per year for the Irigaray facility located in Johnson County, both well below the 10 CFR Part 20 annual radiation dose limit of 1 mSv/yr [100 mrem/yr] (NRC, 2009a).

The GEIS also provides a summary of doses to occupationally exposed workers at ISR facilities. As stated, doses would be similar regardless of the facility's location and are well within the 10 CFR Part 20 annual occupational dose limit of 0.05 Sv [5 rem] per year. The largest annual average dose to a worker at a uranium recovery facility over a 10-year period

[1994–2006] was 7 mSv [700 mrem]. More recently, the maximum total dose equivalents reported for 2005 and 2006 were 6.75 mSv and 7.13 mSv [675 and 713 mrem].

The license application for the proposed Nichols Ranch ISR Project addresses several normal operations activities that have the potential to expose workers and members of the public to sources of radiation. The primary source of exposure would be from the release of radon-222 during operations, which includes extraction of the uranium onto ion-exchange columns from the pregnant lixiviant that is pumped from the wellfield, the elution of the uranium from the ion-exchange columns and subsequent precipitation of uranium, followed by the drying and packaging of the yellowcake for shipment to an offsite facility for further processing.

As described in the GEIS and discussed in Section 2.2.1.3.1.7 of this SEIS, the drying and packaging of the precipitated uranium would be conducted under vacuum, thereby limiting release of airborne radioactive materials (uranium and short-lived particulate progeny) to zero or near zero. The applicant has proposed to dispose of radioactive and potentially toxic liquid effluent from the operations phase via deep well injection. Therefore, there would be no anticipated routine liquid releases or pathways of exposure from routine operations. Leaks and spills are evaluated as abnormal conditions in Section 4.13.1.2.2.

For normal operations, radon-222 would be the only significant radionuclide anticipated to be released; the primary sources would be from wellfield venting and releases from within the central plant for process operations (predominantly via vent stacks on the IX columns and various tanks). As discussed in Section 7.2.4 of the technical report the applicant has proposed using pressurized down flow IX columns that are designed to significantly reduce the radon emissions from the processing circuit (Uranerz, 2007).

The NRC staff's analysis of impacts to public health included review of local meteorological data the applicant provided based on existing sampling stations in the region of the proposed Nichols Ranch ISR Project. During the review, the staff concluded local topography at the Nichols Ranch ISR Project warrants onsite meteorological measurements as documented in SER Section 2.2.3.2. To address this concern, the staff has added a license condition requiring the applicant to collect onsite meteorological data for at least 1 year prior to operating as described in Section 2.2.4 of the SER. The following review of public health impacts assumes the applicant's regional meteorological data is representative of site meteorological conditions. When the applicant submits its onsite data for NRC review, the NRC staff will evaluate whether the conclusions of the following analysis would change based on the additional information.

The applicant calculated the potential source term (i.e., radiological releases to the atmosphere) for normal operations using the NRC, approved methodology of Regulatory Guide 3.59 for releases from the production fluids and NUREG–1569 for the processing of resins from satellite facilities. The application of this methodology for the proposed Nichols Ranch ISR Project and the resultant source term is discussed in Section 4.12 of the applicant's Environmental Report (Uranerz, 2007). Table 4-2 summarizes these releases.

Table 4-2. Estimated Radon-222 Releases

Location	Drilling (Ci/yr)	Production (Ci/yr)	Restoration (Ci/yr)
Nichols Ranch Unit Production Area #1	0.045	170	180
Nichols Ranch Unit Production Area #2	0.045	170	180
Hank Unit Production Area #1	0.038	260	230
Hank Unit Production Area #2	0.038	260	230
Source: Uranerz, 2007			

Based on this source term, radiation doses at the site boundary in each of the 16 meteorological sectors (e.g., N, NNE, NE, ENE, and E) and at the locations of nearby residences were calculated using the MILDOS-AREA code (Argonne National Laboratory, 1989). The MILDOS-AREA code was also used to assess radiation dose in the GEIS. The principal exposure pathways modeled include inhalation, ingestion, and direct exposure. The highest dose at the site boundary for the Nichols Ranch Unit is 0.04 mSv [4 mrem] per year total effective dose equivalent (TEDE) at the west boundary, which is 4 percent of the 1 mSv [100-mrem] per year dose limit for a member of the public as specified in 10 CFR 20.1301. For the Hank Unit, the highest dose at the site boundary is 0.11 mSv [11 mrem] per year TEDE at the east boundary, which is 11 percent of the 1 mSv [100 mrem] per year public dose limit. The maximum exposed nearby resident (Pumpkin Butte Ranch) located approximately 2 km [1 mi] east of the proposed Hank Unit is calculated to be 0.01 mSv [1 mrem] per year, which is 1-percent of the 1 mSv (100 mrem) per year regulatory limit. These doses are consistent with the doses identified for other ISR facilities considered in the GEIS, where the range was from a high of 0.317 mSv [31.7 mrem] per year for the Crow Butte facility to 0.004 mSv [0.4 mrem] per year for the Irigaray facility.

The applicant also calculated the collective dose using MILDOS-AREA for the population residing within 80 km [50 mi] of the facility. This dose, which is a measure of the total radiological impact from routine operations for the potentially affected communities, was estimated at 0.002 person-Sv [0.2 person-rem] per year.

The applicant also evaluated the deposition of the radon-222 particulate decay products (polonium-210, bismuth-214, and lead-210) in soil. The calculated soil concentrations were no more than 1.1 pCi/g at the surface, which is a small fraction of that normally present in the soil from the natural background levels of uranium and decay products. Therefore, any impact from increased soil radioactivity levels from airborne releases of radon during normal operations would be SMALL.

Based on typical occupational injury and illness rates for the Wyoming mining industry, the NRC staff estimated that operations at the proposed Nichols Ranch ISR Project could potentially result in 3.21 lost time incidents per 200,000 hours of employee hours worked (Arch Coal, Inc., 2010).

In summary, potential radiation doses to occupationally exposed workers and members of the public from operation of the proposed Nichols Ranch ISR Project would be SMALL. Calculated radiation doses from the modeling of releases of radioactive materials to the environment are small fractions of the limits of 10 CFR Part 20 that have been established for the protection of

the public health and safety. The NRC staff has not identified any new and significant information during its independent review of the Nichols Ranch ISR Project Environmental Report, the site visit, or evaluation of other available information. Therefore, the NRC staff has determined that there would be no significant radiological impacts from normal operations to the public or occupational exposed workers beyond those discussed in the GEIS.

4.13.1.2.2 Radiological Impacts from Accidents

The GEIS provides an identification, discussion, and consequence assessment for accident conditions that could occur with an ISR operation (NRC, 2009a). As discussed, a radiological hazard assessment (Mackin, et al., 2001) considered three types of accidents, representing the sources containing the higher levels of radioactivity for all aspects of operation:

- Thickener failure and spill
- Pregnant lixiviant and loaded resin spills (radon release)
- Yellowcake dryer accident release

An overview of each of these accident scenarios is presented previously. In addition, Section 4.3.1.2 of the SEIS evaluates the impacts of shipping ion-loaded exchange resins from the Hank Unit satellite facility to the Nichols Ranch Unit central processing plant.

The following discussion presents an overview of the accident scenarios, as evaluated in the GEIS, along with a specific application to the proposed Nichols Ranch ISR Project. Table 4-3 summarizes the potential dose to workers and the public from the accident scenarios described in the following paragraphs.

Thickener Failure and Spill. Thickeners are used to concentrate the yellowcake slurry before it is transferred to the dryer or packaged for offsite shipment. Radionuclides could be inadvertently released to the atmosphere through a thickener failure or spill. The accident scenario evaluated in the GEIS assumed a tank or pipe leak that releases 20 percent of the thickener outside of the processing building. The analyses included a variety of wind speeds, stability classes, release durations, and receptor distances. A minimum receptor distance of 100 m [330 ft] was selected because it was found to be the shortest distance between a processing facility and an urban development for current operating ISR facilities. Offsite,

Table 4-3. Generic Accident Dose Analysis for ISR Operations

Accident Scenario	Maximum Dose to Workers	Maximum Dose to Public
Thickener spill	50 mSv [5,000 mrem]	0.25 mSv [25 mrem]
Pregnant lixiviant, resin spill	13 mSv [1,300 mrem]	<0.13 mSv [<13 mrem]
Yellowcake dryer release	0.088 Sv [8.8 rem] Generic <0.01 Sv [1 rem]	<1 mSv [<100 mrem]
Data adapted from GEIS (NRC, 2009a)		

unrestricted doses from such a spill could result in a dose of 25 mrem, or 25 percent of the annual public dose limit of 100 mrem y^{-1} with negligible external doses based on sufficient distance between the facility and receptor (NRC, 2009a). Because the nearest resident to the proposed Nichols Ranch ISR Project is located 1 km [0.6 mi] north of the proposed license area, the potential dose would be even less.

As discussed in the GEIS, doses to unprotected workers inside the facility have the potential to exceed the annual dose limit of 0.05 Sv (5 rem) per year if timely corrective measures were not taken for protecting workers and remediating the spill. Typical protection measures, such as monitoring, respiratory protection, and material control, which would be a part of the applicant's Radiation Protection Program, would reduce worker exposures and the resulting doses to a small fraction of those evaluated.

Pregnant Lixiviant and Loaded Resin Spills. Process equipment (IX columns, drying and packing facilities) would be located on curbed concrete pads, as discussed in Section 7.3.1.1, to prevent any liquids from exiting the building via spills or leaks and contaminating the outside environment. Therefore, except for wellfield leaks, as further evaluated, the potential for an accidental liquid release with exposure from a liquid pathway was not considered realistic. The primary radiation source for liquid releases within the facility would be the resulting airborne radon-222 as released from the liquid or resin tank spill.

The radon accident release scenario assumes a pipe or valve of the IX system, containing pregnant lixiviant, develops a leak and releases (almost instantaneously) all present radon-222 at a high activity level (8×10^5 pCi L^{-1}). For a 30-minute exposure, the dose to a worker located inside the central plant performing light activities without respiratory protection was calculated to be 13 mSv [1,300 mrem], which is below the 10 CFR Part 20 occupational annual dose limit. The analysis did not evaluate public dose; however, because atmospheric transport offsite would reduce the airborne levels by several orders of magnitude, any dose to a member of the public would be less than the 1 mSv [100 mrem] public dose limit of 10 CFR Part 20. The applicant's Radiation Protection Program controls and monitoring measures would be expected to minimize the magnitude of any such release and further reduce the consequences of this type accident.

Yellowcake Dryer Accident Release. Dryers used to produce yellowcake powder from yellowcake slurry are another source for accidental release of radionuclides. A multiple-hearth dryer is capable of releasing yellowcake powder inside the processing building as a result of an explosion and was evaluated in the GEIS as a bounding condition for this type of accidental scenario. The analysis assumes about 4,300 kg [9,500 lb] of uranium yellowcake is released within the building area housing the dryer, and of this, 1 kg [2.2 lb] is subsequently released as an airborne effluent to the outside atmosphere as a 100 percent respirable powder. Due to the nature of the material, most of the yellowcake would rapidly fall out of airborne suspension. For the occupationally exposed worker using respiratory protection, which is the normal mode during dryer access and drum-filling operations, the dose was calculated to be 0.088 Sv [8.8 rem], which exceeds the annual occupational dose limit of 0.05 Sv [5 rem]. The amount assumed to remain airborne and to be transported outside the building for atmospheric dispersion to an offsite location would be 1 kg [2.2 lb] of yellowcake. The rapid fallout within the building and the atmospheric dispersion to an offsite location would significantly reduce the exposure to members of the public, where the calculated dose was less than 100 mrem.

The applicant proposes to use a rotary vacuum dryer with heat-transfer fluid that circulates through the dryer shell. This configuration separates the heater combustion source from the

dryer itself, thereby mostly eliminating the possibility of an explosion, which is the initiating event for the assumed catastrophic failure and significant release of dryer radioactive content. The removal of the driving force for the resuspension of the yellowcake greatly reduces consequences. Additionally, the applicant would have emergency response procedures in place to provide proper directions for mitigating worker exposures; emergency training drills, dosimetry, respiratory protection, and contamination control and decontamination are required as part of the applicant's Radiation Protection Program. Both of these would further reduce the consequences of this type accident.

Accident Analysis Conclusions. With the addition of site-specific consideration for the yellowcake dryer accident, the GEIS evaluations appropriately encompass the type of accidents and consequences for the proposed Nichols Ranch ISR Project. The NRC Staff has not identified any new and significant information during its independent review of the Nichols Ranch ISR Project Environmental Report, the site visit, or evaluation of other available information. Therefore, there would be no significant radiological impacts from potential accidents to the public or occupationally exposed workers beyond those considered in the GEIS. The impacts to workers would be SMALL, if radiation safety and incident response procedures in the applicant's NRC-approved Radiation Protection Plan were followed; the impacts to the general public would also be SMALL

4.13.1.2.3 Nonradiological Impacts from Normal Operations

The GEIS identified the various chemicals, hazardous and nonhazardous, along with typical quantities that are generally used at ISR facilities. The use of hazardous chemicals at ISR facilities is controlled under several regulations that are designed to provide adequate protection to workers and the public. The primary regulations applicable to the use and storage include

- 40 CFR Part 68, Chemical Accident Prevention Provisions. This regulation includes a list of regulated toxic substances and threshold quantities for accidental release prevention.

- 29 CFR 1910.119, OSHA Standards [which includes Process Safety Management (PSM)]. This regulation provides a list of highly hazardous chemicals, including toxic and reactive materials that have the potential for a catastrophic event at or above the threshold quantity.

- 40 CFR Part 355, Emergency Planning and Notification. This regulation contains a list of extremely hazardous substances and their threshold planning quantities (TPQs) for the development and implementation of ERPs. A list of reportable quantity (RQ) values is also provided for reporting releases.

- 40 CFR 302.4, Designation, Reportable Quantities, and Notification–Designation of Hazardous Substances. This regulation provides a list of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances compiled from the Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act, and the Toxic Substances and Control Act.

The following lists the hazardous chemicals and their associated protective provisions expected to be used at the proposed Nichols Ranch ISR Project (Uranerz, 2007):

- Sodium chloride (NaCl) and sodium bicarbonate ($NaHCO_3$)–Systems utilizing these chemicals would be designed to industry standards.

- Sodium hydroxide (NaOH)–Systems utilizing these chemicals would be designed to industry standards.

- Hydrochloric acid (HCl)–Due to the quantities that would be used, reporting quantities would be required per 40 CFR Part 302.4. The hydrochloric acid storage tank would be located away from other process tanks to preclude accidental mixing with other chemicals.

- Hydrogen peroxide–50 percent (H_2O_2)–Because the concentration would be less than 52 percent, no additional regulatory protective measures would be required.

- Carbon dioxide (CO_2)–Carbon dioxide would be stored adjacent to the central plant. Floor-level ventilation and low-point carbon dioxide monitors would be installed to preclude a buildup of carbon dioxide in occupied areas.

- Oxygen (O_2)–Oxygen would be stored near, but a safe distance from, the central plant or within wellfield areas. The oxygen storage facility would be designed to meet industry standards contained in National Fire Protection Association 50–Standards for Bulk Oxygen Systems at Consumer Sites. (National Fire Protection Association, 2001). Procedures would be developed for spills or fires in the oxygen system.

- Anhydrous ammonia (NH_3)–Systems utilizing these chemicals would be designed to industry standards.

- Diesel, gasoline, and bottled gases–Systems utilizing these chemicals would be designed to industry standards.

The typical onsite quantities for some of these chemicals exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices. Compliance with applicable regulations reduces the likelihood of a release. Offsite impacts would be SMALL and do not typically pose a significant risk to the public, while workers involved in a response and cleanup could experience MODERATE impacts if the proper emergency and cleanup procedures and worker training were not available or were inadequate.

In general, the handling and storage of chemicals at the facility would follow standard industrial safety standards and practices. Industrial safety aspects associated with the use of hazardous chemicals are regulated by the Wyoming Occupational Safety and Health Administration. Uranerz (2007) Section 3.3.1 of the applicant technical report provides an overview of storage practices. Chemical storage facilities would include hazardous and nonhazardous material storage areas. Bulk hazardous materials would be stored outside and segregated from areas where licensed materials are processed and stored to minimize potential impact on radiation safety. Bulk storage of hazardous chemicals would be separated to avoid mixing of incompatible materials; outside storage areas would be located at a sufficient distance from facilities to minimize hazards to people during an accidental release. Other nonhazardous bulk process chemicals (e.g., sodium carbonate) that do not have the potential to impact radiological safety could be stored within the central plant facilities. The applicant plans to use chemicals to

extract uranium, process wastewater, and restore groundwater. Material Safety Data Sheets (MSDSs) for each of the chemicals would be reviewed for facility safety and for radiological effects, and the sheets would be located at the Nichols Ranch and Hank Units.

The applicant identifies anhydrous ammonia as the most hazardous chemical to be used onsite and has proposed an overall chemical safety program that includes

- Risk Management Planning, as required in 40 CFR Part 68, which would include accidental release modeling, safety information, hazards reviews, operating procedures, safety training, and emergency preparedness
- Process Safety Management of Highly Hazardous Chemicals standard contained in 29 CFR 1910.119
- Threshold Planning Quantities as contained in 40 CFR Part 355
- Reportable quantities for spills from CERCLA in 40 CFR 302.4

The types and quantities of chemicals (hazardous and nonhazardous) for proposed use at the Nichols Ranch ISR Project do not differ from those evaluated in the GEIS. Information provided for the proposed Nichols Ranch ISR Project does not contain any new or significant information that is either contrary to or varies from the information in the GEIS conclusions regarding potential impacts to the public or occupational health and safety. Therefore, the nonradiological impacts during normal operations at the proposed Nichols Ranch ISR Project would be SMALL.

4.13.1.2.4 Nonradiological Impacts from Accidents

The risks from accidents associated with the use of the typical hazardous and nonhazardous chemicals for ISR operations are not different from those for other typical industrial applications. In general, these risks are deemed acceptable as long as design and safety policies and practices meet industry and regulatory standards. Past history at current and former ISR facilities has shown they can be designed and operated with appropriate measures to ensure proper safety for workers and the public (Uranerz, 2007).

GEIS Appendix E, Hazardous Chemicals, provides an accident analysis for the more hazardous chemicals (NRC, 2009a). That analysis indicates chemicals commonly used at ISR facilities can pose a serious safety hazard if not properly handled. The GEIS does not evaluate potential hazards to workers or the public due to specific types of high-consequence, low-probability accidents (e.g., a fire or large magnitude sudden release of chemicals from a major tank or piping system rupture). The application of common safety practices for handling and use of chemicals is expected to decrease the likelihood of these high-consequence events.

Spills of reportable quantities from chemical bulk storage areas are to be reported to WDEQ in accordance with [WDEQ-Water Quality Division (WQD) Rules and Regulations, Chapter 17, Part E] and 40 CFR Part 302 (CERCLA).

The types and quantities of chemicals (hazardous and nonhazardous) for proposed use at the Nichols Ranch ISR Project do not differ from those evaluated in the GEIS. Information provided for the proposed Nichols Ranch ISR Project does not contain any new or significant information that is either contrary to or varies from the information and conclusions in the GEIS regarding potential nonradiological impacts on public and occupational health and safety from chemical accidents. Offsite impacts would be SMALL and do not typically pose a significant risk to the public, while workers involved in a response and cleanup could experience MODERATE

impacts that would be mitigated by establishing procedures and training requirements. Based on this finding and the GEIS conclusions, the impacts from potential accidents for both occupationally exposed workers and members of the public would be SMALL.

4.13.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.11.3 discussed potential radiological and nonradiological impacts from aquifer restoration. Activities occurring during aquifer restoration would overlap similar activities occurring during operations (e.g., operation of wellfields, wastewater treatment and disposal). Therefore, the potential impact on public and occupational health and safety would be bound by the operational impacts. The GEIS also stated that the reduction of some operational activities (e.g., yellowcake production and drying, remote IX) as aquifer restoration proceeded would be expected to limit the relative magnitude of potential worker and public health and safety hazards. The GEIS concluded that the overall impacts from aquifer restoration would be SMALL.

Aquifer restoration activities for the proposed Nichols Ranch ISR Project involve activities similar to those during operations (e.g., operation of wellfields, wastewater treatment and disposal); therefore, the potential impact on public and occupational health and safety would be expected to be similar to the operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote IX) would further limit the relative magnitude of potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the operations assessment in Section 4.13.1.2.1. Similarly, nonradiological hazards during aquifer restoration are assessed in Section 4.13.1.2.3. Accident consequences would be expected to be smaller than those evaluated in Sections 4.13.1.2.2 and 4.13.1.2.4. Therefore, aquifer restoration would be expected to have a very localized SMALL occupational impact to workers (primarily from radon gas) and to the general public for the duration of the aquifer restoration phase, which is estimated to last for 5.5 years (Uranerz, 2007).

4.13.1.4 Decommissioning Impacts

GEIS Section 4.3.11.4 discussed potential radiological and nonradiological impacts to public and worker health and safety during the decommissioning phase of an ISR facility. Worker and public health and safety would be addressed in an NRC-required and approved decommissioning plan. This plan would be prepared in compliance with 10 CFR 40.42 and discusses implementation of the safety program to ensure worker safety and protection of the public during decommissioning and compliance with applicable safety regulations. An ISR licensee would conduct decommissioning activities in accordance with the approved plan, and compliance would be enforced through NRC inspections.

The GEIS also assumed that as decommissioning proceeded, the potential environmental impact would be expected to decrease because the hazard would be removed, soils and structures would be decontaminated, and disturbed lands would be reclaimed.

As discussed in the GEIS, the environmental impact from decommissioning an ISR facility would be SMALL. The degree of potential impact would decrease as the hazards were either reduced or removed, soils and facility structures were decontaminated, and lands were restored to preoperational conditions. Typically, the initial decommissioning steps would include removal of hazardous chemicals. As such, the majority of safety issues to be addressed during the decommissioning phase would involve radiological hazards at the facility.

To ensure the safety of the workers and the public during decommissioning, NRC requires licensed facilities to submit a decommissioning plan for review. The plan would include details of the radiation safety program that would be implemented during decommissioning to ensure that the workers and public would be adequately protected and that their doses are compliant with 10 CFR Part 20, Subparts C and D limits. An approved plan would also provide ALARA provisions to further ensure best safety practices are being use to minimize radiation exposures. Finally, adequate protection of workers and the public during decommissioning is further ensured through NRC plan approval, license conditions, and inspection and enforcement.

The decommissioning of the proposed Nichols Ranch ISR Project and any subsequent NRC approval for release of the site for unrestricted access would have to be in conformance with the NRC radiation protection standards for decommissioning of uranium recovery facilities. Therefore, any potential radiation dose to members of the public would also be in conformance with standards established for protecting public health and safety.

The applicant's proposal does not contain any new or significant information that is contrary to or varies significantly from the GEIS information and conclusions regarding the potential impact to public and occupational health and safety. Therefore, the potential impact from and following decommissioning would be short term and SMALL.

4.13.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no occupational exposure. There would be no additional radiological exposures to the general public from project related effluent releases, and there would be no impact on long-term environmental radiological conditions. Radiation exposure and risk to the general public would continue to be determined by exposure from natural background, medical-related exposures, consumer products, and exposures from existing residual contamination. Under the No-Action alternative, the existing residual radioactivity would remain in these areas and would not be remediated.

4.13.3 Modified Action–No Hank Unit (Alternative 3)

4.13.3.1 Construction Impacts

Issuing a license to conduct ISR operations solely at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would reduce the scope of construction activities to approximately one half. Although the Hank Unit is physically twice the size of the Nichols Ranch Unit, the ore bodies on the two units are approximately the same size. No satellite facility would be constructed at the Hank Unit and fewer total wells would be drilled. Therefore, low potential construction impacts from human interaction with background concentrations of radioactive material in soil would decrease by about 50 percent by eliminating the Hank Unit. NRC staff concluded in Section 4.13.1.1, that the combined public and occupational health impacts from construction of the Nichols Ranch and Hank Units would be SMALL. Therefore, eliminating the impacts from construction of the Hank Unit would also result in SMALL impacts to public and occupational health and safety.

4.13.3.2 Operations Impacts

Issuing a license to conduct ISR operations at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would reduce ISR operation to approximately one-half of that of the proposed action. There would be no change in the types of activities conducted, though

approximately 50 percent fewer wells would be needed. Also, there would be no shipments of resin or chemicals to or from a satellite facility, thus reducing the number of shipments by approximately 50 percent. Based on the information in Table 4-2, the estimated radon-222 emissions from the Nichols Ranch ISR Project would be reduced by 58 percent compared to the proposed action. Eliminating the Hank Unit would further reduce the proposed action's SMALL impacts to public and occupational health and safety in the proposed action. Therefore, NRC staff concluded the impacts would be SMALL under Alternative 3.

4.13.3.3 Aquifer Restoration Impacts

Issuing a license to conduct ISR operations at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would reduce the scope of aquifer restoration activities by approximately 50 percent. There would be no change in the types of activities conducted. However, because no wellfield development would occur at the Hank Unit and approximately 50 percent fewer aquifer restoration activities would be required, this alternative would further reduce the proposed action's SMALL impacts to public and occupational health and safety from aquifer restoration. Therefore, the NRC staff concludes the impacts would be SMALL under Alternative 3.

4.13.3.4 Decommissioning Impacts

Issuing a license to conduct ISR operations at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would result in a reduction of decommissioning activities by approximately 67 percent because the Hank Unit is approximately twice the size of the Nichols Ranch Unit. In addition, a 67 percent smaller area would be required to be released for unrestricted use. There would be no change in the types of activities conducted. As with the proposed action, the construction of access roads would make the released site easier to access than it was prior to operations, which would result in an increase in public usage and, likewise, an increase in potential public exposure to any remaining, residual radioactivity. However, under this alternative, the site would be 67 percent smaller and there would be a 67 percent decrease in the amount of road development, potentially limiting future public access and exposure. Choosing this alternative would further reduce the proposed action's SMALL impacts to public and occupational health and safety from decommissioning. Therefore, the NRC staff concludes the impacts would be SMALL under Alternative 3.

4.14 Waste Management Impacts

Potential environmental impacts from waste management at the proposed Nichols Ranch ISR Project site could occur during all phases of the ISR lifecycle. ISR facilities generate radiological and nonradiological liquid and solid wastes that must be handled and disposed of properly. The types of waste streams to be disposed of by the proposed Nichols Ranch ISR Project are discussed in Section 2.2.1.6 of this SEIS. See the text box in Section 2.2.1.6 for a list of liquid and solid waste types. The primary radiological wastes to be disposed of by the proposed Nichols Ranch ISR Project are process-related liquid wastes and process-contaminated structures and soils, all of which are classified as byproduct material. Before operations could begin, NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material. The applicant has committed to disposing of byproduct material at a licensed disposal site. The disposal agreement would both be submitted to NRC and be in place prior to the start of operations as required by license condition.

Discussion of the estimated environmental impacts from waste management actions during the construction, operations, aquifer restoration, and decommissioning phases of the proposed Nichols Ranch ISR Project are presented in the following paragraphs. Discharges of storm water and wastewater runoff to surface waters are discussed in Section 4.5.1.

4.14.1 Proposed Action (Alternative 1)

Under the proposed action, the applicant would dispose of liquid effluent via Class I injection wells discussed in Section 4.14.1.1 of the SEIS. Alternative wastewater disposal options, including evaporation ponds, surface water discharge, land application, and disposal via Class V injection wells, are discussed in Section 4.14.1.2.

4.14.1.1 Disposal Via Class I Injection Well

4.14.1.1.1 Construction Impacts

GEIS Section 4.3.12.1 concluded that waste management impacts from the construction phase of an ISR facility would be SMALL. Because construction activities would be on a relatively small-scale, a low volume of construction waste would be generated. The primary wastes to be disposed of during this phase of the ISR facility lifecycle would be nonhazardous solid waste, such as building materials and piping. As discussed in Section 3.13.2, the applicant has proposed to dispose of nonhazardous solid wastes at the Campbell County Landfill in Gillette, Wyoming, which is approximately 74 km [46 mi] north-northeast of the proposed project site. The municipal waste or construction and demolition waste cells at the Campbell County Landfill in Gillette are not at or near capacity.

Based on the available disposal capacity and the proposed small-scale development and resulting low volumes of waste that would be generated, the NRC staff concludes that the site-specific conditions at the proposed Nichols Ranch ISR Project are comparable to the generic conditions described in the GEIS for waste management. Therefore, this SEIS supports the GEIS conclusions that the impacts to waste management during construction are expected to be SMALL. Furthermore, the NRC staff has not identified any new and significant information during its independent review that would change the environmental impacts beyond those evaluated in the GEIS.

4.14.1.1.2 Operations Impacts

GEIS Section 2.7 indicated that radiological wastes generated during the operations phase would primarily be liquid waste streams consisting of process bleed (1 to 3 percent of the process flow rate). Wastes would also be generated from flushing of eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes, and plant washdown water. The method used to handle and process these wastes (disposal by deep well injection) reduces the solid waste volume that must be disposed of at an approved facility. State permitting actions, NRC license conditions, and NRC inspections ensure proper practices would be used to comply with safety requirements to protect workers and the public and protect the environment; therefore, the waste management impact would be SMALL (NRC, 2009a).

At the proposed Nichols Ranch ISR Project, liquid wastes from operations (Section 2.2.1.6.2) are classified as byproduct material and would be disposed of via deep well injection, which is regulated by WDEQ. The applicant plans to have a maximum of eight Class I deep disposal wells, up to four at the Nichols Ranch Unit and up to four at the Hank Unit, for disposal of liquid

byproduct materials generated during operations. The applicant has submitted an application for a UIC permit from WDEQ. This method of waste disposal would isolate the waste constituents from the accessible environment while protecting potential drinking water sources. WDEQ has EPA-delegated authority for this program in Wyoming. WDEQ analyzes proposed deep disposal wells as part of its permitting process, and the applicant would have to operate its ISR project in accordance with both the provisions of the WDEQ permit and NRC license. As part of the NRC staff's review, the staff considered the WDEQ permitting process and examined a recently approved deep disposal permit for another ISR project (WDEQ, 2010). That permit specified well construction, testing, and operating conditions the applicant must follow to ensure adequate protection of the public and environmental health and safety. Because the WDEQ permit application review evaluates whether potential underground sources of drinking water would be affected by proposed deep disposal wells and this is the primary concern for potential environmental impacts in the NRC review, the NRC staff concludes that an additional NRC detailed technical review of the proposed deep disposal wells is not needed to adequately evaluate the potential impacts. The NRC would, however, impose two license conditions governing aspects of the operation and monitoring of these wells. One license condition specifies the liquid waste streams that can be disposed in the deep disposal wells and establishes specific recordkeeping and reporting practices that the applicant must follow should a license be granted. The other license condition requires specific actions the applicant would have to take to ensure liquid effluent disposal capacity is adequate to support operations. This condition specifies the minimum number of deep disposal wells that the applicant would have to construct prior to operations; notification requirements the applicant would have to follow if or when a disposal well became inoperable; and contingency actions the applicant would have to take to provide capacity in the event of well shutdown. Considering the applicant would have to satisfactorily complete the WDEQ permitting process prior to starting operations and comply with all NRC license conditions, the NRC staff concludes that the proposed deep disposal wells would not impact underground sources of drinking water and would provide the necessary waste isolation capacity to support the proposed operations. Therefore, the NRC staff concludes the waste management impacts from the disposal of process-related liquid effluents at the proposed Nichols Ranch ISR Project site would be SMALL.

Solid byproduct material that would be generated during operations (i.e., material that does not meet NRC criteria for unrestricted release) would likely include maintenance and housekeeping rags and trash, packing materials, replacement components, filters, protective clothing, and solids removed from process pumps and vessels. As discussed in Section 2.2.1.6.3 in this SEIS, the proposed action would annually generate approximately 46 to 69 m^3 [60 to 90 yd^3] of solid byproduct material (that does not meet NRC criteria for unrestricted release) from facility operations. This solid byproduct material would be stored onsite within a restricted area until sufficient volume was generated for disposal. As mentioned earlier, the applicant does not presently have an agreement in place with a licensed site to accept its solid byproduct material for disposal; however, the applicant has committed to disposing of byproduct material at a licensed disposal site. Prior to the start of operations, as required by license condition, the applicant would need to enter into a written agreement with a disposal site, which would ensure there was available capacity for byproduct material disposal. Options the applicant considered include disposal at Pathfinder-Shirley Basin in Mills, Wyoming; Energy Solutions in Clive, Utah; or White Mesa in Blanding, Utah. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations, the staff concludes that the waste management impacts associated with the generation of byproduct material would be SMALL.

GEIS Section 4.3.12.2 concluded that the impacts of nonhazardous waste management during the ISR operational phase would be SMALL. Nonhazardous solid wastes generated during

Nichols Ranch ISR operations would include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). As appropriate, solid wastes would be reused, recycled, or disposed of at the Gillette landfill, as discussed in Section 3.13.2. The NRC staff concluded that the impact would be SMALL because a small volume of material would be disposed of in comparison to the size of the Campbell County landfill located in Gillette. The Campbell County landfill's Recycling Center can accept small quantities of hazardous waste and is the likely destination for disposal of small quantities of hazardous waste from the proposed Nichols Ranch ISR Project.

Based on the type and quantity of expected waste generation and the availability of disposal options, the NRC staff concludes that the operations phase waste management activities at the proposed Nichols Ranch ISR Project would have a SMALL impact on the environment. The NRC staff has not identified any new and significant information during its independent review that would change the estimated environmental impacts beyond those evaluated in the GEIS.

4.14.1.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.12.3 discussed waste management activities that would occur during the aquifer restoration phase of an ISR project and noted that the same treatment and disposal options would be implemented during aquifer restoration as are used during operations. The GEIS concluded that the waste management impacts would be similar to those occurring during the operations phase of an ISR project. Some increase in wastewater volumes could be experienced, but the increase in volume would be offset by the decrease in production capacity. The impact on waste management from aquifer restoration would be SMALL.

At the proposed Nichols Ranch ISR Project, produced water from aquifer restoration (described in Sections 2.2.1.4.3 and 2.2.1.6.2) would be treated through the combination of ion-exchange and reverse-osmosis processes and injected back into the production aquifer. The proposed water treatment and reinjection into the aquifer would help limit the amount of water that is permanently withdrawn from the production aquifer. The concentrated waste solutions resulting from this treatment would be classified as byproduct material and would be disposed of in the deep disposal wells. The impacts associated with the use of the deep disposal wells during aquifer restoration would be the same as previously discussed for the operations phase in Section 4.14.1.1.2. No additional volume of byproduct materials and associated treatment wastes beyond those estimated for the operations phase is expected for the aquifer restoration phase. Other waste management activities during aquifer restoration would also be similar to those for the operations phase, and therefore, the NRC staff concludes that the impacts would be SMALL.

4.14.1.1.4 Decommissioning Impacts

GEIS Section 2.6 estimates that wastes generated from decommissioning an ISR facility would be predominantly byproduct material and nonhazardous solid waste (NRC, 2009a). GEIS Section 4.3.12.4 stated that decommissioning byproduct material (including contaminated facility demolition materials, process and wellfield equipment, and contaminated soils) would be disposed of at a licensed facility (NRC, 2009a). Safe handling, storage, and disposal of decommissioning wastes would be addressed in a decommissioning plan required for NRC review prior to the initiation of decommissioning. The decommissioning plan would describe how a 10 CFR Part 20-compliant radiation safety program would be implemented to ensure the safety of workers and the public. The GEIS concluded that volumes of radioactive, chemical,

and solid wastes generated during decommissioning would be SMALL and the waste management impacts from decommissioning would be SMALL (NRC, 2009a).

For decommissioning the proposed Nichols Ranch ISR Project, the applicant proposes to survey process equipment and materials for residual radioactivity as part of the waste management process. Materials that are not radiologically contaminated or that meet NRC release limits would be removed for reuse, recycling, or disposal. Contaminated materials would be decontaminated, transferred to another licensed facility for use, or disposed of as byproduct material. The NRC staff expects the applicant-proposed use of wellfield monitoring instrumentation and wellfield visual inspection to support timely identification and remediation of potential leaks and spills would reduce the potential for generating large volumes of contaminated soil that would need to be excavated and disposed of as byproduct material at a licensed facility. Any hazardous wastes generated during decommissioning would be stored, in accordance with WDEQ regulations, and transported to a nearby hazardous waste facility for disposal.

As discussed in Section 2.2.1.6.3, the NRC staff's estimate of byproduct material from decommissioning the plant facilities and all well fields (over a planned 5 year period) is 8,731 m^3 [11,410 yd^3] plus 245 t [270 T] of concrete. This estimate exceeds the decommissioning byproduct material volume {4,593 m^3 [6,000 yd^3]} evaluated in the GEIS, but the GEIS did note that the disposal of these volumes of material of this type did not present any unique problems regarding available disposal capacity. As discussed in Section 3.13.2 of the SEIS, the applicant does not presently have an agreement in place with a licensed site to accept its solid byproduct material for disposal; however, the applicant has committed to having an agreement for disposal of byproduct materials in place before commencing construction on the proposed Nichols Ranch ISR Project. Options the applicant is considering include disposal at Pathfinder-Shirley Basin in Mills, Wyoming; Energy Solutions in Clive, Utah; or White Mesa in Blanding, Utah. Additionally, another site licensed by NRC to accept byproduct material for disposal is the Waste Controls Specialists site in Andrews, Texas. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations, NRC concludes that the potential waste management impacts associated with the disposal of byproduct material from Nichols Ranch ISR decommissioning would be SMALL.

The staff's cumulative estimate of nonhazardous solid waste that would be generated from decommissioning is 941 m^3 [1,230 yd^3] plus 2,074 t [2,288 T] of concrete (Sections 2.2.1.6.3 and 3.13.2). This material would be generated within a 5-year period as the plant facilities are decommissioned. Assuming 1.96 T/yd^3 for the concrete waste, the total solid waste volume would be approximately 1,834 m^3 [2,397 yd^3]. This estimated volume of solid waste is lower than what was analyzed in the GEIS, and therefore the NRC staff concludes the GEIS analysis and conclusions are applicable. The staff also considered potential local limitations of disposal capacity. As discussed in Section 3.13.2, the landfill in Gillette, Wyoming, where the applicant expects to dispose of its nonhazardous solid waste, plans to ensure available capacity for approximately the next 30 years. The total decommissioning nonhazardous solid waste volume is approximately 3 percent of the annual volume of waste disposed at the Gillette landfill, which is 25,956 t [33,924 T] or 64,889 m^3 [84,810 yd^3] (Wyoming Office of State Lands and Investments, 2007). Based on this comparison and the information on the future capacity of the landfill, the staff concludes the region has sufficient capacity to dispose of the nonhazardous solid waste generated from the proposed action. Therefore, because (i) the volume of waste is within the bounds evaluated in the GEIS, (ii) the volume of waste is a small percentage of the annual waste disposed locally, and (iii) the local landfill has available capacity currently and

planned capacity for the next three decades, the NRC staff concludes that waste management impacts for disposal of decommissioning nonhazardous solid waste would be SMALL.

4.14.1.2 Alternative Wastewater Disposal Options

If the NRC granted the applicant's licensing request and they are unable to obtain a UIC Class I injection well permit, they would have to submit a license amendment request to obtain approval for another wastewater disposal option prior to the initiation of operations at the facility. This section discusses the environmental impacts for the alternate wastewater disposal options identified in Section 2.2.2. All of these alternative wastewater disposal options would involve treatment of the wastewater that would generate solid waste, which also must be managed.

In most of the alternative wastewater disposal options considered in the following sections, the footprint of the disposal system would increase as compared to disposal via a UIC Class I injection well (Section 4.14.1.1). Increasing the size of the proposed facility with other wastewater disposal options would lead to more land disturbance and a heavier use of construction equipment, with an anticipated increase in potential impacts to resource areas such as ecological and wetland systems, cultural and historical resources, and nonradiological air quality. The applicant would have to amend its license application to select one of these alternative wastewater disposal options. NRC would perform an additional environmental and safety review prior to deciding whether to grant or deny the licensing application with the new wastewater disposal option. The applicant would survey the areas to be affected prior to construction, and the applicant and NRC would consult with agencies such as WY SHPO, WGFD, and FWS. In addition, the licensee would have to apply for a license amendment. NRC would then conduct another environmental and safety review before deciding whether to grant or deny the request for the license amendment to use another wastewater disposal option. Mitigation measures, such as avoidance of sensitive areas or documentation of cultural resources, would be established as part of these consultations, as necessary.

4.14.1.2.1 Evaporation Ponds

The types of waste streams and the infrastructure necessary for using evaporation ponds as a wastewater disposal option are described in Section 2.2.2. The types and amounts of wastewater that would be disposed in an evaporation pond would be the same as described in the previous section for disposal by deep injection into a Class I UIC well. Before the applicant could begin disposing wastewater into an evaporation pond system, the NRC staff would review the design and construction of the ponds and monitoring system against the criteria in 10 CFR Part 40, Appendix A (NRC, 2003b, 2008a), taking into consideration EPA criteria in 40 CFR Part 61, Subpart W. The applicant would be required to demonstrate that the evaporation ponds could be designed, operated, and decommissioned to prevent migration of wastewater to subsurface soil, surface water, or groundwater. Applicants would also be required to demonstrate that monitoring requirements would be established to detect any migration of contaminants to the groundwater. The NRC staff would establish any license conditions needed to ensure that the applicant meets the necessary requirements.

Individual evaporation ponds could have a surface area of up to 2.5 ha [6.25 ac], and the total pond system could be as much as 40 ha [100 ac]. During the period of operations for the proposed Nichols Ranch ISR Project, this area would be fenced to exclude wildlife and livestock. This would provide a footprint that is less than about 3 percent of the total permitted area {1,365 ha [3,370 ac]} for the proposed Nichols Ranch ISR Project (including both the Nichols Ranch and Hank Units), but it would be much larger than the footprint for a central

processing plant without evaporation ponds (Uranerz, 2007). The additional land disturbance required to install an evaporation pond for wastewater disposal would be similar in scale to the current proposed action {120 ha [300 ac]} for the proposed Nichols Ranch ISR Project. It is also anticipated that the applicant would need to have at least one other wastewater disposal option or additional storage capacity during the winter months in Wyoming when evaporation rates would be low.

Although a wastewater disposal option that uses an evaporation pond system would roughly double the facility footprint relative to UIC Class I injection wells, the total amount of disturbed and fenced land would be small compared to the permitted area and comparable to the generic conditions evaluated in the GEIS with respect to land use. For these reasons, NRC staff concludes that the overall impacts to land use associated with an evaporation pond system would be SMALL.

Construction of an evaporation pond system would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment. The equipment would produce diesel emissions and fugitive dust emissions during construction that could have a temporary and adverse effect on nonradiological air quality. Depending on how the applicant elected to phase in the pond system, these effects could extend into the operational phase of the facility as well. BMPs such as wetting unpaved roads would minimize fugitive dust, and the anticipated impacts to nonradiological air quality would be SMALL. The applicant may also need to obtain an NESHAP review to evaluate whether the anticipated radiological releases to air from the evaporation ponds would meet the criteria in 40 CFR Part 61, Subpart W. The applicant would be required to have an NRC-approved air monitoring system for the wastewater disposal system. Keeping the pond wet to reduce dust and radon emissions would effectively reduce potential air emissions, and the anticipated impacts to radiological air quality would be SMALL.

As described in NRC (2008a), the evaporation ponds would be designed and constructed with clay or geotextile liners to reduce the potential for infiltration into the subsurface. An NRC-approved monitoring system would be installed to detect leaks from the ponds, and the applicant would also implement an NRC-approved inspection plan for the ponds (NRC, 2008). Based on these measures, it is anticipated that impacts to surface water and groundwater resources would be SMALL.

The evaporation ponds would be constructed at the same time and with the same mitigation measures described in Section 4.6 (Ecological Resources) for the construction of the rest of the facility. For these reasons, the potential impact on ecological resources from an evaporation pond disposal system would be the same as identified in Section 4.6 and could be reduced to SMALL.

At the end of the operational phase of the facility, all of the pond liners and berms, as well as accumulated precipitates and sludges, would be classified as solid byproduct material. For example, the GEIS indicates that about 52 m^3 [68 yd^3] of byproduct material would be generated during evaporation pond decommissioning. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of decommissioning byproduct material, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct waste disposal capacity, the NRC staff concludes that the impacts from an evaporation pond wastewater disposal system to waste management would be SMALL to MODERATE during the decommissioning phase of the facility. Note that at the conclusion of

operations, the licensee would be required to provide a decommissioning plan for NRC review that demonstrates it has a disposal path for any decommissioning wastes, including those related to the wastewater disposal system. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.2.2 Land Application

For the land application of process wastewater, the applicant would be required to meet the regulatory provisions in 10 CFR Part 20, Subparts D and K and Appendix B (NRC, 2003b). The applicant would also be required to analyze the chemical toxicity of radioactive and nonradioactive constituents, including an assessment of projected concentrations of radioactive contaminants in the soil and projected impacts on groundwater and surface-water quality and on land uses, especially crops and vegetation. The applicant would also be required to obtain NRC approval of a monitoring program that would include (i) periodic soil surveys to verify that contaminant levels in the soil would not exceed those projected and (ii) a remediation plan that can be implemented if projected levels are exceeded. The applicant would also need to treat the wastewater to quality requirements for surface discharge under a WYPDES permit from WDEQ. Finally, the applicant would need to demonstrate that the soils in the land application area would meet the criteria in 10 CFR Part 40, Appendix A, at the time of decommissioning. Practices would be subject to NRC license conditions and enforced through the NRC inspection program to ensure protection of public health and safety and the environment.

Land application typically requires large areas to ensure that soil concentrations do not exceed regulatory levels. Typical land application areas are on the order of about 40 ha [100 ac]. During the period of operations for the proposed Nichols Ranch ISR Project, this area would be fenced to exclude wildlife and livestock. Like a wastewater disposal system using evaporation ponds, land application would have a footprint that is less than about 3 percent of the total permitted area {1,365 ha [3,370 ac]} for the proposed Nichols Ranch ISR Project (including both the Nichols Ranch and Hank Units), but it would be much larger than the footprint for a central processing plant without land application (Uranerz, 2007). The additional land disturbance required to install a land application system for wastewater disposal would be similar in scale to the current proposed action {120 ha [300 ac]} for the proposed Nichols Ranch ISR Project (Section 4.2.1). It is also anticipated that the applicant would need to have at least one other wastewater disposal option or additional storage capacity during the winter months in Wyoming when evaporation rates would be low and the ground would be covered by snow. Like the evaporation pond system discussed in the previous section, a wastewater disposal option that uses land application would roughly double the facility footprint relative to the proposed action using UIC Class I injection wells. The amount of disturbed and fenced land, however, would be small compared to the permitted area and comparable to the generic conditions evaluated in the GEIS with respect to land use. For these reasons, the NRC staff concludes that the overall impacts to land use associated with wastewater disposal by land application would be SMALL.

Establishing the land application area would not require extensive use of earthmoving equipment other than to install pipelines, small berms, access roads, and fencing, and the potential impacts to land use would be anticipated to be SMALL. The wastewater, however, would likely require additional treatment to meet WYPDES standards, including facilities providing an ion-exchange circuit, reverse osmosis, one or more radium-settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, and purge storage reservoirs {4 ha [10 ac] or more}. Constructing wastewater treatment facilities, including basins and storage reservoirs, would require earthmoving equipment, such as bulldozers, scrapers, backhoes, and trucks, to prepare the site and construct the impoundments. The equipment would produce diesel emissions and fugitive

dust emissions during construction that could have a temporary and adverse effect on nonradiological air quality. BMPs such as wetting unpaved roads would minimize fugitive dust, and the anticipated impacts to nonradiological air quality would be SMALL. The applicant would also need to manage radiological releases to air from the land application area(s). Given the low radionuclide content anticipated for the wastewater and low calculated radon fluxes for similar application areas (NRC, 1997, 2003b), it is anticipated that the impacts to radiological air quality would be SMALL.

As described previously, the applicant would be required to demonstrate that the soil in a land application area would meet 10 CFR Part 20 requirements. In addition, during operations the applicant would be required to routinely monitor the soil to ensure that allowable concentrations were not exceeded. It is not anticipated that decommissioning the land application area would produce any additional solid byproduct material for disposal, and the potential impacts on waste management would be SMALL during the decommissioning phase of the facility. For decommissioning the wastewater treatment facility, all pond liners and berms associated with radium-settling basin(s), as well as accumulated precipitates and sludges generated at an estimated annual rate of about 22.4 m^3/yr [29.3 yd^3/yr] (Section 2.2.2.2), would be classified as solid byproduct material. These solids, as well as any other solid byproduct material generated by the wastewater treatment process (e.g., spent resins, contaminated building debris), would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of decommissioning byproduct materials, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct material disposal capacity, the potential impacts to waste management from decommissioning the radium-settling basin(s) and other storage facilities associated with treating wastewater for disposal by land application would be SMALL to MODERATE.

Note that at the conclusion of proposed operations, the licensee would be required to provide a plan for decommissioning any wastewater treatment facilities for NRC review (NRC, 2003b). The decommissioning plan would include final radiological surveys to identify whether there were any areas of soil contamination that would require disposal as byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.2.3 Surface Water Discharge

For surface discharge of wastewater, the applicant would be required to meet the regulatory provisions in 10 CFR Part 20, Subparts D and K and Appendix B. The applicant would also be required to obtain a zero-release WYPDES permit from WDEQ. The applicant would be required to distinguish between process wastewater generated during uranium recovery operations and mine wastewater generated during aquifer restoration (NRC, 2003b). In accordance with EPA regulations, the applicant would not be allowed to discharge process wastewater to navigable waters of the United States (NRC, 2003b). The applicant would either need to develop storage capabilities, depending on whether it intended to maintain separate wastewater streams, or comingle (mix) process and mine wastewater prior to treatment to 10 CFR Part 20 standards. In addition, the applicant would need to address any radioactivity at the discharge point or from storage facilities (tanks, impoundments), radium-settling basins, and related liners and sludges as part of the decommissioning of the facility (NRC, 2003b; Cohen and Associates, 2008).

Establishing the discharge point for the treated effluent would likely require short-term use of earthmoving equipment to install pipelines, small berms, access roads, and fencing to exclude livestock and wildlife. The amount of land to be fenced for the discharge point alone would be limited (see Section 2.2.2), and the potential impacts to land use would be anticipated to be SMALL. As is the case with land application, however, the wastewater would likely require additional treatment to meet WYPDES zero-release permit requirements, including facilities providing an ion-exchange circuit, reverse osmosis, one or more radium-settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, or purge storage reservoirs {4 ha [10 ac] or more}. These treatment facilities would be also be fenced to exclude wildlife and livestock and limit public access. The amount of land needed for the wastewater treatment facilities would be similar to that for land application, but if the applicant chose to segregate process and mine wastewaters to meet the WYPDES permit requirements, the involved land area would be greater to provide separate storage facilities. As with evaporation ponds and land application, the increased footprint of the additional wastewater treatment facilities needed to meet WYPDES requirements would be small relative to the entire permitted area {1,365 ha [3,370 ac]}, but large relative to the central processing plant as described in the proposed action (Section 4.2.1) (Uranerz, 2007). The current proposed action identifies about 120 ha [300 ac] of disturbed land for the proposed Nichols Ranch ISR Project. Overall, the increase in the amount of disturbed land to accommodate the addition of a wastewater treatment facility would be about 3 to 5 percent and would have a SMALL impact on land use.

Constructing the wastewater treatment facilities (e.g., radium-settling basins) would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment(s). The equipment would produce diesel emissions and fugitive dust emissions during construction that could have a temporary and adverse effect on nonradiological air quality. BMPs such as wetting unpaved roads would minimize fugitive dust. Taking into consideration the likely short-term duration of the construction period, the anticipated impacts to nonradiological air quality would be SMALL. The applicant may also need to consider emissions of radionuclides such as radon from the surface discharge points. Given that the WYPDES permit would require the applicant to monitor and maintain low radionuclide concentrations for the treated wastewater, the anticipated impacts to radiological air quality would be SMALL.

The proposed Nichols Ranch Unit would be developed in the Cottonwood Creek drainage basin, while the Hank Unit would lie within the Willow Creek and Dry Willow Creek drainages (Section 3.5.1.1). Most of the drainages are ephemeral, but a surface water discharge disposal option would create more reliable water flow and could lead to the development of aquatic habitat; surface discharge could lead to an increase in erosion and suspended sediments in existing stream channels. The applicant indicated it will avoid development in ephemeral drainages to minimize erosional impacts (Section 4.5.1.1) and will also avoid these drainages in a wastewater disposal system based on surface discharge. Sediment loads would be expected to taper off quickly both in time and distance; therefore, long-term impacts would be SMALL. The applicant would use WGFD standard management practices to limit impacts to aquatic life.

As noted previously, the applicant would not be allowed to discharge treated wastewater into navigable waters of the United States. A recent wetlands delineation survey identified four potential jurisdictional emergent wetlands in the southeastern portion of the Nichols Ranch Unit, and no potential jurisdictional wetlands were identified within the Hank Unit (Section 3.5.1.5 of the SEIS). A Nationwide Permit 44 under Section 404 of the Clean Water Act would be required for discharges of dredged or fill material into a wetland or WUS exceeding 0.2 ha [0.5 ac]. The proposed Nichols Ranch ISR Project would likely avoid surface discharge points that might

disturb any of these wetlands areas, and potential impacts to these wetlands from surface discharge of treated wastewater would be SMALL.

The applicant would be required to demonstrate that any soil affected by the surface discharge of treated wastewater would meet 10 CFR Part 20 requirements. In addition, during operations the applicant would be required to routinely monitor the soils and discharged water to ensure predicted concentrations were not exceeded. For these reasons, it is not anticipated that decommissioning the surface discharge point would produce any additional solid byproduct material for disposal. As with the land application wastewater disposal option, however, decommissioning wastewater treatment facilities may produce solid byproduct material such as spent resins, sludges, and liners from radium settling basin(s), or contaminated building debris. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of decommissioning byproduct materials, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct material disposal capacity, it is anticipated that the potential impacts to waste management from decommissioning the radium-settling basin(s) and other storage facilities associated with treating wastewater for surface water discharge would be SMALL to MODERATE.

Note that at the conclusion of operations, the licensee would be required to provide a decommissioning plan for NRC review. The decommissioning plan would include final radiological surveys to identify whether there were any areas of soil contamination that would require disposal as byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.2.4 Class V Injection Well

The potential impacts associated with wastewater disposal through a UIC Class V deep injection well would be similar to those associated with the proposed action (disposal via a UIC Class I deep injection well). Under the terms of a UIC Class V permit issued by WDEQ, however, the wastewater would require additional treatment to meet class of use or federal drinking water standards (whichever is more stringent) prior to injection.

The potential impacts associated with constructing, operating, and decommissioning the necessary wastewater treatment facilities would be similar to those described in the previous sections for land application (Section 4.14.1.2.2) and surface water discharge (Section 4.14.1.2.3) disposal options. For example, although the footprint of the Class V well itself would be small {0.1 ha [0.25 ac]}, the wastewater would likely require additional treatment to meet the necessary discharge requirements (Class of Use or federal drinking water standards). This treatment would require facilities providing an ion-exchange circuit, reverse osmosis, one or more radium-settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, and purge storage reservoirs {4 ha [10 ac] or more}. These treatment facilities would be fenced to exclude wildlife and livestock and would limit public access. The amount of land needed for the wastewater treatment facilities would be similar to that for land application or surface discharge. The increased footprint of the additional wastewater treatment facilities would be small relative to the entire permitted area {1,365 ha [3,370 ac]}, but large relative to the footprint of a central processing plant as described in the proposed action (Section 4.2.1). The current proposed action identifies as much as 120 ha [300 ac] of disturbed land for the proposed Nichols Ranch ISR Project. Overall, the increase in the amount of disturbed land to accommodate addition of a wastewater treatment facility would be about 3 to 5 percent and would have a SMALL impact on land use.

Constructing the wastewater treatment facilities (e.g., radium-settling basins) would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment(s). The equipment would produce diesel emissions and fugitive dust emissions during construction that could have a temporary and adverse effect on nonradiological air quality. BMPs such as wetting unpaved roads would minimize fugitive dust. Taking into consideration the likely short-term duration of the construction period, the anticipated impacts to nonradiological air quality would be SMALL. The applicant may also need to consider emissions of radionuclides such as radon during the wastewater treatment process. These emissions would be included as part of the NRC-approved monitoring plan for the facility, and the anticipated impacts to radiological air quality would be SMALL.

As with the land application and surface discharge wastewater disposal options, the solid wastes generated by decommissioning wastewater treatment facilities associated with a UIC Class V injection well, such as piping, spent resins, sludges, and liners from radium-settling basin(s), or contaminated building debris would need to be disposed as byproduct material. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of byproduct decommissioning wastes, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct disposal capacity, it is anticipated that the potential impacts to waste management from decommissioning the radium-settling basin(s) and other storage facilities associated with treating wastewater for surface water discharge would be SMALL to MODERATE.

Note that at the conclusion of operations, the licensee would be required to provide a plan for decommissioning any wastewater treatment facilities for NRC review (NRC, 2003b). The decommissioning plan would include final radiological surveys to identify whether there were any areas of soil contamination that would require disposal as byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.2 No-Action (Alternative 2)

Under the No-Action alternative the Nichols Ranch ISR Project would not proceed and the associated construction, operating, aquifer restoration, or decommissioning actions that would produce environmental impacts would not occur. No radioactive or nonradioactive liquid or solid waste would be generated because the facility would not be licensed. No earthmoving activities that could result in the generation of nonhazardous solid waste would occur, no buildings would be constructed, no wellfields would be developed, and no wastewater would be injected into the subsurface. No arrangements would need to be made for waste management.

4.14.3 Modified Action–No Hank Unit (Alternative 3)

For the Modified Action–No Hank Unit (Alternative 3), the impact on waste management would be the same as evaluated for the proposed action; however, under the modfied action alternative the smaller scope of activities during all phases of the proposed project would generate less waste compared to the proposed action would therefore reduce the overall impacts to waste management. Only a central processing plant would be constructed, and fewer wells would be drilled, reducing the quantity of construction-related nonradioactive wastes generated. The lower production rate would result in lower volumes of operational wastes including process bleed and nonhazardous solid waste. In addition, only one septic system and up to four deep disposal wells would be constructed due to the reduced quantity of liquid

byproduct the process materials generated. During decommissioning, the smaller facility footprint would reduce the volume of byproduct material and nonhazardous solid waste that would need to be sent offsite for disposal at an approved facility. Based on information in the applicant's surety estimate (Uranerz, 2007), almost all of the byproduct material generated during decommissioning would be from wellfields and almost all of the wellfield waste would be byproduct material. The 50 percent reduction in the number of wellfields under the Modified Action Alternative 3 would result in an approximately 50 percent reduction in byproduct material from decommissioning that would need to be disposed at a licensed facility. The decommissioning nonhazardous solid waste generated under the modified alternative would be about 96 percent of the amount estimated for the proposed action because the majority of decommissioning nonhazardous solid waste would be from demolition of plant facilities and buildings (i.e., associated with both the proposed action and modified alternative). Because the overall impacts were found to be SMALL for the proposed action, the overall impacts for a smaller facility under the modified alternative would also be SMALL. Based on this analysis, the NRC staff concludes the modified alternative project would have a SMALL incremental impact on waste management.

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5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations, as amended (40 CFR Parts 1500 to 1508) define cumulative effects as "...the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects or impacts[1] can result from individually minor but collectively significant actions taking place over a period of time." Thus, the proposed Nichols Ranch *In-Situ* Recovery (ISR) Project could contribute to cumulative impacts when its impacts overlap with those of other past, present, or reasonably foreseeable future actions. For this supplemental environmental impact statement (SEIS), other past, present, and future actions in the proposed project area include, but are not limited to, coal mining, oil and gas production, coal bed methane (CBM) operations, other mining (i.e., sand, gravel, bentonite, clinker), ISR operations, conventional uranium mining, and wind farms.

The analysis of the cumulative impacts of the proposed action was based on publicly available information on existing and proposed projects, information in the Generic Environmental Impact Statement (GEIS) (NRC, 2009a), general knowledge of the conditions in Wyoming and in the nearby communities, and reasonably foreseeable actions that could occur. The primary activity in the area is a resurgence, within the last few years, of mineral mining and oil and gas development, although this interest has not necessarily translated into active projects. Within 8 km [5 mi] of the proposed Nichols Ranch ISR Project and within the proposed project area, CBM and oil and gas operations are occurring. No long-term changes from the proposed action within the project area are anticipated because the applicant plans to return the proposed project area to its preextraction use following restoration and reclamation activities (Uranerz, 2007). There are several ISR and conventional uranium projects within the vicinity of the proposed Nichols Ranch ISR Project that are either in the decommissioning or prelicensing stages. Oil and gas operations are ongoing throughout the area. At distances beyond 8 km [5 mi], the U.S. Nuclear Regulatory Commission (NRC) assumed that the resurgence in extractive industries would continue, along with government and industry support, to develop infrastructure.

The GEIS (NRC, 2009a) provides an example methodology for conducting a cumulative impacts assessment. SEIS Section 5.1.1 describes other past, present, and reasonably foreseeable future actions considered in the cumulative impact analysis. The methodology to conduct the cumulative impact analysis for this SEIS is provided in Section 5.1.2.

5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The proposed project area is located in the middle of the Powder River Basin, which covers an approximately 26,000-km^2 [10,000-mi^2] area and spans large portions of northeastern Wyoming and southeast Montana. In comparison, the proposed activities at the Nichols Ranch ISR

[1]For the purposes of this analysis "cumulative impacts" is synonymous with "cumulative effects."

Project would affect approximately 0.05 percent of the area within the Powder River Basin. This area holds the largest deposits of coal in the United States, as well as significant reserves of uranium and other natural resources such as oil and gas. As such, there has been, and continues to be, substantial extraction activities throughout the Powder River Basin. CBM extraction continues to be the most prolific mining activity in the region and is a form of natural gas extraction from coal beds. Several Environmental Impact Statements (EISs) issued by the U.S. Bureau of Land Management (BLM) and studies by environmental groups in the Powder River Basin dating back to the 1970s have evaluated the various effects coal-related mining activities have on the affected environment.

The various past, present, and reasonably foreseeable future actions in the vicinity of the proposed Nichols Ranch ISR Project are discussed separately, as follows.

5.1.1.1 Uranium Recovery Sites

Along with the proposed Nichols Ranch ISR Project, there are other ISR and conventional uranium (underground and pit) operations in various stages of the licensing process within the Powder River Basin. Uranium-related exploration in the area includes the Smith Ranch-Highland Uranium Project, an ISR project operated by Power Resources, Inc. (PRI), and the Irigaray/Christensen Ranch Project, operated by Cogema Mining, Inc., which are located approximately 78 km [48.5 mi] south-southeast and 12 km [7.5 mi] northwest of the proposed Nichols Ranch ISR Project, respectively (Table 5-1).

As indicated in Table 5-1, there are two conventional uranium milling sites that are in the decommissioning process, Bear Creek and Highlands, and a Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I (reclamation work at inactive tailings site) site, the Spook site. The Bear Creek Uranium Recovery Project (Bear Creek) is owned by Bear Creek Uranium Company and is located approximately 53 km [35 mi] south-southeast of the proposed facility in Rock Springs, Wyoming. Highlands (Highlands) Uranium Recovery Facility is owned by Exxon Mobil Corporation and is located in Converse, Wyoming, approximately 82 km [51 mi] south-southeast of the proposed Nichols Ranch ISR Project site. Both the Bear Creek and Highlands site decommissioning activities are being performed under NRC license.

The UMTRCA Title I program established a joint Federal/State-funded program for remedial action at abandoned mill tailings sites where tailings resulted largely from production of uranium for the weapons program. Under Title I, the U.S. Department of Energy (DOE) is responsible for cleanup and remediation of these abandoned sites. NRC is required to evaluate DOE's design and implementation and, after remediation, concur that the sites meet the U.S. Environmental Protection Agency (EPA) standards. In 1993, DOE became a licensee of NRC under the general license provisions of 10 CFR 40.27. This occurred after NRC concurred in the completion of construction and surface cleanup at the Spook, Wyoming, inactive tailings site and accepted DOE's plan for long-term surveillance at the Spook site. The Spook facility is located in Johnson, Wyoming, and is approximately 63 km [39 mi] south-southeast of the proposed Nichols Ranch ISR facility.

The NRC staff is aware that several companies are actively investigating the potential for ISR extraction, as well as other types of mining and milling, in areas near the proposed Nichols Ranch ISR Project. These projects are in various stages of development, will be monitored by the NRC staff and other local government agencies, and will be discussed within the context of cumulative impacts in this SEIS based on the available information. Currently, four NRC-licensed ISR facilities are located within 80 km [50 mi] of the proposed Nichols Ranch ISR

Table 5-1. Uranium Recovery Sites Near the Proposed Nichols Ranch ISR Project

Site Name	Company/Owner	Type*	County, State	Status†	Approximate Distance in km [mi]	Direction
Reno Creek 1	Rocky Mountain Energy Co.	ISR[1]	Converse, WY	License terminated	35.5 [22]	ESE
Reno Creek 2	International Uranium Corp.	ISR[3]	Converse, WY	Not licensed—applicant withdraws	3.5 [2]	NW
Ruby Ranch	Conoco	ISR[1]	Converse, WY	Not licensed—applicant withdraws	21 [13]	N
Ruby Ranch	Power Resources, Inc. (PRI)	ISR	Converse, WY	Potential site	21 [13]	N
Reno Creek	AUC, LLC	ISR	Campbell, WY	Potential site	3.5 [2]	NW
Moore Ranch	Uranium One	ISR[3]	Campbell, WY	Licensed	19 [12]	SSE
North Butte & Ruth	PRI	ISR[2,3]	Campbell and Johnson, WY	Licensed—on standby	24 [15]	WSW
Collins Draw	Cleveland Cliffs Iron Co.	ISR[1]	Johnson, WY	License terminated	8 [5]	SSW
Shirley Basin South	U.S. Department of Energy (DOE)	Conv.	Johnson, WY	UMTRCA Title II disposal site	157 [97.5]	SSW
Peterson Ranch	Arizona Public Service Co. Malapai Resources	ISR[1]	Johnson, WY	Not pursued	98 [61]	SSE
Ludeman	Uranium One	ISR	Converse, WY	Potential site—license application withdrawn by applicant	69 [43]	SSE
Highland 1	Exxon Minerals	ISR[3]	Converse, WY	Licensed, but not pursued	81 [50.5]	SSE
Reynolds Ranch	PRI	ISR[2]	Converse, WY	Licensed, but not operational	70 [43.5]	SSE
Highland 2	Everest Minerals	ISR[3]	Converse, WY	Licensed—later combined with Smith Ranch facility license	78 [48.5]	SSE
Smith Ranch–Highland	PRI	ISR[3]	Converse, WY	Operating	78 [48.5]	SSE

Table 5-1. Uranium Recovery Sites Near the Proposed Nichols Ranch ISR Project (continued)

Site Name	Company/Owner	Type*	County, State	Status†	Approximate Distance in km [mi]	Direction
Bear Creek	Bear Creek Uranium Co.	Conv.	Converse, WY	Decommissioning	56 [35]	SSE
Highlands	Exxon Mobile Corp.	Conv.	Converse, WY	Decommissioning	82 [51]	SSE
Leuenberger	Teton Exploration Drilling	ISR[1,3]	Converse, WY	License terminated	91 [56.5]	SSE
South Powder River Basin	Kerr–McGee	ISR[1]	Converse, WY	License terminated with approval of Smith Ranch license	78 [48.5]	SSE
Spook	DOE	Conv.	Johnson, WY	UMTRCA Title I disposal site	63 [39]	SSE
Allemand–Ross	Uranium One	ISR	Johnson, WY	Potential site	33 [20.5]	SW
Irigaray/ Christensen Ranch	Cogema Malapai Resources	ISR[2,3]	Johnson, WY	Licensed for operations	12 [7.5]	NW
Willow Creek	J&P Corp. Western Nuclear	ISR[1]	Johnson, WY	License terminated with approval of Irigaray license	12 [7.5]	NW
Shirley Basin	Pathfinder Mines Corp.	Conv.	Platte, WY	Decommissioning	154. [96]	SSW
North Platte	Uranium Resources	ISR[1]		License terminated	94 [58.5]	SSE

Source: NRC, 2009b

*Type: 1 = Research and Development/Pilot, 2 = Satellite, 3 = Commercial scale, Conv. = Conventional uranium mill

†UMTRCA Title I and Title II sites are uranium mill processing or tailings sites that have been decommissioned. DOE or the state is the long-term custodian of these sites.

Project. The Uranium One, Inc. Irigaray/Christensen Ranch ISR facility is located approximately 12 km [7.5 mi] northwest of the proposed project site. Power Resources, Inc.-licensed North Butte amendment area is located approximately 24 km [15 mi] to the southwest. The PRI Smith Ranch-Highland ISR facility is located approximately 78 km [48.5 mi] southeast of the proposed Nichols Ranch ISR Project. The Uranium One Moore Ranch site is approximately 19 km [12 mi] to the southeast. Two of the licensed facilities, Irigaray/Christensen Ranch and Smith Ranch-Highland, currently have existing yellowcake processing plants with the latter in operation. Table 5-1 lists 25 past, existing, and potential uranium recovery sites near the proposed Nichols Ranch ISR Project.

5.1.1.2 Coal Mining

The Powder River Regional Coal Team (PRRCT) decertified the Powder River Federal Coal Region as a Federal coal production region in 1990, which allowed leasing to occur in the region on an application basis. Because of decertification, U.S. coal production increased 11 percent, from 1.03 billion tons [1.14 billion T] in 1990 to 1.15 billion tons [1.27 billion T] in 2007 (BLM, 2009e). Between 1990 and 2008, the BLM Wyoming State Office held 25 competitive lease sales and issued 19 new Federal coal leases containing more than 5.17 billion metric tons [5.7 billion short tons] of coal using the “lease by application” process (BLM, 2005a,b,c). In 2003, Powder River Basin coal mines produced 329 million metric tons [363 million short tons] of coal (BLM, 2005a,b,c). These mines make up more than 96 percent of the coal produced in Wyoming each year (BLM, 2005a,b,c). In 2003, the cumulative disturbed land area of the Powder River Basin attributable to coal mines totaled nearly 28,000 ha [70,000 ac]. Reasonably foreseeable future development projects for cumulative disturbed land area range from 47,400 to 50,600 ha [117,000 to 125,000 ac] in the year 2015, under estimated low and high production scenarios, respectively. Other development related to coal includes railroads, coal-fired power plants, major (230 kV) transmission lines, and coal technology projects. The total land area of other coal-related disturbance in the Powder River Basin in 2003 was nearly 2,000 ha [5,000 ac].

Table 5-2 lists coal mines near the proposed Nichols Ranch ISR Project in Wyoming. The Wyoming East Uranium Milling Region has 16 surface mines. Surface mining of coal can cause adverse impacts to land use, geology and soils, water resources, ecology, air quality, noise, historic and cultural resources, visual and scenic resources, socioeconomics, and waste management.

5.1.1.3 Oil and Gas Production

There are approximately 472 oil and gas production units in the Powder River Basin in various stages of production. These are evenly dispersed throughout the entire Powder River Basin. The Wyoming Oil and Gas Conservation Commission reported that in 2003, oil and gas wells in the Powder River Basin produced approximately 13 million barrels of oil and 1.1 billion m^3 [40 billion ft^3] of conventional gas (BLM, 2005a, 2005b, 2005c).

Most of Wyoming’s current oil production is from old oil fields with declining production, and the level of exploration drilling to discover new fields has been low (BLM, 2008a). From 1992 to 2002, oil production from conventional oil and gas wells in Campbell and Converse Counties within the Powder River Basin decreased approximately 60.4 percent. Oil- and gas-related development includes major transportation pipelines and refineries.

Table 5-2 Coal Mines Near the Proposed Nichols Ranch ISR Project

Site Name	Company/Owner	Type	County, State	Production in 2008 metric tons [short tons]	Distance in km [mi]	Direction
Buckskin	Buckskin Mining Company	Surface	Campbell, WY	23,656, 072 [26,076,356]	83.5 [52]	NNE
Rawhide	Powder River Coal Company	Surface	Campbell, WY	16,700,642 [18,409,307]	82 [51]	NNE
Dry Fork	Western Fuels of Wyoming, Inc.	Surface	Campbell, WY	4,772,918 [5,261,242]	79 [49]	NNE
Eagle Butte	Foundation Coal West	Surface	Campbell, WY	18,545,952 [20,443,413]	79 [49]	NNE
KFx Plant	Evergreen Energy	Surface	Campbell, WY	0 (was in production 2006, 2007)	80.5 [50]	NNE
Wyodak	Wyodak Resources Development Corp.	Surface	Campbell, WY	5,458,812 [6,017,311]	75.5 [47]	NNE
Caballo	Powder River Coal Company	Surface	Campbell, WY	28,309,045 [31,205,381]	63.5 [39.5]	NE
Belle Ayr	Foundation Coal West	Surface	Campbell, WY	26,043,443 [28,707,982]	59.5 [37]	NE
Cordero/Rojo Complex	Rio Tinto Energy America	Surface	Campbell, WY	36,317,583 [40,033,283]	57 [35.5]	NE
Coal Creek	Thunder Basin Coal Company, LLC	Surface	Campbell, WY	10,390,483 [11,453,547] (not in production from 2001 to 2005)	56 [35]	ENE
Jacobs Ranch	Rio Tinto Energy America	Surface	Campbell, WY	38,233,940 [42,145,705]	54 [33.5]	ESE
Black Thunder	Thunder Basin Coal Company, LLC	Surface	Campbell, WY	80,365,056 [88,587,310]	50.5 [31.5]	ESE

Table 5-2 Coal Mines Near the Proposed Nichols Ranch ISR Project (continued)

Site Name	Company/Owner	Type	County, State	Production in 2008 metric tons [short tons]	Distance in km [mi]	Direction
North Antelope/ Rochelle Complex	Powder River Coal Company	Surface	Campbell & Converse, WY	88,521,725 [97,578,499]	55.5 [34.5]	ESE
North Rochelle	Triton Coal Company	Surface	Campbell, WY	no data	54.5 [34]	ESE
Antelope	Rio Tinto Energy America	Surface	Campbell & Converse, WY	32,473,123 [35,795,491]	55 [34.5]	SE
Dave Johnston	Glenrock Coal Company	Surface	Converse, WY	Reclaimed—no production since 2000	76 [47]	S

Source: WMA, 2008

In 2003, the cumulative disturbed land area in the Powder River Basin from oil and gas, CBM, and related development was nearly 76,100 ha [188,000 ac]. Increasing development associated with extraction of these energy resources will result in a total of 123,000 ha [305,000 ac] under development by 2015 (BLM, 2005a,b,c). The depth to producing gas and oil-bearing horizons generally ranges from 1,220 to 4,120 m [4,000 to 13,500 ft], but some wells are as shallow as 76 m [250 ft] (BLM, 2005a, b, c).

5.1.1.4 Coal Bed Methane Development

Natural gas production has been increasing in Wyoming. In the Powder River Basin, this is from the development of shallow CBM resources (BLM, 2005a,b,c). Annual CBM production in the Powder River Basin increased rapidly between 1999 and 2003, with nearly 15,000 producing CBM wells in the Powder River Basin in 2003 and a total production volume of 10.3 billion m^3 [364 billion ft^3] (BLM, 2005a,b,c). In 2007, CBM production within Campbell County was 4.7 million m^3 [167,000 million ft^3] (BLM, 2009i). The BLM Buffalo Field Office, which administers the area where the proposed Nichols Ranch ISR Project is located, has processed approximately 3,000 applications for permits to drill since 2003; more than 98 percent of these applications are for CBM recovery (BLM, 2009i).

The recovery of CBM involves the installation of facilities that include access roads; pipelines for gathering gas and produced water; electrical utilities; facilities for measuring and compressing recovered gas; facilities for treating, discharging, disposing of, containing, or injecting produced water; and pipelines to transport gas high-pressure transmission pipelines. The wells are collocated on a well pad installed in a 32-ha [80-ac] spacing pattern (eight pads per square mile). The overall life of each well is approximately 7 to 10 years after which pipes are abandoned in place and well sites are reclaimed (NRC, 2010).

Currently, there are 24 permitted and completed CBM wells located in or adjacent to the Nichols Ranch Unit while 33 permitted and completed CBM wells are found in and adjacent to the Hank Unit. As shown in Table 3-1, there are numerous permitted or completed CBM wells within 4.8 km [3 m] of the Nichols Ranch (200 wells) and Hank Units (180 wells). Three CBM operators began working in or near the Nichols Ranch and Hank license areas in 2007. The target coal seam occurs approximately 554 m [1,474 ft] below ground surface (bgs) at the Nichols Ranch Unit and 450 m [1,820 ft] bgs at the Hank Unit. The formation is vertically separated from the Nichols Ranch site by 230 m [756 ft] and the Hank site by 353 m [1,160 ft] (Uranez, 2008).

5.1.1.5 Other Mining

Sand, gravel, bentonite, and clinker (or scoria) have been and are being mined in the Powder River Basin. Bentonite is weathered volcanic ash that is used in a variety of products, including drilling mud and cat litter, because of its absorbent properties. There are three major bentonite-producing districts in and around the Powder River Basin. Aggregate, which consists of sand, gravel, and stone, is used in the construction purposes. In the Powder River Basin, the largest identified aggregate operation is located in northern Converse County. It has an associated total disturbance area of approximately 27 ha [67 ac], of which 1.6 ha [4 ac] have been reclaimed. Scoria, or clinker, is used as aggregate where alluvial terrace gravel or in-place granite/igneous rock is not available. Scoria generally is mined in Converse and Campbell Counties in the Powder River Basin (BLM, 2005a,b,c).

5.1.1.6 Environmental Impact Statements as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

Another indicator of present and reasonably foreseeable future actions is the number of draft and final EISs Federal agencies prepared within a recent time period. Using information in NUREG–1910 (NRC, 2009a, Section 5.2.2) and other publicly available information, several EISs were identified for the Powder River Basin in addition to draft and final programmatic EISs for large-scale actions related to several states, including Wyoming (see GEIS Tables 5.2-3 and 5.2-4). These projects could contribute to both local and regional cumulative impacts on air quality, land usage, terrestrial plants and animals, and groundwater and surface water resources.

5.1.2 Methodology

In determining potential cumulative impacts, the following methodology was developed based on the GEIS recommendation to follow CEQ guidance (CEQ, 1997):

- Identify for each resource area the potential environmental impacts that would be of concern from a cumulative impacts perspective. These impacts are discussed and analyzed in Chapter 4.
- Identify the geographic scope for the analysis for each resource area. This scope is expected to vary from resource area to resource area, depending on the geographic extent to which the potential impacts could be an issue.
- Identify the timeframe over which cumulative impacts would be assessed. The timeframe selected begins in 2007 when the applicant submitted a license application to NRC for a new source material license for the proposed Nichols Ranch ISR Project. The cumulative impact analysis timeframe would terminate in 2020, which represents the license termination at the end of the decommissioning period.
- Identify existing and anticipated future projects and activities in and surrounding the project site. These projects and activities are identified in Tables 5-1 and 5-2 of this chapter.
- Assess the cumulative impacts for each resource area from the proposed action and reasonable alternatives and other past, present, and reasonably foreseeable future actions. This analysis would take into account the environmental impacts of concern identified in Step 1 and the resource-area-specific geographic scope identified in Step 2.

The following terminology was used to define the level of cumulative impact:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

In conducting this assessment, NRC recognized that for many aspects of the applicant-proposed activities, there would be SMALL impacts on the affected resources. However, an impact that may be SMALL by itself could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline. The NRC staff determined the appropriate level of analysis merited for each resource area potentially affected by the proposed action and alternatives. The level of detailed analysis was determined by considering the impact level to that resource, as described in Chapter 4, as well as the likelihood that the quality, quantity, or stability of the given resource could be affected.

Table 5-3 summarizes the cumulative impacts from the proposed Nichols Ranch ISR Project on environmental resources, based on analyses the NRC staff conducted and considering the other past, present and reasonably foreseeable activities identified in Section 5.1.1.

5.2 Land Use

Cumulative impacts to land use were assessed using two different study areas. The first study area is land within the planning area administered by the BLM Buffalo Field Office (hereinafter referred to as the “Buffalo Planning Area”). The second study area is defined in the BLM Powder River Basin (PRB) Coal Review Cumulative Effects Report (2009d). The second study area encompasses part of the Buffalo Planning Area and a portion of northern Converse County. These areas delineate the geographic boundary utilized for the cumulative analysis of land use resources and will be collectively referred to as the “land use study area.” The land use study area was selected as the cumulative analysis geographic boundary because this study area incorporates the four counties surrounding the proposed project. Additionally, the proposed Nichols Ranch ISR Project is centrally located within the study area. Within the land use study area, activities on both public and private lands, including oil, gas, CBM, and coal development, are ongoing and projected to expand in the future. Note that throughout the analysis of the land use section, data on geographic area will refer to uses specifically occurring within the Buffalo Planning Area, the PRB Coal Review Cumulative Effects study area, or the combined land use study area.

Potential land use impacts could result from interruption to, reduction of, or impedance of livestock grazing areas, open wildlife areas, and land access. Recent BLM reports provide valuable information on past, present, and future development activities that could result in cumulative effects on land use when added to impacts associated with the proposed Nichols ISR project. The cumulative effects analysis timeframe begins in 2007 and terminates in 2020. The year 2007 is when the applicant submitted a license application to NRC for a new source material license for the proposed Nichols Ranch ISR Project. The cumulative impact analysis timeframe would terminate in 2020, which is the year that NRC estimates license termination would occur at the end of the decommissioning period. At the completion of decommissioning, the applicant would restore the land to pre-extraction conditions and uses, including all roads, except those the landowner has requested to remain (Uranerz, 2007). Data from a BLM draft report were used as part of this analysis to forecast the projected magnitude of development activities to the year 2028 (BLM 2009a).

Table 5-3. Cumulative Impacts on Environmental Resources

Resource Category	Cumulative Impacts	Comment
Land Use	MODERATE	The proposed project is projected to have a SMALL incremental effect when added to the MODERATE cumulative impacts to land use.
Transportation	MODERATE	The proposed project is likely to have a SMALL incremental effect when added to the MODERATE cumulative impacts to transportation.
Geology and Soils	MODERATE	The proposed project would have a SMALL incremental effect when added to the MODERATE cumulative impacts to geology and soils.
Water Resources		
Surface Waters and Wetlands	MODERATE	The proposed project may have a SMALL incremental impact when added to the MODERATE cumulative impacts to surface waters and wetlands.
Groundwater	SMALL to MODERATE	The proposed project may have a SMALL incremental impact when added to the SMALL to MODERATE cumulative impacts on groundwater resources.
Ecological Resources		
Terrestrial Ecology	MODERATE	The proposed project may have a SMALL incremental impact when added to the MODERATE cumulative impacts on terrestrial ecological resources.
Aquatic Ecology	SMALL	The proposed project would have a SMALL impact when added to the SMALL cumulative impacts on aquatic ecological resources.
Protected Species	SMALL to MODERATE	The proposed project would have a SMALL impact on threatened and endangered species when added to the MODERATE cumulative impacts.
Meteorology		
Air Quality	MODERATE	The proposed project would have a SMALL impact on air quality when added to the MODERATE cumulative impacts.
Noise	SMALL	The proposed project would have a SMALL incremental impact on noise when added to the SMALL cumulative impacts.

Table 5-3. Cumulative Impacts on Environmental Resources (continued)

Resource Category	Cumulative Impacts	Comment
Historical and Cultural Resources	MODERATE	The proposed project would have a SMALL incremental impact on historical and cultural resources when added to the MODERATE cumulative impacts.
Visual and Scenic Resources	MODERATE	The proposed project would have a SMALL to MODERATE incremental impact on visual and scenic resources when added to the MODERATE cumulative impacts to the viewshed.
Socioeconomics	MODERATE	The proposed project would have a SMALL incremental impact on socioeconomic resources when added to the MODERATE cumulative impacts.
Environmental Justice	SMALL	The proposed project would have a SMALL incremental impact on environmental justice when added to the SMALL cumulative impacts.
Public and Occupational Health and Safety	SMALL	The proposed project would have a SMALL incremental impact on public and occupational health and safety when added to the SMALL cumulative impacts.
Waste Management	SMALL	The proposed project would have a SMALL incremental impact on waste management when added to the SMALL cumulative impacts.

The Buffalo Planning Area includes part of Campbell, Johnson, and Sheridan Counties and covers approximately 2.9 million ha [7.3 million ac]. The size of the PRB Coal Review Cumulative Effects study area is 1.9 million ha [4.6 million ac]. The total size of the land use study area is 3.3 million ha [8.1 million ac]. Land use within the land use study area is diversified and cooperative, with CBM and oil and gas extraction activities sharing land with livestock grazing. Although federal grasslands and forests cover approximately 21 percent of the Powder River Basin area, most rangeland is privately owned (68 percent) and is primarily used for grazing cattle and sheep. Figure 5-1 shows the extent of BLM pasture allotments in the region.

Ranching in the area stretches back to the Civil War when Texas cattlemen moved their herds of Longhorn cattle north looking for open range. Coal and mineral mining and oil and gas production are other important land uses. The first commercial oil field discovery was made in 1948. Oil discoveries in 1956 touched off the first oil boom in the area. Other major oil and gas discoveries were made in the 1960s and 1970s. Conventional mining, oil and gas, and CBM production are expected to continue into the future.

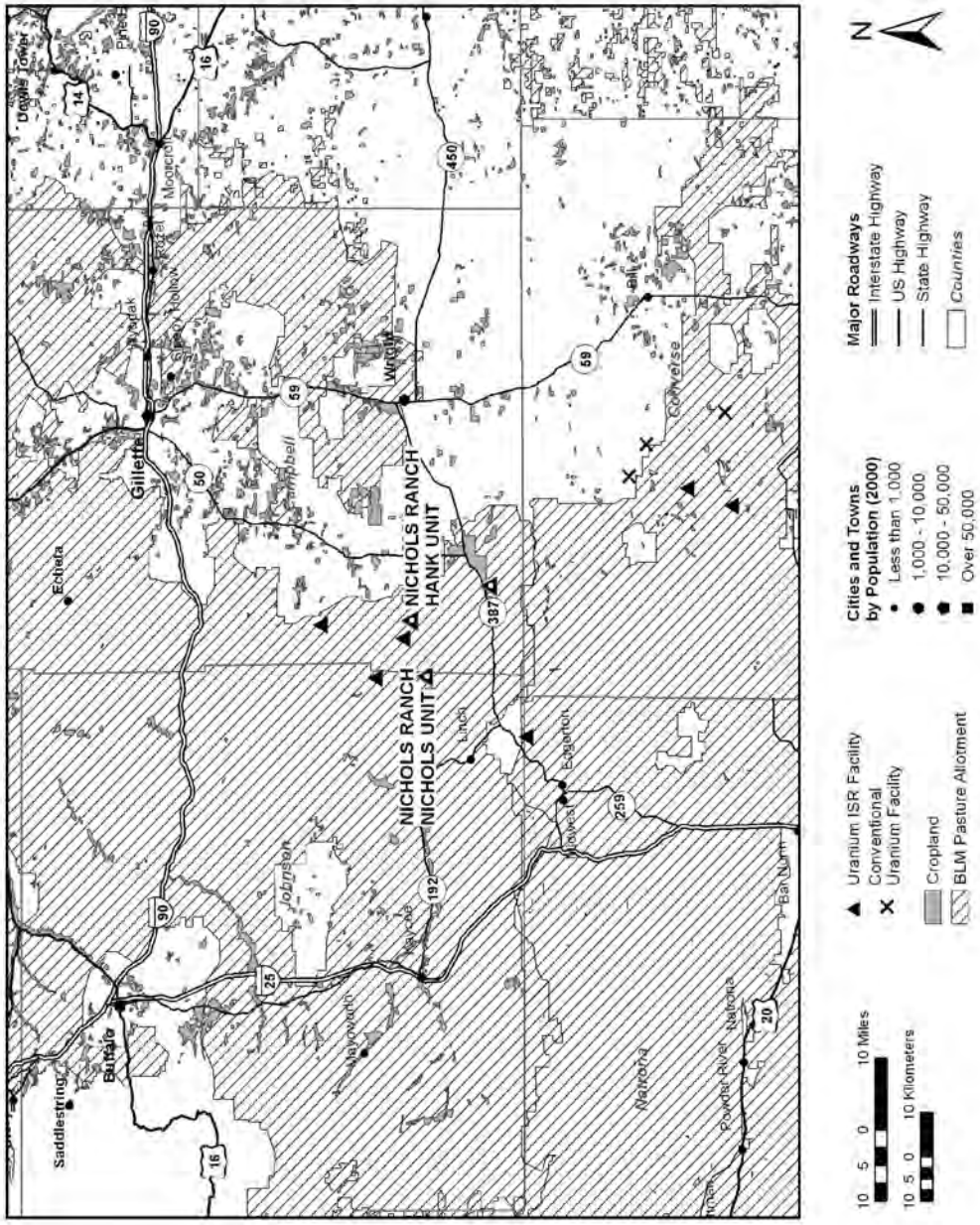

Figure 5-1. Conventional and ISR Uranium Recovery Facilities, BLM Pasture Allotments and Croplands near the Proposed Nichols Ranch ISR Project. Sources: BLM, 2010a; EIA, 2007; WOGCC, 2010; WyGISC, 1990

Livestock grazing is one of the primary land uses within the land use study area. The majority of the area consists of rangeland, most of which is privately owned. Livestock grazing also occurs on lands administered by BLM, USFS, and State of Wyoming. Potential short-term cumulative impacts associated with loss of rangeland include decreased foraging opportunities, temporary loss of animal unit months (AUMs), and temporary loss of water-related range improvements (e.g., improved springs, water pipelines, stock ponds). Impacts would be minimized after successful reclamation had been achieved. Potential cumulative long-term impacts consist of permanent loss of forage and forage/cropland productivity in areas that would not be reclaimed in the near term. Impacts may also include dispersal of noxious and invasive weed species within and beyond the surface disturbance boundaries, which decreases the amount of desirable forage available for livestock (BLM, 2009d).

A total of approximately 90,070 ha [222,568 ac] of vegetation has been disturbed by development in the PRB Coal Review Cumulative Effects study area as of 2007. Of the 222,568 acres of total cumulative disturbance, approximately 45,884 ha [113,382 ac] (51 percent) have been reclaimed. The remaining 53,680 ha [132,645 ac] of disturbance would be reclaimed incrementally or following a project's completion, depending on the type of development activity and permit requirements. Projections out to 2020 forecast that between 58,483 ha and 63,197 ha [144,515 ac and 156,165 ac] of additional rangeland will be lost. However, most of this will be regained as part of reclamation activities. (BLM, 2009d)

As of 2009, there were a total of 6,421 conventional oil and gas wells in the Buffalo Planning Area, of which 3,090 were active. An additional 1,359 conventional wells are projected to be drilled between 2009 and 2028. An estimated 4,857 ha [12,003 ac] of short-term surface disturbance related to well pad and access road construction would occur in the study area through 2028, which encompasses less than 0.16 percent of all the land in the Planning Area. Of the 4,857 ha [12,003 ac], 2,868 ha [7,087 ac] would remain un-reclaimed at the end of 2028, equal to 0.09 percent of the land administered by the Buffalo Planning Area. (BLM, 2009a)

Through the year 2008, 28,776 CBM wells were drilled, while an additional 13,800 are forecast to be developed between 2009 and 2028. A total of 25,958 ha [64,144 ac] are projected to be disturbed by well pads and access roads associated with CBM activity through the year 2028. This represents 0.9 percent of the land included in the Buffalo Planning Area. Unreclaimed surface disturbance is estimated at 5,542 ha [13,696 ac], which is equivalent to 0.2 percent of Planning Area surface lands. (BLM, 2009a)

Coal mining activity in the Powder River Basin began during 1883, and underground coal mines began operation during 1894. The Powder River Basin emerged as a major coal production area during the 1970s and early 1980s. The largest area, the Gillette coal field, is approximately 24.1 km [15 mi] wide and extends from approximately 35.4 km [22 mi] north of Gillette, Wyoming, to approximately 40.3 km [25 mi] south of Wright, Wyoming. It is located approximately 34 km [21 mi eas]t of the proposed Nichols ISR facility. A second coal field area is approximately 32.2 km [20 mi] wide and extends from Sheridan, Wyoming, north to the Wyoming/Montana State line, which is approximately 130 km [80 mi] northeast of the proposed ISR facility. In 2007, the Powder River Basin was the single most productive coal basin in the United States, producing nearly 40 percent of the nation's coal. The Powder River Basin accounts for approximately 97 percent of Wyoming's production and boasts all of the 10 largest coal mines in the United States by 2007 production. Figures 5-2 and 5-3 show the location of coal mining activities near and within an 80 km [50 mi] radius of the proposed project. Wyoming's Powder River Basin coal production is expected to grow at an annual rate of 2 to

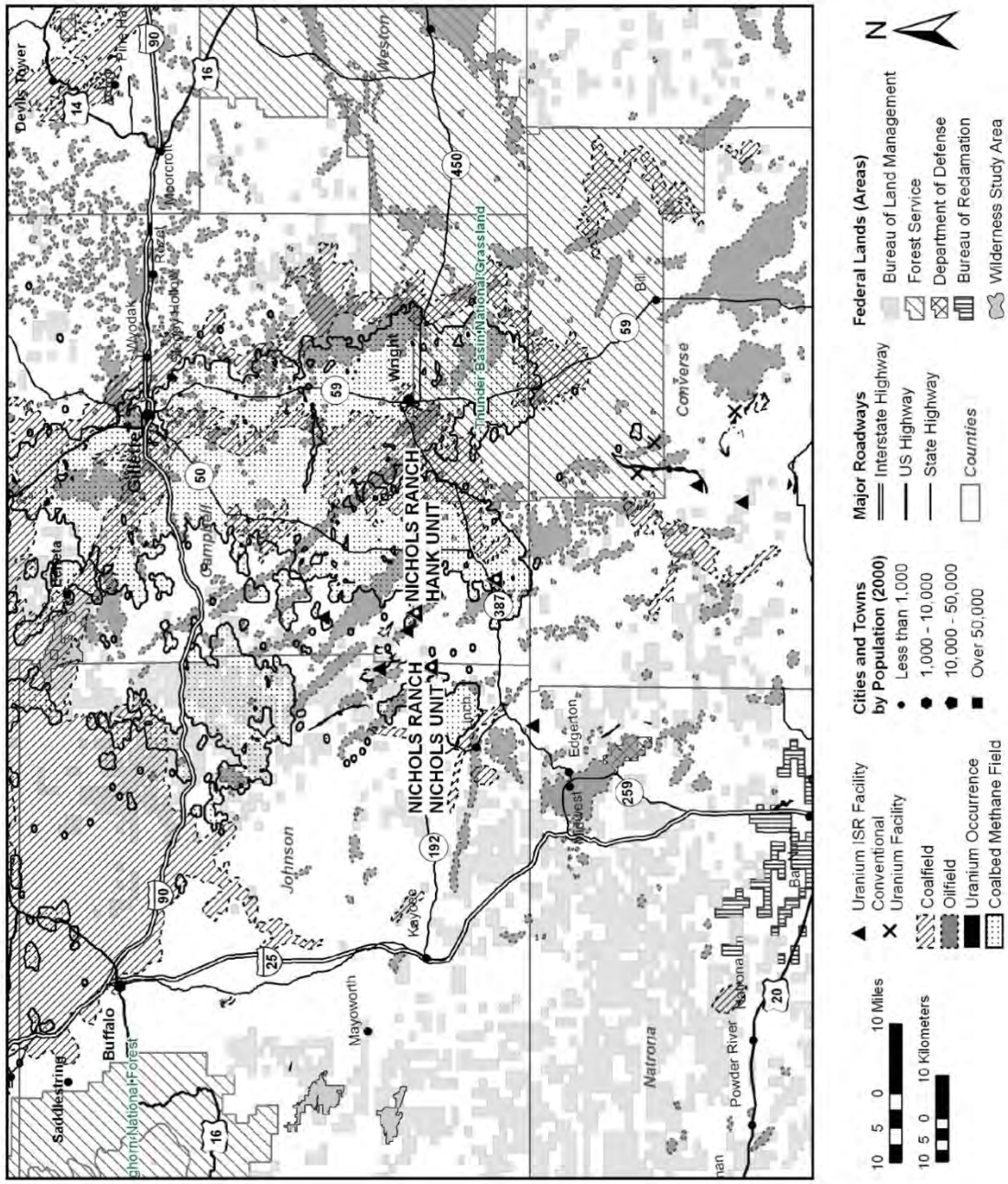

Figure 5-2. Oilfields, Coalfields, CBM Project Areas, Uranium Occurrences, and Uranium Facilities near the Proposed Nichols Ranch ISR Project. Sources: BLM, 2010a; EIA, 2007; WOGCC, 2010; WyGISC, 1990

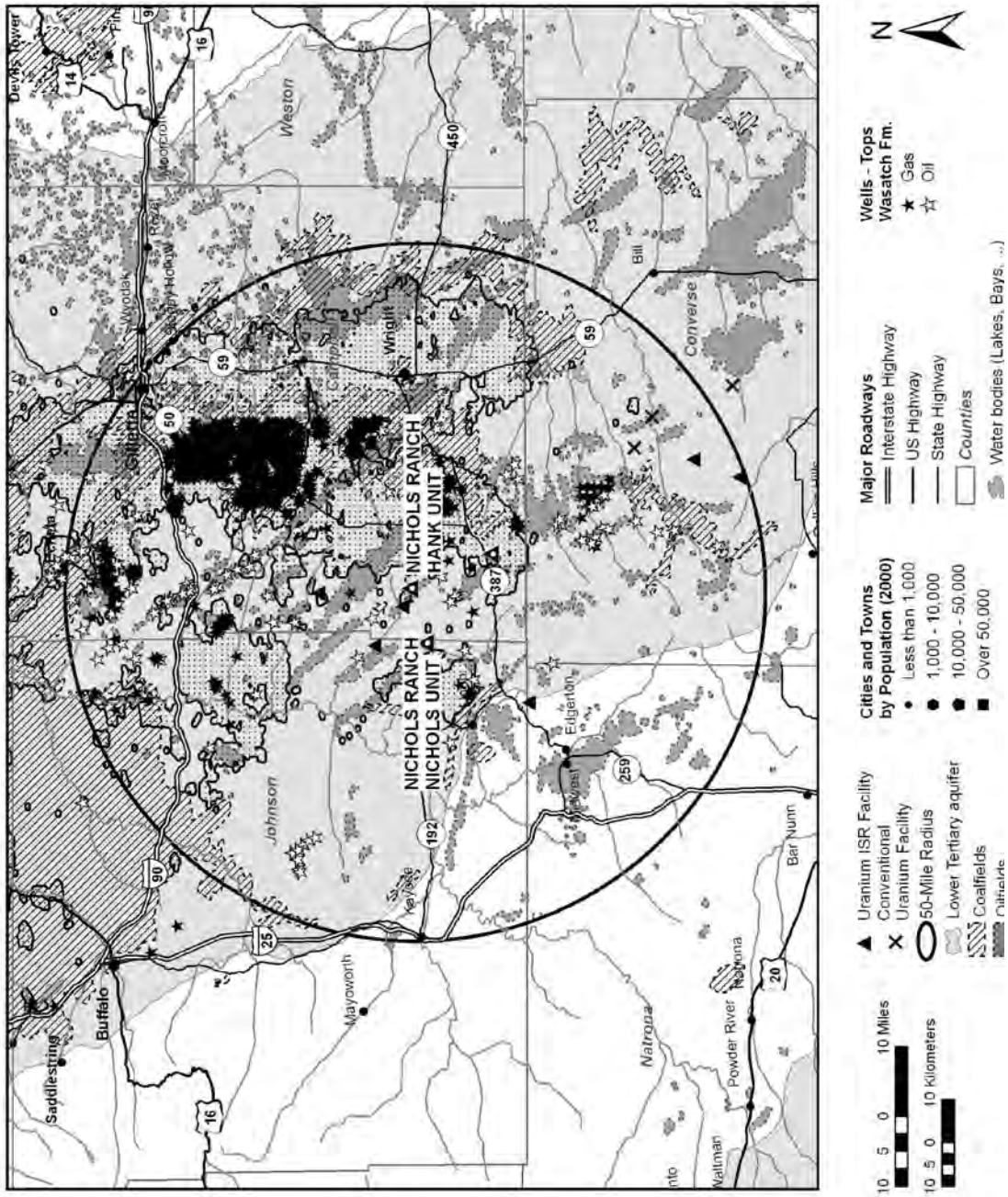

Figure 5-3. Energy Developments Within a 50-Mile Radius of Proposed Nichols Ranch ISR Project. Sources: EIA, 2007; USGS, 2003; WOGCC, 2010; WyGISC, 1990.

3 percent per year. Additional coal leases and associated lands may be required to keep up with demand (BLM, 2009b).

Within the PRB Coal Review Cumulative Effects study area (BLM, 2009d), a total of approximately 90,070 ha [222,568 ac] (5 percent) had been disturbed by development activities in the land use study area by the end of 2007. Of this total, approximately 33,828 ha [83,593 ac] (37 percent of the total) were disturbed by coal mining activities. The PRB report forecast minimum (lower) and maximum (upper) coal production expected in 2020. According to the estimated lower coal production scenario, an estimated 171,071 ha [422,727 ac] or approximately 9.4 percent of the land use study area would be disturbed by various reasonably foreseeable future activities. It is projected that 55,621 ha [137,443 ac] (33 percent of the total) would be associated with coal mining activities. Approximately 117,333 ha [289,937 ac] (39 percent of the total disturbance) would be reclaimed by 2020, leaving 53,737 ha [132,789 ac] of unreclaimed disturbance. This would result in about 3 percent of the total study area remaining unreclaimed. Under the 2020 upper production scenario, approximately 175,784 ha [434,374 ac] (9.7 percent of the land use study area) would be disturbed by coal mining activities accounting for 60,334 ha [149,089 ac] or 34 percent of the disturbance. Approximately 68 percent of the total disturbance or 160,405 ha [396,370 ac] would be reclaimed by 2020. The unreclaimed acreage of 55,726 ha [137,702 ac] again represents about 3 percent of the total study area. Anticipated impacts related to this development would include degradation of the dispersed recreation experience and of the hunting experience, in particular. A reduction in land available for hunting also makes herd management more difficult for the Wyoming Fish and Game Department and reduces its hunting-derived revenues. Additionally, un-reclaimed disturbance areas would result in increased conflicts with existing land uses, which would be primarily grazing and agricultural uses (BLM, 2009d).

In the United States, the total uranium mine production in 2007 was 2,059,763 kg [4,541,000 lb] almost half of which came from the southernmost Powder River Basin. Uranium deposits in Wyoming are concentrated in southeastern Johnson and southwestern Campbell Counties. Uranium was first mined in Wyoming in 1920. Continued exploration for uranium resulted in discovery of additional sedimentary uranium deposits in the major basins of central and southern Wyoming. Most uranium production in the Buffalo Planning Area occurred during the years 1955 to 1959. Uranium production declined in the mid-1960s, but increased again in the late 1960s and 1970s with the discovery of major uranium deposits in the Powder River Basin, including Christensen Ranch, Smith Ranch, Morton Ranch, and the Highland sites. Conventional mine production peaked in 1980 and then decreased in the early 1980s through the early 1990s when ISR facilities were developed (BLM, 2009c).

During the 1980s, ISR replaced conventional mines as the preferred means for extracting uranium ores in the United States. Currently, only ISR facilities are producing uranium in Wyoming. There is an active ISR operation in the Wyoming portion of the Powder River Basin, which is Power Resources' Highland/Smith Ranch ISR facility located in Converse County. In addition to this ISR facility, there are two permitted uranium Plans of Operations within the Buffalo Planning Area (Ruth and Christensen Ranch) and three licensed but presently nonoperational satellite properties of the Power Resources' Highland/Smith Ranch ISR facility including: North Butte located approximately 3.2 km [2.0 mi] to the north of the Hank Unit and 8.1 km [5.0 mi] to the northeast of the Nichols Ranch Unit; Reynolds Ranch located 70km [43.5 mi] to the southeast of the Nichols Ranch ISR Project; and Ruth located 24 km [15 mi] to the southwest. The Moore Ranch ISR Project has also recently been licensed and is located 32 km [20 mi] southeast of the proposed Nichols Ranch ISR Project. Figure 5-2 shows the location of uranium facilities as well as other energy' development projects in the area.

According to BLM, the potential impacts on land use from the proposed Nichols Ranch ISR Project would be SMALL through all stages of the ISR process as discussed in SEIS Section 4.2. The proposed license area encompasses 1,365 ha [3,371 ac], which represents less than 0.05 percent of the Buffalo Planning Area and an even smaller portion of the entire land use study area (0.04 percent). Furthermore, of the licensed area, only 121 ha [300 ac] would be used for facility operation. Even less surface, approximately 37 ha [92 ac], would be disturbed by earthmoving activities and other activities as described in SEIS Section 4.2.1.1 (Uranerz, 2007). Except for roads that would remain in use after decommissioning, the impact would be short term (for the life of the facility) because the applicant has stated in its environmental report that the land would be returned to its preoperational condition. The access roads built to connect existing T-Chair Livestock Company ranch roads with both the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would remain in use for some period after decommissioning to facilitate site monitoring.

The NRC staff has determined that the cumulative impact on land use within the land use study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Based upon the BLM reports identified in this section, the primary types of actions leading to this moderate finding are energy development activities, namely: (i) coal mining, which includes an expected annual 2 percent to 3 percent growth rate in coal production as of yearend 2007 with approximately 33,791 ha [83,500 ac] in the land use study area disturbed by coal mining activities; (ii) CBM, with 28,776 wells in the Buffalo Planning area as of yearend 2008 with an additional 13,800 CBM wells projected to be drilled by year end 2028; (iii) oil and gas production, with 3,090 active wells in operation in the Buffalo Planning area as of 2009 with an additional 1,359 wells projected to be drilled between 2009 and 2028; and (iv) uranium ISR facilities, including one operating ISR facility, the Power Resources' Highland/Smith Ranch ISR facility located in Converse County along with their licensed but unconstructed satellite facilities Ruth and North Butte, the recently licensed Moore Ranch ISR facility, (expected to commence operation in 2012) and the Irigaray/Christensen Ranch which is expected to resume operations in 2011 (Mills, 2010).

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on land use when considered with all other past, present, and reasonably foreseeable actions in the land use study area. This conclusion is based on the fact that the proposed action would only disturb approximately 120 ha [300 ac], with an additional 24 ha to 32 ha [60 to 80 ac] fenced off from grazing activities over the life of the project.

For the Modified Action–No Hank Unit (Alternative 3), NRC staff concludes that the cumulative land use impacts would be similar to, but less than those described above for the proposed action. Section 4.2.3 describes impacts associated with Alternative 3. Only 60 ha [120 ac] would be affected under Alternative 3 compared to 121 ha [300 ac] for the proposed action. There would be less land restricted under Alternative 3 since only 12 to 16 ha [30 to 40 ac] would be fenced off from grazing activities compared to the 24 to 32 ha [60 to 80 ac] that would be fenced under the proposed action over the life of the project. Impacts from decommissioning and land reclamation would also be less since the Hank Unit site would not be developed. The NRC staff determined that the SMALL impacts from the proposed action would be further reduced for Alternative 3 and would have a SMALL incremental effect on land use when added to the MODERATE cumulative impact on land use from other past, present, and reasonably foreseeable future actions within the land use study area.

5.3 Transportation

Potential cumulative impacts on transportation were assessed that could result from past, present, and reasonably foreseeable development activities. Campbell, Johnson, and Natrona Counties served as the geographic boundary area (hereinafter referred to as the cumulative effects study area). This geographic area was selected because major transportation routes within the region (both Interstate and U.S. Highways) occur within these three counties. The cumulative effects analysis timeframe begins in 2007 and terminates in 2020, as discussed in Section 5.1.2. The year 2007 is when the applicant submitted a license application to NRC for a new source material license for the proposed Nichols Ranch ISR Project. Upon completion of decommissioning activities, transportation impacts associated with the proposed Nichols Ranch ISR project would cease.

Potential environmental impacts from transportation associated with the proposed Nichols Ranch ISR Project are described in Section 4.3 of this SEIS. Impacts would be from worker commuting to and from the site and from the shipment of materials and chemicals on and off the site. Impacts could occur from fugitive dust, noise, incidental wildlife or livestock kills, increased traffic on local roads, and accidents. During the ISR phases of the proposed Nichols Ranch ISR Project, the annual average daily traffic count was estimated by NRC staff to increase 0.6 to 2 percent along State Route (SR) 387, the main entrance to the proposed facility. For State Route 50, the proposed project-related traffic would increase annual average daily traffic count (AADT) counts on SR50 by roughly 3 percent. The NRC staff evaluated the potential traffic increases to the same roads if no carpooling were assumed, and the estimates for SR387 increased by 4.5 to 16 percent depending on the location, while the estimates for SR50 increased by 28 percent at a location with relatively low existing traffic. These potential changes to traffic were compared with another regional traffic impact analysis and were found to be small. Based on the low volume of operational traffic, the low radiological risks from transportation accidents, and the implementation of the applicant's additional safety practices as discussed in Section 4.3.1.2, the the NRC staff concluded the potential impacts from accidents were SMALL. The NRC staff also concluded road dust impacts would be SMALL based on the low volume of traffic generated and required road dust mitigation. Furthermore, NRC staff considered that the transportation system constructed to support the proposed Nichols Ranch ISR Project would be reclaimed and, therefore, the project-related road construction impacts would be SMALL.

Therefore, the NRC staff concluded the overall transportation impact would be SMALL, as discussed in Section 4.3.1. Fugitive dust emissions are also evaluated as air quality impacts in Section 5.7, noise impacts are evaluated in Section 5.8, and the impact from wildlife kills is considered in ecological impacts in Section 5.6 in this SEIS.

As noted in Section 5.1.1 of the SEIS, there are other ongoing or planned activities occurring within the Powder River Basin and within the vicinity of the proposed Nichols Ranch ISR Project that contribute to the analysis of cumulative impacts. These activities, which include CBM development, oil and gas extraction activities, and large surface mining operations that may have railways and roadways to support the transport of coal among others, all have associated transportation impacts. BLM recently completed cumulative impact assessment of activities occurring within the Powder River Basin, including coal development, power generation, oil and gas, coal bed natural gas, and other mining activities, evaluated the potential transportation impacts to Campbell County roads, including the region surrounding the towns of Wright and Gillette (BLM, 2010b). That study concluded potential regional direct effects to roads and highways would include increased vehicular traffic and risk of traffic accidents on existing

roadways in the BLM cumulative effects study area from daily travel by workers and their families. Indirect effects would include increased wear and tear on existing roads, additional air emissions, fugitive dust from roads, noise, increased potential access to remote areas, and an increased risk of vehicle collisions with livestock and wildlife. A lower and upper coal production model was used to forecast potential cumulative effects through 2020. The study projected increases in future traffic by assuming cumulative transportation impacts are largely tied to population increases (BLM, 2009d). BLM evaluated the impact of an estimated 48 percent increase in population (and therefore traffic) for Campbell County roads from year 2003 to 2020 based on high coal production population projections and concluded highways along major routes would not be affected but urban areas such as Gillette could experience additional traffic delays (BLM, 2010b).

In addition to the aforementioned ongoing or planned activities, there are six ISR sites either operating or planned within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project (Table 5-2), each with transportation requirements comparable to the Nichols Ranch ISR Project. Considering the trip frequency information evaluated in Section 4.3 of this SEIS, the additional number of daily vehicle trips for 6 additional sites would range from approximately 110 to 910 (i.e., 8 to 75 additional commuting vehicles plus 1 truck, 2 trips per day, for 6 facilities) depending on the degree of carpooling or employer provided transportation. The increases in projected traffic from the operating or planned ISR facilities combined with the other ongoing or planned activities in the region, and projected increases in population over time, could lead to regional traffic impacts that are similar to those evaluated by the aforementioned BLM study (that concluded no impacts to highways along major routes but an increased potential for traffic delays in urban areas such as Gillette). The staff considered, for comparison, a recent traffic study of the coal mining operations near the city of Wright that calculated the capacity of local two-lane highways to be approximately 1,375 vehicle trips per hour (both directions) based on an ideal capacity of 3,200 vehicles per hour (Kadrmas, et al., 2010). Considering these levels of hourly capacity, the existing annual average daily traffic counts on the roads evaluated in this SEIS (ranging from 550 to 3,930) suggest additional capacity is available that could accommodate the increases in traffic (because the daily traffic figures apply to a longer period than the hourly peak capacity). In addition to potential traffic impacts, the existing or planned ISR facilities would require construction of new road surfaces or improvement of existing roads within the vicinity of the proposed Nichols Ranch ISR Project. Therefore, the number of roads and road networks would grow concurrently with the natural resource exploration and extraction activities with a concomitant increase in traffic and the potential for accidents. Based on this information, the NRC staff concludes the cumulative impacts to transportation resulting from past, ongoing, and future ISR projects, CBM projects, oil and gas operations, surface coal mining activities, and other development with transportation requirements identified in Section 5.1.1 would be MODERATE.

The proposed Nichols Ranch ISR Project would have a SMALL incremental effect on the MODERATE cumulative impacts to transportation resulting from past, ongoing, and future ISR projects, CBM projects, oil and gas operations, surface coal mining activities, and other development with transportation requirements identified in Section 5.1.1.

For the Modified Action–No Hank Unit (Alternative 3), the cumulative transportation impacts would be the same types of impacts as evaluated for the proposed action; however, the impacts would be generated by activities associated with the operation of only the Nichols Ranch Unit. For this alternative the number of wellfields developed would be halved, and therefore wellfield construction activities would be substantially reduced.

The number of commuting construction workers and equipment and supply shipments would be reduced along with the fugitive dust that the construction activities would generate (Section 4.3.3.1). During operations (Section 4.3.3.2) there would be no ion exchange shipments from the Hank wellfields to the central processing plant. Because the proposed operations periods for the Nichols and Hank sites overlap, Alternative 3 would produce less yellowcake annually, and that would result in fewer commuting workers and shipments of supplies, yellowcake, and waste materials each year compared to the proposed action. Therefore, operational traffic impacts and accident risks would be reduced under Alternative 3. Aquifer restoration (Section 4.3.3.3) would also involve fewer workers and a reduction in shipping activities resulting in lower traffic and accident impacts. During the decommissioning phase (Section 4.3.3.4), the total duration and number of wellfields to reclaim would be halved and based on the proposed phased scheduling, would have the same magnitude of annual transportation impacts (e.g., equipment, waste shipments). Based on this analysis, Alternative 3 of the Nichols Ranch ISR Therefore, Alternative 3 would have a SMALL incremental effect on transportation when added to the MODERATE cumulative impact on transportation from other past, present, and reasonably foreseeable future actions within the transportation study area.

5.4 Geology and Soils

Cumulative impacts on soils and geology were assessed within the planning area administered by the BLM Buffalo Field Office (herein referred to as the “Buffalo Planning Area”). This area was chosen as the geographic boundary for the analysis of cumulative impacts on soils and geology because the Nichols Ranch ISR Project is centrally located within the area administered by this office, the BLM owns 118 ha [280 ac] and some of the mineral rights within the proposed license area, and the BLM’s mission is to manage and conserve resources on public lands. Within the Buffalo Planning Area, which encompasses Johnson, Campbell, and Sheridan Counties, the BLM administers 315,907 ha [780,291 ac] of public land and 1.9 million ha [4.7 million ac] of the mineral rights in these counties. Within the Buffalo Planning area, energy extraction activities affecting the geology and soils include oil and gas and CBM development, coal mining, and uranium extraction. Impacts to soils result from earthmoving activities associated with these energy extraction activities, and the subsurface geology is affected by the removal of a resource (e.g., oil) or by the injection of fluids to recover a resource (e.g., *in-situ* recovery of uranium). Recent BLM reports, discussed in the following paragraphs, provide valuable information on past, present, and reasonably foreseeable future development activities within the Buffalo Planning Area. These reports were used to assess the cumulative impact on geology and soils. The timeframe for the analysis of cumulative impacts begins in 2007 and terminates in the year 2020 as discussed in SEIS Section 5.1.2 and is based on the estimated operating life of the proposed Nichols Ranch ISR Project.

The past, ongoing, and reasonably future foreseeable actions to explore for and extract minerals within the region contribute to the cumulative impact on geology and soils (BLM, 2008a). As of 2009, there was a total of 6,421 conventional oil and gas wells in the Buffalo Planning Area. An additional 1,359 conventional wells are projected to be drilled between 2009 and 2028, resulting in the potential disturbance of soils covering an area of approximately 7,728 ha [19,090 ac] (BLM, 2009). BLM has estimated the potential surface disturbance of soils from the development of coal bed methane within the same area as 25,969 ha [64,144 ac] (BLM, 2009). BLM (2005) reported that coal mining across the Powder River Basin, which comprises all of Campbell, Johnson, and Sheridan Counties less the land comprising the Bighorn National Forest, had disturbed 20,691 ha [51,107 ac]; however, none of that disturbance occurred within the watershed in which the proposed Nichols Ranch ISR Project is located.

BLM (2005c) evaluated the cumulative impact on geology and soils from past, present, and reasonably foreseeable future actions in the Powder River Basin under two different coal production scenarios. Under the upper coal production scenario, a total of 60,360 ha [149,089 ac] of disturbed land are projected for the year 2020, versus the 2003 baseline total of 27,852 ha [68,794 ac].

There are12 other ISR projects either licensed or planned within an 80 km [50 mi] radius of the proposed Nichols Ranch ISR Project, as shown in Table 5-1, that could impact geology and soils at an intensity comparable to that which would occur at the proposed Nichols Ranch ISR Project.

Increased vehicle traffic, clearing of vegetated areas, salvaging and redistributing soils, discharging CBM- and ISR-produced groundwater, and constructing and maintaining project-specific components (e.g., roads, well pads, industrial sites, and associated ancillary facilities) all contribute to the cumulative impacts on soils from both energy-related projects (BLM, 2008a). As stated in SEIS Section 4.4.1.2, the removal of uranium from the target sandstones during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure, and therefore no significant matrix compression or ground subsidence is expected.

The main soil resource concerns within the Buffalo Planning Area are wind erosion and water erosion that occur where the ground cover has deteriorated (BLM, 2009i). Long-term and short-term impacts on soils include accelerated wind or water erosion; declining soil-quality factors; declining microbial populations, fertility, and organic matter; compaction; and the permanent removal of soil (BLM, 2005c). Some degree of soil reclamation is possible, although not all overburden materials can be used to reestablish vegetation. Potential impacts on soils can also include a change in alkalinity due to discharge of CBM-produced water. The principal impact on soils from the proposed Nichols Ranch ISR Project would result from earthmoving activities. Earthmoving activities that could impact soils include clearing of ground or topsoil and preparing surfaces for the Nichols Ranch Unit central processing plant, Hank Unit satellite facility, header houses, and access roads, and from drilling sites, laying pipeline, and building associated structures. As discussed in SEIS Section 4.4.1.1, soil covering approximately 40 ha [100 ac] would be affected by the proposed action resulting in a SMALL impact on soils. These potential impacts would be further reduced by the applicant's implementation of best management practices. The potential impacts on the subsurface geology are described in Section 5.5.2, which assesses the cumulative impact on groundwater.

The 40 ha [100 ac] of temporary soil disturbance over the life of the proposed Nichols Ranch ISR Project accounts for less than 0.06 percent of the soil disturbance occurring in the Buffalo Planning Area as described previously. Furthermore, the ways in which soils would be impacted during the proposed Nichols Ranch ISR Project are also far less damaging or adverse than soil impacts that result from surface coal mining, which is more invasive and removes much more soil.

The NRC staff has determined that the cumulative impact on geology and soils within the Buffalo Planning Area resulting from past, present, and reasonably foreseeable future actions is MODERATE. The activities contributing to this moderate finding are oil and gas exploration and development, CBM development, coal mining, and other ISR activities occurring or projected to occur within the vicinity of the proposed Nichols Ranch ISR Project, which collectively will result in the disturbance of soil covering an area of approximately 76,393 ha [168,000 ac].

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on geology and soils because the soil disturbance for an ISR project is approximately 40 ha [100 ac]. The potential impact from soil disturbance at the proposed Nichols Ranch ISR Project would have a SMALL incremental effect when added to the MODERATE cumulative impact on geology and soils from other past, present, and reasonably foreseeable future actions in the Buffalo Planning Area.

For the Modified Action–No Hank Unit (Alternative 3), NRC staff concludes that the cumulative impact on geology and soils would be similar to, but less than, that described for the proposed action because Alternative 3 would have a smaller footprint. Ground-disturbing activities during construction and decommissioning, such as trenching and digging and associated impacts, would affect an area of approximately 60 ha [150 ac] for the Nichols Ranch Unit compared to approximately twice the land area if the Hank Unit were involved. These impacts would be short term, because areas disturbed by the proposed project would be restored and reclaimed after the project concluded. Similar to the proposed action, the applicant would strip and stockpile excavated topsoil, use the same procedure for excavating mud pits as outlined for the proposed action, apply the same monitoring program and spill procedures outlined for the proposed action, and submit a decommissioning plan for NRC review and approval prior to decommissioning. Based on this analysis, NRC staff concluded that implementation of Alternative 3 would have a SMALL incremental effect on geology and soils when added to the MODERATE cumulative impact on geology and soils expected from other past, present, and reasonably foreseeable future actions within the Buffalo Planning Area.

5.5 Water Resources

5.5.1 Surface Waters and Wetlands

Cumulative impacts on surface water and wetlands were assessed within the Dry Fork Basin of the Upper Powder River because the proposed Nichols Ranch ISR Project is located within this drainage basin and could potentially be affected by other activities that discharged surface water to drainages within this basin. The Dry Fork Basin was used as the geographic boundary for the surface water study area, in addition the impacts from other activities occurring within an 80-km [50-mi] radius of the site were consolidated because they could potentially drain into the surface water study area. Within this study area, the principal activities contributing to potential surface water impacts are discharges from CBM operations. The cumulative effects analysis timeframe begins in 2007 and terminates in 2020 as discussed in Section 5.1.2 and is based on the estimated operating life of the proposed Nichols Ranch ISR Project.

BLM estimated that 9 to 52 percent of CBM-produced water would contribute to surface water flows and perennial flows would be likely to develop in former ephemeral channels (BLM, 2003). CBM-produced water would increase the availability of surface waters for irrigation and other purposes for downstream users. BLM noted that noticeable changes in water quality would occur in the main channel drainages during periods of low flow and that sodicity and salinity are key water quality parameters because of their impact on water used for irrigation. BLM projected that the concentrations of suspended sediments in surface water would likely rise above baseline levels from increased flow and surface water runoff from disturbed areas. Wyoming Department of Environmental Quality (WDEQ) adopted the Most Restrictive Proposed Limit for sodicity and salinity into its Wyoming Pollutant Discharge Elimination System (WYPDES) permitting process to mitigate potential water quality impacts to downstream users.

A review of the CBM permits in the surface water study area on the Wyoming Oil and Gas Conservation Commission website indicated that in the year 2009, 163 million L [42.95 million gal] of CBM water was produced. According to Greystone Environmental Consultants et al., (2003), who conducted surface water modeling of water quality impacts associated with coal bed methane development in the Powder River Basin in support of the Final EIS for the Powder River Basin Oil and Gas Project (BLM 2003), 20 percent of CBM discharges infiltrate the surface, indicating that 33 million L [8.6 million gal] infiltrated the surface in 2009. The balance is either totally contained or discharged via WYPDES permits.

Other activities occurring within the proposed license area, as well as within 80 km [50 mi] of the proposed Nichols Ranch ISR Project, also have the potential to impact surface water. In its license application, the applicant indicated that CBM production has occurred and continues to occur within the proposed project area from coal seams within the Fort Union Formation; these occur at a depth greater than 300 m [1,000 ft] bgs in the Nichols Ranch and Hank Units (Uranerz, 2007). Furthermore, the applicant also stated that all the CBM impoundments are total containment (meaning no discharge) except one permit that expired in March 2009 (Uranerz, 2007). Those facilities with outfalls to surface water are located outside and hydrologically downgradient of the Nichols Ranch Unit and are therefore unlikely to impact surface water quality or wetlands at the site. For the Hank Unit, no discharges have been made to any of the permitted outfalls (Uranerz, 2007).

The Smith Ranch/Highland (operated by Power Resources, Inc., south-southeast of the proposed Nichols Ranch ISR Project), the Irigaray/Christensen Ranch (operated by Uranium One, Inc., northwest of the proposed Nichols Ranch ISR Project), and the Moore Ranch Project are the only operating licensed ISR projects within 80 km [50 mi] of the proposed Nichols Ranch ISR Project site. The PRI North Butte site is a licensed but nonoperational satellite facility of the Smith Ranch/Highland project and is located approximately 3.2 km [2.0 mi] to the north of the Hank Unit and 8.1 km [5.0 mi] to the northeast of the Nichols Ranch Unit. No construction of wellfields or other infrastructure has occurred on the North Butte site since the license was issued in 1999; however, the licensee has stated that activities may be initiated in 2011. Licensees are required to obtain U.S. Army Corps of Engineers (USACE) permits if surface waters and wetlands within their ISR permit boundaries are jurisdictional. Moreover, the licensees are required to obtain industrial and construction permits from WDEQ. These permits require best management practices (BMPs) for spill prevention and control.

The DOE Spook facility is the only conventional mill within 80 km [50 mi] of the proposed Nichols Ranch ISR Project. The facility has been decommissioned, and therefore, no discharge to surface water would be occurring.

Oil wells are scattered within 80 km [50 mi] of the proposed Nichols Ranch ISR Project site (Figure 5-3). At present, six oil and gas wells exist on the lands within and adjacent to the Hank Unit, of which three are within the boundaries of the Hank Unit. No oil and gas wells are located within or adjacent to the Nichols Ranch Unit. According to the Wyoming Oil and Gas Conservation Commission, no further oil and gas development would take place in the proposed Nichols Ranch ISR Project site. Within 80 km [50 mi] of the proposed Nichols Ranch ISR Project site, oil wells are largely clustered around Johnson City, west of Gillette, between the proposed Nichols Ranch ISR Project and the Moore Ranch ISR Project site, and south of the Moore Ranch ISR Project site. Oil and gas operators would be required to obtain construction and industrial Wyoming Pollutant Discharge Elimination System permits from WDEQ, in addition to USACE permits jurisdictional waters could potentially be disturbed.

No surface water would be discharged as part of the ISR facility operations, and the potential impact to onsite ephemeral channels would be from increased surface water runoff, primarily during the construction and decommissioning phases of the proposed project. The creeks within and surrounding the proposed Nichols Ranch ISR Project site are ephemeral streams and remain dry the majority of the year. Stream flows in ephemeral channels result from heavy snowmelt and large rain storms. There are four potential jurisdictional emergent wetlands, which have resulted from human activities, in the southeastern portion of the Nichols Ranch Unit (Uranerz, 2007). No wetlands exist on the Hank Unit site (Uranerz, 2007). All the wetlands at the Nichols Ranch Unit are located outside of the proposed construction area and would be avoided during all phases of the proposed project. The wetlands survey completed for this proposed project is described in SEIS Section 3.5.1.5. Nationwide Permit 44 under Section 404 of the Clean Water Act (CWA), issued by the USACE, is required for discharges of dredged or fill material into a wetland or waters of the United States (WUS) exceeding 0.2 ha [0.5 ac] in area. As discussed in SEIS Section 4.5.1, none of the wetlands delineated at the Nichols Ranch Unit exceed 0.2 ha [0.5 ac] in size; therefore, no Nationwide Permit 44 would be required. The potential impact would be mitigated through the industrial and construction WYPDES permits the applicant would be required to obtain from the WDEQ before operations commence. Furthermore, the applicant has proposed to avoid installing wells in the channels and washes of ephemeral drainages. If a well were to be installed in an ephemeral drainage, then appropriate erosion protection controls would be implemented to minimize damage. Such controls would include grading and contouring, culvert installation, low-water crossing constructed of stone, water contour bars, and designated traffic routes (Uranerz, 2007).

The NRC staff has determined that the cumulative impact on surface water and wetlands within the surface water study area resulting from past, present, and reasonably foreseeable future actions is MODERATE. Based on the information from BLM and other state agencies identified in this section; the primary types of actions leading to this MODERATE finding are energy development activities within the surface water study area, namely from CBM development, oil and gas production, and uranium ISR facilities.

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on surface water and wetlands when added to the MODERATE cumulative impact from other past, present, and reasonably foreseeable actions in the surface water study area. This conclusion is based on the fact that no surface water discharge would occur as part of ISR facility operations. Liquid byproduct material generated during ISR processes would be disposed of via deep well disposal, which is regulated by WDEQ. The applicant may be allowed to discharge non process liquids under a WYPDES permit. Any impacts would be mitigated through the industrial and construction WYPDES permits that the applicant would be required to obtain from the WDEQ before operations commence.

For the Modified Action–No Hank Unit (Alternative 3), NRC staff concludes that the cumulative surface water and wetlands impacts would be similar to, but less than those described previously for the proposed action. Under this alternative, the Hank Unit would not be constructed and all proposed facilities would be confined to the Nichols Ranch Unit. Similar to the proposed action, the primary disturbances that could potentially impact surface water during construction would be well drilling, road and facility construction, and pipeline installation. Spills, leaks, and other inadvertent discharges into surface waters could occur during operations, but the potential would be reduced because only one unit would be operating. As described in SEIS Section 4.5.1, no potential jurisdictional wetlands are located on the Hank Unit. Best management practices and the required permits implemented for the proposed action would

also be implemented for Alternative 3. The NRC staff determined that the SMALL impact from the proposed action would be further reduced for Alternative 3. Based on this analysis, NRC staff concluded that implementation of Alternative 3 would have a SMALL incremental effect on surface water when added to the MODERATE cumulative impact on surface water expected from other past, present, and reasonably foreseeable future actions in the surface water study area.

5.5.2 Groundwater

Potential environmental impacts on groundwater resources from the proposed Nichols Ranch ISR Project would occur primarily during the operation and aquifer restoration phases of the ISR facility lifecycle. The analysis of impacts to groundwater resources from operation of the proposed Nichols Ranch ISR Project in Section 4.5.2 showed that the water yields in some private wells located outside of the proposed project area that are completed in the ore zone aquifer could potentially be affected by the facility's operation at the Nichols Ranch Unit. Specifically, the NRC staff concluded the proposed operation would reduce groundwater levels in the production aquifer around the Nichols Ranch Unit; however, the predicted drawdown from the Nichols Ranch Unit represents a small fraction of the current groundwater levels in the affected production aquifer outside the license boundary. Therefore, impacts to well yield would be expected to be SMALL. Moreover, NRC concluded that because the applicant would be required to install monitoring wells around and within the proposed facility, as part of its license application, for early detection, control, and reversal of potential horizontal and vertical excursions, the potential groundwater quality impacts on nonexempted aquifers would be SMALL. Furthermore, after production and aquifer restoration were completed and groundwater withdrawals were terminated at the proposed Nichols Ranch ISR Project, the groundwater levels would recover with time. Therefore, as discussed in SEIS Section 4.5.2, the potential impact on groundwater resources from operating the proposed Nichols Ranch ISR Project would be SMALL.

To assess the cumulative impacts of a proposed ISR operation to groundwater resources over the life of the project from 2007 to 2020 as discussed in Section 5.1.2, NRC typically evaluates ongoing or planned activities within a radius of approximately 80-km [50-mi]. Although the production aquifers at the Nichols Ranch Project are known to be present for several miles around the proposed project area, their true extent is unknown. The Wasatch Formation, in which the extraction zone is located, does not constitute a regional aquifer. Rather, it is a sedimentary formation that contains local water-saturated lenses that can be locally productive but not hydraulically interconnected with other sand lenses because of the considerable clay content of the Wasatch Formation (ENSR, 2006). Given the heterogeneity of the geology in the Powder River Basin, the target aquifers at the proposed Nichols Ranch ISR Project are unlikely to cover an 80-km [50-mi] radius. Therefore, the NRC staff considers an 80-km [50-mi] radius to be a conservative estimate of the possible areal extent of potential impacts. Other ISR facilities occur within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project (although production may be from a different ore-producing zone) and oil and gas and CBM production also occur with an 80-km [50-mi] radius; however the production is from different geologic horizons than the proposed production at the Nichols Ranch ISR Project.

BLM estimated that CBM development in the Powder River Basin through the year 2018 would remove about [3 million acre-feet], less than 0.3 percent of the total recoverable groundwater [nearly 1.4 billion acre-feet] in the Wasatch and Fort Union Formations within the Powder River Basin. An estimated 15 to 33 percent of the removed groundwater would infiltrate the surface and recharge the shallow aquifers above the coals (BLM, 2003). Table 3-1 of this SEIS

summarizes the number of permitted or completed CBM wells and oil and gas wells within the Nichols Ranch and Hank Units and those within 4.8 km [3 mi] of the Nichols Ranch and Hank Units. SEIS Section 3.5.1.3 discusses CBM-produced water, which the applicant reported would be discharged at the surface into impoundments designed to infiltrate into the surficial aquifers. Therefore, CBM produced water is and will continue to be discharged to surface impoundments, which are designed to infiltrate into the surficial aquifer near the Nichols Ranch Unit and potentially the Hank Unit.

BLM predicted that within the Powder River Basin, the redistribution of pressure within the coals after CBM water production ended would allow the hydraulic pressure head to recover to within approximately 15 m [50 ft] or less of preproject levels within 25 years after project completion (BLM, 2003). The complete recovery of water levels would take tens to hundreds of years, depending on the specific location. Groundwater wells completed in the Fort Union Formation within the areal extent of a 30-m [100-ft] CBM well-induced drawdown could experience drops in water level and possibly encounter methane (BLM, 2003). BLM (2003) noted that the areal extent and magnitude of drawdown effects on coal zone aquifers and overlying or underlying sand units in the Wasatch Formation would be limited by the discontinuous nature of different coal zones within the Fort Union Formation and sandstone layers within the Wasatch Formation.

Cumulative impacts on groundwater resulting from the interaction between ISR activities and CBM activities may occur but are not likely because CBM production and ISR activities are conducted in stratigraphically separate aquifers. For the proposed Nichols Ranch ISR Project, the ISR activities would take place in sandstone aquifers 230 m [765 ft] stratigraphically above the top of the coal seam at the Nichols Ranch Unit and 355 m [1,160 ft] above the coal seam at the Hank Unit. Because of the presence of multiple layers of sand/sandstone and low-permeable silt/shale (confining layers) between the coal seams and uranium ore-bearing aquifers, hydraulic communication between them would be insignificant. As presented by the applicant (Uranerz, 2007), the drawdown induced by groundwater withdrawals from CBM coal seams would be progressively attenuated across impermeable silt/shale layers within 30 to 60 m [100 to 200 ft] above the coal seams; therefore, the potential impacts of groundwater withdrawals from coal seams on groundwater levels in the uranium ore-bearing aquifers would be SMALL. However, the potential impacts could be larger if the coal seams and ore-bearing aquifers are artificially connected through improperly abandoned, deep exploratory oil and gas wells. In such cases, CBM drawdowns could propagate up into shallower ore-bearing aquifers. However, as part of site characterization for its license application, the applicant is required to identify all abandoned exploratory wells in compliance with 10 CFR 51.45, which requires a description of the affected environment containing sufficient data to support the Commission's conduct of an independent analysis. Any improperly abandoned wells within the proposed project site would be sealed prior to ISR operations at the proposed Nichols Ranch ISR Project site. In its application, the applicant stated that no improperly abandoned borings or oil and gas wells were identified in its evaluation of the Nichols Ranch and Hank Units (Uranerz, 2007). Therefore, the potential cumulative impact of CBM production in the Powder River Basin on the quality and quantity of groundwater at and near the proposed Nichols Ranch ISR Project would be SMALL.

The Smith Ranch/Highland (operated by Power Resources, Inc., south of the proposed Nichols Ranch ISR Project), the Reynolds Ranch, North Butte, and Ruth ISR satellite facilities (licensed to PRI), the Irigaray/Christensen Ranch (operated by Uranium One, north of the proposed Nichols Ranch ISR Project), and the Moore Ranch (recently licensed to Uranium One, southeast of the proposed Nichols Ranch ISR Project) ISR projects are the only licensed ISR projects within 80 km [50 mi] of the proposed Nichols Ranch ISR Project site. Operations have

not yet commenced at the licensed North Butte ISR project {operated by Power Resources, Inc., approximately 3.2 km [2 mi] north of the Hank Unit and 8 km [5 mi] northeast of the Nichols Ranch Unit} (Uranerz, 2007) or at the Moore Ranch ISR Project located 32 km [20 mi] southeast of the proposed Nichols Ranch ISR Project. The Reynolds Ranch and Ruth satellite facilities are also currently non-operational properties located 70km [43.5 mi] southeast and 24 km [15 mi] southwest of the Nichols Ranch ISR Project.

The North Butte ISR is sufficiently close to the Hank Unit to be of concern with respect to cumulative groundwater impacts. Of special concern is the potential for an excursion in the Hank Unit to be drawn away from the wellfields by the drawdown created by the North Butte operations. The ore-bearing sands at North Butte ISR are located in the B, C, and A Sands of the Wasatch Formation (see Figure 3-3 of the SEIS). The B and C Sands extend to and act as the underlying aquifers to the ore bearing F Sand at the Hank Unit. These sands were treated as one unit, the BC Sand, by PRI. The F Sand at both North Butte and the Hank Unit is separated from the underlying BC Sand by a thick shale layer known as the FB Aquitard. No hydraulic connection was demonstrated between the F and BC Sands from pumping tests at either the Hank Unit or the North Butte ISR. As described earlier, operations in the F Sand at the Hank Unit are in an unconfined aquifer and the applicant has demonstrated that the drawdown from consumptive groundwater use in the Hank Unit will not extend to the North Butte lSR license boundary. However, the proposed operations in the North Butte BC Sand may create sufficient drawdown to impact the underlying BC Sand at the Hank Unit where these sands act as the underlying aquifer.

To evaluate this impact, NRC staff estimated the amount of drawdown that would occur in the underlying BC Sand aquifer at the Hank Unit after 1 year of operation at North Butte, using reported values for aquifer hydraulic parameters and proposed consumptive groundwater rates from the North Butte mine unit application (PRI, 2006). Using a reported bleed rate of 114 Lpm [30 gpm] located at one well in the combined BC Sand in the center of T44N R76W Section 24 (roughly the centroid of the proposed wellfields at North Butte), a reported transmissivity of 630 gal/day/ft, and a storage coefficient of 2.4 E-4 (PRI, 2006), the project drawdown in the BC Sand at the Hank Unit was determined using the Cooper-Jacob unsteady drawdown equation for a single well in an homogeneous isotropic aquifer of infinite areal extent and constant thickness. The drawdown in the underlying BC Sand aquifer at the Hank Unit after 1 year of operation at North Butte was determined to be approximately 2.1 m [7 ft] under the northernmost edge of the ore body, located approximately 2.8 km [1.75 mi] from the North Butte pumping well. This drawdown decreased to about 0.5 m [1.8 ft] in the underlying BC Sand aquifer at the center of the ore body at the Hank Unit. The NRC staff finds these drawdowns at these distances are not sufficiently large to increase the chance of an excursion in the underlying BC Sand aquifer being drawn outside of the proposed Hank Unit license area. In addition, the applicant will be required to conduct sufficient monitoring of the underlying BC Sand aquifer to detect and correct potential excursions. The NRC staff therefore concludes that operations at the North Butte site would have a SMALL impact on the underlying BC Sand aquifer and the potential for excursions at the Hank Unit.

The Smith Ranch Highlands ISR (including Ruth and Reynolds Ranch satellites), Irigary/Christensen Ranch, and Moore Ranch license areas are located at sufficient distances from the proposed Nichols Ranch ISR Project, such that their potential cumulative impact on groundwater levels at and near the proposed Nichols Ranch ISR Project site would be SMALL. Moreover, because the licensees at the Smith Ranch/Highland, Irigaray/Christensen Ranch, and Moore Ranch ISR sites are required to implement excursion detection, control, mitigation,

and remediation plans under NRC regulations, their contribution to the potential cumulative impact on groundwater quality and quantity would be SMALL.

At present, six oil/gas wells occur on the lands within and adjacent to the Hank Unit. No oil/gas wells are located within or adjacent to the Nichols Ranch Unit. According to the Wyoming Oil and Gas Conservation Commission, no further oil and gas development would take place within 80 km [50 mi] of the proposed Nichols Ranch ISR Project. Oil wells are completed at greater depths {approximately 3,050 m [10,000 ft] with some wells less than 2,750 m [9,000 ft] near the Hank Unit} than the targeted aquifers for ISR uranium production in the Wasatch Formation, which typically occur at depths ranging from 90 to 210 m [300 to 700 ft] bgs. The ISR uranium production wells are completed at depths hundreds of meters [thousands of feet] above the oil-producing horizons. Therefore, the potential cumulative impact on oil production in the Powder River Basin from the proposed Nichols Ranch ISR Project would be SMALL.

The DOE Spook facility is the only decommissioned conventional mill within a 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project. Given that the facility has been decommissioned and therefore meets NRC regulatory standards which demonstrate it will not impact the public health, safety, or environment, the potential contribution to a cumulative impact on groundwater would be SMALL.

Deep disposal of process wastewater is one of the disposal methods that CBM, ISR, and oil production facilities practice in the Powder River Basin. For deep well disposal, the applicant is required to obtain underground injection control (UIC) permits for the targeted deep aquifer from the WDEQ. The permit would be granted if the deep disposal practice is safe for public health and safety and would not impact potential underground sources of drinking water.

The NRC staff has determined that the cumulative impact on groundwater resources within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project resulting from past, present, and reasonably foreseeable future actions is MODERATE. Based upon a BLM report for the Buffalo Planning Area, in which the Nichols Ranch Project is centrally located, the primary types of actions leading to this moderate finding are energy development activities including CBM development and oil and gas production. However, as described previously cumulative impacts on groundwater resulting from the interaction between ISR activities and CBM activities and oil and gas production could occur but are not likely because CBM and oil and gas production and ISR activities are conducted in stratigraphically separate aquifers separated by hundreds to thousands of feet from the ore production zone at the proposed Nichols Ranch ISR Project. Other ISR projects are located within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project that could also extract uranium from deposits within the Wasatch Formation; however, as noted previously the occurrence of these deposits is discontinuous and locally productive within the area evaluated.

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on groundwater when added to the MODERATE cumulative impact from other past, present, and reasonably foreseeable actions in the groundwater study area based on the localized occurrence of the ore-bearing aquifer.
For the Modified Action–No Hank Unit (Alternative 3), the cumulative impacts to groundwater would be the same as evaluated for the proposed action; however, the impacts would be limited to the Nichols Ranch Unit. The facility footprint where surface-disturbing activities are proposed would be approximately half that of the proposed action, and therefore the potential for impacts to groundwater would be reduced relative to the proposed action. As with the proposed action, the limited construction water use and the applicant's commitments to use BMPs would protect

shallow groundwater from potential impacts from spills. Consumptive use of groundwater during operations and aquifer restoration would remain small but would be significantly reduced as the process bleed projected for the Hank Unit (almost twice that of Nichols Ranch Unit) would not be consumed as wastewater under this alternative. The smaller wastewater volume could reduce the number of deep disposal wells required for the disposal of liquid byproduct material. During the decommissioning phase, substantially less land area would need to be decommissioned and reclaimed. As with the proposed action, prior NRC review and approval of the applicant's decommissioning plan would evaluate the applicant's measures to protect public health and safety and the environment including groundwater resources from the potential impacts of decommissioning activities. Earlier NRC approvals of the completion of wellfield restoration would have determined whether restoration standards that were protective of public health and safety had been met for the production zone aquifer. Before NRC terminates the ISR source material license, the licensee must demonstrate there would be no long-term impacts to underground sources of drinking water (USDWs).

Based on this analysis, NRC staff concluded that implementation of Alternative 3 would have a SMALL incremental impact on groundwater resources when added to the MODERATE cumulative impact on groundwater resources anticipated from other past, present, and reasonably foreseeable future actions within the groundwater study area.

5.6 Ecological Resources

The cumulative impact on ecological resources from the proposed Nichols Ranch ISR Project was considered. The geographic boundary area considered for the analysis of cumulative impacts encompasses the Powder River Basin. The basin is dominated by sagebrush shrubland and mixed grasslands, which cover 88 percent of proposed project area. The basin is currently experiencing rapid growth due to various types of energy development activities, and this trend is projected to continue in the future. As such, ecosystems and species within the basin are subject to varying levels of incremental impacts associated with this expansion. The timeframe selected for the analysis begins in 2007, when the applicant submitted a license application to NRC for the proposed Nichols Ranch ISR Project, and ends in 2020, which represents the license termination at the end of the decommissioning period. No impacts to biota would be expected from the proposed action beyond license termination. Older data are considered where applicable to demonstrate historical trends.

5.6.1 Terrestrial Ecology

Activities occurring within the proposed Nichols Ranch ISR Project license area include grazing and herd management, hunting, and mineral exploration. Potential cumulative impacts to ecological resources, both flora and fauna, may occur and include reduction in wildlife habitat and forage productivity, modification of existing vegetative communities, and the potential spread of invasive species and noxious weed populations. Concerning wildlife, impacts may involve loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct or indirect mortalities. In Section 4.6 these direct impacts are characterized as being SMALL at the proposed Nichols Ranch ISR site. Land disturbance resulting from other development activities in the study area would have similar ecological impacts as those described in Section 4.6. Numerous development activities across the Powder River Basin could cumulatively reduce wildlife and plant populations and alter population structure. BLM (2003) concluded that continued natural resource development across the Powder River Basin has the potential to alter the distribution of various types of native vegetation, resulting in cumulative impacts to biodiversity. For some species that may require specific conditions for

their habitats, future use would be strongly influenced by the quality and composition of the remaining habitats.

Because sagebrush shrublands and mixed grasslands cover close to 90 percent of the proposed Nichols Ranch ISR Project, these vegetative plant communities would be most affected by the proposed action (Uranerz, 2007). Surface disturbance from the construction and operations activities of the proposed Nichols Ranch ISR Project could result in the spread of invasive and noxious weeds. Because the area of disturbed land area of 121 ha [300 ac] would be noncontiguous and comprise less than 10 percent of the total proposed project site {1,364 ha [3,371 ac]}, some vegetation would be affected but would not affect a sizeable segment of any species' population. Furthermore, disturbed areas would be revegetated according to a reclamation plan, and the applicant would implement mitigative measures to minimize the spread of noxious weeds (Uranerz, 2007). Therefore, the potential impact on vegetation would be SMALL.

Impacts to wildlife species were described in Section 4.6.1.1.1.2. Big game species travel across huge expanses of land, and the proposed Nichols Ranch ISR Project will only occur on 0.003 percent of the land covered by the Pumpkin Buttes Antelope Herd Unit and 0.002 percent of the range covered by the Pumpkin Buttes Mule Deer Herd Unit. As such, the impact of the proposed action is negligible. Waterfowl and shorebirds would experience SMALL impacts from the proposed project because there is limited seasonal favorable habitat for these species. The impact to nongame/migratory birds would be SMALL because at any given time only 1 percent of the project area would be disturbed. The proposed project is anticipated to have SMALL impacts on most mammal species as most species would be able to travel to nearby suitable habitat. Reptiles and amphibians would experience SMALL impacts as only a small area of the proposed project {24 to 32 ha [60 to 80 ac]} would be disturbed at any one time.

Given the small footprint of the proposed project, the NRC staff has concluded that the proposed Nichols Ranch ISR Project would have a SMALL incremental effect on wildlife. However, the numerous SMALL impacts occurring at other oil and gas, CBM, and coal development projects would result in cumulative impacts to wildlife that are MODERATE across the entire study area. BLM (2003) concluded, for example, that there could be cumulative impacts to certain species of raptors and migratory birds in the region resulting from shifts in the habitat composition or distribution. This determination reflects the many thousands of acres of habitat that will be disturbed by development actions.

The NRC staff has determined that the cumulative impact on terrestrial ecology within the ecological resources study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. BLM reports that close to ten percent of the study area would be disturbed by various reasonably foreseeable future activities. This amount of habitat disturbance would impact vegetation by promoting spread of noxious weeds and fragmenting vegetative communities. Impacts to wildlife could involve loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct or indirect mortalities

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on terrestrial ecology when considered with all other past, present, and reasonably foreseeable actions in the land use study area. This conclusion is based on the fact that the proposed action would only disturb approximately 121 ha [300 ac] of habitat.

The cumulative impacts to terrestrial ecology described previously for the proposed action would be similar to, but less than the Modified Action–No Hank Unit (Alternative 3). Section 4.6.3 describes impacts associated with Alternative 3. Only 60 ha [120 ac] would be affected under Alternative 3 compared to 121 ha [300 ac] for the proposed action. Impacts from decommissioning and land reclamation would also be less because the Hank Unit site would not be developed. The SMALL impact from the proposed action would be further reduced for Alternative 3. Based on this analysis, NRC staff concluded that implementation of Alternative 3 would have a SMALL incremental effect on terrestrial ecology when added to the MODERATE cumulative impact on terrestrial ecology expected from other past, present, and reasonably foreseeable future actions in the study area.

5.6.2 Aquatic Ecology

The NRC staff has determined that the cumulative impact on aquatic ecology resulting from all past, present, and reasonably foreseeable future actions is SMALL. Cumulative impacts from other oil and gas, CBM, and coal development projects do not seem to be affecting aquatic ecosystems across the study area. This conclusion is based on water quality data from a study in the Powder River Basin conducted by the U.S. Geologic Survey (USGS). Water quality measurements can serve as indicators of impacts to freshwater communities and organisms. Despite the widespread development that has already occurred, the USGS concluded that, with few exceptions, water quality constituents generally did not exceed State or Federal acute and chronic criteria for the protection of aquatic life (Peterson, 2010). Assuming that development activities employ best management practices and adhere to water quality regulations, future development would have only a SMALL effect on aquatic ecology.

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on aquatic ecology when considered with all other past, present, and reasonably foreseeable actions in the land use study area. This conclusion is based on the fact that the site of the proposed action does not contain any aquatic habitat; there would be no outlets into other study area aquatic habitats originating from the proposed project site; and a recent study concluded that there has not been any significant diminishment of water quality in the Powder River Basin.

Any cumulative impacts to aquatic ecology described previously for the proposed action would be similar to, but less than the Modified Action–No Hank Unit (Alternative 3). The SMALL impact from the proposed action would be further reduced for Alternative 3. Based on this analysis, NRC staff concluded that implementation of Alternative 3 would have a SMALL incremental effect on aquatic ecology when added to the SMALL cumulative impact on aquatic ecology expected from other past, present, and reasonably foreseeable future actions.

5.6.3 Protected Species

As discussed in Section 5.6.1, one federally listed candidate species, the Greater sage-grouse, is known to occur in the vicinity of the proposed Nichols Ranch ISR Project site. There are eight known leks within a 3.2-km [2-mi] radius of the Hank Unit and one lek within a 3.2-km [2-mi] radius of the Nichols Ranch Unit.

No federal candidate or proposed species, such as the Greater sage-grouse and the mountain plover (*Charadrius montanus)*, are known to occur on the proposed Nichols Ranch ISR Project site, although both have been observed in the vicinity of the project site. Of the state-listed species, the black-tailed prairie dog (*Cynomys ludovicianus*) and swift fox (*Vulpes velox*) are

known to occur on or in the vicinity of the site and were observed during the wildlife inventories the applicant conducted (Uranerz, 2007).

Loss and degradation of native sagebrush shrubland habitats have imperiled much of this ecosystem type as well as sagebrush-obligate species, including the Greater sage-grouse (*Centrocercus urophasianus*). Sage-grouse are found in sagebrush shrubland habitats, and sagebrush is essential during all seasons and for every phase of their lifecycle. Most of the sagebrush lands have been changed by land use, such as livestock grazing, agriculture, or resource extraction. These uses can influence habitats either directly or indirectly or can alter the disturbance regime by changing the frequency of fire (Naugle, et al., 2009). The long-term viability of the sage-grouse rangewide continues to be at risk because of population declines related to habitat loss and degradation. Sage-grouse populations have declined overall from 1965 to 2007, with the greatest decline occurring before the mid-1980s. The total rangewide population decline is estimated at 45 to 80 percent from historic levels (Becker, et al., 2009). Populations have been declining at 2.0 percent per year from 1956 to 2003 (Connelly, et al., 2009). As of this writing, the U.S. Fish and Wildlife Service (FWS) has designated the Greater sage-grouse as a "candidate species" under the Endangered Species Act of 1973 (ESA). FWS would consider the bird on an annual basis for listing as a threatened or endangered species. The State of Wyoming is critical for sage-grouse as it currently contains 64 percent of all known sage-grouse habitat and more active leks than any other state (Doherty, et al., 2009). According to information gathered from the BLM Buffalo Field Office and WGFD, eight sage-grouse leks are located within a 3.2-km [2.0-mi] radius of the proposed Nichols Ranch ISR Project site (Uranerz, 2007). One additional active lek was identified during formal surveys conducted in April 2006, bringing the total number of active leks in the vicinity of the proposed site to nine in 2006 (Figure 3-8) (Uranerz, 2007). None of these leks, however, occurs within the proposed license area.

Because of its spatial extent, oil and gas resource development is regarded as playing a major role in the decline of the species in the eastern portion of the species' range, which includes the study area (Becker, et al., 2009). Future oil and gas development is projected to cause a 7 to 19 percent decline in sage-grouse lek population counts throughout much of the current and historic sage-grouse range (Connelly, et al., 2009). Forecasts of future population viability across 23 populations and 7 sage-grouse management zones (SMZs) suggest that 75 percent of the populations and 29 percent of the SMZs are likely to decline below effective population sizes of 500 within 100 years, if current conditions and trends persist. Preventing high probabilities of extinction in many populations and in some SMZs in the long term would require concerted efforts to decrease continuing loss and degradation of habitat that may negatively affect sage-grouse at local scales (Garton, et al., 2009).

The NRC staff concludes in Section 4.6.1.1.1.1 that the impact from the proposed Nichols Ranch ISR Project site upon vegetation would be SMALL. However, for species with specialized habitat requirements, such as sage-grouse, future population viability would be strongly influenced by the quality and composition of any remaining habitat. As such, it is possible that the addition of the proposed license area would contribute to a slight decrease in sagebrush shrubland, thereby reducing the amount of habitat for sage-grouse.

Black-tailed prairie dog complexes are found at the project site, which provides potentially suitable habitat for the federally endangered black-footed ferret (*Mustela nigripes*). However, no black-footed ferret population exists at the proposed site. The closest successfully reintroduced population of black-footed ferrets is in Shirley Basin, Wyoming, approximately 160 km [100 mi] south of the proposed Nichols Ranch ISR Project site. No suitable habitat for the blowout

penstemon (*Penstemon haydenii*) or Ute ladies'-tresses orchid (*Spiranthes diluvialis*) exists on the proposed site. As discussed in Section 4.6.1.1.3, NRC conducted informal consultation with FWS to ensure the provisions of the ESA were upheld regarding the black-footed ferret for the proposed project. FWS concluded no adverse impacts to the species would be likely as a result of the proposed action (NRC, 2009c).

The NRC staff has determined that the cumulative impact on protected species within the study area resulting from all past, present, and reasonably foreseeable future actions is SMALL to MODERATE. Impacts to swift fox, prairie dog, and mountain plover were characterized as SMALL. For state-listed species such as the swift fox and prairie dog, individual members of these species have the ability to relocate or recolonize areas surrounding the development sites. WGFD gives priority management attention to black-tailed prairie dog complexes that cover an area of at least 2,000 ha [5,000 ac] because WGFD considers conserving these to be integral to the species ecology and important habitat for many associated or dependent species. The black-tailed prairie dog habitat on and in the vicinity of the proposed Nichols Ranch ISR Project site is not large enough to be considered a management priority. The swift fox is nocturnal, the species would likely avoid habitat near construction areas, development activities across the study area would not noticeably alter these species' patterns or behavior. The mountain plover is not common in the area and has never been observed on the proposed project site. Additionally, plovers could respond positively to proposed project activities by nesting in pipeline corridors, on roads, and in cleared areas.

The negative impacts of energy development projects on sage-grouse have been well documented (Doherty, et al., 2008; Walker, et al., 2007; Holloran, 2005; Braun et al., 2002,) These investigations demonstrated that energy projects, especially CBM-related activities, can have direct impacts on the species. Examples include avoidance of human infrastructure or negative impacts on survival and reproduction. Indirect impacts include changes in habitat quality and predator communities (Naugle, et al., 2009). It has been demonstrated that sage-grouse respond negatively to CBM development in the Powder River Basin. Additionally, conventional densities of oil and gas wells far exceed the species' threshold of tolerance and energy development threatens to extirpate birds from otherwise suitable habitats and further isolate remaining populations (Naugle, et al., 2006). With an additional 13,800 CBM wells projected to be drilled in the area by yearend 2028, cumulative impacts to sage-grouse across the study area would be MODERATE.

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on protected species when considered with all other past, present, and reasonably foreseeable actions in the study area. This conclusion is based on the fact that the proposed action would only disturb only 121 ha [300 ac] of habitat and the proposed project license area does not contain critical habitat for any of the protected species. Furthermore, while the species has been observed in the area, the sage-grouse may be migratory and, therefore, only be present near the site during the spring and summer months. As such, mitigative measures agreed to by the applicant in its license application would minimize impacts.

The cumulative impacts to protected species described previously for the proposed action would be similar to, but less than, the Modified Action–No Hank Unit (Alternative 3). Section 4.6.3 describes impacts associated with Alternative 3. Only 60 ha [120 ac] of habitat would be affected under Alternative 3 compared to 121 ha [300 ac] for the proposed action. The SMALL impacts from the proposed action would be further reduced for Alternative 3. Based on this analysis, NRC staff concluded that implementation of Alternative 3 would have a SMALL

incremental effect on protected species when added to the SMALL to MODERATE cumulative impact on protected species expected from other past, present, and reasonably foreseeable future actions.

5.7 Air Quality

Potential cumulative impacts on air quality were assessed that could result from past, present, and reasonably foreseeable development activities. The geographic area for the impact analysis was based on the NRC staff's consideration of other regional air modeling studies addressing larger scale emission sources applicable to oil and gas activities, CBM production, and conventional coal mining suggesting the region of influence (ROI) for air emissions could range from about 60 km [37 mi] (Stoeckenius, et al., 2006) to beyond 241 km [150 mi] (BLM, 2009f). Based on the NRC staff's general understanding of the effect of source emission strength on the magnitude and spatial extent of downwind air impacts (i.e., larger plumes transport longer distances downwind before diminishing to insignificant levels), the NRC staff expects the lower magnitude of proposed emissions, relative to the larger scale sources described previously, would have the potential to impact a smaller geographic area. Therefore, the staff selected the geographic area for source emissions as a 80km [50 mi] radius around the proposed facility. The geographic area for evaluating the impacts of the emissions was selected more conservatively as a 161 km [100 mi] radius around the proposed facility with particular emphasis on areas that are in the path of the predominant wind direction (Section 3.7.1.2). The timeframe for the air quality cumulative impacts analyses runs to 2020, which represents the license termination at the end of the decommissioning period as described in Section 5.1.2 of this SEIS. Beyond license termination, there would be no impact on air quality from the proposed action.

Past, present, and reasonably foreseeable future actions in the vicinity of the proposed Nichols Ranch ISR project site that emit air pollutants include other uranium mining/milling activities, CBM, coal mining, and oil and gas operations (Section 5.1.1). As described in Section 3.7.2 of this SEIS, the area around the site is in attainment for all NAAQS. Emissions from projected development of future oil and gas exploration and production, including CBM and coal mining, have been evaluated for impacts to air in previous EISs and supporting documents for proposed developments in the Powder River Basin area (BLM, 2003, 2006, 2009f, 2010b) where the proposed Nichols Ranch ISR project is located. While the concurrent activities emit a variety of pollutants, the NRC staff concludes principal emissions from the oil and gas industry that would overlap significantly with emissions from the proposed action are nitrogen oxides, volatile organic compounds (VOCs), and fugitive road dust. The principal emissions from coal mining include fugitive dust (particulates including coal dust) and exhausts from diesel-powered equipment (BLM, 2010b). Therefore, the NRC staff cumulative impact analysis focuses on the cumulative impact to air quality from nitrogen oxides and fugitive dust emissions from the proposed Nichols Ranch ISR Project facility, other proposed ISR facilities, and future oil and gas and coal operations in the Powder River Basin area of Wyoming.
The potential air impacts from future CBM activities, coal mining, and oil and gas exploration in the Powder River Basin have been previously evaluated (BLM, 2003, 2006, 2009f, 2010b).
A recent BLM cumulative air analysis of the Powder River Basin was conducted to support review of coal development in the Powder River Basin (BLM, 2009f). That analysis involved executing a state-of-the-art EPA guideline dispersion model, CALPUFF, Version 5.8 (Scire, et al., 1999) to calculate local-scale, short-range dispersion as well as region-scale, long-range dispersion of emissions assuming worst case meteorological conditions. Emissions in the BLM analysis were developed for base year 2004 (NO_2, SO_2, $PM_{2.5}$, and PM_{10}) and were projected for year 2020. Emission sources included coal-related (mines, power plants, railroads,

conversion facilities); permitted sources in Wyoming and Montana; CBM production sources; and miscellaneous sources (roads, urban areas, conventional oil and gas, noncoal power plants). The estimated impacts from that study for the baseline year (2004) indicated calculated air concentrations were below NAAQS, except for short-term PM_{10} and $PM_{2.5}$ in the near field (BLM, 2009f). The threshold for the distinction between near field and far field is 50 km [31 mi] (EPA, 2010). The BLM year 2020 projected impacts showed compliance with standards, except for short-term and annual $PM_{2.5}$ and PM_{10} in localized areas. Far-field visibility impacts were identified by BLM for downwind Class I areas (Northern Cheyenne Indian Reservation, Badlands National Park, Wind Cave National Park) as a consequence of power plant and CBM emissions, and visibility impacts to several Class II areas were projected from power plant and coal mine emissions. These modeling results suggest local and regional air quality in the Powder River Basin and nearby areas is presently good but is degrading with time, primarily from particulate emissions, as various emissions sources are projected to increase until 2020. While NO_x projections for near-field receptors in 2020 were below the ambient standard, the calculated concentrations were at 80 percent of the limit compared to the base-year calculation of 30 percent of the limit. Therefore, the NRC staff concludes from these results the potential air quality impacts from future CBM activities, coal mining, and oil and gas exploration in the Powder River Basin would be MODERATE because the margin for compliance is being reduced with the future projected development and the associated increase in emissions.

In Section 4.7 of this SEIS, the NRC staff concluded the potential impacts to air quality from the proposed Nichols Ranch ISR Project would be SMALL. Nonradiological air emission impacts primarily involve fugitive road dust from vehicles used throughout the facility lifecycle and combustion engine emissions from diesel equipment used predominantly during the construction and decommissioning phases. The NRC staff concluded that the air quality for the region in the vicinity of the site is in compliance with the NAAQS, and based on emissions estimates described in Section 2.2.1.6.1.1 of the SEIS, the facility would not be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs. The NRC staff analysis noted the presence of Prevention of Significant Deterioration (PSD) Class I and II areas within the region that emissions from the proposed action could potentially impact; however, based on the magnitude of emissions from the proposed action, the prevailing wind direction, and distance from the proposed facility, the NRC staff concluded impacts would be SMALL.

Within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project, there are at least six other operating or planned ISR facilities (Table 5-1) that would generate emissions comparable to emissions projected for the proposed project. Because ISR facilities commonly use a phased approach to well drilling and wellfield construction (NRC, 2009a) and all seven facilities would not undergo construction concurrently (each proposed ISR facility must go through the average 2-year licensing process and obtain the necessary Federal, State, and local permits), the NRC staff assumes the degree of overlap in construction activities would be most likely to occur for wellfield drilling activities because each facility would construct more than one wellfield over a period of years. To estimate the potential annual contribution of the seven facilities to local air emissions, the NRC staff considered the emissions results in Appendix D of this SEIS. The contribution from the proposed Nichols Ranch ISR Project, as detailed in Table D3-4, was assumed to be the full development of the first proposed wellfield, partial construction of the second proposed wellfield, and the development of four deep wells. The contribution from each of the remaining six ISR facilities, as detailed in Table D3-1, was assumed to be the development of one wellfield and one deep well. For that scenario, the total annual contribution of ISR facility nitrogen oxide emissions in the region that would add to the emissions from other past, present, and reasonably foreseeable future actions would be approximately 107 t/yr

[118 T/yr]. Fugitive road dust emissions would be expected to scale directly with each new facility because emissions are expected to occur during all phases of the facility lifecycle. The NRC staff assumed an average value of 63.5 t/yr [70 T/yr] for each facility, resulting in a total of 444 t/yr [490 T/yr] of fugitive road dust. These facilities, and therefore their emissions, would be spatially dispersed throughout the region and therefore do not represent a single point source.

The construction and operation of proposed ISR facilities would contribute incremental increases to area emissions including, in particular, NO_x and fugitive dust and therefore would incrementally impact air quality. A number of variables affect downwind concentrations of emitted air pollutants, including ambient meteorological conditions and the magnitude of the emission rate. Based on the low magnitude of estimated emissions from the proposed action (Section 2.2.1.6.1.1 of this SEIS), good air quality in the region (Section 3.7.2 of this SEIS), and meteorology often favorable for dispersion (Section 3.7.1 of this SEIS), the NRC staff concludes that detailed quantitative air analyses are not necessary to support the evaluation of potential air impacts. Because ISR nonradiological emissions are low compared to existing and future proposed developments in the region, NRC concludes the relative contribution to future air quality impacts from proposed ISR facilities would be SMALL. While detailed emissions data for individual projects, practices, or industries in the local area were not identified by the NRC staff to compare with the proposed action estimates, the NRC staff did identify general information to provide context and support for the NRC staff conclusion that proposed annual ISR nonradiological air emissions levels are relatively low. This information is detailed in the following paragraph.

At the State level, emissions inventory estimates (Russell and Pollack, 2005) for 2002 suggest the total amount of NO_x emitted from oil and gas drilling that year was approximately 4,500 t [4,964 T] from the construction of 2,948 wells. From these numbers, the NRC staff approximates an average of 1.54 t [1.7 T] of NO_x per well. For comparison, the calculated drill-rig emissions for the proposed Nichols Ranch ISR Project wellfield development activities are 8.0×10^{-3} t [8.8×10^{-3} T] of NO_x per well (derived from emission calculation results reported in Appendix D in this SEIS), orders of magnitude less than the aforementioned emissions from wells drilled to support oil and gas exploration and production. The state average value is more comparable to the emissions calculated for a single proposed deep disposal well {calculated to emit approximately 5.4 t [6.0 T] per well as shown in Appendix D}. The higher emissions from the deep well drilling are temporary, with two to eight deep disposal wells expected per proposal and approximately 528 hours per well (Appendix D) or 66 eight-hour drilling days each. Other regional sources of NO_x include power plants and trains (e.g., shipping locally mined coal). Year 2004 NO_x emissions from coal-fired power plants in southwest Wyoming are reported as 31,116 and 12,004 t/yr [34,321 and 13,240 T/yr]. Maximum NO_x emissions from a proposed rail line from Miles City to Decker, Wyoming, were reported as 10.1 t/km/yr [6.9 T/mil/yr] (BLM, 2006) and therefore 184 t/yr [203 T/yr] along the 47.3-km [29.4-mi] route. Oil and gas drilling varies considerably in well depth and associated emissions. Examples of NO_x emissions from oil and gas drilling in the Jonah-Pinedale area of southwestern Wyoming (Stoeckenius, 2010) indicate large clusters of drilling rigs emit approximately between 0.91 and 5.9 t [1 and 6.5 T] of NO_x per day. While this area complies with the NO_x ambient air quality standard (Section 3.7.2) (NO_x is a precursor to ozone formation), it has experienced episodic exceedances of the ambient ozone standard based on a combination of specific factors (including strong temperature inversions, low winds, snow cover, bright sunlight, and emissions), which is resulting in more regulatory and research attention (Stoeckenius, 2010). The aforementioned NO_x emitted from drilling and construction equipment for seven proposed ISR facilities that would be within an 80-km [50-mi] radius was calculated by the NRC staff as 107 t/yr [118 T/yr] {approximately 0.3 and 0.9 percent of the aforementioned coal plant

emissions, 58 percent of the 47.3-km [29.4-mi] rail spur estimate, and 5.0 to 32 percent of the Jonah-Pinedale oil and gas drilling cluster example}. The contribution to annual NO_x emissions calculated for the proposed action of 31 t/yr [34 T/yr] is approximately 29 percent of the seven-facility estimate used in this analysis. Based on the preceding analysis, the NRC staff concludes the facility emissions from the proposed ISR projects are low relative to other regional emissions and therefore potential air quality impacts from these emissions would be SMALL.

Fugitive dust emissions from the proposed action and other existing or proposed ISR facilities would contribute to the cumulative particulate matter emissions from power plant, CBM activities, and coal mining, in particular. As the projected emissions from these activities for 2020 indicate near-field exceedances of $PM_{2.5}$ and PM_{10} (BLM, 2009f) and potential far-field visibility impacts would be increasing (BLM, 2009f), the NRC staff expects particulate emissions would continue to be an air-quality concern in future years. Therefore, the NRC staff concludes the cumulative impact could be MODERATE for these other sources. Because the principal particulate emissions are from fugitive dust, ISR facilities are not major sources of particulate emissions as discussed in SEIS Section 4.7.1.1. The NRC staff concludes that the proposed action impacts to air would be localized, intermittent, and temporarily MODERATE (e.g., visible plumes of dust are possible from intermittent traffic on unpaved roads), but the overall impacts would be predominantly SMALL.

Overall, based on the preceding analysis, the NRC staff concludes the proposed Nichols Ranch ISR Project would have a SMALL incremental effect on the MODERATE cumulative impacts to air quality resulting from past, ongoing, and future ISR projects, CBM projects, oil and gas operations, surface coal mining activities, and other development identified in Section 5.1.1. While the proposed ISR emissions are relatively low, the actual cumulative effect of multiple, new ISR facilities that could be licensed in the future would depend on the ambient air quality at the time of licensing, the continued development of other emission-generating activities in the area and region, and the timing and magnitude of emission-generating activities at each proposed ISR facility. Because NRC would license these ISR facilities and permit them sequentially on a first-come, first-served basis, the addition of emissions from each new facility would be incremental. This incremental development of uranium milling facilities in the region allows NRC to evaluate each proposal and allows state air quality staff to evaluate potential impacts within the context of existing air quality.

For the Modified Action–No Hank Unit (Alternative 3), the cumulative nonradiological impacts to air quality would be the same types of impacts as those evaluated for the proposed action; however, because the number of wellfields would be halved under this alternative, some annual air emissions would be reduced and the total lifecycle emissions for the facility would be less than the total lifecycle emissions for the proposed action. Because the Hank Unit would not be constructed, fugitive dust and diesel emissions from well drilling and construction equipment (Section 4.7.3.1) from the Hank Unit would not occur. The lack of active wellfields in the Hank Unit would also diminish the traffic volume with respect to incoming shipments of process chemicals, onsite shipments of ion exchange resins, and outgoing shipments of yellowcake and waste materials (Section 4.7.3.2), therefore reducing the generation of fugitive road dust. The types of nonradiological air impacts from decommissioning this alternative would be the same as those stated for the proposed action (Section 4.7.3.4); however, the magnitude of emissions would be lower because half the number of wellfields would need to be decommissioned and reclaimed, reducing the operating hours for construction equipment and proportionally decreasing emissions from that equipment. Though soil and road reclamation and infrastructure demolition would result in emissions greater than the operation and aquifer restoration phases

for this alternative, the levels of pollutants generated would be similar to the construction phase and would be diminished relative to the proposed action because the Hank Unit would not be present. Therefore, Alternative 3 would have a SMALL incremental effect on air quality when added to the MODERATE cumulative impact on air quality from other past, present, and reasonably foreseeable future actions within the air quality study area.

5.7.1 Global Climate Change and Greenhouse Gas Emissions

As discussed in the U.S. Global Change Research Program (GCRP) report (GCRP, 2009), it is the "… production and use of energy that is the primary cause of global warming, and in turn, climate change will eventually affect our production and use of energy." This assessment is focused on greenhouse gas (GHG) emissions. GHG emissions associated with construction, operation, and decommissioning of an ISR facility are addressed in Chapters 3 and 4 of this SEIS (see Table 5-4). Evaluating the cumulative impacts of GHG emissions is challenging.

Evaluation of cumulative impacts of GHG emissions requires the use of a global climate model. GCRP (2009) synthesized in a technical support document the results of numerous climate modeling studies as discussed in Section 3.7.1.5. Based on this study, EPA determined that potential changes in climate caused by GHG emissions endanger public health and welfare. NRC recognizes that the global cumulative impacts of GHG emissions as presented in the report are the appropriate basis to evaluate cumulative impacts. Based on the impacts identified in the GCRP report, NRC recognizes that the national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The timeframe for the global climate change and greenhouse gas emissions cumulative impacts analyses runs to 2020, which represents the license termination at the end of the decommissioning period as described in Section 5.1.2 of this SEIS. Annual emissions comparisons are used in this analysis to describe the relative magnitude of proposed project emissions with other existing sources.

5.7.1.1 Greenhouse Gas Emissions in the Region

The Center for Climate Strategies (CCS) prepared a report for WDEQ that provides an inventory and forecast of the Wyoming GHG emissions (CCS, 2007). These emissions data were based on projections from electricity generation, fuel use, and other GHG-emitting activities. Emissions are reported as CO_2 equivalents (CO_2e), a conversion to put any of the various gases emitted (i.e., methane or nitrous oxides) into the equivalent greenhouse effect compared to CO_2 (BLM, 2008b). Gross carbon-dioxide-equivalent (CO_2e) emissions in 2005 for Wyoming were 56 million Mt [61.7 million MT].

This volume accounted for less than 1 percent (0.8 percent) of the total U.S. gross GHG emissions. This total is reduced to 20 million Mt [22 million MT] CO_2e as a result of annual sequestration (removal) due to forestry and other land uses (CCS, 2007).

Wyoming has a higher per capita emission rate than the national average (greater than four times). This is due to the state fossil fuel production industry and industries that consume high amounts of fossil fuels, as well as a large agricultural industry, large distances between cities, and a small population (CCS, 2007). The CCS report expects that Wyoming GHG emissions

Table 5-4. Comparison of Annual Mass of Carbon Dioxide Emissions by Source

Source	CO_2 Emission
Global Emissions	28,000,000,000 t [30,884,000,000 T]*
United States	6,000,000,000 t [6,618,000,000 T]*
Single ISR Facility (Nichols Ranch)	2,810 t [3,100 T]
Current/Proposed ISR Facilities	6,237 t [6,880 T]
Average U.S. Passenger Vehicle	4.5 t [5T]†
*EPA, 2009 †FHWA, 2006	

would continue to grow as demand for electricity is projected to increase, followed by emissions associated with transportation. These GHG projections are reflected in Table 5-5.

As of 2009, there are 13 active coal mines in the Wyoming portion of the Powder River Basin, and these mines produced approximately 450 million Mt [496 million MT] (BLM, 2010c). According to the Wyoming Oil and Gas Conservation Commission, the State of Wyoming contains more than 33,000 active gas and oil wells, 45 operational gas processing plants, 5 oil refineries, and more than 14,484 km [9,000 mi] of gas pipelines (CCS, 2007). Because there is no regulatory requirement to track carbon dioxide or methane emissions, there is a high degree of uncertainty associated with the Wyoming GHG emissions from this industry. However, the CCS (2007) estimated approximately 13.5 million Mt [14.9 million MT] of CO_2e emissions were emitted by fossil fuel industries. Of this amount, 80 percent was due to the natural gas industry. This amount is expected to grow an additional 8 to 10 percent in the next decade (CCS, 2007). No data currently exist for the nonfossil fuel industries, including uranium.

Table 5-5. Wyoming Historical and Reference Case GHG Emissions in Million Mt [Million MT] CO_2e

Year	1990	2000	2005	2010	2020
Energy Sector	38.0 [41.9]	43.6 [48.1]	47.5 [52.4]	51.6 [56.9]	59.6 [65.7]
Electricity Production Based	39.8 [43.9]	43.3 [47.8]	44.2 [48.7]	47.8 [52.7]	54.2 [59.8]
Coal	39.8 [43.9]	43.2 [47.8]	44.1 [48.7]	47.7 [52.6]	53.9 [59.4]
Natural Gas	0.0 [0.0]	0.1 [0.1]	0.1 [0.1]	0.1 [0.1]	0.2 [0.2]
Petroleum	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]
Geothermal, Biomass, and Waste (CO_2, CH_4, and N_2O)	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]
Source: CCS, 2007					

5.7.1.2 GHG Emissions from the Proposed Nichols Ranch ISR Project

In response to current concerns related to GHG emissions, NRC has focused on evaluating CO_2 emissions for the life of the proposed facility and compared this with other forms of extraction. The primary source of CO_2 emissions from ISR facilities is combustion engine emissions from construction equipment (including drill rigs). Construction equipment is used most during initial

wellfield and facility construction and later during the decommissioning phase to remove buildings and equipment and reclaim land surfaces.

NRC staff estimated annual and cumulative CO_2 emissions over the life of the facility from the proposed Nichols Ranch ISR Project for construction and decommissioning activities, as documented in Appendix D of this SEIS. Combustion engine exhaust calculations performed for the Nichols Ranch ISR Project were based on a combination of proposal-specific and representative information appropriate to support a conservative emissions screening analysis (Appendix D). Only nonroad combustion emissions were considered. Diesel emissions, including drilling rigs, were estimated using emission factors EPA provided using different engine classes, based on power output and operating time (Appendix D). The applicant proposes to initially drill two wellfields of approximately 490 and 400 wells. This includes injection and production wells (for the ISR process) as well as monitoring wells. In addition, the applicant proposes to have up to eight UIC Class I wells [for deep well injection of byproduct material (wastewater)]. Analyses from Appendix D show that well-drilling rigs and other construction equipment used during the construction phase have the highest annual emissions of CO_2 for the proposed action. This amounts to 2,810 t [3,100 T] of CO_2 per year. The cumulative calculated CO_2 emissions from the proposed Nichols Ranch ISR Project including drilling and construction of all wellfields and then decommissioning all wellfields and associated facilities is 5,712 t [6,300 T].

The majority of estimated annual CO_2 emissions are from drilling, and nearly 67 percent of the calculated drilling CO_2 emissions are from deep disposal well-drilling activities. As described in Figure 2-1, well-drilling activities would occur over a period of several years. The estimate did not include sequestration (removal) due to forestry or other agricultural activities (EPA, 1996).

If the applicant implemented the Modified Action–No Hank Unit (Alternative 3), the aforementioned annual emissions estimate would be approximately 95 percent of the value reported for the proposed action and the cumulative facility lifecyle emission estimate would be approximately 50 to 75 percent of the estimate for the proposed action (with the greater reduction occurring based on an assumption that the applicant would reduce the number of deep disposal wells from eight to four). For the modified alternative, the duration of construction and decommissioning activities would be reduced with the reduction in well fields, and therefore the annual emissions reported here and in Appendix D, while similar alternatives would occur over a shorter duration of years for the modified alternative.

5.7.1.3 Nichols Ranch ISR Project GHG Emissions Impact

As described in Section 5.7.1.1, the total amount of GHGs produced in Wyoming in 2005 was 56 gross million Mt [61.7 million MT], not taking into account sequestration (CCS, 2007). By taking into account 36 gross million Mt [39.7 million MT] for sequestration of GHGs, as estimated in the Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990–2020 (CCS, 2007), the net total of GHGs produced annually in Wyoming is 20 Mt [22 MT]. The proposed Nichols Ranch ISR Project conservatively would produce a maximum annual total of 2,810 t [3,100 T] of GHGs (as carbon dioxide). This equates to approximately 0.014 percent of the net total GHGs produced in Wyoming in 2005. This compares to approximately 2.2 percent from conventional mining operations as discussed in Section 5.7.1.6. If GHG emissions increased or sequestration decreased from 2005 levels, the effect of the Nichols Ranch ISR Project would be even less. Therefore, the potential impact of GHGs from the proposed Nichols Ranch ISR Project and the modified alternative project would be SMALL.

5.7.1.4 Effect of Climate Change on the Proposed Nichols Ranch ISR Project

While there is general agreement in the scientific community that some change in climate is occurring, considerable uncertainty remains in the magnitude and direction of some of the changes, especially in predicting trends in a specific geographic location. To predict the effect of climate change on the proposed Nichols Ranch ISR Project, temperature and precipitation data from two National Weather Service (NWS) stations located in Kaycee {56 km [35 mi] from the proposed site} and Midwest {40 km [25 mi] from the proposed site} were reviewed (NCDC, 2010a). The most comprehensive historical temperature and precipitation records for NWS in the Powder River Basin covered a period from November 1900 to May 2010 for Kaycee and from January 1939 to May 2010 for Midwest. Aside from the year-to-year fluctuations, there was no observable increase or decrease in either temperature or precipitation during the periods of record for the two NWS stations (NCDC, 2010a). In looking at annual temperature data from the National Climatic Data Center (NCDC) for the State of Wyoming from 1895 to 2009, there was a slight upward trend in temperature {0.09 °C [0.16 °F] per decade} (NCDC, 2010b). In the report, *Global Climate Change Impacts in the United States* (GCRP, 2009), the U.S. Global Change Research Team indicated that the temperatures in the past 15 years had risen even faster {0.56 to 1.1 °C [1 to 2 °F] for the Powder River Basin}, most of which is attributed to warmer winters. This trend is expected to continue into the next decade, and by the end of this century, average annual temperatures in the Powder River Basin could rise as much as 2.2 to 4.4 °C [4 to 8 °F] (GCRP, 2009).

While the aforementioned study of individual weather station data from NCDC (2010a) showed no change in annual precipitation from 1900 to 2010, a similar evaluation of 105 years of climatological data for the entire State of Wyoming, revealed a slight downward trend in precipitation {0.33 cm [0.13 in] per decade} (NCDC, 2010b). Nevertheless, the U.S. Global Change Research Team is predicting that the Northern Great Plains Region (which includes the Powder River Basin) would receive increased precipitation in future decades. Most of the precipitation is expected to fall in the colder months (winter and spring), and the summer and fall are to become drier. In addition, with the colder months expected to warm over the next several decades, more precipitation would fall in liquid form, resulting in less snow pack in the higher elevations (GCRP, 2009).

Based on the previous discussion, the overall effect of projected climate change on the proposed Nichols Ranch ISR Project facility is SMALL. The small predicted increases in temperatures and precipitation over the next decade would have no effect on any of the phases of the proposed project. Because the major functioning of the facility is below ground, the effects of the surficial and atmospheric environments are not expected to impact the target (ore body) aquifer. Aquifer recharge could increase in future years, resulting from expected increased precipitation (and consequent infiltration into the groundwater), which could affect the proposed project by increasing the volume of groundwater in the ore body and improving the effectiveness of the aquifer restoration process. Similarly, while potential changes to the proposed site environment and resources such as ecology are plausible, the NRC staff considers the small magnitude of the predicted climate changes during the period when the proposed activities would be conducted not to be sufficient to alter the proposed site environmental conditions in a manner that would significantly change the environmental impacts from what has already been evaluated in this SEIS.

5.7.1.5 GHG Mitigation Measures

BMPs and mitigation measures could be used to minimize the emission of GHGs at the proposed Nichols Ranch ISR Project facility. These include, but are not limited to

- Using fossil-fuel vehicles that meet latest emission standards
- Ensuring diesel-powered construction equipment and drill rigs are properly tuned and maintained
- Using low-sulfur diesel fuel
- Using newer, cleaner-running equipment
- Avoiding leaving equipment idling or running unnecessarily
- Minimizing trips to well pads.

5.7.1.6 Other Mining Activities in the Powder River Basin

Extensive research into the relative volumes of GHGs that ISR facilities and other natural resource extraction methods emit has been performed. In support of the analysis for this final SEIS, the NRC staff surveyed the recent EISs issued for projects located in the Powder River Basin. Based on this survey, the NRC staff found that estimates and projections of the carbon footprint of the natural resource extraction activities vary widely.

West Antelope II Coal Lease Application FEIS

The Final Environmental Impact Statement (FEIS) for the West Antelope II Coal Lease Application also addressed GHG emissions as specifically related to the proposed action (Antelope Mine), the mine adjacent to the West Antelope II lease by application (LBA) tract. An inventory of expected GHG emissions in 2007 was conducted at Antelope Mine. Additionally, West Antelope projected emissions for a typical year of operations at Antelope Mine if the West Antelope II lands are leased and mined. Emissions are measured as CO_2 equivalents (CO_2e), a conversion to put any of the various gases emitted (i.e., methane or nitrous oxides) into the equivalent greenhouse effect as compared to CO_2 (BLM, 2008b).

Emissions would be generated from the following: carbon fuels used in mining operations, electricity used onsite, blasting, methane released from mined coal, spontaneous combustion, onsite rail transport, and coal transported to purchasers (see Table 5-6).

Projected emission rates increase if the West Antelope II tract is added to mining operations. The increase in CO_2 emissions would result from the additional diesel fuel that would be used in consideration of the added haul distances and overburden hauling, as well as increased electricity and explosives related to increasing strip ratios (BLM, 2008a).

Table 5-6. Annual Greenhouse Gas Emissions at the West Antelope II Mine

Source	2007*	Average Year with West Antelope II LBA*
Fuel	110,877	195,173
Electricity	77,574	111,854
Mining Process	36,772	40,884
Onsite Rail	1,959	2,251
Total at Mine	227,182	347,911
Other Rail†	656,444	754,338

*CO_2e in metric tons
†Assumes 10 percent increase, based on demand in eastern United States
Source: BLM, 2008b

The CCS estimated that activities in Wyoming accounted for 55.6 million metric tons of gross CO_2e emissions in 2005 (CCS, 2007). Using that estimate, the 2007 Antelope Mine emissions total represents 0.41 percent of statewide emissions. With the addition of the West Antelope II LBA tract, the projected total Antelope Mine emissions would represent 0.63 percent of statewide emissions (BLM, 2008b).

Wright Area Coal Lease Application Final Environmental Impact Statement

The Wright Area Coal Lease Applications (BLM, 2010b) FEIS analyzes the environmental impacts of leasing six tracts of Federal coal reserves adjacent to the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines. All are operating surface coal mines in the southern Powder River Basin, near the town of Wright, Wyoming. While BLM does not authorize mining through the issuance of a Federal coal lease, WDEQ, with oversight from the Office of Surface Mining (OSM), has regulatory authority in issuing permits to mine coal in Wyoming. However, BLM considered the impacts of mining coal because it is a logical consequence of issuing a maintenance lease to an existing coal mine. BLM analyzed GHG emissions specifically related to mining activities for the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines; adjacent to the North, South, and West Highlight Fields, West Jacobs Ranch, North Porcupine; and South Porcupine LBA tracts. The use of the coal after it is mined is not determined at the time of leasing. However, almost all coal that is currently being mined in the Wyoming Powder River Basin is being used to generate electricity by coal-fired power plants (BLM, 2010b).

CO_2e emissions are projected to increase at the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines if these additional LBA tracts are added to the mining operations (see Table 5-7). The increase in CO_2e emissions is expected to result from the additional fuels (especially diesel) that would be used in consideration of the increased coal and overburden haul distances, as well as increased use of electricity and explosives related to increasing overburden thicknesses. Estimates assume that the combined annual production rate from these three mines is 270 million tons (BLM, 2010b).

CCS estimated that activities in Wyoming will account for approximately 60.3 million metric tons of gross CO_2e emissions in 2010 and 69.4 million metric tons in 2020 (CCS, 2007). Using the CCS projects, the 2007 emissions from the three conventional mines identified in Table 5-7 would contribute 2.22 percent of the 2010 Wyoming statewide emissions. The addition of six LBA tracts (the North Highlight Field, South Highlight Field, West Highlight Field, West Jacobs

Table 5-7. Estimated Annual Equivalent CO_2 Emissions at the Black Thunder, Jacobs Ranch, and North Antelope Rochelle Mines

Source	2007*	With LBA Tracts
Fuel	577,463	1,429,582
Electricity	465,908	777,141
Mining Process	201,871	296,166
Total of Three Sources	1,245,241	2,502,889

*CO_2e in metric tons
Source: BLM, 2010b

Ranch, North Porcupine, and South Porcupine) together with the conventional mines identified in Table 5-7 would increase the projected 2020 statewide emissions to 3.61 percent (BLM, 2010b).

5.8 Noise

Cumulative impacts from noise were assessed within an 8-km [5-mi] radius of the proposed Nichols Ranch ISR Project. This area served as the cumulative assessment geographic boundary and was chosen because noise dissipates quickly from the source. GEIS Section 4.3.7 stated that sound levels as high as 132 dBA will taper off to the lower limit of human hearing (20 dBA) at a distance of 6 km [3.7 mi] in this region. The cumulative effects timeframe runs from 2007 to 2020. The year 2007 is when the applicant submitted a license application to NRC for a new source material license for the proposed Nichols Ranch ISR Project. The cumulative impact analysis timeframe would terminate in 2020, which represents the license termination at the end of the decommissioning period. Noise impacts may occur during all phases of the proposed Nichols Ranch ISR Project and are projected to be SMALL. Impacts are detailed in Section 4.8.1 of this SEIS. The GEIS noted that noise would not be discernible to an offsite person at distances of greater than 300 m [1,000 ft] (NRC, 2009a). Section 4.8 of the SEIS evaluated potential noise impacts to the nearest resident (Pfister Ranch) who lives approximately 970 m [3,170 ft] north of the Hank Unit. Because this person lives beyond 300 m [1,000 ft] of the proposed project area, there would be no noise impact above background levels.

Past, present, and reasonably foreseeable future noise-generating activities in the vicinity of the proposed Nichols Ranch ISR Project would primarily be from traffic noise, uranium mining/milling operations, oil and gas operations, and CBM operations. The FEIS for the Powder River Basin Oil and Gas Project noted that sound levels from CBM operations would be expected to be unnoticeable at distances of 490 m [1,600 ft] and beyond, and the FEIS concluded there would be no cumulative impact on the surrounding area (BLM, 2003). CBM operations also are active near the proposed license area. Table 3.1 shows that 200 CBM wells are within 4.8 km [3 mi] of the Nichols Ranch Unit, while 180 CBM wells are within the same distance of the Hank Unit. There is one oil and gas well within 4.8 km [3 mi] of the Nichols Ranch Unit and 27 wells within the same distance as the Hank Unit. The FEIS noted that oil and gas operations would generate noise during well drilling, which decreases to 54 decibels (dBA) at 610 m [2,000 ft] from the drill rig. Oil and gas operations generate noise during the ongoing operations of compressor stations, although noise levels were anticipated to be below 55 dBA at distances of 490 m [1,600 ft] and beyond (BLM, 2003). According to EPA, 55 dBA is the level that protects against interference and annoyance with a margin of safety (EPA, 1978).

Wildlife within the study area could be impacted by noise as nine Greater sage-grouse leks have been identified within 3.2 km [2.0 mi] of the proposed Nichols Ranch ISR Project site (Figure 3-8). However, the applicant has committed to implement mitigation measures that include delaying or minimizing project activities and vehicle traffic avoidance near active leks during key mating periods as well as following seasonal WGFD guidelines (WGFD, 2010). These actions should reduce potential noise impacts on the Greater sage-grouse.

The NRC staff has determined that the cumulative impact on noise within the noise study area resulting from all past, present, and reasonably foreseeable future actions is SMALL. There are few sensitive noise receptors (e.g., residences, churches, community centers) in the study area, and noise levels will dissipate before reaching those that exist do exist.

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL incremental effect on noise when considered with all other past, present, and reasonably foreseeable actions in the noise study area. The noise generated from either the proposed Nichols Ranch ISR Project or from CBM or oil and gas operations would be at background levels at distances ranging from 300 to 610 m [1,000 to 2,000 ft]. The nearest residence is found at a distance of 970 m [3,170 ft], and there are few sensitive noise receptors within the study area. The applicant has also committed to employing mitigative measures to reduce any potential impacts to Greater sage-grouse.

The cumulative noise impacts described previously for the proposed action would be similar to, but less than, the Modified Action–No Hank Unit (Alternative 3). Section 4.8.3 describes impacts associated with Alternative 3. Noise associated with construction activity and construction-related traffic would decrease under Alternative 3, and the SMALL impact from the proposed action would be further reduced for Alternative 3. Based on this analysis, NRC staff concluded that implementation of Alternative 3 would have a SMALL incremental effect on noise when added to the SMALL cumulative noise impact expected from other past, present, and reasonably foreseeable future actions in the noise study area.

5.9 Historical and Cultural Resources

Cumulative impacts to historic and cultural resources were assessed within the planning area administered by the BLM Buffalo Field Office (hereinafter referred to as the “Buffalo Planning Area”). The Buffalo Planning Area encompasses 315,772 ha [780,291 ac] of public lands and 1,914,624 ha [4,731,140 ac] of mineral estate within Campbell, Johnson and Sheridan counties in north-central Wyoming. This area delineates the geographic boundary utilized for the cumulative analysis of historic and cultural resources and will be collectively referred to as the “historic and cultural resources study area.” This area was selected as the cumulative analysis geographic boundary because the proposed Nichols Ranch ISR Project is centrally located within the boundary area and the BLM charter includes land management.

Potential impacts to historic and cultural resources could result from energy development, erosion, and grazing activities. Recent BLM reports (regional management plans; coal, gas, oil, lease applications) provide valuable information on past, present, and future development activities that could result in cumulative effects on historic and cultural resources when added to impacts associated with the proposed Nichols ISR project. The cumulative effects analysis timeframe begins in 2007 and terminates in 2020. The year 2007 is when the applicant submitted a license application to NRC for a new source material license for the proposed Nichols Ranch ISR Project. The cumulative impact analysis timeframe would terminate in 2020, which represents the license termination at the end of the decommissioning period.

According to the Buffalo Resource Management Plan Revision, bentonite, uranium and gypsum are the only locatable (metallic and nonmetallic) minerals that the Buffalo Field Office has received Notices of Intent or Mine Plans of Operations since the Buffalo RMP Record of Decision was signed in 1985. Consequently, as the price of uranium began to increase, there has been an increase in interest in development within southeastern Johnson and Campbell Counties. There are also significant coal, federal oil and gas reserves within the Powder River Basin (PRB). PRB coal production is expected to increase at an annual rate of 2 to 3 percent per year. (BLM, 2009-RMP)

Since the emergence of CBM activities in the late 1990s, over one thousand archaeological sites are evaluated each year (BLM, 2009h – RMP Revision dated March 27, 2009). Hundreds of archaeological sites are discovered and recorded each year as the result of cultural resource investigations associated with energy development projects (BLM, 2009 –RMP). The revised RMP states as the demand for federally-owned minerals increases, there will be a demand to identify cultural resources. Within the study area, activities on both public and private lands include oil, gas, CBM and coal development. These activities are ongoing and are projected to expand in the future. However, any potential impacts to historic and cultural resources would likely be minimized for projects occurring on federal or state lands, licensed or permitted by Federal agencies, or which are licensed or funded in part by the government because these projects would be subject to the National Historic Preservation Act (NHPA), Section 106 consultation process, and applicable statues.

Along with the proposed Nichols Ranch ISR Project, there are other ISR and conventional uranium (underground and pit) operations in various stages of the licensing process within the Powder River Basin. Uranium-related exploration within the study area includes the Smith Ranch-Highland Uranium Project, an ISR project operated by Power Resources, Inc. (PRI), and the Irigaray/Christensen Ranch Project, operated by Cogema Mining, Inc., which are located approximately 78 km [48.5 mi] south-southeast and 12 km [7.5 mi] northwest of the proposed Nichols Ranch ISR Project, respectively (Table 5-1).

A records search conducted by the applicant revealed that 18 cultural resource inventories have been conducted within or near the proposed Nichols Ranch ISR permit area. These cultural resource inventories were completed between 1976 and 2008 for various energy development projects; including uranium mines, coal bed methane wellfields, and oil and gas wells. A total of 54 sites have been recorded within the 11 surveyed sections which include and surround the proposed Nichols Ranch ISR project area. These sites are mainly associated with prehistoric occupation of the area. (Uranerz, 2010)

The entire area within the proposed Nichols Ranch unit permit boundary was previously surveyed as part of the Tex Draw Federal Plan of Development (POD). A Class III archaeological survey identified 13 archaeological sites. These included six prehistoric, two historic, and five prehistoric/historic sites. Based on the available data, the sites are mostly artifact scatters, though historic building remains are present at Site 48JO2953, which is not eligible for listing on the NRHP. Only 1 of the 13 sites is eligible for listing on the NRHP and is identified in Table 3-11 (see SEIS Section 3.9.2.1).

The proposed Hank unit project area has been completely surveyed in association with five projects. These projects include the Nichols Ranch ISR project, 2007 Hank In-situ Uranium Project, 2006 Dry Willow Phase 4 POD, and the 2006 Dry Willow CBM POD. A total of 25 sites were recorded. Of the 25 sites, 7 are eligible for listing on the NRHP, 16 are not eligible for listing, and 2 remain unevaluated for NRHP eligibility (see Table 3-11 in Section 3.9). Except

for Sites 48CA268 and 48CA6147, all of the cultural resources identified in the Hank Unit are prehistoric or protohistoric (Uranerz, 2010).

The Hank Unit falls within the 3.2 km [2 mi] radius of the Pumpkin Buttes, the applicant must follow the stipulations listed in BLM's Programmatic Agreement (PA) with the WY SHPO for mitigation of adverse effects for the Pumpkin Buttes TCP (BLM, 2009g). The PA outlines various measures that a project proponent (federal oil, gas, and uranium leaseholders) within a 3.2 km [2 mi] radius of the Pumpkin Buttes must take to mitigate the adverse effect of its proposed actions on the TCP. In addition to the Pumpkin Buttes TCP, consultation with Native American tribes also identified four additional TCPs within the proposed Hank Unit permit area.

As stated in SEIS Section 4.9.1.1, no sites will be directly affected by construction activities; because sites located near proposed construction areas will be marked, fenced, and avoided. However, there will be an adverse effect to the visual setting of five TCPs. NRC, the WY SHPO, BLM, Uranerz, and interested Native American tribes are consulting to develop an MOA to address the mitigation of adverse effects to the five TCPs. The applicant has committed to following cultural resource mitigation measures identified in its in the Mine Plan for the NRC and WDEQ/LQD permit applications for the entire Nichols Ranch ISR Project site. Direct impacts to historic and cultural resources from the proposed Nichols Ranch ISR project would range from SMALL to MODERATE, depending upon the activities occurring throughout the lifecycle of this proposed facility.

The NRC staff has determined that the cumulative impact on historic and cultural resources resulting from all past, present, and reasonable foreseeable future actions is MODERATE. This is based upon previous cultural resource inventories, applicant-committed mitigation measures, the adverse effect to the visual setting of five TCPs from activities at the proposed Hank Unit, and future energy development activities in the area. Regarding paleontological resources, should project activities involve ground disturbance depths exceeding a few feet, the applicant would have a monitor in place and its procedures would cover inadvertent discoveries. Based on this analysis, the proposed project would have a SMALL incremental impact on paleontological resources when added to the SMALL cumulative impact to these resources expected from other past, present, and reasonably foreseeable future actions.

For the Modified Action–No Hank Unit (Alternative 3), the cumulative impact on historic and cultural resources would be the same as evaluated for the proposed action, however, the magnitude of impact would be less compared to the proposed action because Alternative 3 would have a smaller footprint. Ground-disturbing activities during construction and decommissioning such as trenching and digging and associated impacts, would affect an area of approximately 60 ha [150 ac] for the Nichols Ranch Unit compared to twice the land area if the Hank Unit were involved. Under this alternative, no proposed activities would occur at the Hank Unit that could adversely impact the nine known archeological sites that include seven NRHP-eligible and two unevaluated sites. There would be no adverse impacts to the Pumpkin Buttes TCP nor the four additional TCPs identified during NRC's review.

Because the Nichols Ranch Unit is located 9.6 km [6 mi] west of Pumpkin Buttes, there would be negligible effects to the five TCPs from activities associated with the Nichols Ranch Unit. There is one NRHP-eligible site (48CA5391) located near a projected wellfield at the Nichols Ranch Unit. This site would mark it with protective fencing and avoided. Additionally, the applicant committed to a number of mitigation measures (Uranerz, 2007, 2010), which are listed in Section 4.9.1.1 of the SEIS and are specific to reducing impacts. NRC staff concludes that Alternative 3 would have a SMALL incremental effect on historic and cultural resources when

added to the MODERATE cumulative impact on land use from other past, present, and reasonably foreseeable future actions within the land use study area.

Regarding paleontological resources, should activities involve ground disturbance depths exceeding a few feet, the applicant would have a monitor in place and its procedures would cover inadvertent discoveries. Based on this analysis, impacts associated with implementing Alternative 3 would have a SMALL incremental impact on paleontological resources when added to the SMALL cumulative impact to these resources expected from other past, present, and reasonably foreseeable future actions.

5.10 Visual and Scenic Resources

Visual and scenic impacts from the proposed Nichols Ranch ISR Project are anticipated to be MODERATE and are detailed in Section 4.10 of this SEIS. The timeframe for the analysis of this resource is 2007 to 2020. The year 2007 is when the applicant submitted a license application to NRC for a new source material license for the proposed Nichols Ranch ISR Project. The cumulative impact analysis timeframe terminates in 2020, which represents the license termination at the end of the decommissioning period. No structures associated with the proposed action would exist after license termination. The geographic boundary for the cumulative effects analysis of this resource is the land within a 3.2-km [2-mi] radius of the proposed Nichols Ranch ISR Project site, which is the area stipulated in the BLM's PA. Beyond this distance, any changes to the landscape would be in the background distance zone and would be either unobtrusive or imperceptible to viewers. As described in Section 2.2.1.1 of this SEIS, the proposed Nichols Ranch ISR Project comprises about 1,365 ha [3,370 ac] of mostly private land, located west and southwest of the Pumpkin Buttes area. With respect to potential cumulative effects, resource development in the vicinity of the proposed ISR facility may affect the visual and scenic resources associated with the Pumpkin Buttes Traditional Cultural Property (TCP) and four associated TCPs. The viewshed for the general area is classified by BLM as a Class III and IV Visual Resource Management resource, with no Class I Visual Resource Management areas nearby. The Hank Unit 910 ha [2,250 ac] would be located on the western flank of North Middle Butte, about 2.4 km [1.5 mi] from the Pumpkin Buttes area. The Nichols Ranch Unit {455 ha [1,120 ac]} is further west, about 10 km [6 mi] away from Pumpkin Buttes. The taller proposed central processing plant {10 m [20 ft]} and related office and maintenance buildings for the ISR facility would be located on the Nichols Ranch Unit (farther from the TCPs). As discussed in Section 4.10, the plant and buildings would be the prominent features of the mostly flat landscape. The Hank Unit, closer to the TCP, would be the location of a smaller satellite plant along with one maintenance building. Although the proposed Hank Unit would not be visible from the main road to the T-Chair Livestock Company Ranch, it would be visible from the top of the Pumpkin Buttes.

BLM visual resources analyses have indicated that infrastructure for existing CBM projects, with wells and infrastructure similar to the infrastructure that would support the proposed Nichols Ranch ISR Project facility, can have a "strong to moderate" visual effect on the Pumpkin Buttes TCP at distances up to about 3.2 km [2 mi]. This distance forms the basis of the area of potential effects established in a programmatic agreement between BLM and WY SHPO to mitigate potential impacts to the Pumpkin Buttes TCP from construction activities in the vicinity (BLM, 2009h). With a taller profile, oil and gas production facilities are visible from a greater distance, about 24 km [15 mi] west from the base of Pumpkin Buttes (BLM, 2007). Coal mines are more than 16 km [10 mi] east (Figure 5-2) and, with the exception of dust emissions, do not affect the viewshed in the vicinity of the proposed Nichols Ranch ISR Project (BLM, 2007). Existing commercial facilities to the west that are potentially visible from the proposed Nichols

Ranch ISR Project and visible from Pumpkin Buttes include conventional oil and gas wells and the supporting infrastructure (well pads, pump jacks, access roads, pipelines), reservoirs, fence lines, power lines, water storage facilities, uranium recovery facilities, ranch buildings, and dust from vehicular traffic (BLM, 2007). Several transmission towers are present outside the Hank Unit permit boundary on top of South Middle Butte (Uranerz, 2007). CBM development has and is likely to take place in the Hank Unit area, and well houses are present in the area. As noted in the BLM analysis, "The setting of the Pumpkin Buttes as they face the project area is nearly dominated by modern visual distractions" (BLM, 2007).

Over the next 15–20 years, reasonably foreseeable developments in the vicinity of the proposed Nichols Ranch ISR Project could include a continuation of current activities such as livestock ranching and energy resource development (oil, gas, coal bed methane, and uranium). With an estimated 1,359 conventional oil and gas wells and 13,800 CBM wells projected to be drilled in the Buffalo Planning Area by 2028, it is likely that some of these facilities will be within the viewshed of the proposed Nichols Ranch ISR Project site.

Section 4.10 of this SEIS describes the potential impacts to visual resources, especially the Pumpkin Buttes TCP and four associated TCPs, from the proposed Nichols Ranch ISR Project (including the Nichols Ranch and Hank Units) as being MODERATE. These impacts would be to a viewshed already dominated by modern visual distractions associated with CBM and oil and gas production. The existing PA between BLM and WY SHPO includes measures to mitigate the effects of construction activities on the viewshed within 3.2 km [2 mi] of the Pumpkin Buttes TCP (BLM, 2009h). Similarly, the BLM has established an MOA with CBM producers to mitigate the potential visual effects from their operations (BLM, 2007). In Section 3.9 of the environmental report, the applicant stated it would also implement mitigation measures such as dust suppression, avoiding development on the tops and sides of the nearby North and South Middle Buttes, burying pipelines and power lines, and painting structures (well head covers, header houses, and buildings) with colors designed to blend in better with the natural landscape (Uranerz, 2007). In addition, NRC-approved decommissioning activities at the end of the proposed project would be required to include reclamation activities to restore the preconstruction landscape and create a more natural viewshed. Section 106 consultation among NRC, WY SHPO, BLM, and the applicant regarding potential impacts to the TCPs is ongoing (Appendix A).

The NRC staff has determined that the cumulative impact on visual and scenic resources to the study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Visual distraction in the form of oil and gas and CBM production-related infrastructure currently dominates the viewshed. A Pumpkin Buttes visual assessment completed in 2006 noted roads and trails, CBM-associated structures, reservoirs, and power lines were readily visible from the base of the buttes (Uranerz, 2007). To offset potential impacts from anticipated development within the viewshed of Pumpkin Buttes, BLM entered into a PA with the WY SHPO focused on mitigation of adverse effects for the Pumpkin Buttes TCP from anticipated Federal minerals development (BLM, 2009h). Since the Hank Unit overlaps with and lies inside the 3.2-km [2.0-mi] buffer area of the Pumpkin Buttes TCP, mitigation measures identified in the PA for the Pumpkin Buttes TCP would apply to the proposed Hank Unit. The applicant has committed to follow mitigation measures outlined in the PA for activities occurring at the Hank Unit (Uranerz, 2010).

The NRC staff has concluded that the proposed Nichols Ranch ISR Project (the proposed action) would have a SMALL to MODERATE incremental effect on visual and scenic resources when considered with all other past, present, and reasonably foreseeable actions in the study

area. Regarding the Nichols Ranch Unit, there would be no visual impacts to Class II areas during any of the project's phases. The Nichols Ranch Unit is located outside the 3.2-km [2-mi] radius for potential impact on a TCP element. Finally, as part of the Section 106 consultation under the NHPA, any visual impacts could be further reduced. Therefore, visual and scenic impacts associated with the Nichols Ranch Unit would be SMALL. However, the Hank Unit is located inside the 3.2-km [2.0-mi] radius of the Pumpkin Buttes TCP. Because of the proximity of the Hank Unit to the Pumpkin Buttes TCP and the presence of construction machinery in plain view, some detrimental effects to visual and scenic resources would occur resulting in MODERATE impacts. These impacts would be greatest during the construction and decommissioning phases.

The cumulative impacts to visual and scenic resources described previously for the proposed action would be similar to, but less than, the Modified Action–No Hank Unit (Alternative 3) since there would be no construction, operations, aquifer restoration, or decommissioning activities within the buffer area stipulated in the Pumpkin Buttes PA. Section 4.10.3 describes impacts associated with Alternative 3. There would be no construction and decommissiong activities associated with the Hank Unit. Therefore, impacts from the Nichols Ranch Unit would be remain SMALL as has been described previously. The SMALL to MODERATE impact~~s~~ from the proposed action would be reduced to SMALL for Alternative 3. Therefore, Alternative 3 would have a SMALL incremental effect on visual and scenic resources when added to the MODERATE cumulative impact on visual and scenic resources from other past, present, and reasonably foreseeable future actions.

5.11 Socioeconomics

The geographic boundary for the socioeconomic cumulative impact analysis includes Campbell and Johnson Counties because the proposed ISR facility at Nichols Ranch would be located along the adjoining border of Campbell and Johnson Counties. Population change in these counties over time can be used as an indicator of future social and economic change. As is shown in Figure 5-4, Campbell County grew from 12,957 in 1970 to 43,440 in 2010 and is projected to reach 52,130 in 2020. Johnson County grew from 5,587 in 1970 to 8,640 in 2010 and is projected to reach 9,990 in 2020. By comparison, the population of Wyoming was 332,416 in 1970 and is projected to grow modestly from 2010 to 2020 (from 539,740 to 578,730).

As previously discussed in SEIS Section 4.11, the construction and operation of the proposed ISR facility at Nichols Ranch would require approximately 45–55 workers with only 20 workers required for aquifer restoration and decommissioning. Overall, the level of socioeconomic impacts that would occur from the construction, operation, aquifer restoration, and decommissioning of the proposed ISR facility at Nichols Ranch would be less than the level of impacts described in GEIS Section 4.3.10, because fewer workers would be required.

A regional economic model (Regional Economic Model, Inc. Policy Insight) that was part of BLM *Powder River Basin Coal Review Task 3C Report: Cumulative Social and Economic Effects* (BLM, 2005d), was used to develop reasonably foreseeable cumulative employment and population projections. Two future scenarios were modeled showing a lower and upper coal-production scenario in the Powder River Basin. The two scenarios represent a projected range of economic activity derived by combining the range of future coal production with other identified foreseeable activities, including oil and gas production and other mining operations. The timeframe for the model analysis spans from 2007 to 2020, and older data were incorporated into the model to build upon historic employment and population trends.

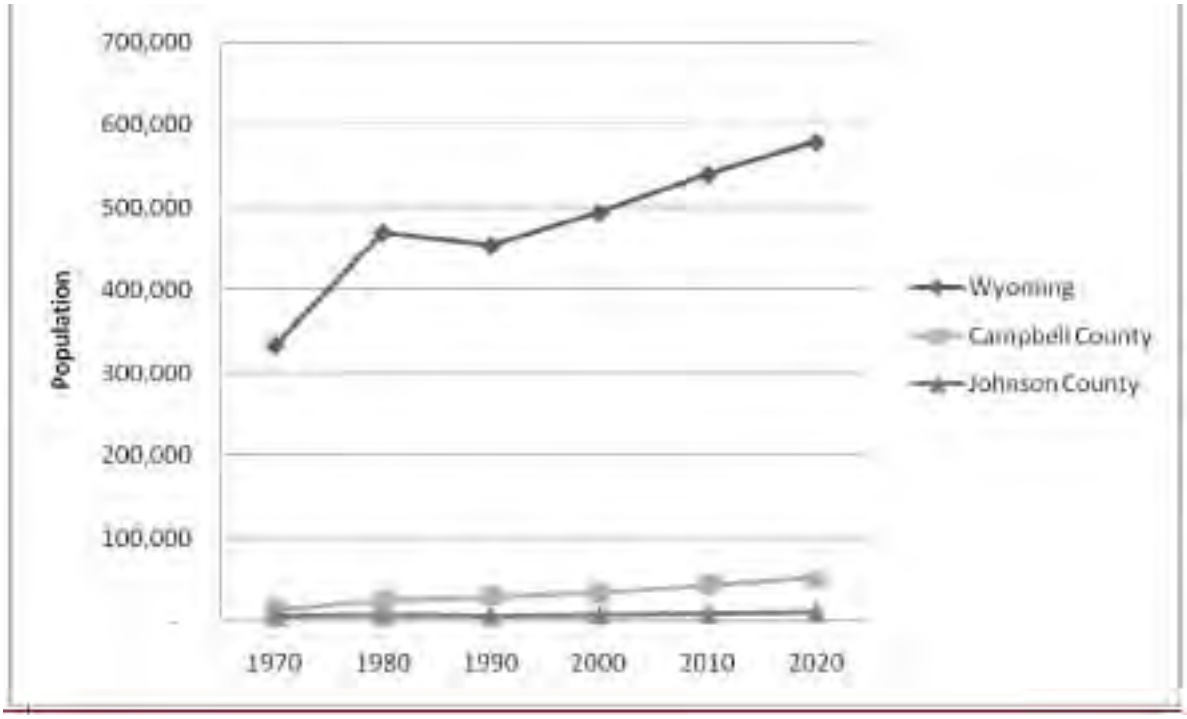

Figure 5-4. Wyoming, Campbell County and Johnson County Population, 1970 to 2020
Source: WDAI-EAD (2008)

The Powder River Basin BLM coal review study area served as the geographic boundary for the coal-review study. Across the entire six-county Powder River Basin (Campbell, Johnson, Converse, Crook, Sheridan, and Wetson), projected increases in employment from coal mining operations and oil and gas development would range from 12,120 to 28,625 jobs under the lower and upper coal-production scenarios between 2003 and 2020. Most of this gain is expected to take place in Campbell County, which is projected to capture 60 percent of the new jobs under the lower projection scenario and 65 percent under the upper coal-production scenario (BLM, 2009e). Figure 5-5 shows employment and population trends for Campbell County from 2000 to 2020. Based on the relatively small number of workers expected at the proposed ISR facility, the Nichols Ranch ISR Project would have a SMALL incremental contributory impact on employment.

While Campbell County and the entire Powder River Basin have been described as possessing an enhanced capacity to respond to and accommodate growth, periods of rapid growth have been known to stress communities and their social structures, housing resources, and public infrastructure and service systems (BLM, 2005a,b,c).

Both the lower and upper coal-production scenarios indicate a strong demand for housing resources through the year 2020.

Based on the lower coal-production scenario, Campbell County is expected to require a minimum 58 percent increase in total housing demand between 2003 and 2020. This demand is anticipated to exert substantial pressure on housing markets, prices, and the real estate development and construction industries, all at a time when demand for labor and other

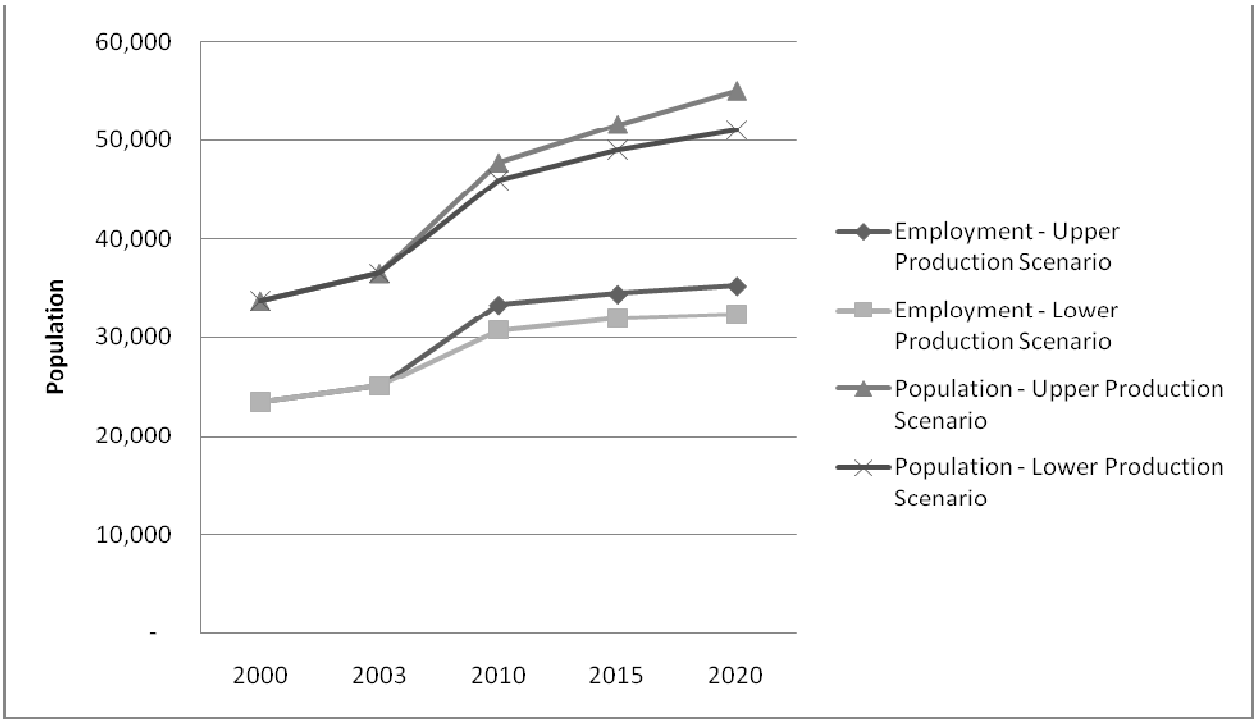

Figure 5-5. Projected Campbell County Population and Employment, 2000 to 2020
Source: WDAI-EAD (2008)

resources would also be high. However, the incremental impact to housing demand from the proposed construction and operation of the ISR facility at Nichols Ranch would be SMALL, based on the small number of expected workers.

Short-term school capacity shortages could also result from an increase in population. Under the lower coal-production scenario, Campbell County is projected to experience a substantial increase in school-aged children through 2020. Based on this scenario, an additional 1,587 students would be added to school enrollments by 2020, representing a 22 percent increase over the 2009 to 2010 school year enrollment. Actual enrollment, however, is outpacing both the lower and upper coal-production scenario projections. This accelerated growth is likely due to recent increases in oil and gas production in the Powder River Basin. By comparison, the incremental impacts to schools from the construction and operation of the ISR facility at Nichols Ranch would be SMALL due to the small number of permanent operations workers. The construction workforce would not relocate entire families during the short construction phase of the project.

Population increases in affected counties and communities would create across-the-board increases in demand for public services. Increased demand for public services from the proposed construction and operation of the ISR facility at Nichols Ranch would be SMALL due to the small number of workers required for all phases of the project. Anticipated increased demand for services include water supply and wastewater systems, which are anticipated to meet projected needs through 2020. Increased a*d valorem* tax payments are anticipated to follow the expanding economy and employment opportunities. Tax revenues generated by the

proposed ISR facility at Nichols Ranch, however, would be minor compared to those projected for the lower and upper coal-production scenarios and oil and gas development.

Based upon the BLM reports, the overall socioeconomic impact within the study area resulting from all past, present, and reasonably foreseeable future actions is projected to be MODERATE. The actions leading to this moderate finding are increased population in the study area due to increased employment in energy development activities, namely coal mining, CBM, oil and gas production, and uranium ISR facilities.

As previously discussed in SEIS Section 4.11, the construction, operation, and decommissioning of the proposed Nichols Ranch ISR Project and aquifer restoration would have little to no impact on socioeconomic conditions in the region beyond those currently being experienced. Also, based on this and other information presented in Chapter 4 of this SEIS, there would be little to no additional contributory effect on future socioeconomic conditions in the region. Based on assessments of population, employment, housing, school enrollment, public services, and local finances, the proposed ISR facility project at Nichols Ranch is projected to have a SMALL incremental socioeconomic effect on the region when added to the MODERATE impacts expected from other past, present, and reasonably foreseeable future actions described in SEIS Section 5.1.1. This conclusion is based on the small number of workers required to support the proposed action.

For the Modified Action–No Hank Unit (Alternative 3), NRC staff concludes that the overall cumulative socioeconomic impact would be similar to, but less than, that described for the proposed action because Alternative 3 would require fewer workers. The potential effect on population, employment, housing, school enrollment, public services, and local finances would consequentially be reduced. Also, less production would generate less tax revenue for the State of Wyoming. Based on this information, NRC staff concluded that implementation of Alternative 3 would have a SMALL incremental socioeconomic effect when added to the MODERATE cumulative socioeconomic impact from other past, present, and reasonably foreseeable future actions within the socioeconomic study area.

5.12 Environmental Justice

No minority and low-income populations have been identified as residing near the proposed ISR facility at Nichols Ranch. The percentage of minority populations living in the two nearest block groups are very small when compared to the percentage of minority populations recorded at the state level and much less than the national level. Potential impacts to minority and low-income populations from the construction, operation, and decommissioning of the proposed ISR facility and aquifer restoration at Nichols Ranch are discussed in Section 4.12.2 of this SEIS. The geographic area and timeframe for the analysis of cumulative impacts follows the area and timeframe for the socioeconomic analysis in SEIS Section 5.11. The GEIS also identified no minority population block groups in the Wyoming East Uranium Milling Region but did identify Albany County as having a low income population (NRC, 2009a). Northern Albany County is predominantly rural with no U.S. Census Bureau-identified population centers or towns in the portion of the county that lies within the Wyoming East Uranium Milling Region.

The economic base of the region is largely comprised of ranching and resource extraction. Low income populations are generally dispersed throughout the study area (see SEIS Section 4.12.1). Based on this information and the analysis of human health and environmental impacts presented in Chapters 4 and 5, any impacts from the construction, operation, and decommissioning of the proposed ISR facility and aquifer restoration at Nichols Ranch under

either the proposed action or Alternative 3, including other past, present, and reasonably foreseeable future actions, would not be disproportionately high and adverse.

5.13 Public and Occupational Health and Safety

The cumulative impact on public and occupational health and safety was considered within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project. Historically, the NRC has used the 80-km [50-mi] radius as a standard bounding geographic area to evaluate population doses from releases at ISR facilities. This section considers both radiological and nonradiological impacts from normal operations and accidents. The public and occupational health and safety impacts from the proposed Nichols Ranch ISR Project could range from SMALL to MODERATE, depending on the specific impact, and are detailed in Section 4.13.1 of this SEIS. During all phases of normal operation, health and safety from radiological and nonradiological impacts would be SMALL. Based on discussions in 4.13.1.2.1, impacts to occupational workers would be SMALL except in the unlikely event that an accident was not mitigated. In this case, the impacts to workers could be MODERATE. The impact to the public from radiological and nonradiological accidents would be SMALL. For non-radiological accidents, as described in Section 4.13.1.2.4, impacts could range from SMALL to MODERATE for onsite workers if not appropriately mitigated. The timeframe for this analysis is 2007 to 2020, which is the expected lifecycle of the proposed facility. The year 2007 is when the applicant submitted its license application to NRC for the proposed Nichols Ranch ISR Project. The cumulative impact analysis timeframe would terminate in 2020, which is the year that NRC estimates license termination would occur should a license be granted. There would be no impact on public health and safety from the proposed action following license termination.

The proposed Nichols Ranch ISR Project site is located in the Wyoming East Uranium Milling Region as defined in the GEIS (NRC, 2009a), which contains 21 previous, current, or potential uranium-handling sites. Two of the 21 sites are operating uranium mines (Smith Ranch-Highland), and two are DOE disposal sites (Shirley Basin South and Spook). The remaining sites are either in active decommissioning or in a terminated or standby status. The GEIS (NRC, 2009a) identified eight draft or final EISs submitted from January 2005 to February 2008 for projects that could contribute to the cumulative impact on public and occupational health and safety within the Wyoming East Uranium Milling Region. In addition, the GEIS identified 10 programmatic EISs for projects that have an impact over the entire State of Wyoming.

Several companies are actively investigating the potential for ISR extraction, as well as other types of mining and milling, in areas near the proposed Nichols Ranch ISR Project. A review of the surrounding area indicated there are four NRC-licensed nuclear facilities within 80 km [50 mi] of the proposed Nichols Ranch ISR Project area (NRC, 2009a) as shown in Table 5-1. These facilities include Uranium One, Inc. Irigaray/Christensen Ranch ISR facility, Power Resources, Inc. licensed North Butte amendment area, PRI Smith Ranch-Highland ISR facility, and Uranium One Moore Ranch site. Two of the licensed facilities, Irigaray/Christensen Ranch and Smith Ranch-Highland, currently have existing yellowcake processing plants, with the latter in operation. Several inactive and decommissioned conventional uranium mills are within an 80-km [50-mi] radius. As noted previously in this SEIS Section 4.13, the proposed Nichols Ranch ISR Project would have a SMALL impact on public health and safety consistent with background radiation. As noted in SEIS Section 4.13.1.2.1, the maximum exposed nearby resident is calculated to receive 0.01 mSv [1 mrem] per year, which is 1-percent of the 1 mSv (100 mrem) per year regulatory limit. These doses are consistent with the doses identified for other ISR facilities considered in the GEIS, where the range was from a high of 0.317 mSv

[31.7 mrem] per year for the Crow Butte facility to 0.004 mSv [0.4 mrem] per year for the Irigaray facility. Thus, because the public dose from the proposed Nichols Ranch ISR facility would not significantly contribute to the cumulative public health and safety effects, the NRC staff concludes that the incremental cumulative impact would be SMALL.

Both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20. Licensees are required to implement an NRC-approved radiation protection program to protect occupational workers. Measured and calculated doses for workers and the public are commonly only a fraction of regulated limits. As stated in Section 4.13, for normal operations, radon-222 would be the only significant radionuclide anticipated to be released; the primary sources would be from wellfield venting and releases from within the central plant for process operations (predominantly via vent stacks on the ion-exchange columns and various tanks). As discussed in Section 7.2.4 of the applicant's technical report, the applicant would use pressurized down flow ion-exchange columns that are designed to significantly reduce the radon emissions from the processing circuit (Uranerz, 2007).

As stated in Section 4.13.1.2.1 of this SEIS, the highest dose at the site boundary for the proposed Nichols Ranch Unit is 0.04 mSv [4 mrem] per year. The calculated collective dose using MILDOS-AREA for the population residing within 80 km [50mi] is 0.002 person-Sv [0.2 person-rem] per year. Table 4.2-2 of the GEIS (NRC, 2009a) shows the offsite maximum dose to a member of the public could range from less than 0.01mSv [1 mrem] per year to 0.317 mSv [31.7 mrem] per year. Because the range of the doses for these facilities are well below the limits in 10 CFR 20.1301(a)(1), the cumulative impacts from other similar facilities located within 80 km [50 mi] would be SMALL.

In SEIS Section 4.13.1.2.2, a radiological hazard assessment (Mackin, et al., 2001) considered three types of accidents, representing the sources containing the higher levels of radioactivity for all aspects of operation: thickener failure and spill, pregnant lixiviant and loaded resin spills (radon release), yellowcake dryer accident release. The impacts to workers from these accidents are considered SMALL except for the unlikely event that the accidents would be unmitigated. Under that circumstance, the dose impacts could be considered MODERATE.

SEIS Section 4.13 provides the baseline information for the cumulative impact discussion. The types and quantities of chemicals (hazardous and nonhazardous) for proposed use at the Nichols Ranch ISR Project do not differ from those evaluated in the GEIS. The use of hazardous chemicals at ISR facilities is controlled under several regulations (see SEIS Section 4.13.1.2.3 for a list of these regulations) that are designed to provide adequate protection to workers and the public. The handling and storage of chemicals at the facility would follow standard industrial safety standards and practices. Industrial safety aspects associated with the use of hazardous chemicals are regulated by the Wyoming Occupational Safety and Health Administration. Nonradological worker safety would be addressed through occupational health and safety regulations and practices.

According to the GEIS (NRC, 2009a), the non-radiological impacts for other similar facilities located within 80 km [50 mi] would also adhere to the standards and regulations described above and within SEIS Section 4.13 and would have SMALL impacts, non-radiological cumulative impacts can be considered SMALL.

The NRC staff determined that the cumulative impact on public and occupational health within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project from all past, present, and reasonably foreseeable future actions would be SMALL. Therefore, the proposed project is

projected to have a SMALL incremental impact on public and occupational health and safety when added to the SMALL cumulative impacts expected from other past, present, and reasonably foreseeable future actions described in Section 5.1.1 of this SEIS. Since the proposed facility is located in a remote, sparsely populated area with limited public access, the exposure to members of the public would be limited. Occupational health hazards would be limited because licensees are required to implement an NRC-approved radiation protection program to protect occupational workers. Additionally, ISR facilities would follow standard industrial safety standards and practices.

For the Modified Action–No Hank Unit (Alternative 3), the cumulative impact on public and occupational health and safety would be similar to, but less than that evaluated for the proposed action; however, the reduced size of the facility would reduce the annual uranium production and consequently some of the potential health and safety risks, but overall the impacts would be similar for either the proposed action or under Alternative 3. Wellfield and resin transfer radon releases at the Hank Unit would be reduced to zero under Alternative 3 and there would be no additional offsite doses to the nearest members of the public from the Hank site. Based on the distance between the Nichols Ranch and Hank Units, however, the NRC staff concludes there would be no reduction in offsite dose at the Nichols Ranch Unit under Alternative 3 since the operations would be the same as for the proposed action because yellowcake processing would still occur at the proposed Nichols Ranch Unit. Worker exposures associated with ion exchange activities at the Hank Unit would also be eliminated under Alternative 3. There would be no daily loaded ion exchange resin shipments from the Hank Unit to the Nichols Ranch Unit under Alternative 3, and, therefore, the risk of accidents and spills would be reduced. The reduced production would require fewer chemical supply and yellowcake product shipments and associated unloading and loading operations and therefore a reduction in risk of spills or other incidents. During decommissioning, the volume of facilities and equipment that would need to be removed, surveyed, and disposed would be subtantially reduced. The reduction in radioactive material handling during decommissioning would result in lower overall worker radiation exposures under Alternative 3, although worker doses would need to comply with NRC dose limits in 10 CFR Part 20. The NRC staff determined that Alternative 3 is projected to have a SMALL incremental impact on public and occupational health and safety when added to the SMALL cumulative impacts expected from other past, present, and reasonably foreseeable future actions.

5.14 Waste Management

Cumulative impacts on waste management were assessed with the impacts from the Powder River Basin BLM coal-review study area (which serves as the geographic boundary for this resource) because uranium mining/milling activities, CBM activities, and oil and gas exploration could generate solid, hazardous, or radioactive wastes that would likely use the same disposal facilities. The timeframe for the analysis of this resource category is 2007 to 2020, as discussed in Section 5.1.2, and is based on the estimated operating life of the proposed Nichols Ranch ISR facility.

As discussed in SEIS Section 2.2.1.6, all stages of the proposed Nichols Ranch ISR Project (construction, operation, aquifer restoration, and decommissioning) would generate effluents and waste streams, all of which must be handled and disposed of properly. These would include liquid and solid wastes. Any wastewater generated during or after the uranium extraction phase of site operations would be classified as byproduct material (NRC, 2000).

The staff reviewed the material submitted by the applicant and estimated the total Nichols Ranch ISR Project facility lifecycle waste volumes as the summation of the operational waste volumes and the total decommissioning waste volumes. Assuming a total operating period of as much as 8 years considering the production and aquifer restoration phases for the Nichols Ranch Unit and the Hank Unit (Uranerz, 2007, Figure 2-1), the total volume of solid byproduct material to be generated for offsite disposal through the end of decommissioning would be about 8,837 m^3 [11,550 yd^3]; the total volume of nonhazardous solid waste to be generated for offsite disposal would be about 7,957 m^3 [10,400 yd^3].

Past, present, and reasonably foreseeable future actions in the vicinity of the proposed Nichols Ranch ISR Project site that could generate solid, hazardous, or radioactive wastes include uranium mining/milling activities, CBM activities, and oil and gas exploration. Each of these facilities would generate solid and hazardous wastes and would be responsible for complying with applicable regulations and site-specific license agreements that manage generated wastes. Within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project, there are at least six either operating or planned ISR facilities that would generate waste volumes consistent with those projected for the proposed project. The cumulative effects on present and reasonably foreseeable future actions that would contribute to the total amount of solid byproduct material generated by ISR facilities could, therefore, be as much as approximately 61,860 m^3 [80,850 yd^3] {i.e., 8,837 m^3 [11,550 yd^3] × 7 facilities}. Similarly, the cumulative volume of nonhazardous solid waste that could be generated from these facilities could be approximately 55,700 m^3 [72,800 yd^3].

Available local capacity for disposal of solid byproduct material is at the Pathfinder-Shirley Basin site in Mills, Wyoming. As reasonably foreseeable additional ISR sites are licensed, this local capacity may become limited. Future ISR applicants could engage other low-level radioactive waste disposal facilities licensed to accept byproduct material. Another existing facility licensed by NRC to accept byproduct material for disposal is the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico. Additionally, three sites in NRC-licensed agreement states can accept byproduct material for disposal (i.e., the Energy Solutions site in Clive, Utah; the White Mesa uranium mill site in Blanding, Utah; and the Waste Controls Specialists site in Andrews, Texas).

Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations, the staff concludes that the potential cumulative waste management impacts associated with the generation of byproduct material would be SMALL.

As discussed in SEIS Section 2.2.1.6.3, the applicant stated in its license application that nonhazardous solid waste would be disposed of at a landfill located near Gillette in Campbell County, Wyoming. As discussed in SEIS Section 4.1.1.1, the landfill in Gillette, Wyoming, has planned available capacity for approximately the next 30 years. The total nonhazardous waste volume from seven ISR projects would represent about 8 percent of the waste that would be disposed at the Gillette landfill based on 2005 disposal rates (Wyoming Office of State Lands and Investments, 2007).

Based on this comparison and the planned operational life of the landfill, the staff concludes the region has sufficient capacity to dispose of the nonhazardous solid waste generated from the proposed action and other present and reasonably foreseeable future actions. Therefore, the cumulative waste management impacts for disposal of nonhazardous solid waste would be SMALL.

The applicant must also comply with applicable State and Federal regulations with respect to disposing of hazardous wastes. Based on the small projected quantities of hazardous wastes the staff estimates for proposed action (Section 2.2.1.6.3) and other similar and reasonably foreseeable ISR facilities that could be licensed in the region, the staff concludes the potential cumulative impacts from the additional generation of hazardous wastes would be SMALL.

Regarding the potential cumulative impacts of liquid byproduct material disposal, the applicant states that it is seeking permits from WDEQ for eight deep disposal wells (four for the Nichols Ranch Unit and four for the Hank Unit) for liquid byproduct material (Uranerz, 2007). Additional deep disposal well use in the region is anticipated as additional ISR facilities are licensed. The State permitting process for these wells evaluates the suitability of proposals to ensure underground sources of drinking water (USDWs) are protected. Because the State would not permit deep injection wells that would have the potential to impact USDWs, the staff concludes the cumulative impact from using deep disposal wells for the proposed action along with the potential impacts from present and reasonably foreseeable future actions would be SMALL.

Given the applicant would obtain the necessary permits and contractual agreements for disposing of its byproduct material, the proposed Nichols Ranch ISR Project is projected to have a SMALL incremental impact on waste management when added to the SMALL cumulative impact from other past, present, and reasonably foreseeable future actions described in Section 5.1.1.

The cumulative impact on waste management would be similar to, but less than the Modified Action–No Hank Unit (Alternative 3). Section 4.14.3 describes why the waste management impacts associated with Alternative 3 would be less than the Proposed Action during all phases of the project. Under Alternative 3, a smaller scope of activities would be conducted because only the Nichols Ranch Unit would be licensed, resulting in the generation of less waste during all phases of the proposed project and a reduction in the waste management impact compared to the proposed action. Only a central processing plant would be constructed, and fewer wells would be drilled, reducing the generation rate of construction-related nonradioactive wastes and ultimately creating a smaller volume of operational wastes, including process bleed and nonhazardous solid waste. In addition, only one septic system and up to four deep disposal wells would need to be constructed because of the reduced volume of liquid byproduct material. During decommissioning, the footprint of the smaller facility would reduce the volume of byproduct material and nonhazardous solid waste that would need to be shipped offsite for disposal. Based on this analysis, the NRC staff concludes that implementation of Alternative 3 would have a SMALL incremental effect on waste management when added to the SMALL cumulative impact on waste management expected from other present and reasonably foreseeable future actions in the waste management study area.

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6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 Introduction

As discussed in Section 8.0 of NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS) (NRC, 2009), monitoring programs, in general, are developed for *in-situ* uranium recovery (ISR) facilities to verify compliance with standards for the protection of worker health and safety in operational areas and for protection of the public and environment beyond the facility boundary. Monitoring programs provide data on operational and environmental conditions so prompt corrective actions can be implemented when adverse conditions are detected. In this regard, these programs help limit potential environmental impacts at ISR facilities and the surrounding areas.

Required monitoring programs can be modified to address unique site-specific characteristics by the addition of license conditions resulting from the conclusions of the U.S. Nuclear Regulatory Commission (NRC) safety and environmental reviews. The discussion of the proposed monitoring programs for the Nichols Ranch ISR Project is organized as follows:

- Radiological monitoring (Section 6.2)
- Physiochemical monitoring (Section 6.3)
- Ecological monitoring (Section 6.4).

6.2 Radiological Monitoring

This section describes the Uranerz Energy Corporation's (Uranerz, referred to herein as the applicant) radiological monitoring program proposed in its license application (Uranerz, 2007) and in responses to NRC requests for additional information and open issues. The purpose of the radiological monitoring program is to (i) characterize and evaluate the radiological environment, (ii) provide data on measurable levels of radiation and radioactivity, and (iii) provide data on the principal pathways of radiological exposure to the public (NRC, 2003).

In accordance with NRC regulations in Title 10 of the Code of Federal Regulations, Part 40 (10 CFR Part 40), Appendix A, Criterion 7, a preoperational monitoring program is required to establish facility baseline conditions. After establishing the baseline program, ISR facility operators are required to conduct an operational monitoring program to measure or evaluate compliance with standards and to evaluate the environmental impact of an operating ISR facility. Although not a requirement, NRC Regulatory Guide 4.14 (NRC, 1980) provides guidance for implementing monitoring programs at uranium mills (which includes ISR facilities) that are acceptable to the NRC staff.

The results from data collected as part of the applicant's baseline monitoring program are discussed in Section 3.12.1 of this supplemental environmental impact statement (SEIS). The following sections briefly describe the applicant's operational monitoring program.

6.2.1 Airborne Radiation Monitoring

The applicant proposes to conduct continuous air particulate sampling with weekly filter changes and to collect quarterly composite samples and analyze them for natural uranium, Ra-226, Th-230, and Pb-210 (Uranerz, 2007). Results of the operational air particulate monitoring program would be reported to NRC in semiannual effluent reports, as required by

10 CFR 40.65. Radon sampling would be conducted at the same eight air particulate sampling locations used for air particulate sampling (Figures 6-1 and 6-2). The applicant has proposed to use track-etch radon detectors, which would be exchanged quarterly and analyzed for radon concentration.

The applicant proposes to implement an airborne radiation monitoring program to detect radon and air particulate releases from the Nichols Ranch Unit central processing plant and Hank Unit satellite facility processes. Figures 6-1 and 6-2 show the proposed air sampling locations, which based on the recommendations in Regulatory Guide 4.14, include air monitoring stations located at or near the site boundaries, in different sectors that represent the highest predicted airborne particulate concentrations, and at one control location located upwind from the site. Air particulate samplers would be located at four different locations at both the Nichols Ranch and Hank Units (Figures 6-1 and 6-2), upwind, downwind, at the nearest residence, and at the proposed plant location on each unit. The NRC staff did not concur with the applicant's proposed air particulate sampling locations because site-specific meteorological information was not used to site the monitoring locations. NRC staff concluded the applicant proposed sampling program did not adequately consider other potential sources of residual uranium from airborne releases at the processing facilities including uranium surface contamination, uranium packaging operations, and maintenance activities. Therefore, based on the NRC staff safety review of the applicant's technical report, NRC will require by license condition that the applicant install a meteorological station within the proposed project area and collect meteorological data for a period of 1 year, or until the data collected are determined to be representative of long-term conditions.

6.2.2 Soils and Sediment Monitoring

During the ISR operations phase, the applicant proposes to annually collect surface soil samples at the same locations sampled for radon (Figures 6-1 and 6-2). Surface soil samples would be collected as grab samples from the surface {of 0 to 15 cm [0 to 6 in]} and analyzed for total uranium, Th-230, Ra-226, and Pb-210 in accordance with Regulatory Guide 4.14. The applicant also proposes to annually collect grab sediment samples at the same preoperational sampling locations shown in Figures 6-3 and 6-4. The sediment samples would be collected upstream at the license boundary, at various locations overlying the ore body, and at the downstream license boundary and be analyzed for total uranium, Ra-226, Pb-210, and Th-230. Before decommissioning, but after operations ended, subsurface soil samples would be collected to compare with subsurface soil samples collected during the preoperational monitoring program.

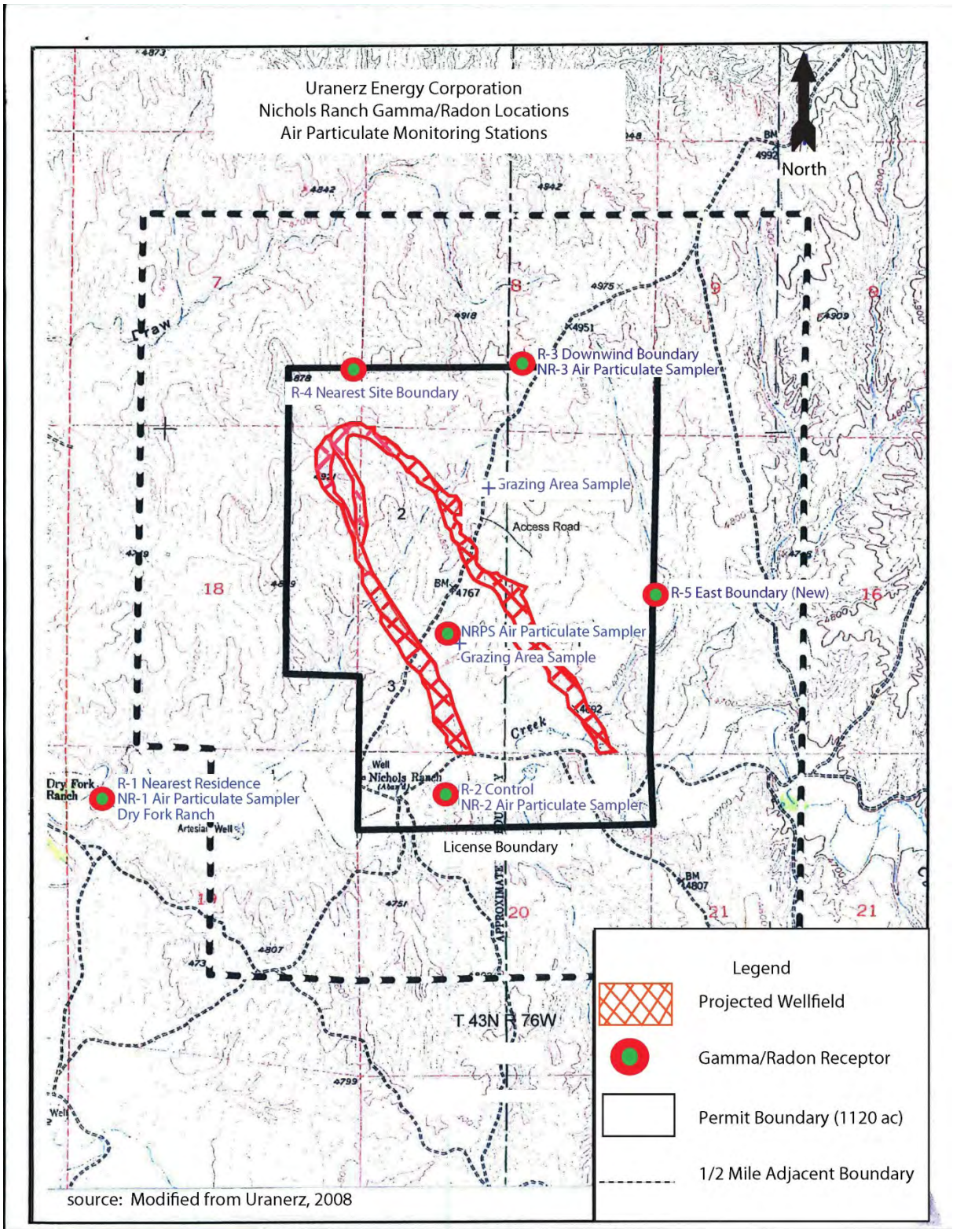
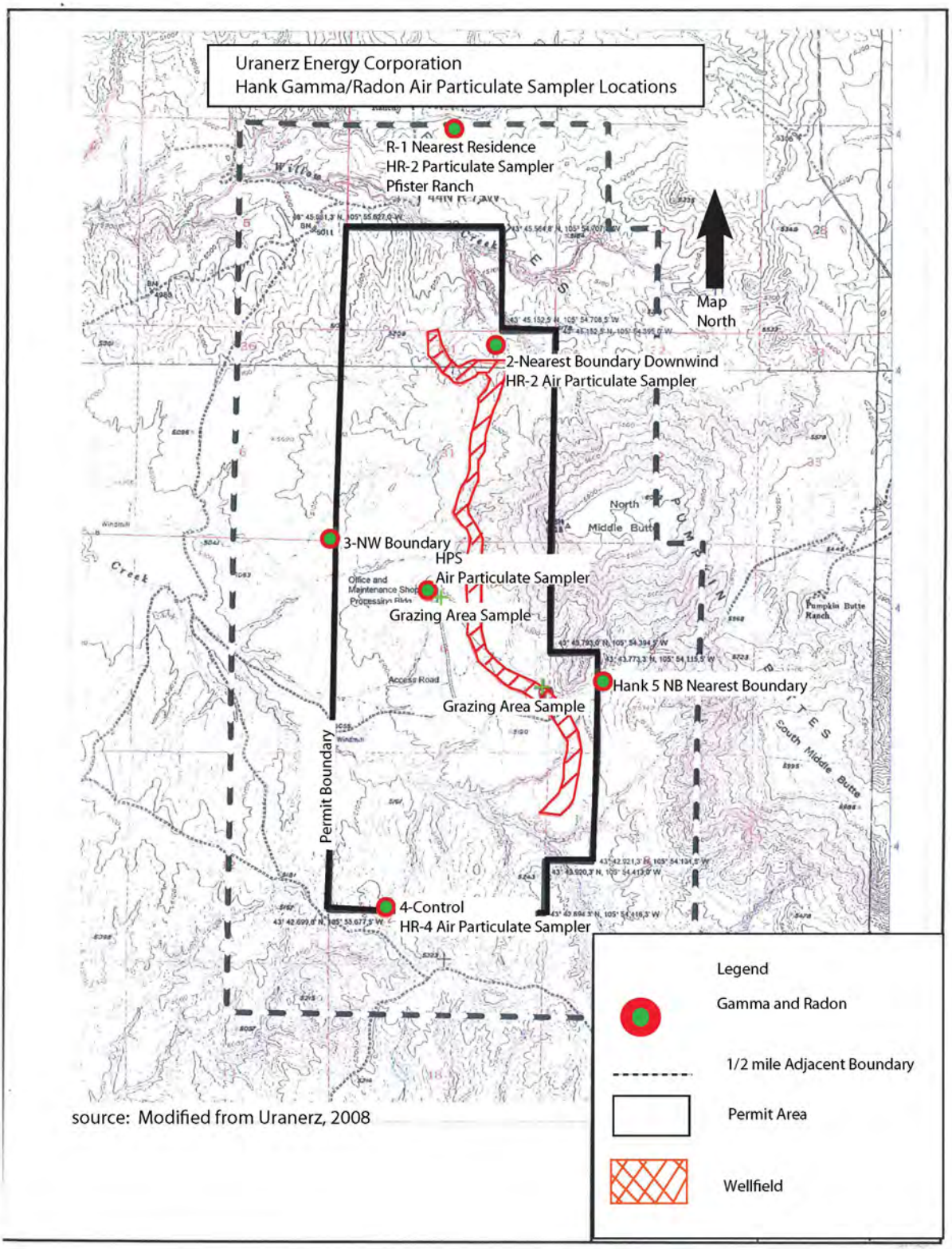


Figure 6-1. Nichols Ranch Unit Air Particulate and Radon Monitoring Locations
Source: Modified from Uranerz (2007)



source: Modified from Uranerz, 2008

Figure 6-2. Hank Unit Air Particulate and Radon Monitoring Locations
Source: Modified from Uranerz (2007)

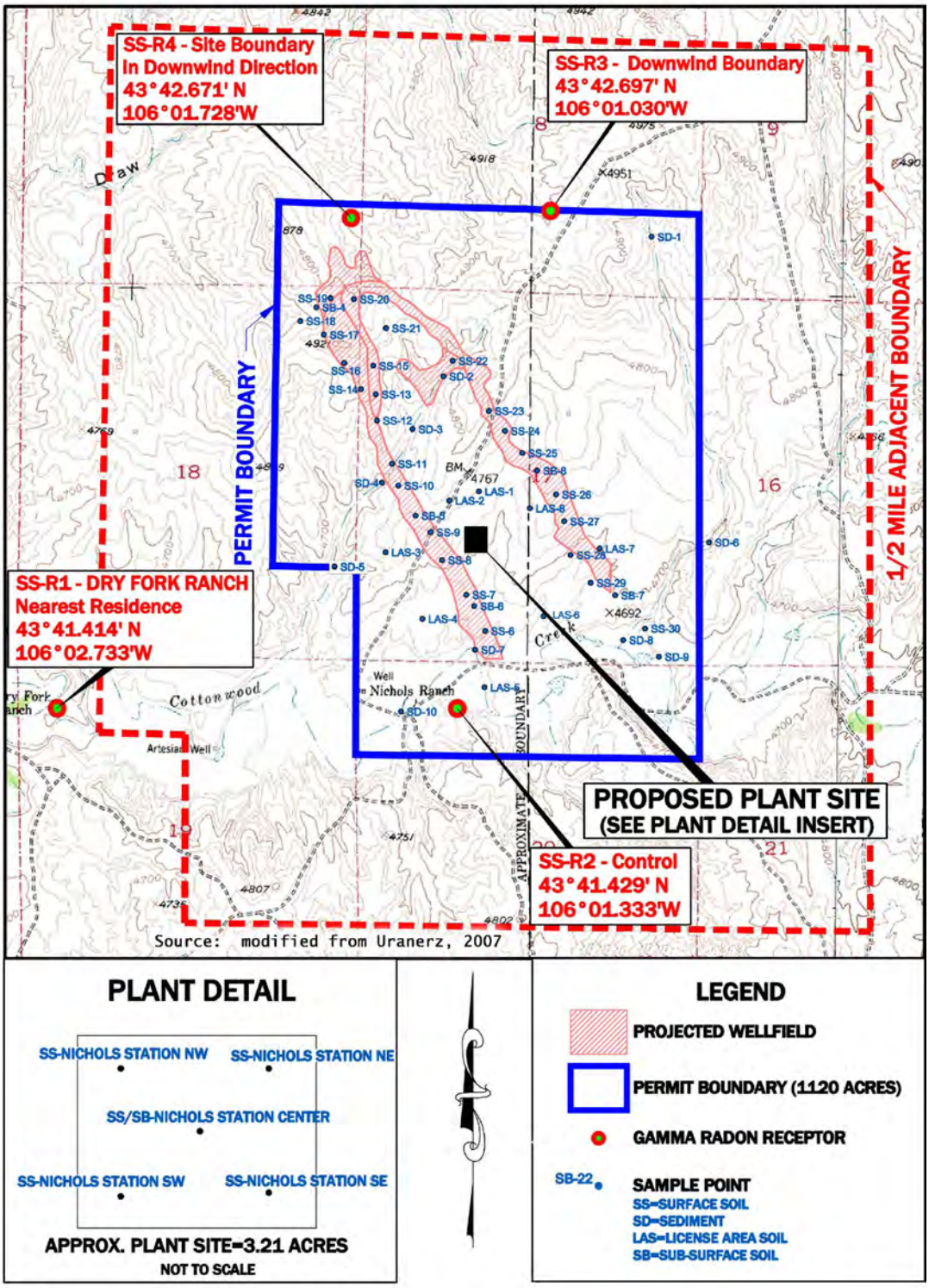


Figure 6-3. Nichols Ranch Unit Sediment Sample Locations

Note: This figure shows both the soil and sediment locations sampled for the applicant's baseline survey. The applicant's proposed operational monitoring program for sediments is to sample at the same location as the baseline survey. The applicant's proposed operational monitoring program for soils is shown in Figure 6-1. Source: Modified from Uranerz (2007)

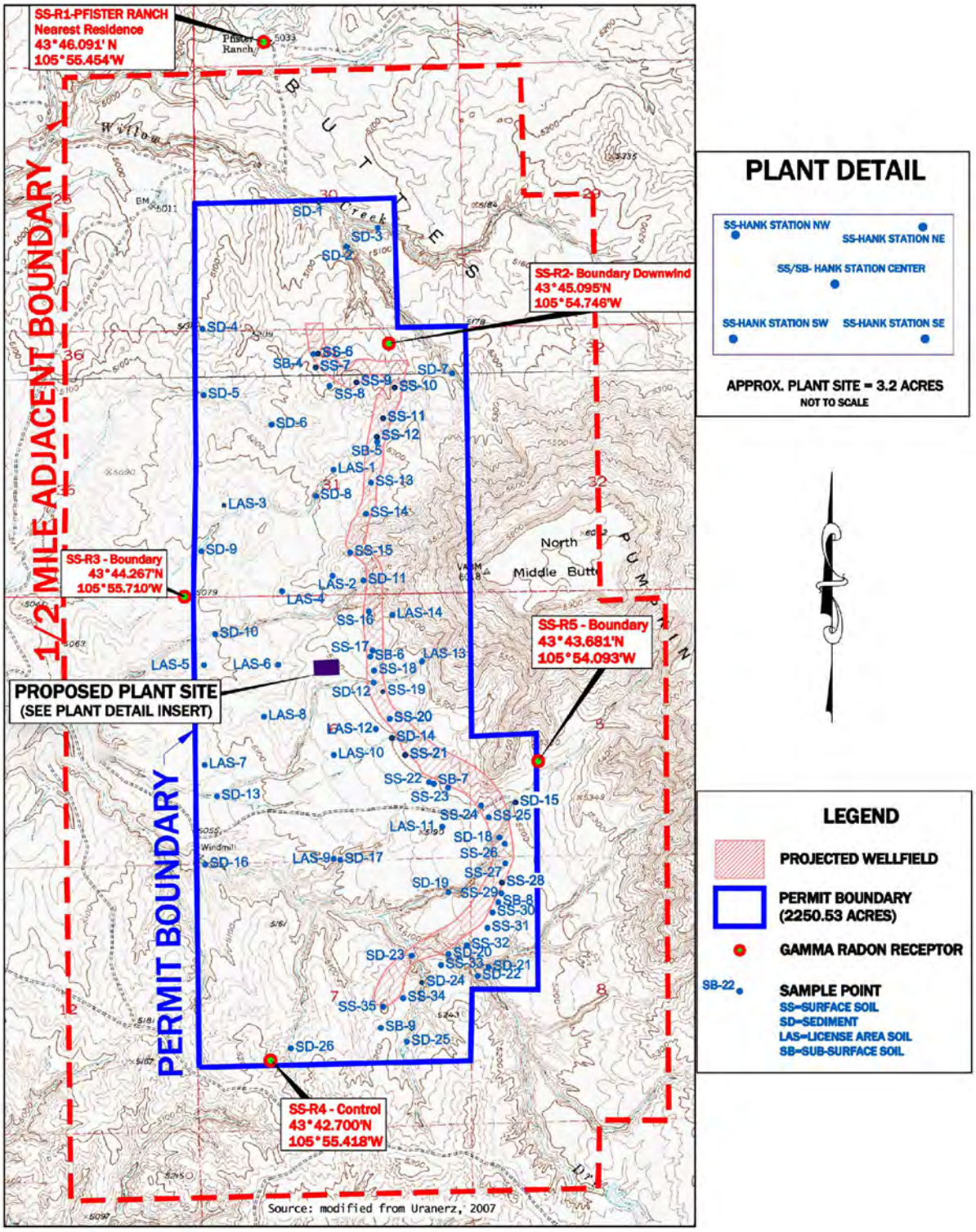


Figure 6-4. Hank Unit Sediment Sample Locations

Note: This figure shows both the soil and sediment locations sampled for the applicant's baseline survey. The applicant's proposed operational monitoring program for sediments is to sample at the same location as the baseline survey. The applicant's proposed operational monitoring program for soils is shown in Figure 6-2. Source: Modified from Uranerz (2007)

6.2.3 Vegetation, Food, and Fish Monitoring

As described in SEIS Section 3.12.1, the applicant conducted preoperational vegetation sampling at various locations on and adjacent to the Nichols Ranch ISR Project site. In its license application, the applicant stated that no liquid effluents would be dispersed of via surface water and that the air pathway would be limited to the generation of radon emissions with no uranium particulate emissions (Uranerz, 2007). The applicant proposes to locate process equipment on curbed, reinforced concrete pads to prevent liquids from entering the environment; any spills or releases would be pumped back into the process circuit or sent to a deep disposal well (Uranerz, 2007).

The applicant evaluated predicted dose to an individual using the MILDOS-Area model, and the NRC staff confirmed that the ingestion pathway to individuals from vegetation, food, and fish would be insignificant. Therefore, in accordance with NRC Regulatory Guide 4.14, the applicant does not intend to conduct vegetation, food, or fish sampling, because the predicted dose to an individual from these pathways would be less than 5 percent of the applicable radiation protection standard in accordance with NRC Regulatory Guide 4.14. However, if the applicant determines that there are other significant potential sources of radioactive particulates that could be released from the process facilities, then the applicant may be required to conduct vegetation, food, and fish sampling in accordance with NRC Regulatory Guide 4.14.

6.2.4 Surface Water Monitoring

The proposed project area contains only ephemeral channels that remain dry for most of the year. As noted in SEIS Section 3.5.1.3, the streams only flow in response to heavy snowmelt and large rainfall events. The applicant has stated that surface water samples would be collected at the same locations sampled for the preoperational baseline and measured for the constituents listed in the license application (Uranerz, 2007, Table D6A-1) when water is present (Uranerz, 2007).

6.2.5 Groundwater Monitoring

Groundwater monitoring of private wells located within 1 km [0.6 mi] of the boundary of an operating wellfield would be performed to detect potential radiological contamination. For the Nichols Ranch Unit, four private wells were identified as the Red Springs #4 Lower (DW-4L), Pats Well #1, and Brown 20-9 (Uranerz, 2007). For the Hank Unit, private wells were identified as BR-F, Dry Willow #1, and Means #1 (Uranerz, 2007). Figures 3-6 and 3-7 show the well locations. These wells would be sampled quarterly and analyzed for natural uranium and Ra-226 with the landowner's consent to monitor for potential radiological impacts from the ISR operation.

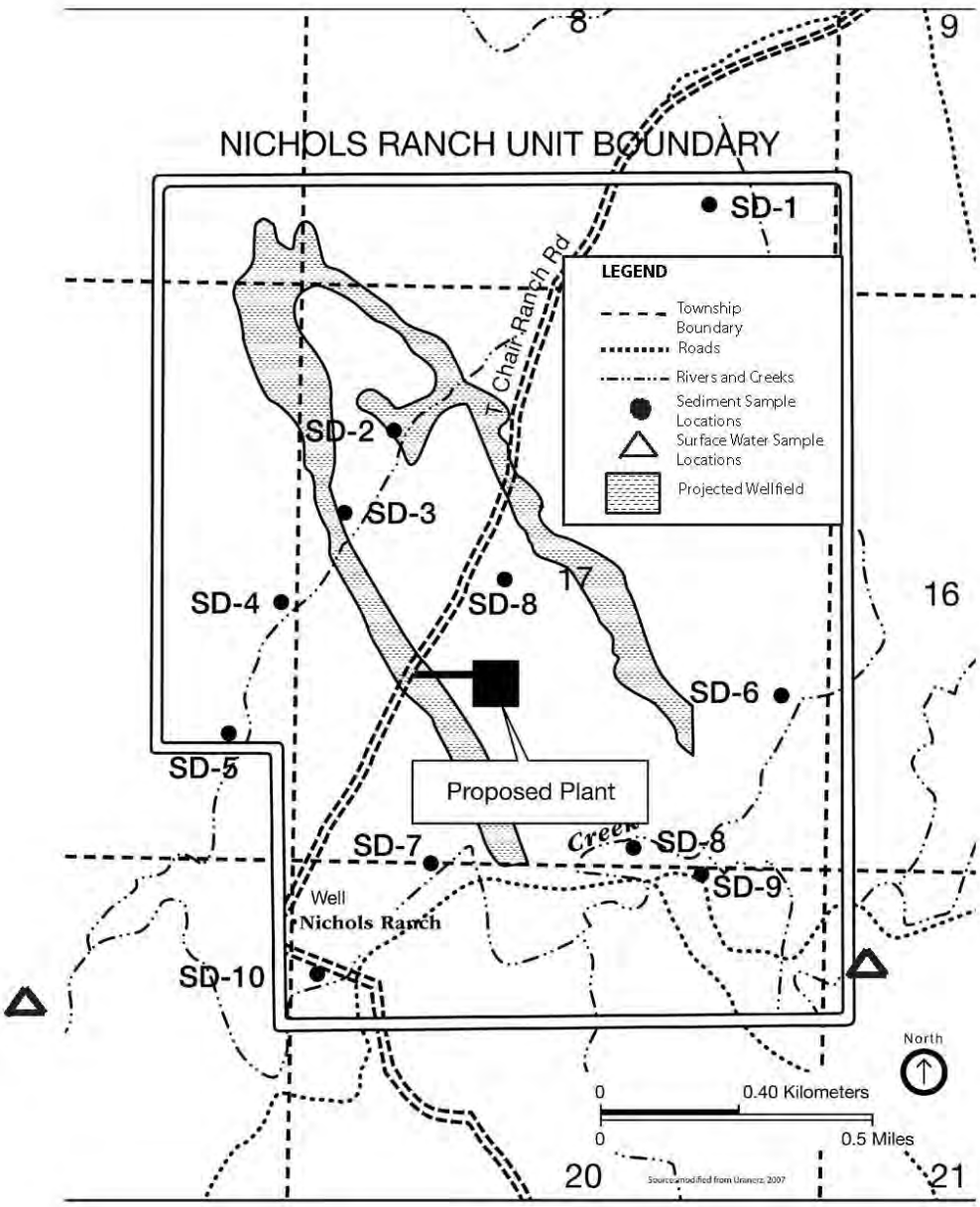


Figure 6-5. Nichols Ranch Unit Surface Water Sample Locations
Source: Modified from Uranerz (2007)

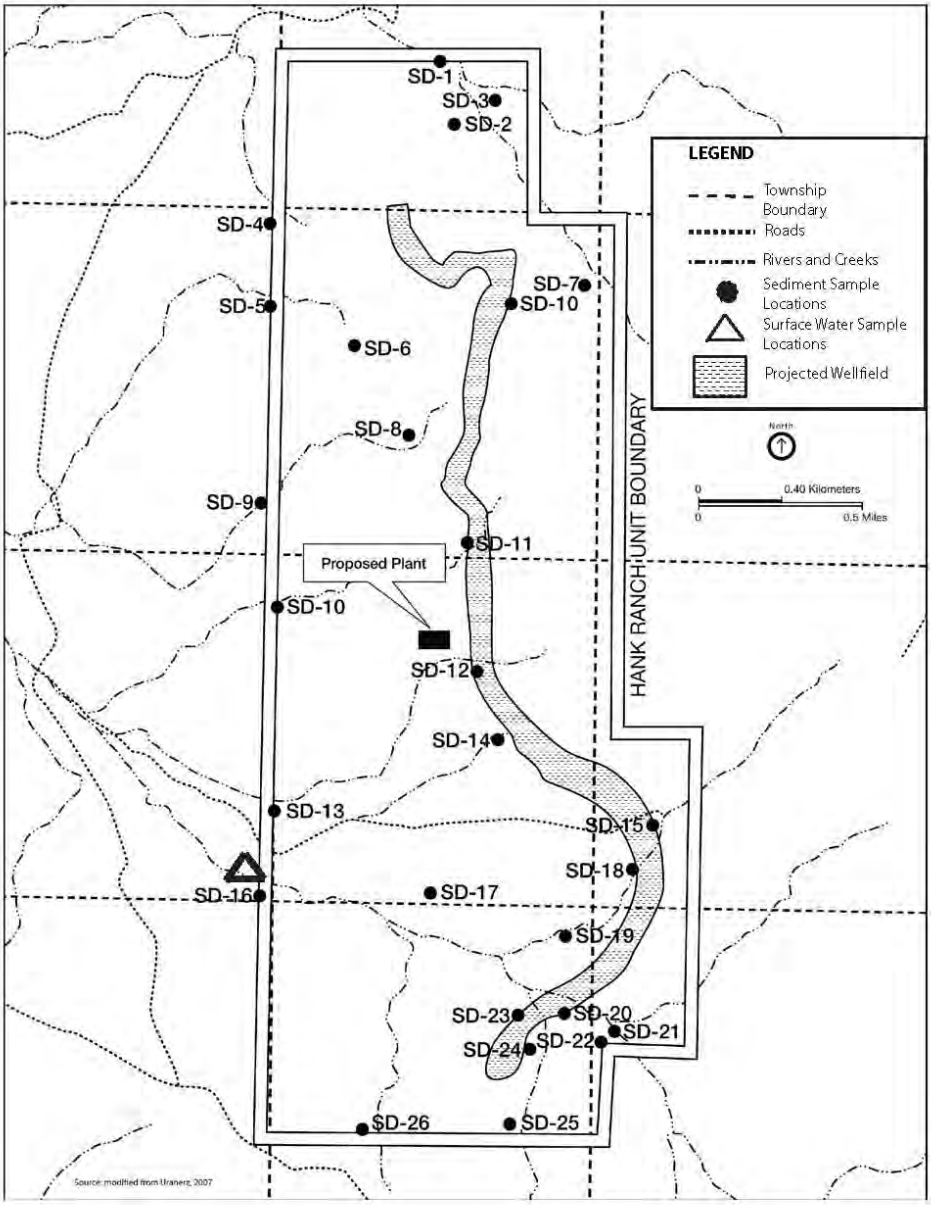


Figure 6-6. Hank Unit Surface Water Sample Locations.
Source: Modified from Uranerz (2007)

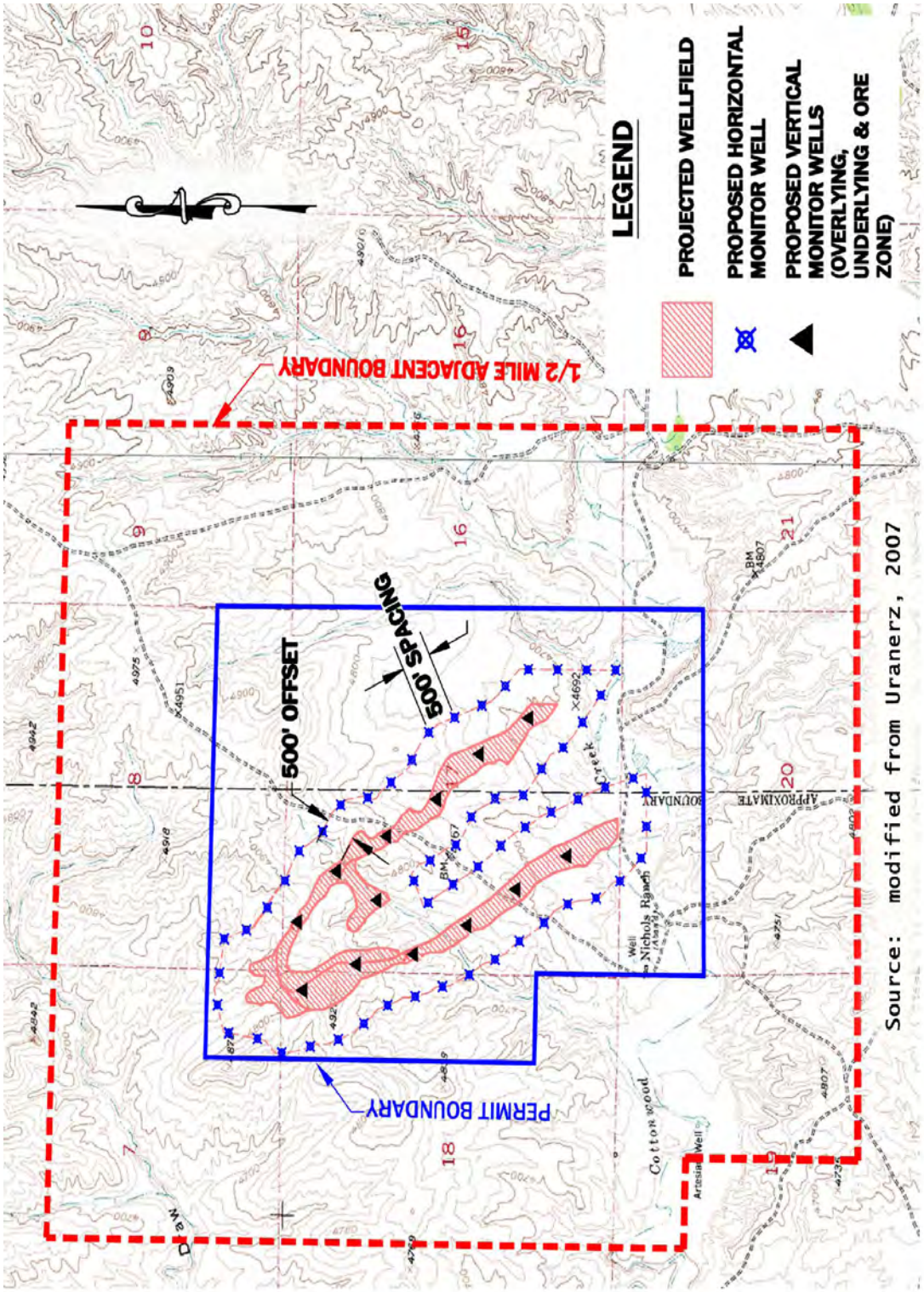


Figure 6-7. Nichols Ranch Unit Monitoring Well Locations
Source: Modified from Uranerz (2007)

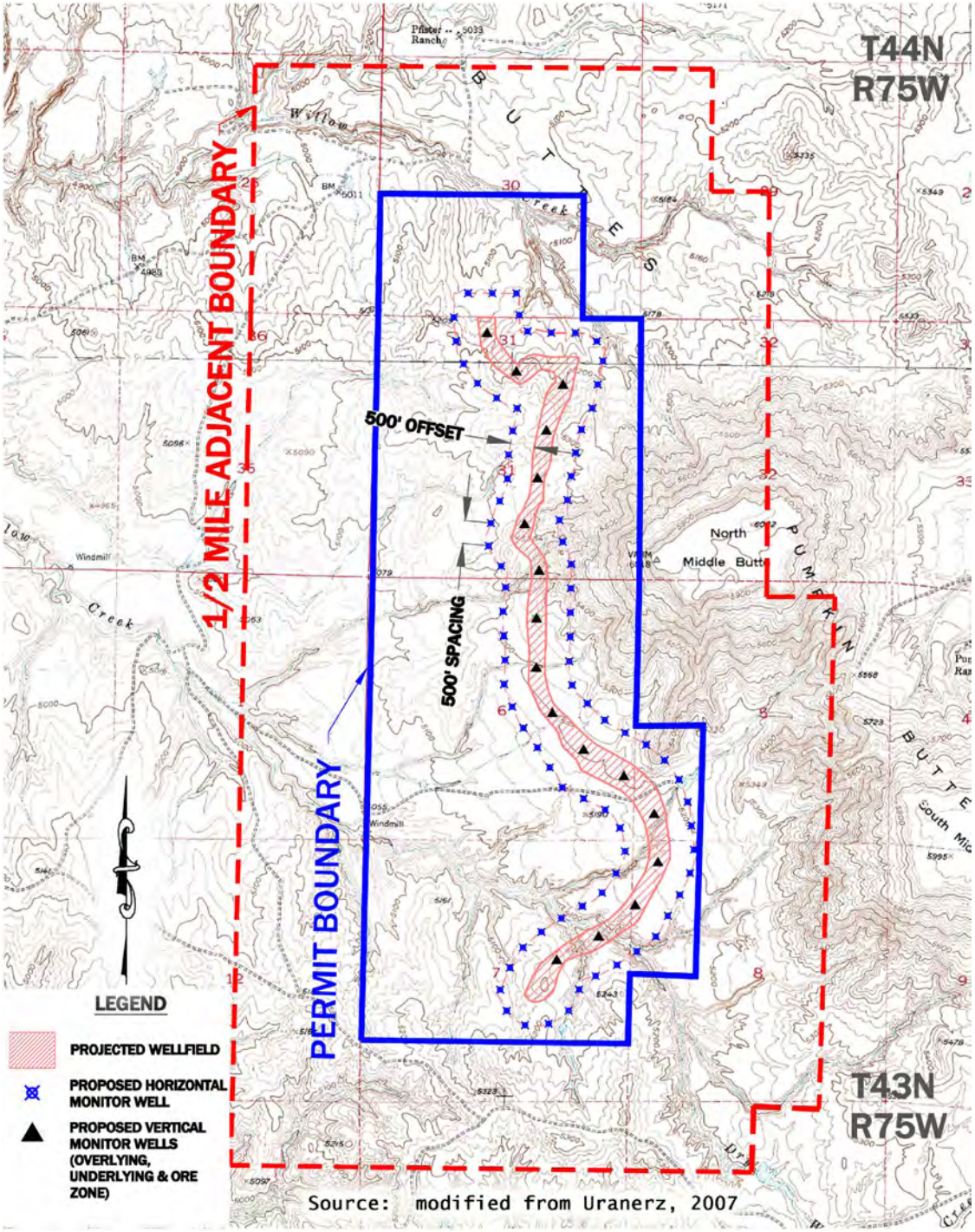


Figure 6-8. Hank Unit Monitoring Well Locations
Source: Modified from Uranerz (2007)

6.3 Physiochemical Monitoring

The ISR process significantly alters the water quality in the production zone aquifer. Therefore, before uranium extraction may occur in a production aquifer, the U.S. Environmental Protection Agency (EPA) must exempt the production aquifer. Appendix C of this final SEIS discusses the criteria EPA uses for an aquifer exemption. During operations, physiochemical groundwater monitoring is conducted by a licensee to limit potential impacts to groundwater quality in nonexempt aquifers surrounding the exempt production zone aquifer. Physiochemical monitoring by a licensee provides data on operational and environmental conditions so that prompt corrective actions can be taken if an adverse condition is detected (NRC, 2009). The applicant's proposed physiochemical monitoring program at the Nichols Ranch ISR Project includes wellfield groundwater monitoring and wellfield and pipeline flow and pressure monitoring discussed in SEIS Sections 6.3.1 and 6.3.2, respectively. The relevant guidance for conducting this monitoring is discussed in each subsection.

6.3.1 Wellfield Groundwater Monitoring

GEIS Section 8.3 discusses the potential for ISR production processes to affect groundwater in and near the operating wellfield (NRC, 2009). For this reason, groundwater conditions are extensively monitored both before and during operations and after restoration. The methodology on how appropriate well spacing and sampling frequency is determined is described in NUREG–1569, the Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications (NRC, 2003). The proposed Nichols Ranch ISR Project preoperational and baseline groundwater monitoring is discussed next in Section 6.3.1.1. The groundwater quality monitoring during operation and restoration is discussed in Section 6.3.1.2.

6.3.1.1 Preoperational Groundwater Sampling

GEIS Section 8.3.1.1 discusses how a baseline groundwater quality program would be established prior to uranium production (NRC, 2009). The purpose of this program is to characterize the water quality in monitoring wells that are used to detect lixiviant excursions from the ore production zones, to recover excursions, and to establish restoration target values (RTVs) for aquifer restoration after the operations phase is complete.

At the proposed Nichols Ranch ISR Project, the applicant collected groundwater samples from wells located throughout the proposed project area to evaluate preoperational water quality as part of the site characterization as discussed in SEIS Section 3.5.2.3.3. The purpose of the preoperational sampling is to evaluate the overall groundwater quality in the proposed project area under normal preoperational conditions. It is not used to establish the baseline water quality for determining the restoration criteria for the individual wellfields. The applicant also conducted pumping tests of the aquifers to characterize aquifer behavior. Nine single-well and three multiwell pumping tests were performed at the Nichols Ranch Unit to determine the hydraulic characteristics of the underlying aquifers. The applicant conducted 11 single-well tests and 3 multiwell pumping tests across the Hank Unit to determine the hydraulic characteristics of the underlying aquifers. The test results provided a preliminary baseline of groundwater behavior in the proposed project area.

During the preoperational phase of an ISR facility, an applicant sets up a monitoring network to monitor the performance of the affected aquifers during the operation of the ISR facility. The applicant at the proposed Nichols Ranch ISR Project has proposed to install ore zone monitoring wells (A Sand at the Nichols Ranch Unit; F Sand at the Hank Unit) at a spacing of

one well per 1.6 ha [4 ac] in the wellfields at both units. By license condition, the ore zone monitoring wells would be sampled four times on a twice per month basis to establish wellfield baseline water quality. Data for each water quality parameter identified in the Wyoming Department of Environmental Quality-Land Quality Division (WDEQ-LQD) Guideline No. 8 (WDEQ, 2005), including uranium parameters, would be averaged (Uranerz, 2010). If the collected wellfield data indicated that waters of different underground water classes coexist (WDEQ-LQD Rules and Regulations, Chapter VIII), then the data would not be averaged but rather treated as subzones. Sub-zone-specific data would also be averaged. A subzone boundary would be delineated halfway between the sampled well sets as appropriate. The third and fourth sample events could be analyzed for a reduced set of parameters depending on which parameters were not detected during the first and second sampling events.

Once the baseline water quality for each wellfield was established, the baseline water quality would be used to establish the RTVs that would be used to assess the effectiveness of groundwater restoration on a wellfield-specific basis. The restoration target values (parameters listed in Uranerz, 2007, Table 5-1) are a combination of the average and a range of baseline values for specific constituents in wells completed in the Nichols Ranch Unit “A Sand” ore production zone and the Hank Unit “F Sand” ore production zone. WDEQ would review and approve the baseline water quality assessment and restoration target values for each wellfield. NRC would also review and approve the restoration target values for specific parameters.

Monitoring wells would be installed in a ring around each wellfield before operations began to monitor for horizontal excursions from the ore production zones, the Nichols Ranch Unit “A Sand,” and the Hank Unit “F Sand.” Monitoring wells would be located approximately 150 m [500 ft] from the production area boundary and spaced 150 m [500 ft] apart within each unit (Uranerz, 2007). Based on the applicant’s analytical and numerical groundwater flow monitoring, the applicant concluded and NRC staff agreed that this spacing and distance were appropriate to detect potential horizontal excursions. Based on the NRC safety review NRC will require by license condition the wells to be sampled four times prior to wellfield operation on a twice per month basis to establish baseline water quality and upper control limits (UCLs) for operational excursion monitoring. The first and second samples would be analyzed for the full set of WDEQ-required constituents (Uranerz, 2007, Table D6-6a); however, the third and fourth sample events could be analyzed for a reduced set of parameters depending on which parameters were not detected during the first and second sampling events. The applicant has also proposed to measure water levels in the monitoring wells; however, these data would not be used as excursion indicators (Uranerz, 2007).

The applicant would also be required to install overlying and underlying aquifer monitoring wells in the wellfields at both units to detect vertical excursions. Overlying and underlying monitoring wells would be spaced approximately one well to every 1.6 ha [4 ac]. The overlying and underlying aquifers at the Nichols Ranch Unit, are the “B Sand” and the “1 Sand”, respectively. The overlying and underlying aquifers at the Hank Unit are the “G Sand” and the “C Sand” or “B Sand”, respectively. In narrow areas of the wellfield, the overlying and underlying monitoring wells would be spaced no farther than 305 m [1,000 ft] apart.

Like the applicant’s proposed sampling for horizontal excursions described previously, NRC will require by license condition that the applicant sample overlying and underlying aquifer wells four times prior to wellfield operation on a twice per month basis. The first and second samples would be analyzed for the full set of WDEQ-required constituents (Uranerz, 2007, Table D6-6a); however, the third and fourth sample events could be analyzed for a reduced set of parameters depending on which parameters were not detected during the first and second sampling events.

The applicant has also proposed to measure water levels in the monitoring wells; however, these data would not be used as excursion indicators (Uranerz, 2007).

The applicant installed four additional monitoring wells in the surficial aquifer—two at the Nichols Ranch Unit and two at the Hank Unit—to better characterize the background groundwater quality. As discussed in SEIS Section 3.5.2, the water quality of the surficial aquifer could be impacted by (i) spills, piping, and casing leaks, which provide an artificial connection (e.g., a wellbore) between the surficial aquifer and deeper aquifers, and (ii) discharges from current and future CBM-produced water to surface impoundments. Based on the NRC safety review, NRC will require by license condition that the applicant sample the surficial aquifer monitoring wells four times on a twice per month basis prior to wellfield operation at both the Nichols Ranch and Hank Units to establish their baseline water quality. The first and second samples would be analyzed for the full set of WDEQ-required constituents (Uranerz, 2007, Table D6-6a); however, the third and fourth sample events could be analyzed for a reduced set of parameters depending on which parameters were not detected during the first and second sampling events.

After completion of well installation and wellfield baseline groundwater sampling and wellfield characterization at both the Nichols Ranch and Hank Units, the applicant has stated it would conduct multiwell pumping tests to verify communication between the wellfield and monitoring well ring. NRC staff determined that the applicant developed an acceptable pumping test strategy to demonstrate communication between the Nichols Ranch Unit A Sand confined aquifer with the monitoring well ring. However, the applicant did not provide a pumping test strategy to demonstrate communication across the Hank Unit unconfined F Sand aquifer. Based on the NRC safety review, NRC will require by license condition that the applicant conduct a hydrogeologic test at the Hank Unit prior to lixiviant injection and report the results to NRC for review and approval. The hydrogeologic test will allow the applicant to demonstrate that a hydraulic gradient can be maintained to prevent excursions beyond the perimeter production zone monitoring well ring. Following completion of the hydrogeologic test, the applicant would develop a pumping test strategy for the Hank Unit F Sand wellfields to provide to NRC and WDEQ for review and approval (Uranerz, 2010).

After wellfield testing is completed, the applicant would prepare a production area pump test report for each production area describing the production area geology, hydrogeology, pumping test results, baseline groundwater quality for all aquifers, UCLs for the excursion monitoring wells, and RTVs for the production zone. The applicant's Safety and Environmental Review Panel (SERP), responsible for monitoring any proposed change in the facility or process, would review these reports to ensure that the hydrologic testing results and planned ISR activities were consistent with the technical requirements and did not conflict with NRC regulatory requirements. The report would then be submitted to WDEQ and NRC for review and approval before ISR operations commenced. Based on the NRC safety review, NRC will have a license condition addressing submission of the first production area pump test reports in each unit for review and approval.

The Uranerz license application (Uranerz, 2007) provides detailed procedures for sampling and analysis, including methods for measuring water levels, well purging and sampling protocols, sample preservation and documentation, analytical methods, and quality assurance/quality control requirements.

6.3.1.2 Groundwater Quality Monitoring

GEIS Section 8.3.1.2 details the placement of monitoring wells at an ISR facility around the wellfields in the aquifers overlying and underlying the ore-bearing production aquifers and within the wellfields for early detection of potential horizontal and vertical lixiviant excursions during production operations. Monitoring well placement is based on a number of factors including the nature and extent of the confining layer and the occurrence of drill holes, hydraulic gradient and aquifer transmissivity, and well abandonment procedures used in the region. The ability of a monitoring well to detect groundwater excursions is influenced by several factors, such as the thickness of the aquifer, the distance between the monitoring wells and the wellfield, the distance between adjacent monitoring wells, the frequency of groundwater sampling, and the magnitude of changes in lixiviant migration indicator parameters. Therefore, the spacing, distribution, and number of monitoring wells are site specific.

The applicant's proposed groundwater monitoring program at the Nichols Ranch ISR Project would be designed to detect lixiviant excursions outside the producing wellfield into the overlying and/or underlying or adjacent aquifers. Lixiviant excursions can be caused by (i) improper water balance between injection and recovery rates, (ii) undetected high permeability strata or geological faults, (iii) improperly plugged or abandoned drill holes, (iv) discontinuity within confining layers, (v) poor well integrity, or (vi) hydrofracturing of the ore zone or surrounding units. Section 5.7.8 of the applicant's technical report documents the groundwater monitoring and underlying aquifer monitoring wells twice monthly at intervals of approximately 2 weeks and analyze them for the UCL parameters of chloride, total alkalinity, and conductivity, which are the excursion indicators (Uranerz, 2007). The applicant would also measure and record static water levels. Chloride was selected as an excursion indicator because of its low concentration in native groundwater; chloride would be introduced into the lixiviant from the ion exchange process and is very mobile in groundwater. Conductivity was selected as an excursion indicator because it is an indicator of overall groundwater quality. Finally, total alkalinity was selected as an excursion indicator because bicarbonate is the major constituent added to the lixiviant during production. The applicant would submit quarterly static water level measurements and monitoring data to WDEQ and maintain copies onsite for NRC review (Uranerz, 2007).

After operations were complete, the wellfields would be restored. The applicant would sample the same horizontal perimeter and overlying/underlying monitoring wells used during production for aquifer restoration. During restoration, lixiviant injection would cease, thereby reducing the potential for an excursion. The applicant has proposed a reduced groundwater monitoring program during aquifer restoration because lixiviant injection would have ceased. During the aquifer restoration phase, wells located in the perimeter monitoring ring and completed in the overlying and underlying aquifers would be sampled every 60 days for chloride, alkalinity, and conductivity excursion parameters. An excursion would be defined in the same manner as during operations and subject to the same corrective action requirements.

6.3.2 Wellfield and Pipeline Flow and Pressure Monitoring

GEIS Section 8.3.2 discusses operator monitoring of injection and production well flow rates to manage the entire wellfield water balance. The pressure of each production well and the production trunk line in each wellfield header house would also be monitored. Unexpected losses of pressure may indicate equipment failure, a leak, or well integrity problems.

The applicant has proposed an extensive program of wellfield and pipeline flow and pressure monitoring at the Nichols Ranch ISR Project as described in Uranerz's license application technical report Section 3.5 (Uranerz, 2007). Injection well and production well flow rates and pressures would be monitored at each header house to balance injection and production in each wellfield pattern and throughout the wellfield. Individual well flow readings would be recorded during each shift, and the overall wellfield flow rates would be balanced daily. Flow data would also be checked at the central processing plant and satellite facility. The recovery and injection trunk lines would be equipped with electronic pressure gauges. Information from these gauges would be monitored from the central processing plant and satellite facility control rooms. High and low pressure and flow alarms would alert wellfield and plant operators if specified ranges were exceeded. Automatic shutoff valves would stop the flow in the event of significant changes of volume or pressure. The wellfield and pipeline flow monitoring would alert the operators to detect malfunctions that could lead to either wellfield infrastructure or pipeline failures, thus minimizing the potential impact to groundwater.

6.3.3 Surface Water Monitoring

The applicant does not plan to conduct physiochemical monitoring (as described in Section 6.3 of the SEIS) of surface water, because no surface water discharges would occur as part of the ISR process at the proposed Nichols Ranch ISR Project. To ensure the protection of surface water from unexpected leaks, the applicant would monitor each injection and production well as described previously to detect a change in flow and/or pressure, which could indicate a leak or rupture in the system. If a leak occurred, the system would be shut down and remediation conducted as appropriate.

6.3.4 Meteorological Monitoring

To describe the affected environment and assess air quality impacts resulting from the proposed Nichols Ranch ISR Project, the applicant used meteorological data from the Antelope Coal Company Mine meteorological station located approximately 77 km [48 mi] southeast of the proposed Nichols Ranch ISR Project. The Antelope Coal Company Mine has similar topographic features as the proposed Nichols Ranch ISR Project site (Uranerz, 2007) and is characterized by mildly rolling hills covered with grass and sparse shrubs. However, based on the NRC safety review of the applicant's technical report, the applicant will be required by license condition to install a meteorological station within the proposed project area to collect meteorological data for at least 1 year before ISR operations begin. The applicant would be required to submit this information to NRC for review.

6.4 Ecological Monitoring

6.4.1 Vegetation Monitoring

As discussed in Section 6.2.3, the applicant concluded from its preoperational vegetation sampling program and through modeling that the ingestion pathway would not be a significant contributor to radiological dose. Therefore, the applicant does not intend to conduct vegetation, food, or fish sampling, because the predicted dose to an individual from these pathways would be less than 5 percent of the applicable radiation protection standard.

6.4.2 Wildlife Monitoring

Large game animal such as deer or pronghorn have extensive ranges and are not confined to the site. Therefore, the potential for bioaccumulation of radionuclides in these animals would be limited because they would likely derive only a small fraction of total sustenance from the proposed Nichols Ranch ISR Project. No fish species occur within the proposed project area because surface water is ephemeral and there is not a sufficient volume of surface water to support aquatic species.

The applicant has proposed wildlife studies that include annual raptor and sage-grouse surveys between late April and early May to identify the occurrence of new nests and leks and to assess whether known nests or leks are still active (Uranerz, 2007). The applicant has proposed to record activity at identified raptor nests and known leks based on the preoperational surveys that were performed. The applicant has also proposed to survey areas of planned activity (i.e., wellfields, central processing plant, satellite facility) for the life of the ISR project and within a 1.6-km [1-mi] radius of the activity (Uranerz, 2007) to protect against unforeseen conditions, such as a new nest or a new lek being affected by ISR operations.

6.5 References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, “Domestic Licensing of Source Material.” Washington DC. U.S. Government Printing Office.

10 CFR Part 40. Appendix A *Code of Federal Regulations*, Title 10, *Energy*, Part 40, “Domestic Licensing of Source Material.” “Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content.” Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Washington, DC: NRC. May 2009.

NRC. NUREG–1569, “Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications—Final Report.” Washington, DC: NRC. June 2003.

NRC. Regulatory Guide 8.25, “Air Sampling in the Workplace, Revision 1.” Washington, DC: NRC. June, 1992.

NRC. Regulatory Guide 4.14, “Radiological Effluent and Environmental Monitoring at Uranium Mills, Revision 1.” Washington, DC: NRC. April 1980.

Uranerz. Letter from M. Thomas, Environmental Safety and Health Manager, Uranerz Energy Corporation, to R. Linton, Project Manager, U.S. Nuclear Regulatory Commission. “Subject: Responses to the Open Issues to the Safety Evaluation Report for the Nichols Ranch ISR Project License Application.” ML100740143. February 24, 2010.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

WDEQ. "Guideline No. 8 Hydrology, Coal and Non Coal." <http://deq.state.wy.us/lqd/guidelns/Guideline8.pdf> March 2005 (13 October 2009).

7 COST-BENEFIT ANALYSIS

7.1 Introduction

This chapter summarizes benefits and costs associated with Alternative 1 (implementing the proposed action), Alternative 2 (the No-Action alternative), and Alternative 3 (Modified Action–No Hank Unit). Chapter 4 of this Supplemental Environmental Impact Statement (SEIS) discusses the potential socioeconomic impacts from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch *In-Situ* Uranium Recovery (ISR) Project by Uranerz Energy Corporation (Uranerz, referred to herein as the applicant).

Implementation of the proposed action would primarily generate regional and local benefits and costs. Regional benefits from constructing and operating the proposed Nichols Ranch ISR Project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Some of these regional benefits, such as tax revenues, would accrue specifically to Campbell and Johnson Counties where the proposed project would be located, and to the towns closest to the project site. Costs associated with the proposed Nichols Ranch ISR Project would be, for the most part, limited to the area surrounding the site. Examples of these costs would include changes to current land use changes to, water use, and increased road traffic.

7.2 No-Action Alternative

Under the No-Action alternative, the U.S. Nuclear Regulatory Commission (NRC) would not grant the license for the proposed Nichols Ranch ISR Project. The No-Action alternative would result in Uranerz not constructing, operating, restoring the aquifer, or decommissioning the proposed Nichols Ranch ISR Project. No facilities, roads, or wellfields would be built; no pipeline would be laid as described in Section 2.1.1.1.2 in this SEIS. No uranium would be recovered from the subsurface ore body; therefore, injection, production, and monitoring wells would not be installed to operate the facility. No lixiviant would be introduced to the subsurface, and no buildings would be constructed to either process extracted uranium or to store chemicals used in the process. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated from the proposed action. As a result, the proposed site would not be disturbed by the proposed project activities and ecological, natural, and socioeconomic resources would remain unaffected. Potential environmental impacts from the proposed action would be avoided. Similarly, project-specific socioeconomic impacts (e.g., employment, economic activity, population, housing, local finance) would also be avoided.

7.3 Benefits and Costs from the Proposed Action in Campbell and Johnson Counties

Under the proposed action, the applicant would construct, operate, conduct aquifer restoration and decommission the proposed Nichols Ranch ISR Project site located in Campbell and Johnson Counties, Wyoming. Construction of the central processing plant, satellite facility, access roads, and initial development of the wellfields for the proposed project would take approximately 9 months to 1 year to complete (Uranerz, 2007). As discussed in Section 2.1.1..2.7, construction of the first production areas (wellfield 1) at the Nichols Ranch and Hank Units would overlap. Following this, the second production areas (wellfield 2) would be constructed at both sites; however, construction of the second production areas (wellfield 2)

would overlap the operations phase (wellfield 1) at both the Nichols Ranch and Hank Units. The schedule showing production, aquifer restoration, and decommissioning phases is shown in Figure 2-1. The Nichols Ranch Unit is expected to require a 6-month ramp up to full annual production, after which the Hank Unit would start a 6-month ramp up to full production. Uranium extraction at the Nichols Ranch Unit would require 3 to 4 years; extraction at the Hank Unit is estimated to require 4 to 5 years. Aquifer restoration activities and stability monitoring following restoration would occur over a 1- to 5-year period within the proposed 10-year license period. The applicant has proposed to conduct final wellfield and site decommissioning within 1 to 2 years following aquifer restoration and stability monitoring.

The principal socioeconomic impact or benefit from the proposed Nichols Ranch ISR Project would be an increase in jobs in the region. Over the 10-year license period, the applicant expects to employ approximately 45 to 55 employees for the construction and operations phases and approximately 20 employees to support aquifer restoration and decommissioning activities (Uranerz, 2007). As discussed in Section 4.11, construction and decommissioning workers would most likely not relocate to the area, because of the shorter period of time (9 months to 2 years) over which these activities would occur. If the majority of operational requirements were filled by a workforce from outside the region, given a multiplier of about 0.7,[1] there could be an influx of 32 to 39 jobs (i.e., 45 jobs × 0.7 = 32 jobs and 55 jobs × 0.7 = 39 jobs).

The closest town to the proposed Nichols Ranch ISR Project is the town of Wright with an estimated population of 1,462 (U.S. Census Bureau, 2008). However, employees supporting operations could prefer to reside in larger communities (NRC, 2009) and therefore could choose to reside in larger population centers such as Gillette and Casper. The influx of these jobs and a reduction of unemployment would have a MODERATE benefit to the businesses in the smaller towns such as Wright and a SMALL to MODERATE impact to businesses in larger towns located within commuting distance from the proposed project site.

In addition to creating jobs, the operation of the proposed Nichols Ranch ISR Project and its employment opportunities would contribute to local, regional, and state revenues through the purchase of goods and services and through the taxes levied on such goods and services. Furthermore, severance taxes of 4 percent of taxable market value associated with uranium milling/mining in Campbell and Johnson Counties are levied by the State of Wyoming Mineral Tax Division of the Department of Revenue (Wyoming Department of Revenue, 2009). The applicant's current resource estimate for the proposed Nichols Ranch ISR Project is 1,145,000 kg [2,521,000 lbs] of uranium for the Nichols Ranch Unit and 841,100 kg [1,852,000 lbs] of uranium for the Hank Unit (Uranerz, 2007). If the applicant is able to fully recover this resource and sell it at a nominal market price of $60 per pound of uranium, the severance tax would yield approximately $10,495,200 in net economic benefits over the life of the project. This figure excludes potential reserve resources and the potential benefits derived from taxes on royalties or lease payments to local landowners stemming from the operation of the proposed Nichols Ranch ISR Project.

[1]The economic multiplier is used to summarize the total impact that can be expected from change in a given economic activity. It is the ratio of total change to initial change. The multiplier of 0.7 was used as a typical employment multiplier for the milling/mining industry (Economic Policy Institute, 2003).

7.3.1 Benefits from Potential Production

The employment generated by the proposed Nichols Ranch ISR Project and the taxes paid by the applicant depend on the production of yellowcake. The volume of yellowcake produced would depend on the market price for yellowcake (as uranium) and the cost of production. Since 2007, the spot-market price for uranium has fluctuated significantly, from a high of over $130 in 2007 to as low as $40 in 2009. As of December 10, 2010, the price was $60 pound.

The project‘s potential benefits to the local community depend on the applicant’s operating costs being lower than the future price of uranium. If the price of uranium drops below the operating costs, then the operation of the facility would become uneconomic and the operations could be suspended and/or discontinued.

7.3.2 Costs to the Local Communities

Table 7-1 identifies towns within a 40-km [25-mi] radius of the proposed Nichols Ranch ISR Project and towns within commuting distance {greater than 40 km [25 mi]} from the site and their population and distance from the proposed project.

As stated in Section 7.3, the proposed Nichols Ranch ISR Project would employ 45 to 55 workers during the ISR operations phase; if the majority of these workers came from outside the region, there could be an influx of 32 to 39 jobs (applying an economic multiplier of 0.7). Assuming that operations workers would tend to relocate closer to the site, the creation of these new jobs could result in an influx of 79 to 97 people, based on an assumption of 2.48 persons per household for the State of Wyoming (USCB, 2000).

Chapter 4 of the SEIS states that because of the small relative size of the workforce at the proposed Nichols Ranch ISR Project, the potential socioeconomics impact would be SMALL except for the impact on housing, which could range from SMALL for the region to MODERATE for nearby communities. As stated in Section 7.3, operations employees could prefer to reside in larger communities (NRC, 2009). The larger population centers closest to the Nichols Ranch ISR Project are Gillette and Casper, as shown in Table 7-1. The influx of new jobs along with the reduction in unemployment would result in a SMALL impact for the region to a MODERATE impact for nearby communities through an increase in housing demand and in the construction of new homes within the region of influence. The population growth would have a SMALL impact on education infrastructure and health and social services.

The local communities would require a minimal increase in emergency response and medical treatment capabilities because of the small risk of an industrial accident from the proposed action.

7.4 Evaluation Findings of Alternative 3 (Modified Action–No Hank Unit)

Under the modified action alternative, the applicant would construct, operate, and decommission and conduct aquifer restoration at only the Nichols Ranch Unit and not the Hank Unit. Thus, the project would only consist of extracting uranium from the Nichols Ranch Unit

Table 7-1. Towns Near the Proposed Nichols Ranch ISR Project

Towns Within 40 km [25 mi] From the Project Site		
Town	**Population**	**Distance from Project in km [mi]**
Wright	1,462	32 [20]
Edgerton	176	40 [25]
Midwest	435	40 [25]
Towns Greater Than 40 km [25 mi] From the Project Site		
Town	**Population**	**Distance from Project in km [mi]**
Gillette	26,871	74 [46]
Casper	54,047	98 [61]
Source: USCB (2008)		

and processing at a central processing plant also located at the Nichols Ranch Unit. Construction of the central processing plant, access road, and initial development of the wellfields at the Nichols Ranch Unit would still take place over a 9-month to 1-year period. Using the projected schedule for the proposed action shown in Figure 2-1 and looking only at the Nichols Ranch Unit wellfields, the production in each of the two wellfields would take approximately 2.5 years within an approximate 9-year project lifespan. Aquifer restoration and stability monitoring following restoration would occur over a 1- to 3-year period within the overall life of the project. The applicant would conduct final wellfield and site decommissioning 1 to 2 years following aquifer restoration and stability monitoring.

Because only two instead of four production areas would be developed under Alternative 3, fewer workers would be employed compared to the proposed action. The principal socioeconomic impact or benefit from this alternative would be an increase in jobs in the region, although it would be less than the proposed action because only one unit would be developed and the operations would be reduced. As discussed in Section 7.3, construction and decommissioning workers could choose not to relocate to the area and some operations workers could prefer to reside in larger communities. Therefore, under Alternative 3, the influx of jobs and a reduction in unemployment would have a MODERATE benefit to businesses in the smaller towns such as Wright and could have a SMALL to MODERATE impact on businesses in larger towns located within commuting distance from the project site.

Chapter 4 of the SEIS states that because of the small relative size of the workforce under Alternative 3, the impact would be less than that described for the proposed action. Thus, the socioeconomic impact would be SMALL except for the impact on housing. The influx of new jobs along with the reduction in unemployment would result in a SMALL impact for the region to a MODERATE impact for nearby communities through an increase in housing demand and in the construction of new homes within the region of influence. The population growth would have a SMALL impact on education, health, and social services.

In addition to creating jobs, the implementation of Alternative 3 and its employment opportunities would contribute to local, regional, and state revenues through the purchase of goods and services and through the taxes levied on such goods and services. The applicant's current resource estimate for the proposed Nichols Ranch ISR Project is 1,145,000 kg [2,521,000 lbs] of uranium for the Nichols Ranch Unit (Uranerz, 2007). If the applicant can fully recover this resource at the Nichols Ranch Unit and sell it at a nominal market price of $60 per pound of uranium, the severance tax would yield approximately $6,050,400 in net economic benefits over the life of the project excluding potential reserve resources and the potential

benefit from taxes on royalties or lease payments to local landowners from the operation of the project.

7.5 Evaluation of Findings

Implementation of either the proposed action or Alternative 3 would have a SMALL to MODERATE overall economic impact on the region of influence and nearby communities. The implementation of the proposed action would generate primarily regional and local benefits and costs. The regional benefits from operation of the proposed Nichols Ranch ISR Project would be increased employment, economic activity, and tax revenues in the region around the site. Some of these regional benefits, such as tax revenues, would accrue specifically to Campbell and Johnson Counties and towns closest to the project site. Other benefits may extend to neighboring counties in the State of Wyoming. Costs associated with the proposed Nichols Ranch ISR Project would be limited to the area surrounding the site and the communities within commuting distance. The implementation of Alternative 3 would still generate primarily regional and local benefits and costs. However, because less yellowcake would be produced, there would be a need for fewer employees and the overall benefits would be reduced. Table 7-2 summarizes the costs and benefits of the proposed action and Alternative 3.

Table 7-2. Summary of Costs and Benefits of the Nichols Ranch ISR Project

Benefits*	
Cost-Benefit Category	**Proposed Action**
Capacity Produced	4.4 million pounds of U_3O_8
Other Monetary	$10.5 million (estimated)
Nonmonetary (50% of jobs would be from Campbell County)	45 to 55 jobs—during construction, operation, aquifer restoration, and decommissioning 32 to 39 jobs—local jobs from economic multiplier during operation and aquifer restoration
Costs	
Cost-Benefit Category	**Proposed Action**
Education Infrastructure	SMALL
Health and Social Services	SMALL
Housing Demand	SMALL for the region MODERATE for nearby communities
Emergency Response	SMALL
*Source: Uranerz (2007)	

7.6 References

Economic Policy Institute. “Updated Employment Multipliers for the U.S. Economy.” Washington, DC. August. < http://www.epi.org/page/old/workingpapers/epi_wp_268.pdf> (13 October 2009). 2003.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

USCB. "2008 Population Estimates for Wright, Edgerton, Midwest, Gillette, and Casper in Wyoming." <http://factfinder.census.gov> (16 October 2009). ML092940144. 2008

USCB. State & County Quick Facts for Wyoming." <http://quickfacts.census.gov/qfd/states/56000.html> ADAMS No. ML092940077. (13 October 2009). 2000.

Wyoming Department of Revenue. "State of Wyoming Department of Revenue 2009 Annual Report." <http://revenue.state.wy.us/PortalVBVS/uploads/Department%20of%20Revenue%20%2010.29.2009.pdf> (11 November 2009). 2009.

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the potential environmental impacts and consequences of the proposed action and reasonable alternatives, including the No-Action alternative. In doing so, the potential impacts and consequences of the proposed action are discussed in terms of (i) the unavoidable adverse environmental impacts, (ii) the relationship between local short-term uses of the environment and the maintenance of long-term productivity, and (iii) the irreversible and irretrievable commitment of resources. The information is presented for the proposed action for the 13 resource areas and discussed by stage of the proposed facility lifecycle (i.e., construction, operation, aquifer restoration, and decommissioning). The impacts are described in Table 8-1.

The following terms are defined in the U.S. Nuclear Regulatory Commission (NRC) NUREG–1748 (NRC, 2003).

- Unavoidable adverse environmental impacts: applies to impacts that cannot be avoided and for which no practical means of mitigation are available
- Irreversible: involves commitments of environmental resources that cannot be restored
- Irretrievable: applies to material resources and would involve commitments of materials that, when used, cannot be recycled or restored for other uses by practical means
- Short-term: represents the period from preconstruction to the end of the decommissioning activities and therefore generally affects the present quality of life for the public
- Long-term: represents the period of time following the termination of the site license, with the potential to affect the quality of life for future generations

As discussed in Chapter 4, the significance of potential environmental impacts is categorized as follows:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: The environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

These alternatives and their environmental impacts are summarized in the following sections. Sections 8.1, 8.2, and 8.3 describe the environmental consequences from implementing the Proposed Action, the No-Action alternative, and Alternative 3 (Modified Action), respectively.

8.1 Proposed Action (Alternative 1)

Under the Proposed Action, NRC would issue a source material license to Uranerz Energy Corporation (Uranerz, referred to herein as the applicant) for the construction, operation, aquifer

restoration, and decommissioning of facilities for *in-situ* recovery (ISR) uranium milling and processing at the proposed Nichols Ranch ISR Project. The construction phase is expected to last from about 9 to 12 months during which time buildings, access roads, wellfields, pipelines, and underground injection control (UIC) disposal wells for injection of liquid effluent would be constructed. The applicant estimates these actions would disturb approximately 120 ha [300 ac] of the 1,365 ha [3,371 ac] of the proposed project area over the life of the project. The operations phase would last about 5 years; however, wellfield production would be staggered by wellfield during that time as shown in Figure 2-1 and described in SEIS Chapter 2. The duration of operations in each wellfield would range from 1.25 to 2.5 years. Injection wells would inject lixiviant (recovery) solutions into the ore body to recover uranium. Production wells would recover the dissolved uranium, which would be processed through the central processing plant at the Nichols Unit. Aquifer restoration would be initiated to ensure that water quality and groundwater use from surrounding aquifers was not impacted by the proposed action. The applicant has estimated that aquifer restoration would take approximately 5 years and would also be staggered for each wellfield following the production schedule as shown in Figure 2-1 (Uranerz, 2007). During the aquifer restoration phase, contaminated groundwater would be transferred from one wellfield to the next, replaced with baseline groundwater through pumping action (i.e., “sweeping” groundwater), and then passed through ion exchange and reverse osmosis equipment during groundwater treatment to minimize the groundwater volume consumed during the aquifer restoration phase. During decommissioning, estimated to take approximately 1 to 2 years, disturbed lands would be returned to their preextraction use. The wells would be plugged and abandoned and land surface reclaimed. In its license application, Uranerz committed to the follow cultural resource mitigation measures (Uranerz, 2010) for the Nichols Ranch ISR Project and to adhere to the stipulations in the Pumpkin Buttes Programmatic Agreement (PA) between the Bureau of Land Management (BLM) and the Wyoming SHPO (BLM, 2009) at the Hank Unit (Uranerz, 2010). The potential environmental consequences from implementing the proposed action are summarized in Table 8-1.

8.2 No-Action (Alternative 2)

Under the No-Action alternative (Alternative 2), NRC would not issue a license. The applicant would neither construct buildings, roads, or wellfields nor would the facility be operated at the proposed Nichols Ranch ISR Project. Uranium ore would not be recovered from the site, and the applicant would not receive a license. Under Alternative 2 there would be no impact to any of the 13 resource areas from the proposed licensing action. There would be no unavoidable adverse environmental impacts attributable to the proposed action, and no relationship between local short-term or long-term uses of the environment. Therefore, there would be no irreversible and irretrievable commitment of resources.

8.3 Modified Action—No Hank Unit (Alternative 3)

Under Alternative 3, the applicant would construct and operate facilities for ISR uranium milling and processing, but only at the Nichols Ranch Unit and not the Hank Unit. NRC would issue a license for construction, operation, aquifer restoration, and decommissioning for an ISR facility located at the Nichols Ranch Unit only. During the construction phase, buildings, an access road, two wellfields, pipelines, and disposal wells would be constructed and operated resulting in the disturbance of approximately 61 to 81 ha [150 to 200 ac] within the 453 ha [1,120 ac] licensed area. The operations phase would last about 7 years; however, the individual wellfields themselves would be operational from 1.25 to 2.5 years (refer to SEIS Figure 2-1). The estimated uranium content to be milled under Alternative 3 would be approximately 1,145,000 kg [2,521,000 lb] compared to an estimated uranium content of approximately

1,986,100 kg [4,373,000 lb] under the proposed action. The potential environmental impacts on each of the 13 resource areas would either be similar to or less than those for the proposed action under Alternative 1 as summarized in Table 8-1. A smaller area of land would be disturbed, reducing the impact to geology and soils and to ecological resources such as sage grouse leks because eight leks could potentially be affected at the Hank Unit. Generally, less equipment and workers would be needed because a smaller area would be developed, thus reducing the potential transportation, air quality, noise, visual and scenic resources, and socioeconomic impacts. Two identified archaeological sites and one TCP (48CA6754 48CA6927, and 48CA6148), which are located on top of or between the ore body and proposed monitoring wells, would be unaffected if the Hank Unit was not licensed. Under Alternative 3, impact to the five identified Traditional Cultural Properties (TCPs) would also be eliminated. The potential environmental consequences from implementing Alternative 3 are summarized in Table 8-1.

8.4 References

BLM. "Programmatic Agreement Between Bureau of Land Management and Wyoming State Historic Preservation Officer Regarding Mitigation of Adverse Effects on the Pumpkin Buttes TCP From Anticipated Federal Minerals Development." ADAMS No. ML092640122. 2009.

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. August, 2003.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

Table 8-1. Summary of Environmental Consequences of the Proposed Action

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Land Use 4.2.1	Under the proposed action (Alternative 1), there would be a small impact on land use during the construction and decommissioning phases of the proposed Nichols Ranch ISR Project. During construction, approximately 121 ha (300 ac) at the Nichol Ranch and Hank Units combined would be fenced and disturbed during earth moving activities to construct the central processing plant, satellite facility, build access roads, and develop wellfields. This acreage is less than 10 percent of the proposed project area. During decommissioning, land would be impacted by earthmoving activities to reclaim and reseed the affected areas.	No impact for either the proposed action (Alternative 1) or Alternative 3. There would be no irreversible or irretrievable commitment of land resources from implementing either Alternative 1 or Alternative 3. As shown in Figure 2-1, the proposed duration for ISR activities at the Nichols Ranch Unit has been estimated at approximately 8 years and at approximately 9 years at the Hank Unit. After this time, the land would be reclaimed and made available for other uses.	There would be a short-term impact to land use at both the Nichols Ranch and Hank Units from implementing the proposed action from temporary alteration of rangeland leases, and short-term, restricted access to neighboring lands. Approximately 121 ha (300 ac) of the proposed project area would be unavailable for other uses such as rangeland or grazing; coal bed methane (CBM) or oil and gas operations could coexist with the applicant's proposed action. The impact would be SMALL.	There would be no long-term impact on land resources from implementing the proposed action (Alternative 1). The land would be available for other uses at the end of the license period.
	Under Alternative 3, approximately 60 ha (150 ac) of land or less than 5 percent of the proposed project area would be affected by earthmoving activities at the Nichols Ranch Unit to build the central processing plant, develop two wellfields at the Nichols Ranch Unit, and construct an access road. No earth-moving activities would occur at the Hank Unit.	Under Alternative 3, the land comprising the Hank Unit (911 ha [2,251 ac]) would be available for other uses such as grazing or mineral exploration.	Under Alternative 3, only 60 ha (150 ac) of land at the Nichols Ranch Unit would be unavailable for other uses. Land use at the Hank Unit would not be limited.	There would be not long-term impact on land resources from implementing Alternative 3. The land would be available for other uses at the end of the license period.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Transportation 4.3.1	Under Alternative 1 (the proposed action, there would be a SMALL impact. Increased truck and vehicle traffic along State Highway (SR) 387 and along SR 50 to access the Nichols Ranch and Hank Units, respectively, would result in small changes to the current uses of these local roads.	No Impact.	Under Alternative 1 there would be a SMALL impact. Small increases in the number of traffic accidents resulting in injuries or fatalities could occur. The small increase in vehicular emissions should not degrade local air quality. The generic environmental impact statement (GEIS) concluded the risk from transporting yellowcake, ion exchange resin, byproduct material, and hazardous chemicals was SMALL (NRC, 2009).	There would be no transportation impacts attributable to the proposed Nichols Ranch ISR Project following license termination.
	Under Alternative 3, there would be a SMALL impact. Increased truck and vehicle traffic would be limited to use of SR 387 at the Nichols Ranch Unit.	No Impact.	Under Alternative 3, there would be a SMALL impact. The number of traffic-related injuries and fatalities would likely be less compared to Alternative I since only roads at the Nichols Ranch Unit would be used. Likewise, air emissions would be less because of less traffic.	There would be no transportation impacts attributable to activities at the Nichols Ranch Unit following license termination.
Geology and Soils 4.4.1	Under the proposed action (Alternative 1), there would be a SMALL impact to soils primarily from earthmoving activities associated with the construction and decommissioning phases of the proposed action. Approximately, 121 ha [300 ac] of the surface at both the Nichols and Hank Units would be disturbed to construct the wellfields including header houses, the facilities, and access roads. These impacts would be temporary and at the end of the decommissioning phase the topsoil would be replaced.	Under the proposed action (Alternative I) soil layers would be disturbed during all ISR phases which is irreversible however, topsoil salvaged during construction would be stored and reapplied during decommissioning. Therefore, the potential impact would be SMALL. Reseeding and re contouring would mitigate this impact.	There would be a SMALL impact on geology and soils during construction, from soil disturbance during construction of the central processing plant, satellite facility, wellfields and access roads at the Nichols and Hank Units. These impacts would be for the duration of the proposed action (approximately nine years) and affect approximately 121 ha [300 ac].	There would be no long-term impacts to geology and soils

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Geology and Soils 4.4.1	Under Alternative 3, the area to be disturbed would be less. Approximately, 61 to 81 ha [150 to 200 ac] of the surface would be disturbed at the Nichols Ranch Unit. The Hank Unit would be unaffected.	Under Alternative 3, since soil removal activities would only occur at the Nichols Ranch Unit, the potential impact would be less than described for the proposed action because less area would be affected. Topsoil salvaged during the construction phase would be replaced during the reclamation and reseeding processes.	Under Alternative 3, less of a disturbance to geology and soils	There would be no long-term impacts to geology and soils
Surface Waters and Wetlands 4.5.1.1	There would be a SMALL impact on surface water from the construction of the central processing plant at the Nichols Ranch Unit and the satellite facility at the Hank Unit, and the two wellfields located at each unit from increased sediment yield in the disturbed areas. No wetlands would be disturbed by the proposed action. However, the applicant has proposed to install wells in the main channels of ephemeral drainages and proposed erosion control mitigation measures such as grading and contouring, installing culverts, and constructing low water crossings of stone, water contour bars and to identify designated traffic routes to mitigate the potential impact on surface water.	There would be no irreversible and irretrievable commitment of either surface water or wetlands from implementing the proposed action. No drainage or body of water would be significantly altered during operations. There would be no impact to wetlands.	Normal construction activities within both the Hank and Nichols Units and within the two wellfields located at each unit, at the central processing plant at the Nichols Unit and at the satellite facility at the Hank Unit, along pipelines and access roads have the potential to result in increased sediment yield in surface water runoff. However, given the absence of perennial streams, the small area to be affected, the potential impact on surface water during construction and decommissioning would primarily be limited to uncommon precipitation or runoff events. These impacts would be further mitigated by implementing the best management practices described above.	There would be no long-term impact to surface water and wetlands following license termination under the proposed action (Alternative 1).

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	Under Alternative 3, there would be a SMALL impact on surface water from the construction of the central processing plant at the Nichols Ranch Unit and the two wellfields located at the unit, and from increased sediment yield in the disturbed areas. Since the Hank Unit would not be developed, there would be no impact to the Dry Willow drainage area, in which the Hank Unit is located. No wetlands would be disturbed by the implementation of Alternative 3. However, since the applicant has proposed to install wells in the main channels of ephemeral drainages they have proposed erosion control mitigation measures such as grading and contouring, installing culverts, and constructing low water crossings of stone, water contour bars and to identify designated traffic routes to mitigate the potential impact on surface water from the operations at the Nichols Ranch Unit.	Under Alternative 3, there would be no irreversible and irretrievable commitment of either surface water or wetlands. No drainage or body of water would be significantly altered during operations. There would be no impact to wetlands.	Under Alternative 3, normal construction activities would only occur at the Nichols Ranch Unit including the central processing plant, along pipelines and access roads to the wellfields, and within the wellfields themselves resulting in the potential for increased sediment yield in surface water runoff from the Nichols Ranch Unit. However, given the absence of perennial streams, the small area that would be affected, the potential impact on surface water during construction and decommissioning would primarily be limited to uncommon precipitation or runoff events. These impacts would be further mitigated by implementing the best management practices described above.	Under Alternative 3, there would be no long-term impact to either surface water or wetlands following license termination.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Groundwater 4.5.2.1	Under the proposed action (Alternative 1), there would be a SMALL impact on groundwater. Groundwater would be impacted from in situ recovery by consumption of groundwater and degradation of water quality in the ore production zone, the "A" Sand aquifer at the Nichols Ranch Unit, and the "F" Sand Aquifer at the Hank Unit. At both the Nichols Ranch Unit and the Hank Units, the net consumptive groundwater use during operations and aquifer restoration would reduce the groundwater levels in the A and F Sand aquifers by a small fraction of the groundwater levels currently within the aquifers in the Powder River Basin.	Under Alternative 1 (the proposed action), about 99 percent of the groundwater used during the ISR process at the Nichols Ranch Unit would be treated and re-injected into the subsurface and about once percent of the groundwater in the A Sand aquifer would be consumed. At the Hank Unit, about 97 percent of the groundwater used during the ISR process would be treated and re-injected into the subsurface; therefore, about three percent of the groundwater from the F Sand aquifer would be consumed.	Under Alternative 1 (the proposed action), short-term impacts to groundwater would include degradation of the water quality within the ore production zones and the potential to drawdown the water level in neighboring private wells. The applicant has stated that it has confidential agreements in place with private well owners to either provide the pumping capability or to replace wells if the water level drawdowns affect well yield.	Both the State of Wyoming and NRC require restoration of affected groundwater following operations. The groundwater quality would be restored to ensure that adjacent aquifers would not be affected. After production and aquifer restoration are completed and groundwater withdrawals were terminated at both the Nichols Ranch and Hank Units, the groundwater levels would recover with time.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	Under Alternative 3, there would be a SMALL impact on groundwater. Groundwater would only be impacted from in situ recovery by consumption of groundwater and degradation of water quality in the ore production zone at the Nichols Ranch Unit, the "A" Sand aquifer. Since the Hank Unit would not be developed under this alternative, the groundwater in the "F" Sand aquifer would be unaffected. The net consumptive groundwater use during operations and aquifer restoration would reduce the groundwater levels in the A Sand aquifer by a small fraction of the groundwater levels currently within the aquifers in the Powder River Basin.	Under Alternative 3, about 99 percent of the groundwater used during the ISR process at the Nichols Ranch Unit would be treated and re-injected into the subsurface and about once percent of the groundwater in the "A" Sand aquifer would be consumed. Since the Hank Unit would not be developed, there would be no net consumption of groundwater from the "F" Sand aquifer.	Under Alternative 3, short-term impacts to groundwater would include degradation of the water quality within the ore production zone and the potential to drawdown the water level in neighboring private wells. The applicant has stated that it has confidential agreements in place with private well owners to either provide the pumping capability or to replace wells if the water level drawdowns affect well yield. Since no development would occur at the Hank Unit, the well yields in private wells in the vicinity of that unit would be unaffected.	Both the State of Wyoming and NRC require restoration of affected groundwater following operations. The groundwater quality would be restored to ensure that adjacent aquifers would not be affected. After production and aquifer restoration are completed and groundwater withdrawals were terminated at the Nichols Ranch Unit, the groundwater level would recover with time.
Ecological Resources 4.6.1	Under Alternative 1 (the proposed action), there would be a SMALL impact. Construction and decommissioning of the Nichols Ranch ISR Project would result in short-term loss (over the ISR facility lifecycle) of vegetation covering a total of 121 ha [300 ac] at the combined Nichols Ranch and Hank Units. Since sagebrush shrublands and mixed grasslands cover 88 percent of the proposed project area, these would be the vegetative communities most likely to be affected. However, the disturbed area would be limited to approximately 24 to 32 ha [60 to 80 ac] of land at any given time. The short-term loss of vegetation could stimulate the introduction and spread of	Vegetative communities directly impacted by earthmoving activities and wildlife injuries and mortalities would be irreversible. However, the implementation of mitigative measures such as the use of fencing to limit wildlife movement and the applicant's enforcement of speed limits would reduce the potential impact to wildlife. Furthermore, areas impacted by earthmoving activities would be reclaimed and reseeded.	During any of the ISR phases, direct impacts to ecological resources from implementing Alternative 1 (the proposed action) could include injuries and fatalities caused by either collisions with project-related traffic or habitat removal actions from the removal of topsoil. Most habitat disruption would consist of scattered, confined drill sites for wells and would not result in large transformation of the existing habitat. Wildlife could also be displaced by increased noise and traffic. The Federally-listed candidate species, the Greater sage-grouse, is known to occur in the vicinity of the proposed Nichols Ranch ISR Project site: eight leks within a	Some of the vegetative communities that exist within the proposed Nichols Ranch ISR Project could be difficult to reestablish through artificial plantings and natural seeding could take many years. Species associated with the affected vegetative communities could be reduced in number or replaced by generalist species.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	undesirable and invasive, nonnative species, and displacement of wildlife species. During the operations and aquifer restoration phases of the ISR facility lifecycle, the use of fences would limit wildlife ingress and egress to wintering habitat.		3.2-km [2-mi] radius of the Hank Unit and one within the same radius at the Nichols Ranch Unit. The applicant has committed to implement mitigative measures to reduce the potential impact on the Greater sage-grouse as well as other wildlife species.	
Ecological Resources 4.6.1	Under Alternative 3, the potential impact on ecological resources would be SMALL. Since the Hank Unit would not be developed the affected area would be less (i.e., 61 to 81 ha [150 to 200 ac]) than that which would be affected under Alternative 1. Like the proposed action, since the dominant vegetative species is sagebrush shrublands and mixed grasslands, these plant communities would be the most affected if Alternative 3 were to be implemented. Over the life of the project, approximately 12 -16 ha [30 – 40 ac] of land would be disturbed and fenced at any given time. Like actions implemented for the proposed action, the short-term loss of vegetation could stimulate the introduction and spread of undesirable and invasive, nonnative species, and displacement of wildlife species. During the operations and aquifer restoration phases of the ISR facility lifecycle, the use of fences would limit wildlife ingress and egress to wintering habitat.	Under Alternative 3, the area of vegetative communities directly impacted by earthmoving activities would be less (approximately 46 ha [113 ac]) compared to the proposed action. The occurrence of wildlife injuries and mortalities would be irreversible. However, the implementation of mitigative measures such as the use of fencing to limit wildlife movement and the applicant's enforcement of speed limits would reduce the potential impact to wildlife. Furthermore, areas impacted by earthmoving activities would be reclaimed and reseeded.	Like the proposed action (Alternative 1) during any of the ISR phases, direct impacts to ecological resources could include injuries and fatalities caused by either collisions with project-related traffic or habitat removal actions from the removal of topsoil. Most habitat disruption would consist of scattered, confined drill sites for wells and would not result in large transformation of the existing habitat. Wildlife could also be displaced by increased noise and traffic. Since most of the Greater sage-grouse leks at the proposed Nichols Ranch ISR Project occur at the Hank Unit, and the Hank Unit would not be developed under Alternative 3, the potential to impact this species would be less than under the proposed action. The applicant has committed to implement mitigative measures to reduce the potential impact on the Greater sage-grouse as well as other wildlife species.	Under Alternative 3, some of the vegetative communities that exist within the proposed Nichols Ranch ISR Project could be difficult to reestablish through artificial plantings and natural seeding could take many years. Species associated with the affected vegetative communities could be reduced in number or replaced by generalist species. However, since less area would be affected under Alternative 3 compared to the proposed action (Alternative 1), the long-term effect would also be less.
Meteorology, Climatology, and Air Quality 4.7.1	There would be a SMALL impact. During implementation of the proposed action (Alternative 1), there would be increased amounts of dust (particulates) from earthmoving activities to construct the central processing	There would be no irreversible or irretrievable commitment of air resources from implementing the proposed action.	There would be a temporary, short-term impact on air quality primarily during the construction and decommissioning phases from earthmoving activities and from vehicle emissions. The effect would be highly localized	No impact. There would be no long-term effect on air quality either from implementing the proposed action (Alternative 1) or following license termination.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	plant and satellite facility at the Nichols and Hank Units, respectively, to develop the wellfields at each unit, lay pipeline, and build access roads to the wellfields. There would be a SMALL impact from vehicular traffic on unpaved roads and from diesel emissions from construction equipment.		and temporary. Use of mitigative measures such as applying water for dust suppression would limit fugitive dust emissions.	
	Under Alternative 3, the impact on air quality would be less than under the proposed action because less area would be disturbed since the Hank Unit would not be developed. Earth moving activities under Alternative 3 would affect approximately 61 to 81 ha (150 to 200 ac).	There would be no irreversible or irretrievable commitment of air resources from implementing Alternative 3.	Under Alternative 3, the short-term impacts would be SMALL and less than under Alternative I because less area would be disturbed.	No impact. There would be no long-term effect on air quality either from implementing the proposed action (Alternative 3) or following license termination.
Noise 4.8.1	There would be a SMALL impact under the proposed action (Alternative 1). The nearest resident is located 1.5 km (0.9 mi) west of the Nichols Ranch Unit and 1 km (0.6 mi) north of the Hank Unit.	No impact.	No impact.	No impact. There would be no noise impact from implementing the proposed action (Alternative 1) following license termination.
	Under Alternative 3, there would be a SMALL impact. The nearest resident is located 1.5 km (0.9 mi) west of the Nichols Ranch Unit. The Hank Unit would not be developed.	No impact.	No impact.	No impact. There would be no noise impact from implementing the proposed action (Alternative 3) following license termination.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Historical, Cultural, and Paleontological Resources 4.9.1	Under the proposed action, there would be a MODERATE impact on historic and cultural resources during the ISR construction phase. Archaeological sites at both the Nichols Ranch and Hank Units could be affected by construction activities. Sites located near construction areas would be marked, fenced and avoided. However, there would be an adverse effect to the visual setting of five traditional cultural properties (TCPs). The applicant has committed to follow cultural resource mitigation measures identified in its Mine Plan for the NRC and Wyoming Department of Environmental Quality-Land Quality Division permit applications. These measures include, but are not limited to, not conducting and ground-disturbing activities in areas that have not been previously inventoried, notifying both NRC and the WYSHPO if ground-disturbing activities were to occur within the boundaries of an eligible site, among others. The applicant has also committed to follow the stipulations identified in the Programmatic Agreement (PA) between the BLM and WY SHPO (BLM 2009) for mitigation of visual impacts to five identified TCPs. The potential impact on historic and cultural resources during ISR operations, aquifer restoration, and decommissioning would be SMALL because no sites would be directly affected by plant activities because sites would be marked, fenced, and avoided. However, there would continue to be an adverse effect	If historic and archeological sites could not be avoided during the ISR lifecycle at the proposed Nichols Ranch ISR Project, this could result in an irreversible and irretrievable loss of cultural resources potentially resulting in a MODERATE to LARGE impact.	Under the proposed action, during all phases of the ISR facility lifecycle, there would be limited access to the Pumpkin Buttes TCP and four additional TCPs resulting in a SMALL impact. The development of a Memorandum of Agreement will address adverse effects to the TCPs.	If potential impacts from construction activities are not mitigated, then long-term MODERATE to LARGE impacts to archaeological sites would likely result.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	to the visual setting of five identified TCPs. Applicant-committed mitigation measures that are specific to reducing impacts would remain in effect.			
	Under Alternative 3, there would be a SMALL impact on historic and cultural resources since only one NRHP-eligible site is located on the Nichols Ranch Unit and it would be marked, fenced, and avoided. No construction would occur at the Hank Unit where most of the NRHP-eligible sites are located. Furthermore, the Nichols Ranch Unit is located beyond the 3.2 km [2 mi] distance stipulated in the PA between the BLM and the WY SHPO regarding the Pumpkin Buttes TCP. The potential impact on historic and cultural resources during ISR operations, aquifer restoration, and decommissioning would be SMALL because either these activities would be occurring in areas where there are either no known historic and cultural resources or no sites would be directly affected by the activity. The applicant-committed mitigation measures would remain in effect throughout the life of this project.	If historic and archeological sites could not be avoided during the ISR lifecycle at the Nichols Ranch Unit under Alternative 3, this could result in an irreversible and irretrievable loss of cultural resources potentially resulting in a MODERATE to LARGE impact.	Under Alternative 3, there would be no short-term impact on either the Pumpkin Buttes or the four other TCPs because ISR activities would only occur at the Nichols Ranch Unit; no ISR activities would occur at the Hank Unit.	No impact. There would be no historical, cultural and paleontological impacts from implementing the proposed action (Alternative 3) following license termination.
Visual and Scenic Resources 4.10.1	Under Alternative 1 (the proposed action), implementing the proposed action would result in a MODERATE impact on the visual landscape during the ISR construction phase with respect to the Hank Unit's location within 3.2 km [2.0 mi] of the base elevation of the Pumpkin Buttes TCP.	No impact.	There would be a MODERATE short-term impact on the visual landscape from implementing the proposed action during the ISR construction phase with respect to the Pumpkin Buttes TCP. However, the activities occurring at the proposed Nichols Ranch ISR Project	No impact. There would be no impact on the visual landscape from the proposed action following license termination.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	However, the number and size of structures at the Hank Unit would be smaller compared to the Nichols Ranch Unit since the Hank Unit would be a satellite facility. The applicant's commitment to implement mitigation measures during operations, aquifer restoration, and decommissioning would result in a SMALL impact. The area surrounding the proposed Nichols Ranch ISR Project contains wellfields, pipelines, and utility lines associated with CBM development.		would be consistent with the BLM visual resource classification of the area and the ongoing natural resource extraction activities in the area. Furthermore, the applicant's commitment to implement mitigation measures would reduce the visual impact on the Pumpkin Buttes TCP.	
	Under Alternative 3 there would be a SMALL impact on the visual landscape. Since no development would occur at the Hank Unit under this alternative and the Nichols Ranch Unit is located at a distance beyond 3.2 km [2.0 mi] from the base elevation of the Pumpkin Buttes TCP, there would be a SMALL impact to the Pumpkin Buttes TCP.	No impact.	There would be a SMALL short-term impact to the visual landscape from implementing Alternative 3. The proposed activities would be consistent with the BLM visual resource classification of the area and the ongoing natural resource extraction activities in the area.	No impact. There would be no impact on the visual landscape from Alternative 3 following license termination.
Socioeconomics 4.11.1	Under Alternative 1 (the proposed action), for each phase of the proposed Nichols Ranch ISR Project, the socioeconomic impact would be SMALL. Over the life of the operation, there could potentially be a MODERATE impact on housing availability.	Not applicable	Implementing the proposed action would predominantly have a SMALL impact on the local communities except for housing availability. Although jobs would be created and tax revenue would be generated to stimulate the local economy, implementation of the proposed action could potentially affect housing availability over the life of the operation and result in a MODERATE impact.	There would be no long-term socioeconomic impact from the proposed action following license termination.
	Under Alternative 3, for each phase of the proposed Nichols Ranch ISR Project, the socioeconomic impact would be SMALL. Over the life of the operation, there	Not applicable	The implementation of Alternative 3 would predominantly have a SMALL impact on the local communities except for housing availability. Although jobs would	There would be no long-term socioeconomic impact from Alternative 3 following license termination.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	could potentially be a MODERATE impact on housing availability. Since the Hank Unit would not be developed, fewer workers would be employed and the potential socioeconomic impact would be less than described for the proposed action.		be created and tax revenue would be generated to stimulate the local economy, implementation of Alternative 3 could potentially affect housing availability over the life of the operation and result in a MODERATE impact.	
Environmental Justice 4.12.1	There would be no disproportionately high and adverse impacts to minority or low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project.	Not applicable.	There would be no disproportionately high and adverse impacts to minority or low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project.	None.
	There would be no disproportionately high and adverse impacts to minority or low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project.	Not applicable.	There would be no disproportionately high and adverse impacts to minority or low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project	None.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Public and Occupational Health 4.13.1	Under Alternative 1 (the proposed action), there would be a SMALL impact on public and occupational health. Construction and decommissioning would generate fugitive dust emissions that could result in a dose comparable to that from natural background exposure based on baseline radiological environmental monitoring which indicates radon in air and the average concentrations of uranium and radium in soils are comparable to those at background.	Not applicable.	Under Alternative 1 (the proposed action), there would be a SMALL impact from radiological exposure. The radon dose calculations for the proposed facility under normal operations showed that the potential dose would be less than the 1mSv [100 mrem] per year dose limit for a member of the public, as specified in 10 CFR 20.1301 and also within the range of doses reported in the GEIS. The radiological impacts from accidents would be SMALL for workers if procedures to deal with accident scenarios were followed, and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health impacts from normal operations, accidents, and chemical exposures would be SMALL if handling and storage procedures were followed.	No impact. There would be no long-term impact to public and occupational health following license termination.
	Under Alternative 3, there would be a SMALL impact from radiological exposure and less than under the proposed action (Alternative 1) because activities would only be occurring at the Nichols Ranch Unit and the scope of construction (no satellite facility, fewer wells to drill, only one access road), operations, aquifer restoration, and decommissioning activities would be likewise reduced.	Not applicable.	Under Alternative 3, there would be a SMALL impact from radiological exposure and less than under the proposed action (Alternative 1) because the elimination of construction activities at the Hank Unit would reduce the combined public and occupational health impacts from construction under the proposed action which includes development of the both the Nichols Ranch and Hank Units. The operations impacts would be less because there would be no satellite facility for the shipment of chemicals; no aquifer restoration activities would occur at the Hank Unit	No impact. There would be no long-term impact to public and occupational health following license termination.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
			since no wellfields would be developed, and no earthmoving activities associated with decommissioning would occur at the Hank Unit.	
Waste Management 4.14.1.1	Waste generation and disposal from activities implemented during all phases of the proposed Nichols Ranch ISR Project under Alternative 1 (the proposed action) would result in SMALL impacts on available disposal capacity, since permitted facilities are available to accept the wastes. Construction wastes would be mostly solids, operations wastes would include solids (primarily municipal waste) and liquids (brine, plant washdown water, and others), and decommissioning wastes would include a range of solid wastes (nonhazardous, hazardous, and solid byproduct material).	The energy consumed during the ISR phases, the construction materials used that could not be reused or recycled, and the space used to properly handle and dispose of all waste types (i.e., wells for liquid wastes and permitted disposal space for solid wastes) would represent an irretrievable commitment of resources, resulting in a SMALL impact.	During all phases, hazards associated with handling and transport of wastes would represent a short-term and SMALL impact.	During all phases, the permanent disposal of wastes in on-site injection wells would represent a SMALL impact on the long-term productivity of the land allocated for these wells.
	Under Alternative 3, the volume of waste generation and disposal from activities during all phases of the ISR facility lifecycle would result in a SMALL impact on available disposal capacity, since permitted facilities are available to accept the wastes. Construction wastes would be mostly solids, operations wastes would include solids (primarily municipal waste) and liquids (brine, plant washdown water, and others), and decommissioning wastes would include a range of solid wastes (nonhazardous, hazardous, and solid byproduct material). Since the Hank Unit	The energy consumed during the ISR phases under Alternative 3, the volume of construction materials used that could not be reused or recycled, and the space used to properly handle and dispose of all waste types (i.e., wells for liquid wastes and permitted disposal space for solid wastes) would represent an irretrievable commitment of resources which would be less than that consumed from implementing the proposed action. Therefore, the impact would be SMALL.	Under Alternative 3, the volume of waste to be handled would be less than that from the proposed action; therefore, the potential hazards associated with handling and transport of wastes during all ISR phases would represent a short-term and SMALL impact.	Under Alternative 3, the permanent disposal of wastes under all of the ISR phases in on-site injection wells would represent a SMALL impact on the long-term productivity of the land allocated for these wells. Since there would be fewer permitted Class I wells under Alternative 3 compared to the proposed action, the potential impact would be less compared to Alternative I (the proposed action).

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	would not be developed under this alternative the volume of wastes that would be generated would also be reduced.			

9 LIST OF PREPARERS

This section documents all individuals involved with the preparation of this Supplemental Environmental Impact Statement (SEIS). Contributors include staff from the U.S. Nuclear Regulatory Commission (NRC) and consultants. Each individual's role, education, and experience is outlined as follows.

9.1 U.S. Nuclear Regulatory Commission Contributors

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Ph.D., Geochemistry/Mineralogy, Pennsylvania State University, 1984
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B.S., Chemistry, Bucknell University, 1970
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Years of Experience: 2

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B.S., Geology, James Madison University, 1984
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10 DISTRIBUTION LIST

The U.S. Nuclear Regulatory Commission (NRC) is providing copies of this Supplemental Environmental Impact Statement (SEIS) to the following organizations and individuals. The NRC would provide copies to other interested organizations and individuals upon request.

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Tope Ranches
Aladdin, WY

Pam Viviano
Ranchers & Neighbors Protecting Our Water
Sheridan, WY

APPENDIX A

CONSULTATION CORRESPONDENCE

CONTENTS

Section Page

A CONSULTATION CORRESPONDENCE A–1

TABLE

Section Page

A–1 Chronology of Consultation Correspondence A–1

A CONSULTATION CORRESPONDENCE

The Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966, as amended, require that federal agencies consult with applicable state and federal agencies and groups prior to taking action that may affect threatened and endangered species, essential fish habitat, or historical and archaeological resources. This appendix contains consultation documentation related to these federal acts.

Table A–1. Chronology of Consultation Correspondence

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming State Historic Preservation Office (M. Hopkins)	July 1, 2008	ML081760693
U.S. Nuclear Regulatory Commission (G. Suber)	U.S. Fish and Wildlife Service (B. Kelly)	July 3, 2008	ML081820857
Wyoming State Parks and Cultural Resources (R. Currit)	U.S. Nuclear Regulatory Commission (G. Suber)	July 25, 2008	ML082270716
U.S. Fish and Wildlife Service (B. Kelly)	U.S. Nuclear Regulatory Commission (G. Suber)	August 15, 2008	ML082840332
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming Game and Fish Department (T. Christiansen)	October 29, 2008	ML082960565
Wyoming Game and Fish Department (T. Christiansen)	U.S. Nuclear Regulatory Commission (I. Yu)	November 3, 2008*	N/A
U.S. Nuclear Regulatory Commission (G. Suber)	Shoshone Business Council (I. Posey)	December 24, 2008	ML083260467
Northern Cheyenne Tribal Historic Preservation Office (C. Fisher)	U.S. Nuclear Regulatory Commission (I. Yu)	February 12, 2009	ML090440030
U.S. Nuclear Regulatory Commission (I. Yu, B. Shroff, and A. Bjornsen)	U.S. Nuclear Regulatory Commission (A. Kock)	March 2, 2009	ML090500544
U.S. Nuclear Regulatory Commission (A. Kock)	Advisory Council on Historic Preservation (C. Vaughn)	August 24, 2009	ML092321010
U.S. Nuclear Regulatory Commission (A. Kock)	Wyoming State Historic Preservation Office (M. Hopkins)	August 26, 2009	ML092320627
U.S. Nuclear Regulatory Commission (B. Balsam and I. Yu)	File (teleconference summary of phone call with U.S. Fish and Wildlife Service [P. Ramirez])	November 10, 2009	ML093130107
U.S. Nuclear Regulatory Commission (B. Balsam)	File (teleconference summary of phone call with U.S. Fish and Wildlife Service [P. Ramirez])	March 25, 2010	ML100760621
U.S. Nuclear Regulatory Commission (K. Hsueh)	Eastern Shoshone Tribe (I. Posey)	April 23, 2010†	ML100880084
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Ft. Peck Assiniboine/Sioux Tribe (D.C. Youpee)	May 12, 2010	ML101370725
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Three Affiliated Tribes (P. Brady)	May 12, 2010	ML101370749
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Oglala Sioux Tribe (M. Catches Enemy	May 13, 2010	ML101370688

Table A–1. Chronology of Consultation Correspondence (continued)

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Cheyenne River Sioux Tribe (J. Brings Plenty)	May 13, 2010	ML101370683
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Northern Cheyenne Tribe (C. Fisher)	May 13, 2010	ML101370646
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Blackfeet Tribe (J. Murray)	May 13, 2010	ML101370610
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Eastern Shoshone Tribe (V. Hill)	May 13, 2010	ML101370754
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Northern Arapaho Tribe (D. Conrad)	May 13, 2010	ML101370564
Oglala Sioux Tribe (M. Catches Enemy	U.S. Nuclear Regulatory Commission (A. Bjornsen)	May 14, 2010	ML101370519
Ft. Peck Assiniboine/Sioux Tribe (D.C. Youpee)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	May 17, 2010	ML101370510
U.S. Nuclear Regulatory Commission (A. Bjornsen)	Eastern Shoshone Tribe (V. Hill)	May 17, 2010	ML101370555
U.S. Nuclear Regulatory Commission (K. Hsueh)	Wyoming State Historic Preservation Office (R. Currit)	June 15, 2010	ML101310126
Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission (K. Hsueh)	July 8, 2010	ML102000147
Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission (K. Hsueh)	July 19, 2010	ML102020089
U.S. Nuclear Regulatory Commission (D. Skeen)	Wyoming State Historic Preservation Office (M. Hopkins) et al.‡	July 22, 2010	ML101600535
U.S. Nuclear Regulatory Commission (K. Hsueh)	Advisory Council on Historic Preservation (R. Nelson)	July 30, 2010	ML101680673
Advisory Council on Historic Preservation (R. Wallace)	U.S. Nuclear Regulatory Commission (K. Hsueh)	August 4, 2010	ML102210205
U.S. Nuclear Regulatory Commission (K. Hsueh)	Wyoming State Historic Preservation Office (R. Currit)	August 9, 2010	ML102090620
TRC Environmental Corporation (J. Lowe)	Uranerz Energy Corporation (M. Thomas)	August 17, 2010	ML102310186
U.S. Nuclear Regulatory Commission (K. Hsueh)	Wyoming State Historic Preservation Office (R. Currit)	October 15, 2010	ML102700045
Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission (K. Hsueh)	November 3, 2010	ML103081008

*This correspondence is nonpublic due to sensitive information on the Greater sage-grouse.
†Similar letters were sent to eight other tribes listed in Section 1.7.3.3.
‡In addition to the Wyoming State Historic Preservation Office, this letter was sent to the U.S. Bureau of Land Management-Wyoming State Office and Buffalo Field Office, Uranerz Energy Corporation, and 8 or the 9 tribes listed in Section 1.7.3.3.

July 1, 2008

Ms. Mary Hopkins
State Historic Preservation Officer
Wyoming State Historic Preservation Office
Department of State Parks
& Cultural Resources
2301 Central Avenue, Barrett Building
3rd Floor
Cheyenne, Wyoming 82002

SUBJECT: INITIATION OF SECTION 106 PROCESS FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT LICENSE REQUEST (Docket 040-09067)

Dear Ms. Hopkins:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* leach operation) located in Campbell and Johnson Counties, WY. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch project is within 5 miles of two currently licensed *in-situ* leach facilities, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an environmental assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 106 of the National Historic Preservation Act, the EA will include an analysis of potential impacts to historic and cultural resources. To support the environmental review, the NRC is requesting information from the State Historical Preservation Officer to facilitate the identification of historic and cultural resources that may be affected by the Nichols Ranch Uranium Recovery Project license application. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 36 CFR 800. After reviewing all the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents

M. Hopkins - 2 -

access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Ms. Kellee Jamerson of my staff by telephone at 301-415-7649 or by email at kellee.jamerson@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure:
Uranerz Energy Corporation Figure 1-4

July 3, 2008

Brian T. Kelly, Field Supervisor
U.S. Fish and Wildlife Service
Mountain-Prairie Region
Wyoming Field Office
5353 Yellowstone Road
Cheyenne, WY 82009

SUBJECT: REQUEST FOR INFORMATION REGARDING ENDANGERED OR THREATENED SPECIES AND CRITICAL HABITAT FOR THE PROPOSED LICENSE APPLICATION FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT (Docket 040-09067)

Dear Mr. Kelly:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell and Johnson Counties, WY. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch project is within 5 miles of two currently-licensed *in-situ* recovery projects, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an environmental assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 7 of the Endangered Species Act, the EA will include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC is requesting information from the U.S. Fish and Wildlife Service to facilitate the identification of endangered or threatened species or critical habitat that may be affected by the proposed project. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 50 CFR 402. After assessing the information provided by you, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is

B. Kelly - 2 -

accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission, Attention: Mr. Gregory Suber, Mail Stop T8F05, Washington, DC 20555. If you have any questions, please contact Ms. Kellee Jamerson of my staff by telephone at 301-415-7649 or by email at kellee.jamerson@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Branch Chief
Environmental Review Branch
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Division of Waste Management and
Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure: Uranerz Energy Corporation Figure 1-4

ARTS. PARKS. HISTORY.
Wyoming State Parks & Cultural Resources

State Historic Preservation Office
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Cheyenne, WY 82002
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http://wyoshpo.state.wy.us

July 25, 2008

Mr. Gregory Suber
U.S. Nuclear Regulatory Commission
Mail Stop T-8F05
Washington, DC 20555

re: Uranerz Energy Corporation, Nichols Ranch Uranium Recovery Project License Request (Docket 040-09067) (SHPO File # 0708RLC009)

Dear Mr. Suber:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project.

A search of our records shows that a cultural resource survey has not been conducted for the entire area of potential effect. Following 36 CFR Part 800, and prior to any ground disturbing activities, we recommend the U.S. Nuclear Regulatory Commission carry out appropriate efforts necessary for identification of historic properties, which may include a file search, background research, consultation, consideration of visual effects, sample field investigations or field survey. The identification efforts must be conducted by a consultant meeting the Secretary of the Interior's Professional Qualification Standards (48 FR 22716, Sept. 1983). A report detailing the results of these efforts must be provided to SHPO staff for our review and comment.

Also be aware that National Register of Historic Places eligible site 48CA268, the Pumpkin Buttes Traditional Cultural Property (TCP), is of interest to numerous Native American tribes. Consultation with the tribes regarding the effects of this project on this TCP, as well as any needed mitigation will be required.

We have enclosed a copy of a cultural resource consultants list for your use. Please refer to SHPO project control number #0708RLC009 on any future correspondence dealing with this project. If you have any questions, please contactme at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Dave Freudenthal, Governor
Milward Simpson, Director

WYOMING SHPO
CULTURAL RESOURCE CONSULTANTS
2008

The Wyoming State Historic Preservation Office (SHPO) does not permit or license consultants and makes no endorsement of any particular consultant.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

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AUG 15 2008

In Reply Refer To:
ES-61411/W.26/WY08SL0251

Gregory F. Suber, Branch Chief
US Nuclear Regulatory Commission
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Washington, District of Columbia 20555

Dear Mr. Suber:

Thank you for your letter (Docket No.: 040-09067) of July 3, received in our office on July 11, regarding the Nichols Ranch Uranium Recovery Project.

This project is for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an in-situ recovery operation) located in Campbell and Johnson Counties, Wyoming. The proposed project will include two areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West, Sections 30 and 31, and Township 43 North, Range 75 West, Section 5, 6, 7, and 8.

You have requested information regarding species listed under the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). In response to your request, the U.S. Fish and Wildlife Service (Service) is providing you with recommendations for protective measures for threatened and endangered species in accordance with the Act. We are also providing recommendations concerning migratory birds in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j".

In accordance with Section 7(c) of the Act, we have determined that the following species or their designated habitat may be present in the proposed project area. We would appreciate receiving information as to the current status of each of these species within the proposed project area.

Listed, Proposed, Candidate Species and their Designated and Proposed Critical Habitat that may be in the proposed Project Area

SPECIES	STATUS	Expected Occurrence
Black-footed ferret (*Mustela nigripes*)	Endangered	Prairie dog towns
Blowout Penstemon (*Penstemon haydenii*)	Endangered	Sand dunes
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 feet

Black-footed ferret: Black-footed ferrets (*Mustela nigripes*) may be affected if prairie dog towns are impacted. Please be aware that black-footed ferret surveys are no longer recommended in black-tailed prairie dog towns statewide. If white-tailed prairie dog towns or complexes greater than 200 acres will be disturbed, surveys for ferrets may be recommended in order to determine if the action will result in an adverse effect to the species. Surveys are recommended even if only a portion of the white-tailed prairie dog town or complex. According to the Black-Footed Ferret Survey Guidelines (USFWS 1989), a prairie dog complex consists of two or more neighboring prairie dog towns less than 7 km (4.3 miles) from each other. If a field check indicates that white-tailed prairie dog towns or complexes may be affected, you should contact this office for guidance on ferret surveys. We encourage project proponents to protect all prairie dog towns or complexes for their value to the prairie ecosystem and the many species that rely on them. We further encourage you to analyze potentially disturbed prairie dog towns for their value to future black-footed ferret reintroduction.

Blowout penstemon: Blowout penstemon (*Penstemon haydenii*) is a perennial herb with stems less than 12 inches tall. The inflorescence is 2-6 inches long and has 6-10 compact whorls of milky-blue to pale lavender flowers. Blowout penstemon was listed as endangered on October 1 1987. The plant's current known range in Wyoming consists of the Ferris dunes area in northwest Carbon County where the plant is restricted to two habitat types: steep, northwest facing slopes of active sand dunes with less than 5 percent vegetative cover; and on north facing sandy slopes, on the lee side of active blowouts with 25-40 percent vegetative cover. Recent surveys have indicated that systematic surveys are warranted in all lower elevations (below 6700 feet) in Wyoming where sand blowout features are located.

Blowouts are formed as strong winds deposit sands from the windward side of a dune to the leeward side and result in a sparsely vegetated crater-like depression. Associated vegetation includes blowout grass, thickspike wheatgrass, lemon scurfpea, Indian ricegrass and western wheatgrass. Threats to the plant occur when sand dunes are removed or overly disturbed by vehicular traffic. Known populations in Wyoming are found between 6680-7440 feet (Fertig 2001). However, recent surveys by Blomquist and Heidel (June 2002) indicate that surveys may be warranted in some lower elevations where active sand blowout features occur. Surveys should be conducted from mid-June to early-July when flowering occurs by knowledgeable botanists trained in conducting rare plant surveys. The Service does not maintain a list of

"qualified" surveyors, but we can refer those wishing to become familiar with the blowout penstemon to experts who can provide training/services.

Ute ladies'-tresses: Ute ladies'-tresses (*Spiranthes diluvialis*) is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens. The Service does not maintain a list of "qualified" surveyors but can refer those wishing to become familiar with the orchid to experts who can provide training or services.

Species of Concern

Greater sage-grouse: The Service is currently conducting a review to determine if the greater sage-grouse (*Centrocercus urophasianus*) warrants listing. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations rangewide (Braun 1998, Wisdom et al. 2002). Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse. If important breeding habitat (leks, nesting or brood rearing habitat) is present in the project area, the Service recommends no project-related disturbance March 1 through June 30, annually. Minimization of disturbance during lek activity, nesting, and brood rearing is critical to sage- grouse persistence within these areas. Likewise, if important winter habitats are present, we recommend no project-related disturbance November 15 through March 14.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats within the project area, and appropriate mitigative measures to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning, to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

Migratory Birds: The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it

shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken. Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the project area, timing is a significant consideration and needs to be addressed in project planning.

If nest manipulation is proposed for this project, the project proponent should contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the project may need to be modified to ensure take of a migratory bird or eagle, their young, eggs or nest will not occur.

Wetlands/Riparian Areas: Wetlands may be impacted by the proposed project. Wetlands perform significant ecological functions which include: (1) providing habitat for numerous aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

***In situ* Uranium Mining**

High selenium concentrations can occur in wastewater from in situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). The disposal of this wastewater can expose migratory birds to selenium which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium.

In 1998, the Service conducted a study of a grassland irrigated with wastewater from an *in situ* uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the *in situ* wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Additionally, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving *in situ* wastewater. Waterborne selenium concentrations ≥ 2 µg/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than 20 µg/L is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994), which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa and Ohlendorf 1991, Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 µg/g in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 µg/L.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and streambanks.

For our internal tracking purposes, the Service would appreciate notification of any decision made on this project (such as issuance of a permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Pedro Ramirez of my office at the letterhead address or phone (307) 772-2374, extension 236.

Sincerely,

Scott Hicks

for Brian T. Kelly
Field Supervisor
Wyoming Field Office

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
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Literature Cited

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October 29, 2008

Tom Christiansen
Sage Grouse Coordinator
Wyoming Game and Fish Department
Green River Field Office
351 Astle Avenue
Green River, WY 82935

SUBJECT: REQUEST FOR INFORMATION REGARDING SAGE GROUSE HABITATS FOR THE PROPOSED LICENSE APPLICATION FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT (Docket 040-09067)

Dear Mr. Christiansen:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell and Johnson Counties, WY. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch project is within 5 miles of two currently-licensed *in-situ* recovery projects, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an Environmental Assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 7 of the Endangered Species Act, the EA will include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC requested information from the U.S. Fish and Wildlife Service (FWS) to facilitate the identification of endangered or threatened species or critical habitat that may be affected by the proposed project. According to a letter sent to the NRC from the FWS dated August 1, 2008, the FWS indicated that they are currently conducting a review to determine if the greater sage-grouse warrants listing and that you may have more information on the greater sage-grouse habitats within the project area and appropriate mitigative measures to minimize potential impacts to the species. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 50 CFR 402. After assessing the information provided by you, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

T. Christiansen - 2 -

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission, Attention: Mr. Gregory F. Suber, Mail Stop T8F05, Washington, DC 20555. If you have any questions, please contact Ms. Irene Yu of my staff by telephone at 301-415-1951 or by email at Irene.Yu@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Branch Chief
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure: Uranerz Energy Corporation Figure 1-4

December 24, 2008

Mr. Ivan Posey
Chairman
Shoshone Business Council
P.O. Box 538
Fort Washakie, WY 82514

SUBJECT: REQUEST FOR INFORMATION REGARDING TRIBAL HISTORIC AND CULTURAL RESOURCES POTENTIALLY AFFECTED BY THE PROPOSED LICENSE APPLICATION FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING (Docket No. 040-09067)

Dear Mr. Posey:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to construct and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell and Johnson Counties, Wyoming. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch Uranium Recovery Project is within five miles of two currently licensed *in-situ* leach facilities, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the general location of the proposed project and a detailed map showing the location of the Nichols Ranch Unit and the Hank Satellite Unit in relation to the Pumpkin Buttes are attached.

As established in Title 10 Code of Federal Regulations Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the NRC is preparing an Environmental Assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. The NRC's EA process includes an opportunity for public and inter-governmental participation in the development of the EA. In accordance with Section 106 of the National Historic Preservation Act, the EA will include an analysis of potential impacts to historic and cultural properties. To support the environmental review, the NRC is requesting information to facilitate the identification of Tribal historic sites or cultural resources that may be affected by the proposed Nichols Ranch Uranium Recovery Project. Specifically, the NRC is interested in learning of any sites that you believe have traditional religious or cultural significance. Any input you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 36 CFR 800. After reviewing all of the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Ms. Irene Yu of my staff by telephone at 301-415-1951 or by email at irene.yu@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Branch Chief
Environmental Review Branch
Environmental Protection and Performance
Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosures:
1. Uranerz Energy Corporation Figure 1-1
2. Uranerz Energy Corporation Exhibit B

From: Conrad Fisher [conrad.fisher@cheyennenation.com]
Sent: Thursday, February 12, 2009 4:20 PM
To: Irene Yu
Subject: RE: Nichols Ranch consultation letter

Dear Ms. Yu:

First, thank you for contacting our office on the Proposed license application for Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project in Campbell and Johnson counties, Wyoming (Docket No. 040-09067). Second, Northern Cheyenne Tribal Historic Preservation Office is concerned with number of issues. Third, Pumpkin buttes are considered spiritual and ceremonial areas that have tangible evidence of various activities and natural resources used or those activities. Also, the idea of having such energy development close to the buttes may have an affect on the integrity of the buttes. Contaminants from extraction, traffic, noise and dust pollution may effect the overall condition of the area.

Having such a development can do irreparable harm to the Pumpkin buttes. I would like to see a plan that would minimize impact to this area.

Conrad Fisher
Northern Cheyenne Tribal Historic Preservation Office

From: Irene Yu [mailto:Irene.Yu@nrc.gov]
Sent: Tuesday, February 10, 2009 10:53 AM
To: conrad.fisher@cheyennenation.com
Subject: Nichols Ranch consultation letter

Hi Mr. Fisher,

Thanks for talking to me earlier. Per our conversation, attached is the consultation letter I sent to you and Mr. Spang back in December 2008. As you can see from the letter, the same letter was sent to points of contact at 8 other tribes. If you could please let me know if you have any comments, that would be very helpful for me. Thanks.

Irene W Yu
U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and Environmental Management Programs
Division of Waste Management and Environmental Protection
301-415-1951

E-mail Properties

Mail Envelope Properties (200902122119.n1CLJwei007974)
Subject: RE: Nichols Ranch consultation letter
Sent Date: 2/12/2009 4:20:00 PM
Received Date: 2/12/2009 4:20:00 PM
From: Conrad Fisher
Created By: conrad.fisher@cheyennenation.com
Recipients: Irene.Yu@nrc.gov (Irene Yu)
Tracking Status: None
Post Office: omr15.networksolutionsemail.com

Files	Size	Date & Time
MESSAGE	16928	2/12/2009

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False
Sensitivity: olNormal
Recipients received:

March 2, 2009

MEMORANDUM TO: Andrea Kock, Chief
Environmental Review Branch
EPPAD/DWMEP/FSME

FROM: Irene W. Yu, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Behram Shroff, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Alan Bjornsen, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

SUBJECT: INFORMAL MEETINGS WITH LOCAL, STATE, AND FEDERAL AGENCIES IN WYOMING REGARDING THE ENVIRONMENTAL REVIEWS BEING CONDUCTED ON THE MOORE RANCH, NICHOLS RANCH, AND LOST CREEK IN-SITU LEACH APPLICATIONS FOR SOURCE MATERIAL LICENSES (DOCKET NOS. 040-09073, 040-09067, 040-09068, RESPECTIVELY)

During the week of January 12, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff and their contractor staff informally met with various local, state, and federal agencies in Wyoming regarding the environmental reviews being conducted on the Moore Ranch, Nichols Ranch, and Lost Creek In-Situ Leach (ISL) applications for Source Material Licenses. The purpose of these meetings was to discuss any comments or concerns they may have on these projects and to better understand the agency's procedures and regulations and how they fit in with NRC's obligations under the National Environmental Policy Act (NEPA). The following is a summary of each meeting and a list of participants.

CONTACT: Irene Yu, DWMEP/FSME
(301) 415-1951

State Historic Preservation Office (SHPO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

Regarding the Nichols Ranch Project, we discussed the proximity to the Pumpkin Buttes, which is designated as a Traditional Cultural Property, and the tribal interest in the Pumpkin Buttes. The SHPO is currently working on a programmatic agreement (PA) with the Bureau of Land Management (BLM) pertaining to the Pumpkin Buttes. We discussed potential best management practices (BMPs) and mitigation strategies to be included in the PA such as painting the buildings a certain color to mitigate the visual effect, keeping the buildings a low profile, and adding a public education component. Regarding the Lost Creek Project, we discussed the presence of tribal artifacts with cultural significance in the nearby town of Bairoll. We also discussed the potential presence of paleontological artifacts in the Great Divide Basin because it was at one time covered with water. The mitigation strategies discussed included data recovery (where a discovery plan would be needed) and a public education component. No tribal concerns were discussed for the Moore Ranch Project. For all three projects, we discussed cumulative impacts and the importance of assessing the impacts of ISL in addition to those for coal-bed methane (CBM), oil and gas (O&G), wind, and/or coal, which are all actively underway in Wyoming. We also discussed the Section 106 process and verified NRC's responsibilities and process to submit the cultural resources information to the SHPO.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Richard Currit, SHPO

Follow-up Items

NRC to talk to BLM about how they want to comment when BLM lands are involved in the Section 106 process. NRC spoke to BLM following the trip about how they want to comment when BLM lands are involved in the Section 106 process. NRC will provide BLM with a copy of the complete cultural resources section of the application for discussion and concurrence prior to submitting the information to the SHPO.

State Engineer's Office (SEO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

We discussed the importance of the ISL wells being constructed well to prevent cross-contamination between aquifers and that the applicant's provide adequate means for the closure of these wells once the facilities are decommissioned so as not to leave a conduit for cross-contamination. We discussed the differences in the roles and responsibilities of the SEO (focused on water quantity) and of the Department of Environmental Quality (DEQ, focused on water quality). The SEO is responsible for well permitting, which is typically done in permit blocks which allow for a certain number of wells to be constructed within a certain tract of acres. The SEO also issues permits for stormwater management impoundments.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
John Harju, SEO
Harry Labonde, SEO

Follow-up Items

None

Bureau of Land Management State Office, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

NRC staff provided an overview of how and why the draft Memorandum of Understanding (MOU) between NRC headquarters and BLM headquarters was developed and the current status of the draft MOU. Having not reviewed the draft MOU, BLM staff expressed their interest in reviewing the MOU and having the MOU signed at the state level instead of at the headquarter level. BLM has an MOU in place with the DEQ and briefly explained how the MOU specifies the roles and responsibilities of each agency and the points of contact. BLM staff provided NRC staff with a copy of their MOU with DEQ and a copy of the new Department of Interior regulations on implementing NEPA to help NRC in their development of an MOU with BLM. BLM staff also stressed the importance of increased communication between them and the NRC. We discussed both BLM and NRC's NEPA responsibilities for the three ISL projects and whether an environmental assessment (EA) or an environmental impact statement (EIS) is more appropriate. BLM staff sees the main issues with ISL to be related to groundwater quality and cumulative impacts. Specifically, they raised the concern of the possible conflict between the reducing nature of CBM and the oxidizing nature of ISL.

Meeting Participants

Patrice Bubar, NRC (via phone)
Irene Yu, NRC
Nancy Barker, VHB
Larry Claypool, BLM
Ed Heffern, BLM
Larry Jensen, BLM
Bob Janssen, BLM
Janet Kurman, BLM
Pam Stiles, BLM

Follow-up Items

NRC to continue to pursue an MOU with BLM.

Department of Environmental Quality, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

DEQ staff stressed the importance of increased communication between them and the NRC and requested the development of an MOU with the NRC. Since the DEQ issues the permits for the underground injection wells and the aquifer exemption related to ISL, we discussed in great detail DEQ's requirements from the applicant and the issues they have seen thus far in their review of the three project applications. DEQ Land Quality Division staff will coordinate the comments from all other DEQ divisions for their review of NRC's environmental documents. DEQ Water Quality Division staff provided background on the stormwater and groundwater concerns. Specifically, we discussed the different classes of injection wells and which ones apply to ISL facilities, the construction of wells and how important the construction is to minimizing cross-contamination between aquifers, the viability of ISL in an unconfined aquifer, and groundwater restoration. DEQ Air Quality Division staff provided information on air quality issues in the state. DEQ Industrial Siting Division staff provided information related to the sage grouse core areas and provided NRC with a map showing those areas. DEQ Solid and Hazardous Waste Division staff provided background on radioactive/hazardous waste disposal in the state. Regarding the Lost Creek Project, we discussed the need for increased federal and state agency interaction because the site consists primarily of federal lands. Also, DEQ staff raised some wildlife concerns as the Lost Creek Project site is located near a sage grouse core area.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Carl Anderson, DEQ Solid & Hazardous Waste Division
Mark Conrad, DEQ Water Quality Division
John Corra, DEQ Administration Division
Kevin Frederick, DEQ Water Quality Division
Andrew Keyfaurer, DEQ Air Quality Division
Brian Lovett, DEQ Water Quality Division
Don McKenzie, DEQ Land Quality Division
Darla Potter, DEQ Air Quality Division
Barb Sahl, DEQ Water Quality Division
Chad Schlichtemeier, DEQ Air Quality Division
Tom Schroeder, DEQ Industrial Siting Division
Paige Smith, DEQ Air Quality Division
Lowell Spackman, DEQ Land Quality Division
Ed Heffern, BLM

Follow-up Items

NRC to discuss internally on possible MOU with DEQ. Internal discussions have been held and a call is scheduled with DEQ to discuss this request.

A. Kock - 5 -

Governor's Planning Office (GPO), Cheyenne, Wyoming – January 13, 2009

Meeting Summary

GPO staff provided an overview of their assistance to several BLM field offices in updating their Resource Management Plans. In addition, we discussed the location of sage grouse core areas and sage grouse conservation initiatives that are being developed or are already underway.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Tom Blickensderfer, GPO

Follow-up Items

None

Bureau of Land Management Field Office, Rawlins, Wyoming – January 13, 2009

Meeting Summary

The status of the Draft Generic EIS for environmental reviews for ISL facilities (GEIS) and the MOU were discussed. It was explained that the NRC would be the lead agency because of their regulation over milling (not mining) operations. The BLM inquired whether the DEQ should be a cooperating agency. The BLM indicated the state has created an MOU format for federal agencies. Typically, an MOU is made with the state and separate agencies are assigned, as applicable. Shirley Basin & Red Desert, where the Lost Creek site is located, has been extensively explored. The effects of ISLs on freshwater aquifers are critical and applicants need to show that leaching will not occur between aquifers. The Cheyenne Office of the DEQ (Steve Engle-hydrologist) will scrutinize the Lost Creek EA for groundwater issues. The Battle Springs aquifer is a major aquifer in the area. ISLs operate under BLM mining laws and these laws address land use issues. A Plan of Operations will be required by BLM for the Lost Creek site. Currently, they are functioning (exploring) under a Notice (<5 acres of disturbance). An issue of concern is fencing. If fencing of the site is proposed, there are public access issues and wild horse routes that may be impacted. In addition, applicants (ISL operators) need to address effects of their ISL operation on grazing leases. The U.S. Fish & Wildlife Service (FWS) recommends that standard BMPs be used. Their principal concerns are for cattle and raptors. Netting would be required over waste ponds, and over mud pits. The BLM plans on meeting with UR-Energy (applicant) on January 27th on the Lost Creek site.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Mark Newman, BLM
Clare Miller, BLM
Patrick Madigan, BLM
Travis Sanderson, FWS

Follow-up Items

NRC to keep BLM Field Offices up to date on status of MOU; BLM to send Environet a copy of the Land Status Map for Wyoming.

Bureau of Land Management Casper Field Office, Casper, Wyoming – January 13, 2009

Meeting Summary

Topics discussed included cumulative impacts, existing coal-related analyses, and hydrology at ISL sites. Specifically, with regards to cumulative impacts, BLM, U.S. Environmental Protection Agency (EPA), and DEQ cooperated on a study of the effects of coal, O&G, CBM, uranium, and wind development in the Powder River Basin. There are several existing coal-related analyses: five coal-related EISs either final or in progress (West Antelope, Wright, and three physical groupings: North, Middle, and South Pods). Chapter 4 in these EISs was recommended as a good resource for NRC's cumulative impacts analysis. Another EIS with good information on cumulative impacts was for Pacific Corporation/Rocky Mountain Corporation's Wind Farm in the northeastern part of the state. BLM's concerns with respect to ISL impacts were about the cross-contamination of groundwater between CBM and ISL and whether NRC was going to require groundwater monitoring. BLM is working on a reliable groundwater model for ISL projects.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Patrick Moore, BLM
Tom Foertsch, BLM
Mike Karbs, BLM

Follow-up Items

None

Sweetwater County (SC), Green River, Wyoming – January 13, 2009

Meeting Summary

Safety and emergency issues were the top concerns raised by Sweetwater County (SC). Site access, particularly on the narrow county roads, was of concern with the Bairoil representatives (trucks, dust, noise, etc.). The proposed routes were of concern, along with road improvements, maintenance, and signage. Of special interest was the amount of radiation that could be expected from trucks carrying product from the facility to the next processing facility. The Sweetwater County Fire Department (SCFD) and emergency personnel were concerned with radiation and potential exposure, construction of the facility, access, materials and waste storage, and emergency plans that the applicant would prepare. The SCFD specifically requested that plans of the facility be available to them in case of an actual emergency. Waste

disposal was an issue of great importance: what types of waste would be generated; how much would be generated; where would the waste be disposed; and what routes would be used to get there. There is also a limited workforce that is available in the SC area. Even unskilled workers are hard to come by. Other issues that were raised included: impacts to Bairoil's municipal water supply well, potential storm water discharges, waste water ponds, utilities, and air quality (dust).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
John Radosevich, SC
Steve Horton, SC
John Barton, SC
Dennis Washam, SC
Wayne Silvers, SC
Judy Valentine, SC
Dennis Claman, SC
Robert Robinson, SC
Tony Riga, Bairoil
Sue Ann Riganco, Bairoil

Follow-up Items

NRC to find out what roads are being proposed for access to the facility. NRC to find out the levels of radiation at various locations throughout the facility, as well as during transportation. NRC to inform applicant that the SCFD would like a hazardous materials inventory.

Fremont County Planning Department, Fremont County, Wyoming – January 13, 2009

Meeting Summary

The county has no zoning laws in effect. Reviews are performed for residential subdivisions. Regarding solid waste disposal, the county operates a transfer station and landfill in Riverton. Regarding highway maintenance in the vicinity of Lost Creek (SC), the county only maintains about ten miles of the Crooks Gap-Wamsutter Road south of Jeffrey City. Beyond that point, the road is poorly maintained.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Price, Fremont County Planning Department

Follow-up Items

None

Casper Planning Department, Casper, Wyoming – January 13, 2009

Meeting Summary

The main points drawn from this discussion were that rental housing is very scarce, especially affordable housing, and that less expensive housing would be available to ISL workers and families in Glenrock, Douglas, and Wright. However, those cities also have a shortage of affordable housing. Also, the Powder River Basin has good roads and the school capacity and retail establishments are sufficient for the present. Fire and police departments are adequately staffed. Medical and hospital facilities are able to provide good service. Additionally, the industry boom-bust cycles are typical, making it hard to maintain available and affordable housing. The population of Casper is about 53,000 (75,000 including suburbs) and the current economic downturn will likely make housing more affordable. Developers are currently building housing for both upper and lower income families.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Craig Collins, Casper Planning Department
Robin Mundell, Casper Planning Department

Follow-up Items

None

Wyoming Community Development Authority (WCDA), Casper, Wyoming – January 13, 2009

Meeting Summary

Discussions centered around the impact of resource extraction, including ISL, on housing. The WCDA was able to provide extensive data on existing housing statewide, and future projections. The main points raised were that rental housing is scarce in the Powder River Basin and Great Divide Basin; single family housing tends to be out of the affordable range; those seeking to move to Wyoming from economically hard-hit areas have a difficult time selling their homes; and the Wyoming economy is doing very well compared to the nation as a whole. Most Moore Ranch and Nichols Ranch workers are expected to live in Casper, Gillette, and other smaller communities such as Wright. The level of healthcare, education, and commercial facilities is generally good. Rawlins would likely be the main base for Lost Creek employees (possibly Wamsutter). There is no office of state planning.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
David Haney, WCDA
Cheryl Gillam, WCDA

Follow-up Items

None

Lander Chamber of Commerce, Lander, Wyoming – January 13, 2009

Meeting Summary

Inquiries were made regarding housing and workforce. There is some limited housing available in Fremont County (Lander Area), but it's pricey. Jeffrey City may be a better bet as there are still houses there from the oil boom in the late 80s/early 90s. The thought was that there would be sufficient skilled labor available due to the slowdown in the oil industry.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Chamber of Commerce Director
Chamber of Commerce Receptionist

Follow-up Items

None

Bureau of Land Management Field Office, Buffalo, Wyoming – January 14, 2009

Meeting Summary

BLM staff explained their responsibilities under NEPA and their review and approval process of Plans of Operations submitted by ISL applicants. BLM staff also provided details on the update to the Buffalo Resource Management Plan, in which they just completed the scoping process. Since no BLM lands are present on the Moore Ranch Project site, BLM staff is not likely to review that application. Regarding the Nichols Ranch Project, BLM staff will provide comments on NRC's environmental documents and request frequent communication with the NRC throughout the environmental review process. BLM staff sees the main issues for the Nichols Ranch Project to be related to cultural resources and tribal concerns since the Pumpkin Buttes was designated a Traditional Cultural Property (TCP) in June 2007. The BLM is in the process of developing a PA for the TCP. BLM staff emphasized the importance of good construction of injection wells and did not seem concerned with CBM operations and ISL operations occurring simultaneously in the same area because of the large distances between CBM wells. BLM has prepared Plan of Development (POD) EISs and a 2003 EIS on CBM and natural gas, which have solid cumulative impacts analyses for the Powder River Basin. FWS staff discussed the locations of sage grouse core areas in the Powder River Basin, the possible need for avoidance of these areas, and the candidate conservation assurances program. FWS staff stated that additional information on sage grouse is present in the Northeast Wyoming Management Plan. FWS staff raised a concern over migratory birds, specifically related to the electrocution of raptors on power poles and they recommended buried power lines or aboveground lines conforming to the requirements set by the Avian Power Line Interaction Committee.

Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Buck Dumone, BLM
Jerry Queen, BLM
Clint Crago, BLM
Tom Bills, BLM
Paul Beels, BLM
Brad Rogers, FWS
Pete Ramirez, FWS

Follow-up Items

NRC to review BLM's POD EISs and 2003 EIS on CBM and natural gas to see if the cumulative impacts analyses can be incorporated into the NRC documents. NRC to also review the Northeast Wyoming Management Plan for sage grouse.

Department of Environmental Quality District 3 Office, Sheridan, Wyoming – January 14, 2009

Meeting Summary

DEQ staff explained their two tier review process of applications, which consists first of a completeness review and then a technical review (150 days to complete). Both the Moore Ranch and Nichols Ranch ISL applications have been through the completeness review and are undergoing the technical review with Moore Ranch to be completed first. DEQ staff's initial assessment of both applications is that additional information is necessary from the applicant and inconsistencies arise in both applications. DEQ staff's main concerns with both projects are cumulative impacts (whether ISL, CBM, and O&G can all occur simultaneously), groundwater quality resulting from unconfined aquifer conditions (effects on drawdown, ability to limit excursions, restoration), and underground injection well viability (which formation to drill into).

Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Mark Rogaczewski, DEQ Land Quality Division District 3
Don Fischer, DEQ Water Quality Division
Glenn Mooney, DEQ Land Quality Division District 3

Follow-up Items

None

Department of Environmental Quality District Office, Lander, Wyoming – January 14, 2009

Meeting Summary

A brief update was presented on the status of the GEIS and the EA for Lost Creek. The topic of requests for additional information (RAIs) was discussed. It was found that the DEQ, in addition to the list of RAIs submitted last summer on UR-Energy's application, was currently preparing a much larger list (200 in addition to the initial 45). The DEQ's primary concern is groundwater impact. The Water Quality Division (WQD) determines the class of use of an aquifer, but the EPA determines the exemption boundary. For deep well injection of wastes, the contact at the WQD identified was John Passehl. The DEQ is the agency that issues the actual mining permit, with the BLM concurring. DEQ, however, is also concerned with surface disturbance. If the total amount of disturbance is less than 5 acres, the DEQ issues a Drilling Notification (similar to the BLM's Notice). If the disturbance exceeds 5 acres, a License to Explore is issued (similar to the BLM's Plan of Operation). Bonding is also required by the DEQ and, in fact, the DEQ is the bond holder, even when BLM land is involved. For bond release, 2 years of successive growing seasons must occur after reclamation. Issues, besides groundwater that were raised during the meeting included the need to address solid waste disposal. This includes a complete characterization of the various waste streams, the disposal facilities intended to be used, and if there is to be any hazardous waste generated. The U.S. Department of Game & Fish (DGF) is concerned with the potential impacts to sage grouse. In particular, there appears to be a lek within the boundary of the Lost Creek site. There is a 1/4-mi exclusion area, as well as a 2-mi limited activity area surrounding each lek. The DGF also has an issue with the installation of overhead utility lines (as roosts for raptors). In addition to groundwater quality, groundwater drawdown is an issue. DEQ is asking the applicant to address potential drawdown outside the boundary of the site (up to 3 mi), and to identify users. The DEQ is also concerned with the fault running through the site, and if the potentiometric surface differs either side of it. Regional (outside the permit boundary) well data is also being asked of the applicant by the DEQ. The DEQ questions the need for such a large permit boundary if the ore body only occupies a portion of the site. A new requirement of the DEQ is the need for the applicant to submit data (including well, and GW data) for the first mine unit to operate at an ISL. This seems to be problematic, in that this information is not normally available until after the NRC issues its license. The DEQ is also requesting the applicant to submit additional cross-sections for the Lost Creek site. DEQ is also requesting a more detailed description of the hydrogeology of the site: thicknesses of the confining units, the multiple sands within the primary production zone in the Battle Spring Formation HJ unit, and deep well injection. Stability monitoring is required after uranium recovery is complete (quarterly monitoring for 12 months, then annually, thereafter).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Amy Boyle, DEQ
Melissa Bautz, DEQ

Carrie Dobey, DGF

Follow-up Items

DEQ WQD to determine the class of aquifer for the HJ unit, as well as the appropriate monitoring well distribution.

Bureau of Indian Affairs (BIA) Wind River Agency, Fort Washakie, Wyoming – January 15, 2009

Meeting Summary

NRC provided a status of the GEIS, the environmental review process the NRC is undertaking, and proposed ISLs in Wyoming. There was more concern over legacy sites than the proposed new uranium recovery facilities in Wyoming. In particular, the conventional mill near Riverton was discussed because of the groundwater plume. While there are no ISL facilities proposed for the Wind River Reservation, it was told us that anytime a new facility is proposed, all the tribes in Wyoming should be notified. The names of two cultural resource contacts were given to us: Amanda White (Northern Arapaho) and Reed Tidzump (Eastern Shoshone). The counties within the state generally send letters to the tribes for concurrence on cultural matters. It was suggested that when cultural resource studies are performed, tribal elders be contacted so that items other than physical features (e.g., spiritual/sacred views) may be identified. The Wind River Reservation has its own environmental commissions (air, water, etc.).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Nation, BIA
Tony Pingree, BIA
Kelly Ferris, BIA
Trisha Cachelin, BIA
John Enos, Shoshone
Steve Babbitts, BIA
Kassel Weeks, WREQC
Don Aragon, WREQC

Follow-up Items

NRC to send copies of draft GEIS (CD) to BIA and Wind River Agency. NRC to send letters to Northern Arapaho and Eastern Shoshone tribes regarding the licensing of the Lost Creek project. The CD and letters were sent in February 2009.

Bureau of Land Management Field Office, Casper, Wyoming – January 15, 2009

Meeting Summary

NRC gave a status of the GEIS and BLM MOU. BLM explained the difference in the types of BLM land. Leasable land, also known as acquired land, is land that the US has bought back the mineral rights. This represents only a small portion of BLM lands. Locatable land is land that

was originally federal-owned, and represents most of BLM lands. BLM was concerned that the GEIS does not distinguish between the two types of land. BLM was pleased to hear that there is progress being made on the MOU, but has a concern about how field office personnel working jointly on a NEPA document with the NRC would be reimbursed for their effort. BLM was also questioning whether the state or field office would participate in the development of the MOU.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Tom Foertsch, BLM
Patrick Moore, BLM

Follow-up Items

NRC to send copies of the proposed ISL Wyoming site map to the Casper Field Office and the State BLM Office. NRC sent the copies of the map in February 2009.

Buffalo Chamber of Commerce (COC), Buffalo, Wyoming – January 15, 2009

Meeting Summary

The COC Board raised the issues of impacts to wildlife (specifically to sage grouse) and socioeconomics (specifically housing capacity) in regards to the potential Nichols Ranch Project. The COC Board stated that Kaycee does not have the housing capacity and services that Buffalo has. The COC Board stated that the County school system has the capacity to handle additional students. RV parks and motels still have ample space in the county for workers who choose not to permanently relocate into the County. The COC Board emphasized that like most of the state, the county's population fluctuates with the industry cycles of booms and busts.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Margaret Dunfee, COC
Various members from the COC Board

Follow-up Items

None

Johnson County Commissioners, Buffalo, Wyoming – January 15, 2009

Meeting Summary

The County Commissioners raised the issues of impacts to socioeconomics, both positive and negative, in regards to the potential Nichols Ranch Project. Specifically, the County

Commissioners mentioned the shortage of housing in Kaycee, the shortage of housing for low-moderate income families in the County, and the poor conditions of Trabing Road (also known as Iragary Road), which is a likely commuter path from Buffalo and Kaycee to the Nichols Ranch Project site. Trabing Road has been heavily utilized by CBM operators and although it is a county-maintained road, the County does not have enough funding currently to upgrade the road. The County Commissioners requested that the path of transport for the yellowcake be described in the NRC's environmental document. We also discussed positive economic impacts from new ISL projects such as the creation of new jobs and the addition to tax base. The County Commissioners stated that emergency response services needed for the Nichols Ranch Project would come from either Buffalo or Kaycee. The County Planner stated that the only local permitting required of the applicant would be for a septic system leach field up to 2,000 gallons in size.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Smokey Wildeman, Commissioner
Gerald Fink, Chairman
Rob Yingling, County Planner

Follow-up Items

None

Campbell County Economic Development Corporation (CCEDC), Gillette, Wyoming – January 15, 2009

Meeting Summary

The discussion focused on the impact of resource extraction, including ISL, on housing, schools and other community facilities, and socioeconomics. The vacancy rate for rental housing has been close to zero for the last four years; 850 rental units in Gillette have recently been built and fully occupied. The local economy is mineral-based and has gone through boom and bust cycles which have discouraged investment in housing. Local government has extended water and sewer lines well beyond city limits to encourage development. Land is being annexed aggressively by the city as a spur to foster residential development. Two new elementary schools have been built and two more are planned.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Michael Surface, CCEDC
Susan Yerke, CCEDC
Brandi Beecher, CCEDC

Follow-up Items

None

Town of Wright, Wright, Wyoming – January 15, 2009

Meeting Summary

A new power plant is being built nearby. O&G extraction and coal mining are active in the vicinity. Almost 200 single family houses have just been built and the town has purchased 113 acres, some of which will be for housing; the land includes water service. It is hard to get developers to come out to a small town of under 5,000 people, although tax credits exist for rural development. There are several private apartments in the community and many employers are building motels and renting rooms to their workers. A new shopping center has been built and the town has one medical clinic. The junior and senior high schools have been combined and capacity is adequate.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Lyle Murdock, Wright Building Official

Follow-up Items

None

Converse County Planning Department Douglas, Wyoming – January 15, 2009

Meeting Summary

In discussing where workers from the Powder River Basin may live, Converse County Planning Department Douglas, Wyoming staff thought that the cities of Glenrock and Douglas would likely home bases for workers for the Nichols Ranch and Moore Ranch projects; Midwest and Wright were also mention as possibilities. Some trailer parks might have vacancies but rental apartments are scarce and expensive. There is the potential for new hotels/motels to be built. There are 130 zoned and platted lots for housing but they are without services. The state has a loan program for first-time home buyers. The current population is about 6,000 people, but the city could accommodate a total of 10,000. Schools are close to capacity in Douglas but Glenrock may have some room.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Forrest Neuerberg, CCPD
Paul Musselman, CCPD

Follow-up Items

None

Converse Area New Development Organization (CANDO) – January 15, 2009

Meeting Summary

CANDO deals primarily with workforce concerns, local economic development, business recruitment and training, and housing. Ranchers are seeking information about energy companies looking for leases on their property. There is a shortage of workers with uranium mining experience. Locally, there is limited housing and Nichols Ranch and Moore Ranch workers would likely face a 1.5 hour commute, which is typical for the area.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Joe Coyne, CANDO
Ed Werner, Consultant to CANDO

Follow-up Items

None

August 24, 2009

Ms. Charlene Dwin Vaughn
Assistant Director
Advisory Council on Historic Preservation
Office of Federal Agency Programs
1100 Pennsylvania Ave, NW, Suite 803
Washington, DC 20004

SUBJECT: NICHOLS RANCH IN-SITU LEACH URANIUM RECOVERY APPLICATION

Dear Ms. Vaughn:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Uranerz Energy Corporation in December 2007 for a new radioactive source material license to construct and operate the Nichols Ranch In-situ Uranium Recovery project located in Campbell and Johnson Counties, Wyoming. The proposed project will consist of two areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20; and 2) the Hank Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the central uranium processing plant with the Hank Unit being the satellite operation.

The NRC has established that, as part of the staff's review of any license application to possess and use source material for uranium milling, a site-specific Supplemental Environmental Impact Statement (SEIS) to its *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*, NUREG-1910, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulations that implement the National Environmental Policy Act of 1969. In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is November 2009.

C. Vaughn 2

If you have any questions or require additional information, please contact the Environmental Project Manager, Ms. Irene Yu, at 301-415-1951 or by e-mail at irene.yu@nrc.gov.

Sincerely,

/RA/

Andrea L. Kock, Branch Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

August 26, 2009

Mr. Richard L. Currit
Senior Archaeologist
Wyoming State Historic
Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: URANERZ ENERGY CORPORATION, NICHOLS RANCH IN-SITU URANIUM RECOVERY PROJECT – SECTION 106 CONSULTATION – STATE HISTORIC PRESERVATION OFFICE FILE #0708RLC009

Dear Mr. Currit:

By letter dated July 1, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff initiated consultation with the Wyoming State Historic Preservation Office concerning the proposed Nichols Ranch In-situ Uranium Recovery (ISR) project by Uranerz Energy Corporation (Uranerz) in Campbell and Johnson Counties, Wyoming. As part of its application to the NRC, Uranerz conducted a Class I literature search, two Class III cultural resource surveys, and a paleontological survey. In accordance with the provisions in 10 CFR Part 51, NRC's regulations that implement the National Environmental Policy Act of 1969 and 36 CFR 800.8(c) of the National Historic Preservation Act, the NRC is currently developing a Supplemental Environmental Impact Statement (SEIS) of Uranerz's request to construct and operate ISR operations, which includes a central processing plant, satellite facility, well fields, and access roads.

As part of its environmental review and development of SEIS for the proposed Nichols Ranch ISR project, NRC staff discussed with the Bureau of Land Management (BLM) concerning the inventoried cultural sites in the vicinity of the proposed project. Mr. Clint Crago, Archaeologist from the BLM-Buffalo Field Office, reviewed the cultural surveys for the project and concluded that "the project will be an adverse effect to the setting of the Pumpkin Buttes traditional cultural property and mitigation measures must be developed to lessen the visual impact." In addition, Mr. Crago acknowledged that "there are a few (recommended) eligible sites in the lease boundary, as well as on top of the ore locations."

NRC staff also corresponded with several Native American tribes concerning the inventoried cultural sites in the vicinity of the proposed project. The NRC received a response from Mr. Conrad Fisher of the Northern Cheyenne Tribal Historic Preservation Office (dated February 12, 2009). Mr. Fisher noted that the "Pumpkin [B]uttes are considered spiritual and ceremonial areas" and that "contaminants from extraction, traffic, noise and dust pollution may effect [sic] the overall condition of the area." To date, no other responses have been received.

After a review of the information provided by Uranerz, potential impacts from the proposed project, and discussed/corresponded with the BLM and Native American Tribes, NRC staff has determined that the proposed action has the potential to adversely impact four cultural sites in the vicinity of the proposed project. Specifically, these are as follows:

R. Currit 2

- Site 48CA5391 (identified in the Class III survey conducted by Western Land Services for the Tex Draw CBM POD);
- Sites 48CA6146/6147 (identified in the Class III survey by James A. Brunette for Uranerz);
- Site 48CA6148 (identified in the Class III survey by SWCA for the Dry Willow 1 POD and in the Class III survey by James A. Brunette for Uranerz); and
- Site 48CA6927 (identified in the Class III survey by Russell Richard for Uranerz).

NRC staff also concurs with BLM's assessment that the proposed action has the potential to adversely impact the setting of the Pumpkin Buttes.

The cultural resource survey and paleontological survey reports provided by Uranerz in their application to the NRC are enclosed. As part of these survey reports, mitigation measures such as avoidance and/or development of a recovery plan were recommended by the contractor.

NRC staff requests your comments and recommendations on mitigation and the path forward within 30 days of receipt of this letter and associated materials. If you have any questions or require additional information, please contact the Environmental Project Manager, Ms. Irene Yu at (301) 415-1951, or at irene.yu@nrc.gov.

Sincerely,

/RA/

Andrea L. Kock, Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 40-9067

Enclosure: Uranerz Cultural Resource
Survey and Paleontological Survey Reports

cc w/o enclosure: D. McKenzie, DEQ, Cheyenne
G. Mooney, DEQ, Sheridan
C. Crago, BLM, Buffalo
P. Beels, BLM, Buffalo
M. Thomas, Uranerz
C. Fisher, Northern Cheyenne THPO

November 10, 2009

MEMORANDUM TO: File

FROM: Briana Balsam, Project Manager... **/RA/**
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Irene Yu, Project Manager **/RA/**
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

SUBJECT: SUMMARY OF TELECONFERENCE WITH PEDRO RAMIREZ, WYOMING FIELD OFFICE, U.S. FISH AND WILDLIFE SERVICE, REGARDING ENDANGERED SPECIES ACT INFORMAL CONSULTATION FOR THE PROPOSED NICHOLS RANCH ISR PROJECT (DOCKET NO. 040-09067)

On November 6, 2009, The U.S. Nuclear Regulatory Commission (NRC) staff held a teleconference with Pedro Ramirez of the Wyoming Field Office of the U.S. Fish and Wildlife Service (FWS) to discuss the status of informal consultation under the Endangered Species Act (ESA) as part of the review for the Supplemental Environmental Impact Statement (SEIS) for the Nichols Ranch In-situ Uranium Recovery (ISR) Project. The following is a summary of the teleconference and a list of participants.

Background

On and within the vicinity of the Nichols Ranch ISR Project site, potential suitable habitat (a black-tailed prairie dog complex totaling 941.8 acres) for the black-footed ferret (*Mustela nigripes*) exists; however, no black-footed ferret population occurs near the site. The black-footed ferret is a federally endangered species that is closely associated with prairie dog habitat. The FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations in 2004 (FWS, 2004). However, the FWS continues to direct Federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a

future reintroduction site for the black-footed ferret for prairie dog complexes 1,000 acres or greater in size. Due to the presence of black-tailed prairie dog habitat of nearly 1,000 acres, the NRC has continued informal consultation with the FWS to ensure that the provisions of the ESA are upheld regarding the black-footed ferret.

Meeting Summary

NRC staff updated Mr. Ramirez on the project status for the proposed Nichols Ranch ISR Project SEIS and discussed the expected conclusions on impacts to federally threatened and endangered species. NRC described the occurrence of black-tailed prairie dog (*Cynomys ludovicianus*) habitat on and in the vicinity of the proposed Nichols Ranch ISR Project site and sought clarification as to whether the habitat was sufficiently large to initiate formal consultation regarding the black-footed ferret.

Mr. Ramirez said that, consistent with the 2004 FWS letter block-clearing the State of Wyoming from conducting black-footed ferret surveys in black-tailed prairie dog habitat less than 1,000 acres in size, the black-tailed prairie dog habitat on the proposed Nichols Ranch ISR Project site does not need to be surveyed. Mr. Ramirez informed the NRC that initiating formal consultation and submitting a Biological Assessment (BA) for the black-footed ferret to the FWS would not be necessary for this proposed project.

Meeting Participants

Pedro Ramirez, FWS
Briana Balsam, NRC
Nathan Goodman, NRC
Irene Yu, NRC

References

FWS (U.S. Fish and Wildlife Service) 2004. Letter to Interested Parties from B.T. Kelly, Field Supervisor, Wyoming Field Office, U.S. Fish and Wildlife Service. Subject: Block Clearance for Black-Footed Ferret Surveys. February 2, 2004. ADAMS No. ML092780370.

March 25, 2010

MEMORANDUM TO: File

FROM: Briana Balsam, Project Manager /**RA**/
Environmental Review Branch-B
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

SUBJECT: SUMMARY OF TELECONFERENCE WITH PEDRO RAMIREZ, WYOMING FIELD OFFICE, U.S. FISH AND WILDLIFE SERVICE, REGARDING EAGLE TAKE RULE FOR THE PROPOSED NICHOLS RANCH ISR PROJECT (DOCKET NO. 040-09067) AND THE PROPOSED MOORE RANCH ISR PROJECT (DOCKET NO. 040-09073)

On March 15, 2010, Ms. Briana Balsam of the U.S. Nuclear Regulatory Commission (NRC) staff held a teleconference with Pedro Ramirez of the Wyoming Field Office of the U.S. Fish and Wildlife Service (FWS) to discuss the applicability of the FWS rule for permitting eagle takes (74 FR 46836) as part of the review of public comments submitted for the draft Supplemental Environmental Impact Statement (SEIS) for the Nichols Ranch In-situ Uranium Recovery (ISR) Project (NRC, 2009b) and the draft SEIS for the Moore Ranch ISR Project (NRC, 2009a). The following is a summary of the teleconference and a list of participants.

Background

On January 27, 2010, the U.S. Department of Interior (DOI) submitted comments (DOI, 2010a) on the draft SEIS for the Moore Ranch ISR Project, and on January 28, 2010, the DOI submitted comments (DOI, 2010b) on the draft SEIS for the Nichols Ranch ISR Project that contained information about the rule for permitting eagle takes, which was published in the *Federal Register* on September 11, 2009 (74 FR 46836). DOI's comments directed the NRC to contact the FWS's Ecological Services Field Office in Cheyenne Wyoming to discuss potential impacts of each project on eagles.

A communal roost is located on the Nichols Ranch ISR Project site, at which 13 eagles were observed in 2009 (DOI, 2010b). No communal roosts are located on the Moore Ranch ISR Project site. No bald eagle nests occur on either the Nichols Ranch ISR Project site or the Moore Ranch ISR Project site.

CONTACT: Briana Balsam, FSME/DWMEP
(301) 415-1042

File 2

Meeting Summary

Ms. Balsam discussed with Mr. Ramirez the potential need for an eagle permit for both the Nichols Ranch ISR Project and the Moore Ranch ISR Project. Mr. Ramirez referred Ms. Balsam to the *National Bald Eagle Management Guidelines* (FWS, 2007), which include recommendations for avoiding disturbance at foraging areas and communal roost sites. Mr. Ramirez indicated that if the projects were following these guidelines, and that specifically, no trees with nests were being disturbed, the NRC would not need to consult with the FWS at this time. Mr. Ramirez indicated that if project plans changed such that the bald eagle management guidelines were not upheld or a nest was discovered in a tree that would be disturbed, then the NRC should consult with the FWS at that time.

Meeting Participants

Pedro Ramirez, FWS
Briana Balsam, NRC

Docket Nos.: 040-09067; 040-09073

References

74 FR 46836, U.S. Fish and Wildlife Service. "Eagle Permits; Take Necessary To Protect Interests in Particular Localities." *Federal Register*: Volume 74, No. 175, pp. 46836-46879. September 11, 2009.

DOI (U.S. Department of Interior). 2010b. Letter from R.F. Stewart, Regional Environmental Officer, to M.T. Lesar, Chief, Rulemaking and Directives Branch. Subject: Comments on the Draft Environmental Impact Statement (DEIS) for the Moore Ranch ISR Project in Campbell County, WY; Supplement to the Generic EIS for In-Situ Leach Uranium Milling Facilities. January 27, 2010. ADAMS No. ML100341191.

DOI (U.S. Department of Interior). 2010b. Letter from R.F. Stewart, Regional Environmental Officer, to M.T. Lesar , Chief, Rulemaking and Directives Branch. Subject: Comments on the Draft Environmental Impact Statement (EIS) for the Nichols Ranch In-Situ Recovery Project in Campbell and Johnson Counties, WY; Supplement to the Generic EIS for In-Situ Leach Uranium Milling Facilities. January 28, 2010. ADAMS No. ML100341216.

FWS (U.S. Fish and Wildlife Service). 2007. *National Bald Eagle Management Guidelines*. May 2007. <http://www.fws.gov/pacific/eagle/NationalBaldEagle ManagementGuidelines.pdf> (March 15, 2010).

NRC (U.S. Nuclear Regulatory Commission). 2009a. NUREG-1910, Supplement 1, D*raft Supplemental Environmental Impact Statement for the Moore Ranch ISR Project in Campbell County, WY*. Washington, DC: December 2009.

NRC (U.S. Nuclear Regulatory Commission). 2009a. NUREG-1910, Supplement 2, D*raft Supplemental Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, WY*. Washington, DC: December 2009.

April 23, 2010

Mr. Ivan Posey, Chairman
Shoshone Business Council
P.O. Box 538
Fort Washakie, WY 82514

SUBJECT: REQUEST FOR INFORMATION REGARDING HISTORIC, CULTURAL AND ARCHAEOLOGICAL RESOURCES POTENTIALLY AFFECTED BY THE PROPOSED NICHOLS RANCH ISR PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING (Docket No. 040-09067) AND INVITATION TO BECOME A SIGNATORY TO ASSOCIATED MEMORANDUM OF AGREEMENT

Dear Mr. Posey:

On December 24, 2008, Mr. Gregory Suber of the U.S. Nuclear Regulatory Commission (NRC) contacted you to request information regarding tribal, historic, and cultural resources potentially affected by the proposed Nichols Ranch *In-Situ* Uranium Recovery (ISR) Project in Campbell and Johnson Counties, Wyoming. Uranerz Energy Corporation (Uranerz) submitted an application for this project by letter dated November 30, 2007, and the NRC's review of this application is ongoing.

As part of the Section 106 consultation under the National Historic Preservation Act for this project, the NRC intends to prepare a draft Memorandum of Agreement (MOA) between Uranerz, NRC, the State Historic Preservation Officer, the U.S. Bureau of Land Management, and the Wyoming State Attorney General's Office to mitigate impacts to cultural resources as a result of the proposed project.

There are a total of 11 sites that are eligible or recommended eligible for listing on the *National Register of Historic Places* within the area of potential effect. One site (48CA5391), a prehistoric lithic scatter is located within the proposed Nichols Ranch ISR Project site. The remaining 10 sites are located within the proposed Hank Unit site. Of these 10 sites, one is the multi-component Pumpkin Buttes Traditional Cultural Place (TCP) (48CA268), one is a multi-component prehistoric camp site with historic trash scatter (48CA6147), and eight are prehistoric sites (48CA6146, 48CA6148, 48CA6475, 48CA6490, 48CA6748, 48CA6751, 48CA6753, and 48CA6927). There will be no adverse effect to archaeological sites from the proposed action. Uranerz will avoid direct ground disturbing activities to these sites. Measures to protect these sites have been incorporated into Uranerz's project mine plan and incorporated into Wyoming Department of Environmental Quality/Land Quality Division permit applications.

Visual impacts associated with the proposed project to the Pumpkin Buttes TCP will be addressed in the MOA. The NRC requests any information regarding the Pumpkin Buttes TCP and assistance in developing the MOA. The NRC also invites you to be a signatory to the MOA. Other potential signatories include Uranerz (the applicant), the Bureau of Land Management, and the Wyoming State Historic Preservation Office.

I. Posey - 2 -

Additional information concerning cultural and archaeological resources in the vicinity of the proposed project can be found in NRC's Draft Supplemental Environmental Impact Statement (DSEIS) for the Nichols Ranch ISR Project. The DSEIS is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the DSEIS is ML093340536. The Nichols Ranch ISR Project license application is also publicly available in the PDR or from the ADAMS Public Electronic Reading Room. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding cultural and archaeological resources that may be helpful in drafting an MOA within 30 days of the receipt of this letter to the NRC, Attn: Mr. Kevin Hsueh, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Ms. Briana Balsam of my staff by telephone at 301-415-1042 or by email at Briana.Balsam@nrc.gov. Additionally, if you would like to become a signatory to the MOA, please include this request with your comments. Thank you for your assistance.

Sincerely,

/RA/

Kevin Hsueh, Branch Chief
Environmental Review Branch-B
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

cc: Arlen Shoyo

Eastern Shoshone Tribe

To: Mr. Ivan Posey, Chairman
Shoshone Business Council
P.O. Box 538
Fort Washakie, WY 82514

cc: Mr. Arlen Shoyo
Shoshone Tribal Historical Preservation Officer
Shoshone Oil & Gas Commission
P.O. Box 538
Fort Washakie, WY 82514

Northern Arapho Tribe

To: Mr. Richard Brannan, Chairman
Arapaho Tribal Business Council
P.O. Box 396
Fort Washakie, WY 82514

cc: Ms. Darlene Conrad
Arapaho Tribal Preservation Officer
P.O. Box 1184
Fort Washakie, WY 82514

Northern Cheyenne Tribe

To: Leroy Spang, President
Northern Cheyenne Tribal Council
P.O. Box 128
Lame Deer, MT 59043

cc: Mr. Conrad Fisher
Tribal Historical Preservation Officer
P.O. Box 128
Lame Deer, MT 59043

Blackfeet Tribe

To: Mr. Willie A. Sharp, Chairman
Blackfeet Tribal Business Council
P.O. Box 850
Browning, MT 59417

cc: Mr. John Murray
Blackfeet Tribal Historical Preservation Officer
P.O. Box 850
Browning, MT 59417

Three Affiliated Tribes

To: Mr. Marcus D. Wells Jr., Chairman
Three Affiliated Tribes Business Council
404 Frontage Rd.
New Town, ND 58763

cc: Mr. Perry Brady
Three Affiliated Tribes Tribal Historical Preservation Officer
404 Frontage Rd.
New Town, ND 58763

Ft. Peck Assiniboine/Sioux Tribe

To: Mr. A.T. Stafne, Chairman
Ft. Peck Tribal Executive Board
P.O. Box 1027
Poplar, MT 59255

cc: Darrell "Curley" Youpee, Director
Ft. Peck Tribal Cultural Resources Director
Fort Peck Assiniboine and Sioux Tribes
P.O. Box 1027
Poplar, MT 59255

Oglala Sioux

To: Mr. John Yellow Bird Steele, President
Oglala Sioux Tribal Council
P.O. Box 2070
Pine Ridge, SD 57770

cc: Ms. Joyce Whiting
Oglala Sioux Tribal Historic Preservation Officer
P.O. Box 2070
Pine Ridge, SD 57770

Crow – Tribe

To: Mr. Carl Venne
Crow Tribal Council
P.O. Box 159
Crow Agency, MT 59022

cc: Mr. Dale Old Horn
Crow Tribalal Cultural Resources
P.O. Box 159
Crow Agency, MT 59022

Cheyenne River Sioux Tribe

To: Mr. Joseph Brings Plenty, Sr.
Cheyenne River Sioux Tribal Council
P.O. Box 590
Eagle Butte, SD 57625

cc: Ms. Donna Rae Peterson
Tribal Historical Preservation Officer
P.O. Box 590
Eagle Butte, SD 57625

From: Bjornsen, Alan
Sent: Wednesday, May 12, 2010 12:14 PM
To: cultres@nemontel.net
Subject: Pumpkin Buttes MOA

Mr. Youpee,

On April 23, 2010 a letter was sent to you regarding the proposed Nichols Ranch ISR facility in the Powder River Basin of Wyoming. In the letter it was stated that because the proposed facility could potentially affect the Pumpkin Buttes TCP, a memorandum of agreement (MOA) was being prepared. The letter asked if you may have information why your tribe considers the site sacred, and if you wish to be a signatory on the MOA. Please let me know by Friday, Mat 14, 2010 if your tribe has an interest in this proposed project.

Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Pumpkin Buttes MOA
Sent Date: 5/12/2010 12:07:00 PM
Received Date: 5/12/2010 12:13:00 PM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
cultres@nemontel.net (cultres@nemontel.net)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	7997	5/12/2010

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Wednesday, May 12, 2010 11:52 AM
To: pbrady@mhanation.com
Subject: Pumpkin Buttes MOA

Mr. Brady,

In accordance with our telephone call this morning, it is my understanding that the Three Affiliated Tribes do not have an interest in the MOA that is being developed for the proposed Nichols Ranch ISR facility near the Pumpkin Buttes in the Powder River Basin of Wyoming. Is this correct?
Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Pumpkin Buttes MOA
Sent Date: 5/12/2010 11:48:36 AM
Received Date: 5/12/2010 11:52:00 AM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
pbrady@mhanation.com (pbrady@mhanation.com)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	7790	5/12/2010

Options
Expiration Date:

Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Thursday, May 13, 2010 6:39 AM
To: ostnrranrd@gwtc.net
Subject: FW: Tribal letter
Attachments: Tribal letter - ML1008800840.pdf

Mike,

As a result of our telephone conversation, yesterday, I am attaching the letter explaining the proposed Nichols Ranch ISR facility in the Powder River Basin of Wyoming. The facility site is close to the Pumpkin Buttes, and a Memorandum of Agreement is currently being prepared. The letter, as you will read asks if the Oglala Sioux would like to be a signatory on the MOA. If you have any questions about the proposed project or the MOA you may contact me at one of the means listed below.

Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: FW: Tribal letter
Sent Date: 5/13/2010 6:32:22 AM
Received Date: 5/13/2010 6:38:00 AM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
ostnrranrd@gwtc.net (ostnrranrd@gwtc.net)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	103461	5/13/2010

Tribal letter - ML1008800840.pdf 95017

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Thursday, May 13, 2010 12:51 PM
To: chairmanjosephbringsplenty@yahoo.com
Cc: r_turningheart@yahoo.com; lakotalace@yahoo.com
Subject: Nichols Ranch ISR

Mr. Chairman,

This afternoon I spoke with your administrative assistant, Lacey, about the letter (dated April 23, 2010) that was sent to you by the NRC concerning the proposed Nichols Ranch ISR uranium recovery project, located in the Powder River Basin in Wyoming. The proposed site is close to the Pumpkin Buttes. Because the Buttes are a TCP, a memorandum of agreement (MOA) is being prepared in accordance Section 106 of the Nation Historic Preservation Act. The letter asks if the Cheyenne River Sioux Tribe has an interest in the Pumpkin Buttes, and invites the Tribe to be a signatory on the MOA.

In speaking with Lacey, she indicated that any decision regarding participation in the MOA would be made by you. I look forward to your response.

Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Nichols Ranch ISR
Sent Date: 5/13/2010 12:36:28 PM
Received Date: 5/13/2010 12:50:00 PM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
chairmanjosephbringsplenty@yahoo.com (chairmanjosephbringsplenty@yahoo.com)
Tracking Status: None
r_turningheart@yahoo.com (r_turningheart@yahoo.com)
Tracking Status: None
lakotalace@yahoo.com (lakotalace@yahoo.com)

Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	10147	5/13/2010

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Thursday, May 13, 2010 1:27 PM
To: conrad.fisher@cheyennenation.com
Cc: Balsam, Briana; Swain, Patricia
Subject: Nichols Ranch

Conrad,

Thank you for returning my telephone call, today. I was happy to be able to briefly explain to you what in-situ uranium recovery (ISR) is. When I find a name for you to contact from the Applicant, and you actually get a chance to see the site, you will have more of an appreciation of ISR.

The NRC appreciates your interest in the proposed Nichols Ranch facility. As I explained during our call, when we get a draft of the Memorandum of Agreement (MOA) together, all potential signatories will be sent a copy for their review. At that point, your Council members and attorneys can decide if they want to become party to the MOA.

Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Nichols Ranch
Sent Date: 5/13/2010 1:10:07 PM
Received Date: 5/13/2010 1:26:00 PM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
conrad.fisher@cheyennenation.com (conrad.fisher@cheyennenation.com)
Tracking Status: None
Briana.Balsam@nrc.gov (Balsam, Briana)
Tracking Status: None
Patricia.Swain@nrc.gov (Swain, Patricia)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	10342	5/13/2010

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Thursday, May 13, 2010 1:52 PM
To: blkftthpo@aol.com
Cc: Balsam, Briana; Swain, Patricia; Davis (FSME), Jennifer; Hsueh, Kevin
Subject: Nichols Ranch ISR
Attachments: Tribal letter - ML1008800840.pdf

John,

Thank you for speaking with me this afternoon. Just to confirm what I heard you say, the Blackfeet Tribe is interested in the proposed Nichols Ranch project in the Powder River Basin of Wyoming, and you would like to receive a copy of the Draft MOA for the Pumpkin Buttes for review.

Attached, as promised, is a copy of the letter (dated April 23, 2010) sent to your Chairman.

Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Nichols Ranch ISR
Sent Date: 5/13/2010 1:44:00 PM
Received Date: 5/13/2010 1:51:00 PM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
blkftthpo@aol.com (blkftthpo@aol.com)
Tracking Status: None
Briana.Balsam@nrc.gov (Balsam, Briana)
Tracking Status: None
Patricia.Swain@nrc.gov (Swain, Patricia)
Tracking Status: None
Jennifer.Davis@nrc.gov (Davis (FSME), Jennifer)

Tracking Status: None
Kevin.Hsueh@nrc.gov (Hsueh, Kevin)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	106866	5/13/2010
Tribal letter - ML1008800840.pdf	95017	

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Thursday, May 13, 2010 1:57 PM
To: vernehill@gmail.com
Subject: Nichols Ranch ISR & MOA
Attachments: Tribal letter - ML1008800840.pdf

Verne,

I thought I would forward you a copy of the letter I was talking about yesterday on the phone.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Nichols Ranch ISR & MOA
Sent Date: 5/13/2010 1:54:54 PM
Received Date: 5/13/2010 1:56:00 PM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
vernehill@gmail.com (vernehill@gmail.com)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	103050	5/13/2010
Tribal letter - ML1008800840.pdf	95017	

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False

Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Thursday, May 13, 2010 2:58 PM
To: D Conrad
Cc: Balsam, Briana; Swain, Patricia; Hsueh, Kevin; Davis (FSME), Jennifer
Subject: Nichols Ranch ISR & MOA
Attachments: Tribal letter - ML1008800840.pdf

Darlene,

On April 23, 2010, a letter was sent to the Chairman of the Northern Arapaho Tribal Business Council, Mr. Richard Brannon. I've attached an electronic copy of the letter for your convenience. The letter references the proposed Nichols Ranch ISR project in the Powder River Basin. The site is located near the Pumpkin Buttes TCP. Because of the nearness of the TCP, a Memorandum of Agreement (MOA) is being prepared.

The letter asks two things of the Chairman: 1) is there information that the Tribe has that would aid in the development of the MOA; and 2) would the Chairman desire to be a signatory on the MOA?

Please get back to me by Monday, May 17, 2010. Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Nichols Ranch ISR & MOA
Sent Date: 5/13/2010 2:44:39 PM
Received Date: 5/13/2010 2:58:00 PM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
narapahothpo_2009@ymail.com (D Conrad)
Tracking Status: None
Briana.Balsam@nrc.gov (Balsam, Briana)
Tracking Status: None

Patricia.Swain@nrc.gov (Swain, Patricia)
Tracking Status: None
Kevin.Hsueh@nrc.gov (Hsueh, Kevin)
Tracking Status: None
Jennifer.Davis@nrc.gov (Davis (FSME), Jennifer)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	107101	5/13/2010
Tribal letter - ML1008800840.pdf	95017	

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Michael Catches Enemy [ostnrranrd@gwtc.net]
Sent: Friday, May 14, 2010 10:03 AM
To: Bjornsen, Alan; 'Wlmer'
Cc: 'Joni Tobacco, NRRA WA'; 'Theresa Two Bulls, OST Madam President'
Subject: RE: Tribal letter

Alan,

Alan,

I have no idea at this time. The THPO office is not in a position right now as we have no paid staff working in it. Our THPO Officer, Mr. Wilmer Mesteth is a volunteer at this time. This is one of many requests such as this to be a part of a MOA, PA, MOU, etc. just so you're aware.

I've included

Respectfully,

Michael Catches Enemy
Natural Resources Director

Oglala Sioux Tribe
Natural Resources Regulatory Agency
(605) 867-5624 bus.
(605) 867-2818 fax

From: Bjornsen, Alan [mailto:Alan.Bjornsen@nrc.gov]
Sent: Friday, May 14, 2010 8:16 AM
To: Michael Catches Enemy; 'Wlmer'
Cc: Joni Tobacco, NRRA WA
Subject: RE: Tribal letter

Okay. Thank you. Do you have a time frame for when the Tribe will make a decision to participate?

From: Michael Catches Enemy [mailto:ostnrranrd@gwtc.net]
Sent: Friday, May 14, 2010 9:47 AM
To: 'Wlmer'
Cc: Bjornsen, Alan; Joni Tobacco, NRRA WA
Subject: FW: Tribal letter

Wilmer,

For your review and consideration. I've included Ms. Joni Tobacco, NRRA Water Administrator as well for her review and input.

Respectfully,

Michael Catches Enemy

Natural Resources Director

Oglala Sioux Tribe
Natural Resources Regulatory Agency
(605) 867-5624 bus.
(605) 867-2818 fax

From: Bjornsen, Alan [mailto:Alan.Bjornsen@nrc.gov]
Sent: Thursday, May 13, 2010 4:39 AM
To: ostnrranrd@gwtc.net
Subject: FW: Tribal letter

Mike,

As a result of our telephone conversation, yesterday, I am attaching the letter explaining the proposed Nichols Ranch ISR facility in the Powder River Basin of Wyoming. The facility site is close to the Pumpkin Buttes, and a Memorandum of Agreement is currently being prepared. The letter, as you will read asks if the Oglala Sioux would like to be a signatory on the MOA. If you have any questions about the proposed project or the MOA you may contact me at one of the means listed below.

Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties (000301caf36e$1fd3d950$5f7b8bf0$)

Subject: RE: Tribal letter
Sent Date: 5/14/2010 10:21:29 AM
Received Date: 5/14/2010 10:21:29 AM
From: Michael Catches Enemy

Created By: ostnrranrd@gwtc.net

Recipients:
Alan.Bjornsen@nrc.gov (Bjornsen, Alan)
Tracking Status: None
wanapeyanajica@gmail.com ('Wlmer')

Tracking Status: None
ostnrrawrd@gwtc.net ('Joni Tobacco, NRRA WA')
Tracking Status: None
theresatb@oglala.org ('Theresa Two Bulls, OST Madam President')
Tracking Status: None

Post Office:
net

Files	Size	Date & Time
MESSAGE	20922	5/14/2010

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Cultural Resources Department [cultres@nemontel.net]
Sent: Monday, May 17, 2010 1:39 PM
To: Bjornsen, Alan
Subject: Re: Pumpkin Buttes MOA

Alan,
We are interested to participate in a section 106 of the NHPA. We will make the determinations of what is sacred
when we've had the opportunity to physically inspect and survey the area. No one else can make these determinations
for us. Are we going to enter into formal Government-to-Government consultation?
Piece meal form letters is not consultation.
Please advise how you will proceed.
Curley

----- Original Message -----
From: Bjornsen, Alan
To: cultres@nemontel.net
Sent: Wednesday, May 12, 2010 10:13 AM
Subject: Pumpkin Buttes MOA

Mr. Youpee,

On April 23, 2010 a letter was sent to you regarding the proposed Nichols Ranch ISR facility in the Powder River Basin of Wyoming. In the letter it was stated that because the proposed facility could potentially affect the Pumpkin Buttes TCP, a memorandum of agreement (MOA) was being prepared. The letter asked if you may have information why your tribe considers the site sacred, and if you wish to be a signatory on the MOA. Please let me know by Friday, Mat 14, 2010 if your tribe has an interest in this proposed project.

Thank you.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties (8AC34705C5F54DCB8E5EBDC25C4F9DD2)

Subject: Re: Pumpkin Buttes MOA
Sent Date: 5/17/2010 1:39:29 PM

Received Date: 5/17/2010 1:39:29 PM
From: Cultural Resources Department

Created By: cultres@nemontel.net

Recipients:
Alan.Bjornsen@nrc.gov (Bjornsen, Alan)
Tracking Status: None

Post Office:
CurleyPC

Files	Size	Date & Time
MESSAGE	12992	5/17/2010

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

From: Bjornsen, Alan
Sent: Monday, May 17, 2010 1:55 PM
To: vernehill@gmail.com
Cc: Davis (FSME), Jennifer; Balsam, Briana; Hsueh, Kevin; Yu, Irene
Subject: Nichols Ranch/Pumpkin Buttes MOA

Vernon,

Based upon our telephone conversation this afternoon, I understand the following:

1. The Eastern Shoshone Tribe is interested in being a Signatory to the Memorandum of Agreement that is to be developed for the Pumpkin Buttes TCP as a result of the proposed Nichols Ranch ISR development
2. Mr. Ivan Posey, Tribal Chairman, would be the Signatory for the Eastern Shoshone Tribe
3. Points of consideration for this MOA would be similar to those for the Lost Creek MOA

Thank you for your interest, and for getting back to me so quickly.

Alan B. Bjornsen
Environmental Project Manager
FSME/DWMEP/EPPAD/ERB
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852
(301) 415-1195
alan.bjornsen@nrc.gov

E-mail Properties

Mail Envelope Properties ()

Subject: Nichols Ranch/Pumpkin Buttes MOA
Sent Date: 5/17/2010 1:45:42 PM
Received Date: 5/17/2010 1:54:00 PM
From: Bjornsen, Alan

Created By: Alan.Bjornsen@nrc.gov

Recipients:
vernehill@gmail.com (vernehill@gmail.com)
Tracking Status: None
Jennifer.Davis@nrc.gov (Davis (FSME), Jennifer)
Tracking Status: None
Briana.Balsam@nrc.gov (Balsam, Briana)
Tracking Status: None

Kevin.Hsueh@nrc.gov (Hsueh, Kevin)
Tracking Status: None
Irene.Yu@nrc.gov (Yu, Irene)
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	12304	5/17/2010

Options:
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False

Sensitivity: olNormal
Recipients received:

June 15, 2010

Mr. Richard L. Currit
Senior Archaeologist
Wyoming State Historic
Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: URANERZ ENERGY CORPORATION, NICHOLS RANCH IN-SITU URANIUM RECOVERY PROJECT – SECTION 106 CONSULTATION – STATE HISTORIC PRESERVATION OFFICE FILE #0708RLC009

Dear Mr. Currit:

With this letter, the U.S. Nuclear Regulatory Commission (NRC) is forwarding you the *Anadarko Petroleum Corporation Dry Willow Phase 4 POD Class III Cultural Resource Inventory Campbell County, Wyoming*, prepared by Arcadis U.S., Inc. in July 2008. In a phone conversation with the NRC on March 3, 2010, you requested a copy of this survey in order to continue your review of the effects of the proposed Nichols Ranch In-Situ Recovery (ISR) Project (the undertaking) on historical properties required by Section 106 of the National Historic Preservation Act (NHPA).

For your reference, the NRC has also included background on the NRC's activities pursuant to Section 106 to date, as well as updates to the cultural resource information contained in the draft Supplemental Environmental Impact Statement (SEIS) for the proposed Nichols Ranch ISR Project.[1] NRC staff requests your comments and recommendations on mitigation and the path forward within 30 days of receipt of this letter and associated materials.

BACKGROUND

By letter dated July 1, 2008,[2] NRC staff initiated consultation under Section 106 of the NHPA with the Wyoming State Historic Preservation Office (WY SHPO) concerning the proposed Nichols Ranch ISR project by Uranerz Energy Corporation (Uranerz) in Campbell and Johnson Counties, Wyoming.

The Area of Potential Effect (APE) for the proposed undertaking has been completely inventoried. The applicant, Uranerz, submitted two Class III reports for newly inventoried areas

[1] The draft SEIS is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the DSEIS is ML093340536.

[2] NRC. 2008. Letter to M. Hopkins, State Historic Preservation Officer from G. Suber, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Initiation of Section 106 Process for Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project License Request (Docket No. 040-09067). July 1, 2008. ADAMS No. ML081760693.

and one Class I report for previously inventoried areas with its application for an NRC license. The reports, which were forwarded to you by letter dated August 26, 2009,[3] are listed below:

- *Class III Cultural Resource Inventory of the Uranerz Energy Corporation, Hank In-Situ Uranium Project*. Prepared by Frontier Archaeology. November 2007.
- *Class III Cultural Resource Inventory for Uranerz Energy Corporation's 80-acre Parcel in the Hank Unit, Campbell County, Wyoming*. Prepared by TRC Environmental Corporation. October 2008.
- *Class I Literature Review of Uranerz Energy Corporation's Nichols Ranch ISR Project, Campbell and Johnson Counties Wyoming*. Prepared by TRC Environmental Corporation. March 2010.

In addition to these reports, an additional survey was completed for an unrelated coal bed natural gas plan of development project whose inventoried areas overlap with the proposed Nichols Ranch ISR Project site:

- *Anadarko Petroleum Corporation Dry Willow Phase 4 POD Class III Cultural Resource Inventory Campbell County, Wyoming*. Prepared by Arcadis U.S., Inc. July 2008.
-

As mentioned previously, this survey is attached to this letter per your March 3, 2010, request. Because the review for the Anadarko final project is still pending, this survey has not been reviewed by the WY SHPO office to date.

In the survey, Arcadis inventoried a total of 7340 acres, of which approximately 1040 acres are within the central and southern portion of the Hank Unit of the proposed Nichols Ranch ISR Project permit boundary. Uranerz has enclosed an annotated copy of the Arcadis' project map that shows the relevant portions of the proposed Nichols Ranch ISR Project permit boundaries within the larger area inventoried by the Arcadis report. Note that only the relevant site forms for those sites within the Nichol's Ranch ISR project APE are enclosed with this report. The Arcadis survey did not identify any new sites beyond those discussed in the draft SEIS for the proposed Nichols Ranch ISR Project. It should also be noted that some areas that were inventoried in the Arcadis report were previously inventoried in Frontier Archaeology's 2006 Hank In-Situ Uranium Prospect and 2007 Hank In-Situ Uranium Project, which were forwarded to you in the August 26, 2009 letter.

IDENTIFICATION, ELIGIBILITY, AND EFFECT

The NRC has determined that the identification efforts detailed in the four reports meet the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716).[4] The draft SEIS for the proposed Nichols Ranch ISR Project assesses the impacts to historic and cultural resources within or near the APE for the undertaking and

[3] NRC. 2009. Letter to R. Currit, State Historic Preservation Officer from A. Kock, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project – Section 106 Consultation – State Historic Preservation Office File #0708RLC009. August 26, 2009. ADAMS No. ML092320627.

includes the eligibility, effect, and treatment determinations made by the NRC. The following table summarizes the cultural resources within or near the APE and each site's eligibility. Updates to Tables 3-10 and 3-11 in the draft SEIS appear in **bold**. Note that the column entitled, "Report No.: SHPO Accession No." is included for your convenience and does not appear in the SEIS. Site 48CA268 is bolded in the following table because it was not included in Table 3-11 of the draft SEIS in error, though the site was discussed in detail in the text of the draft SEIS. Additionally, information regarding the *National Register of Historic Places* (NRHP) eligibility status of three sites has changed and are <u>underlined</u> in the table.

Nichols Ranch ISR Project Archaeological Sites

Site ID	Site Type	NRHP Finding	Comments/ Stipulations	Report No.: SHPO Accession No.
Nichols Ranch Unit Archaeological Sites				
48JO2944	Prehistoric: lithic scatter Historic: debris scatter	Not eligible	**No further work**	IV: 8-425
48JO2946	Prehistoric: open camp	Not eligible	**No further work**	IV: 8-425
48JO2948	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 8-425
48JO2949	Historic: debris scatter	Not eligible	**No further work**	IV: 8-425
48JO2950	Historic: debris scatter	Not eligible	**No further work**	IV: 8-425
48JO2953	Prehistoric: lithic scatter Historic: building remains (razed Nichols Ranch)	Not eligible	**No further work**	IV: 8-425
48JO2957	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 8-425
48CA5386	Prehistoric: lithic scatter Historic: hunting blinds and wind breaks	Not eligible	**No further work**	IV: 8-425
48CA5390	Prehistoric: lithic scatter Historic: debris scatter	Not eligible	**No further work**	IV: 8-425
48CA5391	Prehistoric: lithic scatter with feature Historic: debris scatter	Eligible	**Limit construction; protective fencing**[5]	IV: 8-425
48CA5392	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 8-425
48CA5393	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 8-425

[4] 48 FR 44716, National Park Service. "The Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation." *Federal Register*. Volume 48, pp. 44716. Washington, D.C. September 29, 1983.

[5] Uranerz has committed to protecting these sites in their application for an NRC license. Specific mitigation measures to which they have committed are further discussed in the section of this letter entitled "Stipluations."

Site ID	Site Type	NRHP Finding	Comments/ Stipulations	Report No.: SHPO Accession No.
48CA5406	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 8-425
	Hank Unit Archaeological Sites			
48CA268	**Prehistoric/Historic: Traditional Cultural Property**	**Eligible**	**Mitigation of potential adverse effect to setting through MOA[5]**	IV: 5-1851
48CA379	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 6-1350
48CA6146/ 48CA6147	Prehistoric: lithic, groundstone, and FCR scatter with stone circles Historic: debris scatter	**Not eligible**	**No further work**	I
48CA6148	Prehistoric: lithic scatter with stone circles	**Not eligible**	**No further work**	I
48CA6149	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 6-1350
48CA6151	Prehistoric: lithic scatter	Not eligible	**No further work**	IV: 6-1350
48CA6342	Prehistoric: lithic scatter with hearth	Not eligible	**No further work**	IV: 6-1350
48CA6343	Prehistoric: lithic scatter with features	Not eligible	**No further work**	IV: 6-1350
48CA6344	Prehistoric: lithic scatter with FCR	Not eligible	**No further work**	IV: 6-1350
48CA6345	Prehistoric: lithic scatter with FCR	Not eligible	**No further work**	IV: 6-1350
48CA6475	Prehistoric: open camp	Eligible	**Limit construction; protective fencing**	II
48CA6490	Prehistoric: open camp	Eligible	**Limit construction; protective fencing**	II
48CA6491	Prehistoric: lithic scatter	Not eligible	**No further work**	II
48CA6498	Prehistoric: lithic scatter	Not eligible	**No further work**	II
48CA6499	Prehistoric: lithic scatter	Not eligible	**No further work**	II
48CA6748	Prehistoric: lithic scatter with FCR and activity areas	Eligible	**Limit construction; protective fencing**	I
48CA6749	Prehistoric: lithic scatter	Not eligible	**No further work**	I
48CA6750	Prehistoric: lithic scatter with groundstone	Not eligible	**No further work**	I
48CA6751	Prehistoric: lithic scatter with activity areas and possible stone	Eligible	**Limit construction; protective fencing**	I

[5] The NRC is currently drafting an MOA for signature between the WY SHPO, the BLM, the NRC, Uranerz, and interested Indian Tribes to mitigate potential adverse effects to Site 48CA268 (the Pumpkin Buttes Traditional Cultural Property).

Site ID	Site Type	NRHP Finding	Comments/ Stipulations	Report No.: SHPO Accession No.
	circle feature			
48CA6752	Prehistoric: lithic and FCR scatter	Not eligible	**No further work**	I
48CA6753	Prehistoric: lithic and FCR scatter	Eligible	**Limit construction; protective fencing**	I
48CA6754	Prehistoric: lithic and FCR scatter with FCR concentration	**Eligible**	**Limit construction; protective fencing**	I
48CA6926	Prehistoric: lithic scatter	Not eligible	**No further work**	III
48CA6927	Prehistoric: lithic scatter with features	Eligible	**Limit construction; protective fencing**	III

On the Nichols Ranch Unit, Sites 48JO2944, 48JO2946, 48JO2948, 48JO2949, 48JO2950, 48JO2953, 48JO2957, 48CA5386, 48CA5390, 48CA5392, 48CA5393, and 48CA5406, and on the Hank Unit, Sites 48CA379, 48CA6146/48CA6147, 48CA6148, 48CA6149, 48CA6151, 48CA6342, 48CA6343, 48CA6344, 48CA6345, 48CA6491, 48CA6498, 48CA6499, 48CA6749, 48CA6750, 48CA6752, and 48CA6926, are all not eligible for the NRHP. The proposed project will have **no effect** upon these resources. No further work is necessary.

On the Hank Unit, Sites 48CA6475, 48CA6490, 48CA6748, 48CA6751, 48CA6753, and 48CA6754, are eligible for the NRHP. These sites are all located outside areas that the proposed Nichols Ranch ISR Project would disturb. These sites would be avoided by the project, and thus, the proposed project will have **no effect** upon these resources. No further work is necessary. However in their application, Uranerz has committed to avoiding these sites and providing protective fencing in the event that any disturbance occurs near these sites.

On the Nichols Ranch Unit, Site 48CA5391, and on the Hank Unit, Sites 48CA6754 and 48CA6927, are all eligible for the NRHP and are located within the proposed Nichols Ranch ISR Project's projected wellfield. Uranerz has agreed to avoid these three sites as well as provide protective fencing to avoid inadvertent disturbance. The proposed project will have **no effect** upon these resources with adherence to the stipulations.

On the Hank Unit, Site 48CA268 (Pumpkin Buttes Traditional Cultural Property [TCP]) is eligible for listing on the NRHP. The TCP is located outside any proposed physical disturbance areas and will be completely avoided by the project. The proposed project will have **no effect** on the physical remains of the Pumpkin Buttes TCP. However, the undertaking would have a **potential adverse affect** to the viewshed of the Pumpkin Buttes TCP.

The NRC is consulting on the finding of adverse effect on Site 48CA268 (Pumpkin Buttes TCP). Pending your concurrence, the mitigation of adverse effects to the Pumpkin Buttes TCP will be addressed in a Memorandum of Agreement (MOA) between the WY SHPO, the BLM, the NRC, Uranerz, and interested Indian Tribes. The NRC has contacted interested Indian Tribes in a letter dated April 23, 2010,[7] to request information regarding historic, cultural, and

[7] NRC. 2010. Letter to Tribes from K. Hsueh, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Request for Information Regarding Historic, Cultural, and Archaeological Resources Potentially Affected by the Proposed Nichols Ranch ISR Project in

archaeological resources potentially affected by the proposed undertaking and to invite the tribes to become signatories to the MOA that will likely be developed to mitigate impacts to the Pumpkin Buttes TCP. To date, seven tribes are potentially interested in becoming signatories to an MOA. These tribes are: Eastern Shoshone Tribe, Northern Arapaho Tribe, Northern Cheyenne Tribe, Blackfeet Tribe, Ft. Peck Assiniboine/Sioux Tribe, Oglala Sioux, and Cheyenne River Sioux Tribe.

STIPULATIONS

Uranerz has committed to the following stipulations in their reply to open issues for the safety review[8] in February 2010, which included revisions to Section 2.4 of the Technical Report for the NRC license application. Because the revision to the Uranerz Technical Report was submitted to the NRC after the publication of the draft SEIS, these stipulations are not contained in the draft SEIS. However, they will be incorporated into the final SEIS cultural resources impacts section.

- Uranerz will not conduct any ground-disturbing work in areas that have not been previously inventoried and cleared for cultural resources.

- Uranerz will protect all cultural properties that have been determined eligible for listing on the NRHP within the permit area from ground-disturbing activities. To protect those eligible sites that are located within or near the projected well field (specifically sites 48CA6754, 48CA6927, and 48CA5391), Uranerz will delineate these sites and will mark them with green colored plastic snow fence material. The fencing material will not be highly visible and no signs will be installed but the fencing material will protect these sites from inadvertent disturbance. Uranerz will also provide small openings (6-8 ft) in the fencing to allow livestock and wildlife to move freely in, out, and through the site.

- If Uranerz determines that it must conduct ground disturbing activities within the boundaries of an eligible site, Uranerz will notify NRC, SHPO, and WDEQ-LQD and Uranerz will prepare an appropriate cultural resource mitigation plan and submit said plan to the NRC and SHPO for review and approval. Once approved the mitigation plan will be implemented before any ground disturbing activities are undertaken.

- If cultural resources are discovered during operations, Uranerz will immediately stop ground-disturbing activities in the area of the discovery and will immediately notify the WDEQ-LQD, NRC, and the SHPO. Within two (2) working days of notification, the WDEQ-LQD, the NRC, and the SHPO will evaluate or have evaluated any discovered cultural resources and will determine if any action may be required to protect or preserve such discoveries.

Campbell and Johnson Counties, Wyoming (Docket No. 040-09067) and Invitation to Become a Signatory to Associated Memorandum of Understanding. April 23, 2010. ADAMS No. ML100880084.

[8] Uranerz. 2010. Letter to R. Linton, Project Manager, U.S. Nuclear Regulatory Commission from M. Thomas, Environmental, Safety, and Health Manager, Uranerz Energy Corporation. Subject: Reply to Responses for Open Issues to the Safety Evaluation Report for the Nichols Ranch ISR Project License Application. February 24, 2010. ADAMS No. ML100740143.

- All cultural resources will remain under the jurisdiction of the private landowner (for the 3091 acres of privately owned land on the Nichols Ranch and Hank Units) or the United States government (for the 280 acres of BLM-owned land on the Hank Unit) depending on the where the cultural resource(s) were discovered.

- Uranerz will instruct all employees, contractors, subcontractors and any additional parties involved in the project that they are not to search for archaeological materials (i.e., arrow head hunting).

- If Native American human remains, funerary objects, or objects of cultural patrimony are encountered on BLM land, Uranerz will stop all work in the immediate area and will immediately notify NRC and WDEQ-LQD, and the NRC will comply with Section 3 of the Native American Graves Protection and Repatriation Act and its implementing regulations at 43 CFR Part 10. If Native American human remains, funerary objects, or objects of cultural patrimony are encountered as a result of a NRC undertaking on private surface, the remains will be evaluated as a historic property and procedures. Existing State and local laws will be followed pertaining to discovery of Native American human remains, funerary objects, or objects of cultural patrimony on private surface.

Additionally, Uranerz has committed to following the cultural resource mitigation measures stipulated in the Programmatic Agreement between the BLM and the Wyoming SHPO[9] for the Pumpkin Buttes TCP detailed below. These commitments are also contained in the February 2010 revision to Section 2.4 of the Technical Report for the NRC license application.

- Uranerz will instruct all employees, contractors, subcontractors and any additional parties involved in the project to avoid the Pumpkin Buttes TCP.
- No ground disturbing activities will occur on the tops and sides of Pumpkin Buttes. The tops and bases of the buttes are defined as follows, based on 1:24,000 USGS topographic quadrangles for the area:
    1. North Middle Butte: Top = 6,000-ft contour line; Base = 5,500-ft contour line
    2. South Middle Butte: Top = 5,920-ft contour line; Base = 5,500-ft contour line
- For all activities associated with any future project modification, Uranerz will obtain authorization from the NRC and SHPO before conducting ground disturbing activities. Uranerz, and the NRC will implement measures to reduce the visual contrast for any changes to the project.
- Prior to the NRC and WDEQ-LQD authorization of additional construction activities, Uranerz will:
    1. Perform a Class III cultural resource inventory, biological, and/or other inventories as required;

[9] BLM. 2009. *Programmatic Agreement Between Bureau of Land Management and Wyoming State Historic Preservation Officer Regarding Mitigation of Adverse Effects on the Pumpkin Buttes TCP from Anticipated Federal Minerals Development.* ADAMS No. ML092640122.

2. Submit detailed construction plans; and
3. Participate in an on-site evaluation (if necessary).

- The gravel surface of resource roads of new roads will be a color that does not create a visual contrast to the surrounding topography.
- All gathering pipelines will be corridored next to or within roads, wherever possible. Existing disturbance areas will be used for pipeline corridors where practicable.
- Wherever practicable, areas of existing disturbance will be used. To minimize visual contrast, well locations will not be placed in areas of dense sagebrush or other vegetation unless absolutely necessary. Brush hogging or other vegetation removal on drilling locations within areas of dense sagebrush or other vegetation will be feathered to reduce visual contrast and limited to 30 feet in diameter. All above ground infrastructure related to well production will be painted in a color that best blends in with the surrounding topography. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site specific determination based on visual assessment.
- Wherever practicable, power lines servicing wells will be buried and buried power lines will be placed inside, or within five feet of the trench utilized for pipelines. Construction of over head power lines within two miles from the base elevation of the Pumpkin Buttes will be designed to reduce visual contrast.
- All permanent above-ground structures (e.g., production equipment, tanks, etc.) not subject to safety requirements will be painted to blend with the natural color of the landscape. The color will simulate the standard environmental colors established by the BLM for visual resource management. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site specific determination based on visual assessment.

R. Currit 9

As mentioned in the introduction to this letter, NRC staff requests your comments and recommendations on mitigation and the path forward within 30 days of receipt of this letter and associated materials. The NRC will also be forwarding you a copy of the draft MOA for mitigation of potential adverse impacts to the viewshed of the Pumpkin Buttes TCP once a preliminary draft is available for distribution. If you have any questions or require additional information, please contact the Environmental Project Manager, Ms. Irene Yu at (301) 415-1951, or at irene.yu@nrc.gov.

Sincerely,

/RA/

Kevin Hsueh, Chief
Environmental Review Branch B
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 40-9067

Enclosures:
1. Arcadis U.S. Inc., Anadarko Petroleum Corporation Dry Willow Phase 4 POD Class III Cultural Resource Inventory
2. Map 1
3. Map 2
4. Letter from NRC to SHPO, July 1, 2008 (ML081760693)
5. Letter from NRC to SHPO, August 26, 2009 (ML092320627)

cc w/o enclosures:
D. McKenzie, DEQ, Cheyenne
G. Mooney, DEQ, Sheridan
C. Crago, BLM, Buffalo
P. Beels, BLM, Buffalo
M. Thomas, Uranerz

ARTS. PARKS. HISTORY.
Wyoming Department of State Parks and Cultural Resources
WYOMING STATE HISTORIC PRESERVATION OFFICE
BARRETT BUILDING, 3rd FLOOR, 2301 CENTRAL AVE, CHEYENNE, WY 82002
Phone: (307) 777-7697 Fax: (307) 777-6421
http://wyoshpo.state.wy.us

July 8, 2010

Kevin Hsueh, Chief
Environmental Review Branch B
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

re: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project (SHPO File # 0708RLC009)

Dear Mr. Hsueh:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your determination that the following sites are not eligible for listing in the National Register of Historic Places (NRHP and no further work or protective measures are necessary:

48CA379	48CA6149	48CA6498	48JO2948
48CA5386	48CA6151	48CA6499	48JO2949
48CA5390	48CA6342	48CA6750	48JO2950
48CA5392	48CA6343	48CA6752	48JO2953
48CA5393	48CA6344	48CA6926	48JO2957
48CA6146	48CA6345	48JO2944	
48CA6147	48CA6491	48JO2946	

We further concur that sites 48CA5391, 48CA6490 and 48CA6927 are eligible for the NRHP but will not be affected by the project as planned.

Site 48CA6475 has been determined eligible for the NRHP. However, we recommend that this site remain unevaluated for the NRHP pending evaluative testing. This site will not be affected by the project as planned (fencing and avoidance).

Site 48CA6754 has also been determined eligible for the NRHP, yet no justification for this determination is given. We recommend that 48CA6754 remain unevaluated for NRHP eligibility until a justification of eligibility can be provided. This site will not be affected by the project as planned (fencing and avoidance).

Dave Freudenthal, Governor
Milward Simpson, Director

July 8, 2010
Kevin Hsueh, Chief
Environmental Review Branch B
U.S. Nuclear Regulatory Commission
Page 2 of 2

Site 48CA6148 has been determined not eligible for listing on the NRHP, yet no justification for this determination is given. Additionally, the feature type identified at this site is a type known to be of interest to Native Americans. We recommend that this site remain unevaluated pending Native American consultation. The affect of the project on this site is unknown pending the results of that consultation.

Sites 48CA6748, 48C6751 and 48CA6753 have been determined eligible for the NRHP under criteria "d". However, we recommend that these sites remain unevaluated for NRHP eligibility under criteria "d" pending evaluative testing. Additionally, two of these sites (48CA6748 and 48CA6753) extend into 48CA268, the Pumpkin Buttes Traditional Cultural Property (TCP). While site 48CA6751 is immediately adjacent to 48CA268 and contains a feature type known to be of interest to Native Americans. In addition to the testing, we recommend that these sites remain unevaluated under criteria a, b and c pending Native American consultation. The effect of the project on these sites is unknown pending further evaluation.

Site 48CA268, the Pumpkin Buttes TCP is eligible for the NRHP. Per your letter, Native American consultation is currently underway to determine the effects of this project on this historic property.

We look forward to further consultation with your office concerning the results of further evaluation and Native American consultation. However, please be aware that any discussion of treatment of adverse effects (and development of a Memorandum of Agreement) is premature pending the outcome of that evaluation and consultation.

Please refer to SHPO project #0708RLC009 on any future correspondence regarding this project. If you have any questions, please contact me at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Cc: Don McKenzie, Wyoming DEQ/LQD, Cheyenne, WY
Glenn Mooney, Wyoming DEQ/LQD, Sheridan, WY
Clint Crago, BLM, Buffalo Field Office, Buffalo, WY
Michael Thomas, Uranerz Energy Corporation, Casper, WY

Dave Freudenthal, Governor
Milward Simpson, Director

ARTS. PARKS. HISTORY.

Wyoming Department of State Parks and Cultural Resources
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http://wyoshpo.state.wy.us

July 19, 2010

COPY

Kevin Hsueh, Chief
Environmental Review Branch B
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

re: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project, Letter Correction (SHPO File # 0708RLC009)

Dear Mr. Hsueh:

Please find enclosed a corrected copy of our letter of July 8, 2010 concerning this project. In our original letter, concurrence with eligibility for two sites was inadvertently omitted. These sites, 48CA5406 and 48CA6749 (both ineligible for the National Register of Historic Places), are included in the corrected letter. I apologize for any inconvenience this may have caused.

Please refer to SHPO project #0708RLC009 on any future correspondence regarding this project. If you have any questions, please contact me at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Cc: Don McKenzie, Wyoming DEQ/LQD, Cheyenne, WY
Glenn Mooney, Wyoming DEQ/LQD, Sheridan, WY
Clint Crago, BLM, Buffalo Field Office, Buffalo, WY
Michael Thomas, Uranerz Energy Corporation, Casper, WY

Dave Freudenthal, Governor
Milward Simpson, Director

ARTS. PARKS. HISTORY.

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http://wyoshpo.state.wy.us

July 8, 2010

COPY

Kevin Hsueh, Chief
Environmental Review Branch B
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

re: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project (SHPO File # 0708RLC009)

Dear Mr. Hsueh:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your determination that the following sites are not eligible for listing in the National Register of Historic Places (NRHP and no further work or protective measures are necessary:

48CA379	48CA6147	48CA6491	48JO2944
48CA5386	48CA6149	48CA6498	48JO2946
48CA5390	48CA6151	48CA6499	48JO2948
48CA5392	48CA6342	48CA6749	48JO2949
48CA5393	48CA6343	48CA6750	48JO2950
48CA5406	48CA6344	48CA6752	48JO2953
48CA6146	48CA6345	48CA6926	48JO2957

We further concur that sites 48CA5391, 48CA6490 and 48CA6927 are eligible for the NRHP but will not be affected by the project as planned.

Site 48CA6475 has been determined eligible for the NRHP. However, we recommend that this site remain unevaluated for the NRHP pending evaluative testing. This site will not be affected by the project as planned (fencing and avoidance).

Site 48CA6754 has also been determined eligible for the NRHP, yet no justification for this determination is given. We recommend that 48CA6754 remain unevaluated for NRHP eligibility until a justification of eligibility can be provided. This site will not be affected by the project as planned (fencing and avoidance).

Dave Freudenthal, Governor
Milward Simpson, Director

July 8, 2010
Kevin Hsueh, Chief
Environmental Review Branch B
U.S. Nuclear Regulatory Commission
Page 2 of 2

Site 48CA6148 has been determined not eligible for listing on the NRHP, yet no justification for this determination is given. Additionally, the feature type identified at this site is a type known to be of interest to Native Americans. We recommend that this site remain unevaluated pending Native American consultation. The affect of the project on this site is unknown pending the results of that consultation.

Sites 48CA6748, 48C6751 and 48CA6753 have been determined eligible for the NRHP under criteria "d". However, we recommend that these sites remain unevaluated for NRHP eligibility under criteria "d" pending evaluative testing. Additionally, two of these sites (48CA6748 and 48CA6753) extend into 48CA268, the Pumpkin Buttes Traditional Cultural Property (TCP). While site 48CA6751 is immediately adjacent to 48CA268 and contains a feature type known to be of interest to Native Americans. In addition to the testing, we recommend that these sites remain unevaluated under criteria a, b and c pending Native American consultation. The effect of the project on these sites is unknown pending further evaluation.

Site 48CA268, the Pumpkin Buttes TCP is eligible for the NRHP. Per your letter, Native American consultation is currently underway to determine the effects of this project on this historic property.

We look forward to further consultation with your office concerning the results of further evaluation and Native American consultation. However, please be aware that any discussion of treatment of adverse effects (and development of a Memorandum of Agreement) is premature pending the outcome of that evaluation and consultation.

Please refer to SHPO project #0708RLC009 on any future correspondence regarding this project. If you have any questions, please contact me at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Cc: Don McKenzie, Wyoming DEQ/LQD, Cheyenne, WY
Glenn Mooney, Wyoming DEQ/LQD, Sheridan, WY
Clint Crago, BLM, Buffalo Field Office, Buffalo, WY
Michael Thomas, Uranerz Energy Corporation, Casper, WY

Dave Freudenthal, Governor
Milward Simpson, Director

July 22, 2010

Ms. Mary Hopkins
State Historic Preservation Officer
Wyoming State Historic
Preservation Office
230 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: MEMORANDUM OF AGREEMENT FOR NICHOLS RANCH IN-SITU URANIUM RECOVERY PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING – STATE HISTORIC PRESERVATION OFFICE FILE #0708RLC009

Dear Ms. Hopkins:

Attached for your approval and signature is the draft Memorandum of Agreement (MOA) for mitigation of adverse impacts to Site 48CA268 (Pumpkin Buttes Traditional Cultural Property [TCP]), at the proposed Nichols Ranch In-Situ Uranium Recovery (ISR) Project in Campbell and Johnson Counties, Wyoming. The Pumpkin Buttes TCP is eligible for inclusion in the *National Register of Historic Places (*NRHP).

If you agree with the draft MOA, please sign at your respective location on the signature page and return only that page to Irene Wu of my staff, at the following address:

Mrs. Irene Wu
U.S. Nuclear Regulatory Commission
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001

If you have any questions you may contact Mrs. Wu at (301) 415-1951, or email at Irene.Wu@nrc.gov.

J Y.B. Steele 2

Thank you, for both your assistance and interest in this document.

Sincerely,

/RA/

David Skeen, Acting Deputy Director
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environment Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure:
Memorandum of Agreement

Mr. Bill Hill
Deputy State Director
Resource & Policy Management
5353 Yellowstone Road
P.O. Box 1828
Cheyenne, WY 82003

Mr. Duane Spencer
Buffalo Field Office Field Manager
1425 Fort Street
Buffalo, WY 82834-2436

Mr. Glenn J. Catchpole
President and Chief Executive Officer
1701 East E Street
P.O. Box 50850
Casper, WY 82605-0850

Mr. Don Gerstein
Senior Assistant Attorney General
123 Capitol Building
200 W. 24th Street
Cheyenne, WY 82002

Mr. Willie A. Sharp, Chairman
Blackfeet Tribal Business Council
P.O. Box 850
Browning, MT 59417

Mr. Joseph Brings Plenty, Sr.
Cheyenne River Sioux Tribal Council
P.O. Box 590
Eagle Butte, SD 57625

Mr. Carl Venne
Crow Tribal Council
P.O. Box 159
Crow Agency, MT 59022

Mr. Ivan Posey, Chairman
Shoshone Business Council
P.O. Box 538
Fort Washakie, WY 82514

Mr. A.T. Stafne, Chairman
Ft. Peck Tribal Executive Board
P.O. Box 1027
Poplar, MT 59255

Mr. Harvey Spoonhunter, Chairman
Arapaho Tribal Business Council
P.O. Box 396
Fort Washakie, WY 82514

Mr. Leroy Spang, President
Northern Cheyenne Tribal Council
P.O. Box 128
Lame Deer, MT 59043

Mr. John Yellow Bird Steele, President
Oglala Sioux Tribal Council
P.O. Box 2070
Pine Ridge, SD 57770

July 30, 2010

Mr. Reid Nelson
Director, Federal Agency Programs
Advisory Council on Historic Preservation
1100 Pennsylvania Avenue
Suite 803
Old Post Office Building
Washington, DC 20004

SUBJECT: NOTIFICATION OF POTENTIAL ADVERSE EFFECT TO A CULTURAL RESOURCE AND ASSOCIATED MEMORANDUM OF AGREEMENT FOR NICHOLS RANCH IN-SITU URANIUM RECOVERY PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING

Dear Mr. Nelson:

With this letter, in accordance with 36 CFR Part 800.6(a)(1), the U.S. Nuclear Regulatory Commission (NRC) is notifying the Advisory Council on Historic Preservation (ACHP) of a potential adverse effect to Site 48CA268 (Pumpkin Buttes Traditional Cultural Property [TCP]), as a result of the proposed Nichols Ranch In-Situ Uranium (ISR) Project in Campbell and Johnson Counties, Wyoming. The Pumpkin Buttes TCP is a *National Register of Historic Places* (NRHP)-eligible site. Attached to this letter is a draft Memorandum of Agreement (MOA) that has been prepared by the NRC to mitigate the potential adverse effects to the Pumpkin Buttes TCP.

For your reference, this letter includes background on the NRC's activities pursuant to Section 106 of the National Historic Preservation Act (NHPA) to date, as well as updates to the cultural resource information contained in the draft Supplemental Environmental Impact Statement (SEIS) for the proposed Nichols Ranch ISR Project.[1] NRC staff requests your comments and recommendations within 30 days of receipt of this letter and associated materials.

BACKGROUND:

In November 2007, Uranerz Energy Corporation (Uranerz) submitted its application for a new source material license, and in April 2008, Uranerz's application was accepted by the NRC for detail review. At that time (April 2008), the NRC became the lead federal agency, in accordance with 36 CFR Part 800.1(a).

[1] The draft SEIS is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the DSEIS is ML093340536.

By letter dated July 1, 2008,[2] NRC staff initiated consultation under Section 106 of the NHPA with the Wyoming State Historic Preservation Office (WY SHPO) concerning the proposed Nichols Ranch ISR Project.

The Area of Potential Effect (APE) for the proposed undertaking has been completely inventoried. With the new source material license application, Uranerz submitted two Class III reports for newly inventoried areas and one Class I report for previously inventoried areas with its license application. The reports are listed below:

- *Class III Cultural Resource Inventory of the Uranerz Energy Corporation, Hank In-Situ Uranium Project*. Prepared by Frontier Archaeology. November 2007.
- *Class III Cultural Resource Inventory for Uranerz Energy Corporation's 80-acre Parcel in the Hank Unit, Campbell County, Wyoming*. Prepared by TRC Environmental Corporation. October 2008.
- *Class I Literature Review of Uranerz Energy Corporation's Nichols Ranch ISR Project, Campbell and Johnson Counties Wyoming*. Prepared by TRC Environmental Corporation. March 2010.

In addition to these reports, an additional survey was completed for an unrelated coal bed natural gas plan of development project whose inventoried areas overlap with the proposed Nichols Ranch ISR Project site:

- *Anadarko Petroleum Corporation Dry Willow Phase 4 POD Class III Cultural Resource Inventory Campbell County, Wyoming*. Prepared by Arcadis U.S., Inc. July 2008.

The NRC determined that the identification efforts detailed in the four reports meet the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716).[3] The NRC staff used the cultural reports as well as information contained in Uranerz's license application as the basis of NRC's environmental review required by NRC regulations in 10 CFR Part 51, which implements Section 102(2) of the National Environmental Policy Act (NEPA) of 1969, as amended. The review identified potential adverse impacts to cultural resources that would result from the undertaking.

The NRC staff also contacted the U.S. Bureau of Land Management (BLM) to obtain a list of tribes that may have interest in activities surrounding the Pumpkin Buttes TCP. Subsequent contacts were made with nine tribes[4] to request information regarding historic, cultural, and

[2] NRC. 2008. Letter to M. Hopkins, State Historic Preservation Officer from G. Suber, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Initiation of Section 106 Process for Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project License Request (Docket No. 040-09067). July 1, 2008. ADAMS No. ML081760693

[3] 48 FR 44716, National Park Service. "The Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation." *Federal Register*. Volume 48, pp. 44716. Washington, D.C. September 29, 1983.

[4] The nine tribes are: the Blackfeet Tribe, the Cheyenne River Sioux, the Crow Tribe, the Eastern Shoshone Tribe, the Ft. Peck/Assiniboine Sioux Tribe, the Northern Arapaho Tribe, the Northern Cheyenne Tribe, the Oglala Sioux Tribe, and the Three Affiliated Tribes.

archaeological resources potentially affected by the proposed Nichols Ranch ISR Project[5]. The NRC has also consulted with the WY SHPO. Correspondence related to the Nichols Ranch ISR Project Section 106 consultation can be found in Appendix A of the draft SEIS.

The NRC staff documented its preliminary findings in the draft SEIS for the Proposed Nichols Ranch Project, which was published in December 2009. The draft SEIS identified nine NRHP-eligible sites, one of which (Pumpkin Buttes TCP) may be affected by the proposed project.

UPDATES TO INFORMATION IN THE DRAFT SEIS:

Tables 3-10 and 3-11 in the draft SEIS identify archaeological sites on the proposed Nichols Ranch ISR Project Site within the two units of land (the Nichols Ranch Unit and the Hank Unit) that would be licensed under the proposed action. Since the publication of the draft SEIS, the NRC staff has identified changes to the NRHP eligibility of several cultural sites. Additionally, NRC staff has added information on Uranerz's commitments to avoid certain cultural sites that were made in a February 24, 2010,[6] supplement to Uranerz's license application, and information contained in letters from the WY SHPO dated July 8, 2010[7] and July 19, 2010[8]. The following table lists the NRHP eligible and potentially eligible sites for the proposed Nichols Ranch ISR Project. Site 48CA268 is included in the following table because it was not included in Table 3-11 of the draft SEIS in error, though the site was discussed in detail in the text of the draft SEIS.

All of the sites listed in the table except for Site 48CA268 would not be affected by the project as planned through the use of fencing and avoidance. The potential adverse effects to Site 48CA268 and the resulting MOA are discussed in the following section.

MEMORANDUM OF AGREEMENT

During its environmental review and as documented in the draft SEIS, the NRC staff identified potential adverse effects to Site 48CA268 (Pumpkin Buttes TCP). The TCP is located outside any proposed physical disturbance areas and will be completely avoided by the project. The proposed action will have no effect on the physical remains of the Pumpkin Buttes TCP.

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[5] NRC. 2008. Letter to Tribes from G. Suber, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Request for Information Regarding Tribal Historic and Cultural Resources Potentially Affected by the Proposed Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming (Docket No. 040-09067). December 24, 2008. ADAMS No. ML083260467.

[6] Uranerz. 2010. Letter to R. Linton, Project Manager, U.S. Nuclear Regulatory Commission, from M. Thomas, Environmental, Safety, and Health Manager, Uranerz Energy Corporation. Subject: Responses to the Open Issues to the Safety Evaluation Report for the Nichols Ranch ISS Project License Application. February 24, 2010. ADAMS No. ML100740143.

[7] WY SHPO. 2010a. Letter from R.L. Currit. Wyoming State Historic Preservation Office. Subject: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project (SHPO File #0708RLC009). July 8, 2010. ADAMS No. ML102000147.

[8] WY SHPO, 2010b. Letter from R.L. Currit. Wyoming State Historic Preservation Office. Subject: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project (SHPO File #0708RLC009). July 19, 2010. ADAMS No. ML102020089.

Nichols Ranch ISR Project NRHP Eligible and Potentially Eligible Archaeological Sites

Site ID	Site Type	NRHP Finding and Comments/Stipulations
	Nichols Ranch Unit	
48CA5391	Prehistoric: lithic scatter with feature Historic: debris scatter	Eligible – site will not be affected by project as planned (fencing and avoidance)
	Hank Unit	
48CA268	Prehistoric/Historic: Traditional Cultural Property	Eligible – pending Native American consultations and mitigation through MOA
48CA6148	Prehistoric: lithic scatter with stone circles	Unevaluated for NRHP eligibility pending Native American consultations – site will not be affected by the project as planned (fencing and avoidance)
48CA6475	Prehistoric: open camp	Unevaluated for NRHP eligibility pending evaluative testing – site will not be affected by project as planned (fencing and avoidance)
48CA6490	Prehistoric: open camp	Eligible – site will not be affected by project as planned (fencing and avoidance)
48CA6748	Prehistoric: lithic scatter with FCR and activity areas	Unevaluated for NRHP eligibility pending evaluative testing and Native American consultations – site will not be affected by project as planned (fencing and avoidance)
48CA6751	Prehistoric: lithic scatter with activity areas and possible stone circle feature	Unevaluated for NRHP eligibility pending evaluative testing and Native American consultations – site will not be affected by project as planned (fencing and avoidance)
48CA6753	Prehistoric: lithic and FCR scatter	Unevaluated for NRHP eligibility pending evaluative testing and Native American consultations – site will not be affected by project as planned (fencing and avoidance)
48CA6754	Prehistoric: lithic and FCR scatter with FCR concentration	Unevaluated for NRHP eligibility pending justification – site will not be affected by project (fencing and avoidance)
48CA6927	Prehistoric: lithic scatter with features	Eligible – site will not be affected by project as planned (fencing and avoidance)

However, the undertaking would have a potential adverse effect to the viewshed of the Pumpkin Buttes TCP.

Through Section 106 consultation and as recommended by the WY SHPO, the NRC has prepared a Memorandum of Agreement (MOA) to mitigate the potential adverse effects to the Pumpkin Buttes TCP. The NRC extended an invitation to the nine tribes previously identified in

R. Nelson 5

this letter to become signatories to the MOA by letter dated April 23, 2010.[9] Following this invitation, the Three Affiliated Tribes indicated that they were not interested in becoming a signatory to the MOA. Therefore, in addition to the NRC and the eight interested tribes, the MOA will also include the following signatories: the BLM Buffalo Field Office, the WY SHPO, and Uranerz. The NRC forwarded a copy of the MOA for comment and signature to the signatories on July 23, 2010.[10]

The MOA, as sent to the signatories, is attached to this letter. The NRC has not received any comments on the MOA from any signatories to date.

As mentioned in the introduction to this letter, NRC staff requests your comments and recommendations within 30 days of receipt of this letter and associated materials. If you have any questions or require additional information, please contact the Environmental Project Manager, Mrs. Irene Wu at (301) 415-1951, or at Irene.Wu@nrc.gov.

Sincerely,

/RA/

Kevin Hsueh, Chief
Environmental Review Branch B
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 40-9067

Enclosure:
Memorandum of Agreement
(ML101600556)

[9] NRC. 2010. Letter to Tribes from K. Hsueh, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Request for Information Regarding Historic, Cultural, and Archaeological Resources Potentially Affected by the Proposed Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming (Docket No. 040-09067) and Invitation to Become a Signatory to Associated Memorandum of Agreement. April 23, 2010. ADAMS No. ML100880084.

[10] NRC. 2010. Letter to Signatories from D. Skeen, Acting Deputy Director of the Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs. Subject: Memorandum of Agreement for Nichols Ranch In-Situ Uranium Recovery Project in Campbell and Johnson Counties, Wyoming – State Historic Preservation Office File #0708RLC009. July 23, 2010. ADAMS No. ML101600535.

Preserving America's Heritage

August 4, 2010

Kevin Hsueh, Chief
Environmental Review Branch B
Environmental Protection and Performance Assessment Directorate
Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Management Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Ref: Proposed Nichols Ranch In-Situ Uranium Recovery Project
Campbell and Johnson Counties, Wyoming

Dear Mr. Hsueh:

On August 3, 2010, the Advisory Council on Historic Preservation (ACHP) received your notification regarding the adverse effects of the referenced undertaking on Site 48CA268, a property eligible for listing in the National Register of Historic Places. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to resolve adverse effects is needed at this time. However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer, affected Indian tribe, consulting party, or other party, we may reconsider this decision. Should circumstances change, and you determine that our participation is needed, please notify us accordingly.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final Memorandum of Agreement (MOA), developed in consultation with the Wyoming SHPO and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the MOA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with the opportunity to review this undertaking. If you have any questions, feel free to contact Tom McCulloch at 202-606-8555, or via email at tmcculloch@achp.gov.

Sincerely,

Raymond V. Wallace

Raymond V. Wallace
Historic Preservation Technician
Federal Property Management Section
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION
1100 Pennsylvania Avenue NW, Suite 803 ▯ Washington, DC 20004
Phone: 202-606-8503 ▯ Fax: 202-606-8647 ▯ achp@achp.gov ▯ www.achp.gov

August 9, 2010

Mr. Richard L. Currit
Senior Archaeologist
Wyoming State Historic
Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: URANERZ ENERGY CORPORATION, NICHOLS RANCH IN-SITU URANIUM RECOVERY PROJECT – SECTION 106 CONSULTATION – STATE HISTORIC PRESERVATION OFFICE FILE #0708RLC009

Dear Mr. Currit:

With this letter, the U.S. Nuclear Regulatory Commission (NRC) is submitting its final determination of the effects of the proposed Nichols Ranch *In-Situ* Recovery (ISR) Project (the undertaking) on historic properties required by Section 106 of the National Historic Preservation Act (NHPA). In accordance with the provisions in Title 10 of the *Code of Federal Regulations* (CFR) Part 51, NRC's regulations that implement the National Environmental Policy Act of 1969, as amended (NEPA), and 36 CFR 800.8(c), implementing Section 106 of the National Historic Preservation Act (NHPA), the NRC is using the process and documentation required for the preparation of an Environmental Impact Statement (EIS) to comply with Section 106, and has notified in advance the Wyoming State Historic Preservation Office (WY SHPO) by letter dated July 1, 2008[1] and August 26, 2009[2], nine Native American tribes by letter dated December 24, 2008[3], and the Advisory Council on Historic Preservation (ACHP) by letter dated August 24, 2009 of this intention[4]. By e-mail dated February 12, 2009, Conrad Fisher, the Tribal Historical Preservation Officer of the Northern Cheyenne Tribe, responded to the December 24, 2008 letter and noted that the Pumpkin Buttes are considered spiritual and ceremonial areas and that contaminants related to uranium extraction, traffic, noise, and dust pollution may affect the overall condition of the area.[4]

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[1] NRC. 2008. Letter to M. Hopkins, State Historic Preservation Officer from G. Suber, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Initiation of Section 106 Process for Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project License Request (Docket No. 040-09067). July 1, 2008. ADAMS No. ML081760693.

[2] NRC. 2009. Letter to R. Currit, State Historic Preservation Office from A. Kock, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Uranerz Energy Corporation, Nichols Ranch *In-Situ* Uranium Recovery Project – Section 106 Consultation – State Historic Preservation Office File #0708RLC009. August 26, 2009. ADAMS No. ML092320627.

[3] NRC. 2008. Letter to I. Posey, Shoshone Business Council, from G. Suber, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Request for Information Regarding Tribal Historic and Cultural Resources Potentially Affected by the Proposed License Application for Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project in Campbell and Johnson Counties, Wyoming. December 24, 2008. ADAMS No. ML083260467.

[4] NC THPO. 2009. E-mail from C. Fisher, Northern Cheyenne Tribal Historic Preservation Office to I. Wu, Project Manager, Office of Federal and State Materials and Environmental Management Programs. Subject: Nichols Ranch ISR Project. February 12, 2009. ADAMS No. ML090440030.

R. Currit - 2 -

The WY SHPO and nine Native American tribes received copies of the draft Supplemental Environmental Impact Statement (SEIS) (NUREG-1910, Supplement 2) for the proposed Nichols Ranch ISR Project when it was published in December 2009. The WY SHPO submitted comments on the draft SEIS by letter dated January 25, 2010.[5] No comments were received from any Native American tribes.

By letters dated July 8, 2010[6] and July 19, 2010[7], the WY SHPO provided its concurrence with NRC's determination that 28 sites[8] near the referenced project are not eligible for listing the *National Register of Historic Places* (NRHP), and that no further work or protective measures are necessary. The WY SHPO further concurred with NRC's determination that 3 sites are eligible for the NRHP, but will not be affected by the project as planned. The WY SHPO provided comments and stipulations on the remaining 7 sites, which are eligible or potentially eligible for listing on the NRHP. All 7 of these sites are located in the Hank Unit. The following table summarizes the NRHP findings and comments/stipulations to date.

Nichols Ranch ISR Project NRHP Eligible and Potentially Eligible Archaeological Sites

Site ID	Site Type	NRHP Finding and Comments/Stipulations
48CA268	Prehistoric/Historic: Traditional Cultural Property	Eligible – mitigation of adverse effect to setting through MOA
48CA6148	Prehistoric: lithic scatter with stone circles	Unevaluated for NRHP eligibility pending Native American consultations – site will not be affected by the project as planned (fencing and avoidance)
48CA6475	Prehistoric: open camp	Unevaluated for NRHP eligibility pending evaluative testing – site will not be affected by project as planned (fencing and avoidance)
48CA6748	Prehistoric: lithic scatter with FCR and activity areas	Unevaluated for NRHP eligibility pending evaluative testing and Native American consultations – site will not be affected by project as planned (fencing and avoidance)

[5] WY SHPO. 2010. Letter to Chief, Rulemaking and Directives Branch, from R. Currit, Wyoming State Historic Preservation Office. Subject: Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming. Draft Report for Comment (SHPO File#0708RLC009). January 25, 2010. ADAMS No. ML100341217.

[6] WY SHPO. 2010. Letter to K. Hsueh, Chief, U.S. Nuclear Regulatory Commission, from R. Currit, Wyoming State Historic Preservation Office. Subject: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project (SHPO File#0708RLC009). July 8, 2010. ADAMS No. ML102000147.

[7] WY SHPO. 2010. Letter to K. Hsueh, Chief, U.S. Nuclear Regulatory Commission, from R. Currit, Wyoming State Historic Preservation Office. Subject: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project, Letter Correction (SHPO File#0708RLC009). July 19, 2010. ADAMS No. ML102020089.

[8] The WY SHPO identified Sites 48CA6146 and 48CA6417 separately in their letter. The Draft SEIS combined these two sites under Site ID 48CA6146/48CA6417.

Site ID	Site Type	NRHP Finding and Comments/Stipulations
48CA6751	Prehistoric: lithic scatter with activity areas and possible stone circle feature	Unevaluated for NRHP eligibility pending evaluative testing and Native American consultations – site will not be affected by project as planned (fencing and avoidance)
48CA6753	Prehistoric: lithic and FCR scatter	Unevaluated for NRHP eligibility pending evaluative testing and Native American consultations – site will not be affected by project as planned (fencing and avoidance)
48CA6754	Prehistoric: lithic and FCR scatter with FCR concentration	Unevaluated for NRHP eligibility pending justification – site will not be affected by project (fencing and avoidance)

The NRC contacted interested Native American tribes in a letter dated April 23, 2010,[9] and in subsequent in telephone calls to request information regarding historic, cultural, and archaeological resources potentially affected by the proposed undertaking and to invite the tribes to become signatories to the MOA being developed to mitigate the adverse effects to the Pumpkin Buttes TCP. Eight tribes indicated that they were potentially interested in becoming signatories to an MOA. These tribes are: Eastern Shoshone Tribe, Northern Arapaho Tribe, Northern Cheyenne Tribe, Blackfeet Tribe, Ft. Peck Assiniboine/Sioux Tribe, Oglala Sioux Tribe, Crow Tribe, and Cheyenne River Sioux Tribe. During these phone calls, two tribes, the Northern Cheyenne Tribe and Ft. Peck Assiniboine/Sioux Tribe, requested to visit the proposed site. On July 7, 2010, Uranerz hosted a site visit for the following members of the two tribes: Conrad Fisher, the Tribal Historical Preservation Officer of the Northern Cheyenne Tribe, Darrell "Curley" Youpee, the Tribal Cultural Resources Director of the Ft. Peck Assiniboine/Sioux Tribe, and Eugene Hart of the Northern Cheyenne Tribe. No issues were identified during the site visit regarding the Pumpkin Buttes TCP.

The NRC will forward to you the site visit notes once they are received from Uranerz. A follow-up site visit is scheduled with representatives from the Northern Cheyenne Tribe and the Ft. Peck Assiniboine/Sioux Tribe for July 30, 2010, to specifically look at Sites 48CA6146/48CA6147, 48CA6148, 48CA6748, 486751, and 486753. The WY SHPO has already concurred with NRC's determination that Site 48CA6146/48CA6147 is not eligible for listing in the NRHP, and that no further work or protective measures are necessary. The NRC will forward any issues identified by the tribes to the WY SHPO regarding Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 after the follow-up site visit.

Of the 7 sites which are eligible or potentially eligible for listing on the NRHP, 6 sites remain unevaluated for listing on the NRHP; however, they will not be affected by this undertaking as Uranerz has committed to limiting construction around these sites and the installation of protective fencing, as noted in its application to NRC. Site 48CA268 (Pumpkin Buttes TCP) is

[9] NRC. 2010. Letter to Tribes from K. Hsueh, Branch Chief, Office of Federal and State Materials and Environmental Management Programs. Subject: Request for Information Regarding Historic, Cultural, and Archaeological Resources Potentially Affected by the Proposed Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming (Docket No. 040-09067) and Invitation to Become a Signatory to Associated Memorandum of Agreement. April 23, 2010. ADAMS No. ML100880084.

R. Currit - 4 -

eligible for listing on the NRHP. The Pumpkin Buttes TCP is located outside any proposed physical disturbance areas and will be completely avoided by the project. The proposed project will have no effect on the physical remains of the Pumpkin Buttes TCP. However, the undertaking would have an adverse effect on the viewshed of the Pumpkin Buttes TCP. The mitigation of adverse effects to the Pumpkin Buttes TCP will be addressed in a Memorandum of Agreement (MOA) between the WY SHPO, the BLM, the NRC, Uranerz, and interested Indian Tribes. A draft MOA was sent out to interested parties by letter dated July 22, 2010, for review and comment.

NRC staff requests your comments on the draft Memorandum of Agreement within 30 days of receipt of this letter, and your continued cooperation in finalizing this agreement. If you have any questions or require additional information, please contact the Environmental Project Manager, Mrs. Irene Wu at (301) 415-1951, or at Irene.Wu@nrc.gov.

Sincerely,

/RA/

Kevin Hsueh, Chief
Environmental Review Branch B
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials

cc: D. McKenzie, DEQ, Cheyenne
G. Mooney, DEQ, Sheridan
C. Crago, BLM, Buffalo
D. Spencer, BLM, Buffalo
M. Thomas, Uranerz

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August 17, 2010

VIA email mthomas@uranerz.com

Mr. Mike Thomas
Environmental, Safety, and Health Manager
Uranerz Energy Corporation
1701 East E Street
Casper, WY 82605

RE: Native American Consultation for Section 106 Compliance for Uranerz Energy Corporation's Nichols Ranch In Situ Uranium Recovery Project

Dear Mike:

This document summarizes the results of Native American consultation conducted by TRC Environmental Corporation (TRC) on behalf of the Nuclear Regulatory Commission (NRC) on July 7 and 30, 2010, for Uranerz Energy Corporation's (Uranerz) Nichols Ranch In Situ Uranium Recovery (ISR) project. Consultation was conducted to fulfill Uranerz's compliance requirements under Section 106 of the *National Historic Preservation Act* (NHPA) (1966, as amended).

Background:
On April 23, 2010, the NRC sent letters to regional Native American Tribes in reference to Uranerz's proposed ISR project. The Tribes were asked to comment and/or consult under Section 106 of the NHPA. In the letter, the NRC requested information regarding prehistoric and historic cultural resources in the vicinity that might be potentially affected by the Uranerz ISR project, and the NRC asked that the tribes participate in a draft Memorandum of Agreement (MOA) for the project. The tribes were also invited to be signatories to the MOA. The Pumpkin Buttes Traditional Cultural Property (TCP) (Site 48CA268) occurs east of and adjacent to the Hank Unit, the easternmost portion of the Uranerz ISR project. Several cultural resource sites eligible for the National Register of Historic Places (NRHP) also occur within or adjacent to the Hank Unit. The Northern Cheyenne and Fort Peck Assiniboine/Sioux Tribes responded that they would like to participate in the consultation for the Pumpkin Buttes TCP.

Additionally, pursuant to a July 8, 2010, letter from the Wyoming State Historic Preservation Office (SHPO) to the NRC; SHPO expressed its concern to NRC that final determinations of NRHP eligibility for four sites (Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753) could not be determined at this time. Because these sites contained features of a type known to be of interest to Native American Tribes and due to the sites' proximity to and/or location within and near the Pumpkin Buttes TCP (Site 48CA268), SHPO recommended that the NRHP eligibility status of the sites would have to be determined by consultation with Native American tribal members. Further, until the

eligibility status for each of the four sites is determined, the project effect to each cannot be accurately assessed. Therefore, additional discussion pertaining to the MOA was judged by SHPO to be premature until site eligibility and project effects were determined. For example, if it were judged by Native Americans that there would be no adverse effects, an MOA may not be necessary. Therefore, as a result of these issues and with the concurrence and direction of the NRC and Uranerz, TRC undertook on-site consultation with the Tribes to resolve these issues.

Additionally, pursuant to a July, 8, 2010 letter from SHPO to NRC, Sites 48CA6475 and 48CA6754 remain unevaluated with regard to their NRHP eligibility status under Criteria D pending further testing. These sites occur outside of the area of proposed disturbance, and both sites will be avoided and delineated with protective fencing.

Summary of July 7, 2010, Native American Field Visit to the Project Area:
The Northern Cheyenne and the Fort Peck Assiniboine/Sioux responded to the NRC that they wanted to visit the project area, and a field trip was planned for the consultation on July 7, 2010. Mr. Darrell "Curley" Youpee, Cultural Resource Director for the Fort Peck Tribes, and Mr. Conrad Fisher, Tribal Historic Preservation Officer for the Northern Cheyenne Tribe, participated in the field consultation. Mr. Mike Thomas, Uranerz's Environmental, Safety, and Health Manager, and Mr. James Lowe, TRC's Cultural Resources Program Manager, accompanied the tribal representatives to the project area. Because NRC did not have an archaeologist or other staff member available to participate, Mr. Lowe, who has worked with Mr. Youpee and Mr. Fisher in the past, served to facilitate discussions concerning the cultural resource sites and project effects based on his expertise and years of experience.

Summary of Tribal Concerns/Suggestions from July 7th Field Visit:
Mr. Youpee and Mr. Fischer were provided maps of the project area, which depicted the project permit area boundary, the proposed Area of Potential Effect (APE), and all known cultural resources within and adjacent to the project area, including Site 48CA268. Once in the project area, Mr. Thomas described the proposed Nichols Ranch undertaking and answered questions from the tribes pertaining to project specific details. The tribal representatives were informed that Uranerz would avoid all NRHP-eligible sites, and that the project in the Hank Unit would constitute an adverse visual effect to Site 48CA268, regardless of avoidance to other cultural resources.

Mr. Lowe asked Mr. Youpee and Mr. Fisher if they would follow up the site visit with a formal response. They said they approved of Mr. Lowe recording the visit and producing a summary for their review.

The tribal members were driven through the project area, with stops at several locations along the way, and conversations pertaining to the project were conducted during drive time and while out on the different locations. Mr. Youpee and Mr. Fisher suggested and agreed that, as part of the project, Site 48CA268 should be formally nominated for listing on the NRHP for protection. Mr. Youpee added that all the sites in the area and their eligibility status should be taken into account.

Mr. Youpee said that there should be discussions with the federal agency(s) and with SHPO, and that the tribes should receive a description of the APE from the federal government.

Mr. Youpee asked if they could receive a copy of the undertaking. Mr. Thomas said the undertaking is described in the Mine Permit, and a copy could be provided for their review. Mr. Thomas referenced Mr. Glenn Mooney of the Wyoming Department of Environmental Quality, Sheridan, Wyoming, as a possible source of information.

Mr. Fisher responded that, although the entire project description and undertaking could be found in the Draft Supplemental Environmental Impact Statement available on the Internet, there was a need to be sensitive to the fact that there is limited technology on the tribal reservations, and that copies of the undertaking and/or the permit should be sent to the tribal representatives on each reservation for their review. Mr. Thomas said that could be arranged and would not be a problem.

Mr. Youpee asked about a time line for reclamation. Mr. Thomas responded that reseeding with the appropriate seed mixture would be done after the wells are put in (year unknown), either in fall or spring season.

During the field visit, it was apparent that there were numerous intrusions and impacts within and adjacent to the Hank Unit, including improved roads, coal bed methane wells, currently producing oil wells, support facilities, and large holding tanks, etc.

Mr. Fisher noted that in addition to the physical energy that Pumpkin Buttes possess, they also possess strong spiritual energy as well. The buttes served as an overlook for watching buffalo herds on the plains below, as well as having eagle catch locations and natural springs on top.

Mr. Youpee and Mr. Fisher each agreed that the Tribes would like to come back to the Hank Unit portion of the project area to visit the current eligible sites within and adjacent to the APE and those adjacent to and partially within the TCP boundary (Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753). Mr. Thomas had no objections to that request. Mr. Lowe said he would facilitate a time in the near future to come back and visit the sites, and agreed to move forward with this as soon as it could be arranged because Mr. Fisher was to return to the University of Montana in late August.

Mr. Fisher stated that they would want to monitor all the activities that are close to the TCP boundaries of Site 48CA268 and/or the other nearby eligible prehistoric sites.

Mr. Thomas located the proposed plant site, and Mr. Lowe asked what in particular was planned for the location. Mr. Thomas explained to Mr. Youpee and Mr. Fisher that a steel building with concrete foundation would be constructed that would be approximately 120 ft long x 50 ft wide and about 50 ft tall. Mr. Lowe added that the building would be painted with the appropriate color scheme to blend with the natural landscape pursuant to the stipulations in the draft MOA for disturbance, roads, and construction facilities.

Mr. Thomas explained that there would be minimal planned road improvements because the existing two-track roads would suffice for travel in the project area. When asked about the duration of the project, Mr. Thomas said the life span of the project was determined to be 10 years.

After some time in the field, Mr. Youpee responded that he was not too concerned about the Nichols Ranch project. He said that it would not be too disruptive to the landscape or cultural resources.

Before departure, Mr. Lowe reiterated that he would write the summary of the field visit and coordinate the tribal visit to the sites in the near future. After that, Mr. Thomas provided lunch, and everyone returned to their respective destinations.

On July 23, the Tribes agreed to meet on July 30, 2010, to visit the sites in question.

Summary of the July 30, 2010, Native American Field Visit to the Project Area:
Attendees included: Mr. Curley Youpee, Ms. Diane Youpee, and Ms. Samantha Burshia of the Fort Peck Assiniboine/Sioux Tribe, Mr. Conrad Fisher and Mr. Edward Whitedirt of the Northern Cheyenne Tribe, and Mr. Mike Thomas from Uranerz, and Mr. James Lowe from TRC. The purpose of the site visit was to conduct tribal consultation on Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753, and the party hiked the slopes of North Middle Pumpkin Butte to reach each of the sites.

Mr. Lowe took the party to each site for evaluation and consultation to determine site significance. The tribal members spent as much time as necessary on each site to discuss, reflect, and evaluate among themselves the traditional cultural significance of each site.

Summary of Tribal Consultation:
After deliberation, the Tribes final decision was that all four sites possessed either features and/or traditional spiritual and cultural significance to qualify as sites of extraordinary traditional cultural significance; therefore, the sites are considered by the Tribes to be TCPs. Further they believe each site has a physical and spiritual relationship or connection to Site 48CA268 (Pumpkin Buttes TCP). Therefore, they believe that the sites should be physically avoided by the proposed Uranerz ISR project, and there would be an adverse effect to the visual setting of the four sites. However, the tribes indicated that there would not be an adverse effect to the setting of these four sites, i.e., they would be satisfied if best management practices and mitigation measures stipulated in the MOA were implemented. They also believe that there will be an adverse effect to the setting of Pumpkin Buttes (TCP Site 48CA268) if the mitigation measures are not implemented. Finally, the Tribes would like to see all possible protective measures implemented to preserve the overall physical integrity and setting of Pumpkin Buttes as a TCP.

The Northern Cheyenne and Fort Peck Assiniboine/Sioux Tribes indicated that each Tribe be a consulting signatory to the MOA for the Uranerz ISR project.

Mr. Mike Thomas
Uranerz Energy Corporation
August 17, 2010
Page 5

Key Summary Points:

- Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 are considered by the Tribes to possess traditional cultural and religious significance and are considered to be TCPs. Therefore, TRC recommends that these sites are eligible for the NRHP, and NRC should convey this information to SHPO. There will be no adverse effect to the setting of these four sites if best management practices and mitigation measures stipulated in the MOA are implemented.
- There will be no adverse effect to the setting of the Pumpkin Buttes TCP if the mitigation measures are implemented.
- The Northern Cheyenne and Fort Peck Assiniboine/Sioux Tribes request to be consulting signatories to the MOA for the Uranerz ISR project.
- Based on the results of this Native American consultation, TRC recommends the completion and implementation of the MOA to include Pumpkin Buttes TCP (Site 48CA268) and the NRHP-eligible sites listed above.

This concluded the on-site tribal consultation for the Uranerz ISR project. Please let me know if you have any questions or comments concerning this tribal consultation letter.

Sincerely,

TRC Environmental Corporation

James

James A. Lowe R.P.A.
Program Manager/Cultural Resources

JAL:rmm
51825\letters\thomas-ltr.doc

October 15, 2010

Mr. Richard L. Currit
Senior Archaeologist
Wyoming State Historic
Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: URANERZ ENERGY CORPORATION, NICHOLS RANCH IN-SITU URANIUM RECOVERY PROJECT – SECTION 106 CONSULTATION – STATE HISTORIC PRESERVATION OFFICE FILE #0708RLC009

Dear Mr. Currit:

With this letter, the U.S. Nuclear Regulatory Commission (NRC) is submitting its determination of effects licensing the proposed Nichols Ranch *In-Situ* Recovery Project (the Federal undertaking) will have on four additional historic properties identified during consultation with representatives of the Northern Cheyenne and Ft. Peck Assiniboine/Sioux Tribes as required by Section 106 of the National Historic Preservation Act.

On July 7, 2010, Uranerz hosted a site visit for the following members of the two tribes: Conrad Fisher, the Tribal Historical Preservation Officer of the Northern Cheyenne Tribe, Mr. Darrell "Curley" Youpee, the Tribal Cultural Resources Director of the Ft. Peck Assiniboine/Sioux Tribe, and Mr. Eugene Hart of the Northern Cheyenne Tribe. Mr. Youpee and Mr. Fisher suggested and agreed that, as a part of the proposed project, site 48CA268, Pumpkin Buttes Traditional Cultural Property (TCP) should be formally nominated for listing on the *National Register of Historic Places* (NRHP) for protection. No other issues were identified during the site visit regarding the Pumpkin Buttes TCP.

A follow-up site visit was conducted on July 30, 2010, with representatives from the Northern Cheyenne Tribe and the Ft. Peck Assiniboine/Sioux Tribe to specifically evaluate and conduct consultation for sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753. These sites are considered by the Tribes to possess traditional cultural and religious significance and are considered to be traditional cultural properties. The NRC has determined that sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 are eligible for listing on the NRHP for their religious and cultural significance. Notes from these two site visits are included as an enclosure to this letter.

No sites will be directly affected by construction activities; however, there will be an adverse effect to the visual setting of the four sites. The mitigation of adverse effects will be addressed in a Memorandum of Agreement (MOA) between the Wyoming State Historic Preservation Officer, the Bureau of Land Management, the NRC, Uranerz, and interested Indian Tribes. A draft MOA for the impacts to the Pumpkin Buttes TCP was sent out to interested parties by letter dated July 22, 2010, for review and comment. A revised draft MOA to cover the impacts to the Pumpkin Buttes TCP and impacts to the visual setting of the four additional sites will be sent out to interested parties for review and comment in the near future.

R. Currit - 2 -

If you have any questions or require additional information, please contact Ms. Jennifer Davis at (301) 415-3835, or at Jennifer.Davis@nrc.gov.

Sincerely,

/RA/

Kevin Hsueh, Chief
Environmental Review Branch B
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials

Enclosure:
TRC Ltr. Summarizing
Consultation

cc: D. McKenzie, DEQ, Cheyenne
G. Mooney, DEQ, Sheridan
C. Crago, BLM, Buffalo
D. Spencer, BLM, Buffalo
M. Thomas, Uranerz

ARTS. PARKS. HISTORY.
Wyoming State Parks & Cultural Resources

State Historic Preservation Office
Barrett Building, 3rd Floor
2301 Central Avenue
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Phone: (307) 777-7697
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http://wyoshpo.state.wy.us

November 3, 2010

Kevin Hsueh, Chief
Environmental Review Branch B
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

re: Uranerz Energy Corporation, Nichols Ranch In-Situ Uranium Recovery Project, Results of Native American Consultation and Determinations of Eligibility for Sites 48CA6148, 48CA6748, 48CA6751 and 48CA6753 (SHPO File # 0708RLC009)

Dear Mr. Hsueh:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your finding that sites 48CA268, 48CA6148, 48CA6748, 48CA6751 and 48CA6753 are eligible for listing in the National Register of Historic Places (NRHP) under criteria "a" and will be adversely affected by the project as planned.

Sites 48CA6748, 48CA6751 and 48CA6753 remain unevaluated for the NRHP under criteria "d" pending evaluative testing, but will be physically avoided by project activities.

This letter should be retained in your files as documentation of a SHPO concurrence with your finding of historic properties adversely affected. Please refer to SHPO project #0708RLC009 on any future correspondence regarding this project. If you have any questions, please contact me at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Dave Freudenthal, Governor
Milward Simpson, Director

APPENDIX B
PUBLIC COMMENTS ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE NICHOLS RANCH *IN-SITU* RECOVERY PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING, AND NRC RESPONSES

CONTENTS

Section Page

TABLES iv
ACRONYMS/ABBREVIATIONS v

B PUBLIC COMMENTS ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE NICHOLS RANCH *IN-SITU* RECOVERY PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING, AND NRC RESPONSES B–1
B.1 OVERVIEW B–1
B.2 PUBLIC PARTICIPATION B–1
B.2.1 Notice of Intent To Develop the SEIS B–1
B.2.2 Public Participation Activities B–1
B.2.3 Issuance and Availability of the SEIS B–2
B.2.4 Public Comment Period B–2
B.3 COMMENT REVIEW METHODS B–2
B.4 MAJOR ISSUES AND TOPICS OF CONCERN B–3
B.5 COMMENT SUMMARIES AND RESPONSES B–6
B.5.1 General Opposition B–6
B.5.1.1 References B–8
B.5.2 General Support B–9
B.5.3 General Environmental Concerns B–9
B.5.4 NEPA Process B–10
B.5.4.1 GEIS/SEIS B–10
B.5.4.2 Adequacy of Impact Assessment B–11
B.5.4.3 Range of Reasonable Alternatives B–17
B.5.4.4 References B–18
B.5.5 Purpose, Need, and Scope of the SEIS/GEIS B–18
B.5.5.1 Description of the SEIS/GEIS Purpose and Need B–18
B.5.5.2 Use of the GEIS in Site-Specific Environmental Reviews B–20
B.5.5.3 Scope of the SEIS/GEIS B–22
B.5.5.4 Reference B–23
B.5.6 Scoping Process and Scoping Report B–23
B.5.6.1 References B–24
B.5.7 SEIS/GEIS Methods and Approach B–24
B.5.7.1 Consideration of Compliance History in Assessing Impacts B–24
B.5.7.2 Reliance on Regulatory Compliance to Limit Impacts B–26
B.5.7.3 Methods for Defining Use of Milling Regions B–26
B.5.7.4 General Comments on GEIS Structure, Methods, and Approaches B–27
B.5.7.5 References B–28
B.5.8 Public Involvement B–29
B.5.8.1 References B–30
B.5.9 Regulatory Issues and Process B–30
B.5.9.1 NRC as a Regulatory Authority B–30
B.5.9.2 NRC Policies and Practices B–31
B.5.9.3 Adequacy of NRC Regulations and Practices B–32
B.5.9.4 Applicable Rulemaking Efforts B–35
B.5.9.5 NRC NEPA Process Implementation B–35
B.5.9.6 NRC Licensing Process B–36

B.5.9.7 Consideration of ISR Facility Safety Record and Compliance History B–37
B.5.9.8 Groundwater Restoration Criteria and Methods B–38
B.5.9.9 References B–44
B.5.10 Credibility of NRC B–45
B.5.10.1 Reference B–46
B.5.11 Federal and State Agencies B–46
B.5.11.1 Roles of Federal, Tribal, State, and Local Agencies....B–46
B.5.11.2 Effects of Changes to Federal or State Regulations on the SEIS B–47
B.5.11.3 Clarification of Other Federal/State Regulations and Practices B–48
B.5.11.4 References B–49
B.5.12 Cooperating Agencies and Consultations....B–49
B.5.12.1 References B–51
B.5.13 SEIS Schedule....B–51
B.5.13.1 References B–52
B.5.14 ISR Process Description....B–52
B.5.14.1 Overview B–52
B.5.14.2 Preconstruction and Construction B–52
B.5.14.3 Operations B–54
B.5.14.4 Aquifer Restoration....B–54
B.5.14.5 Gaseous or Airborne Particulate Emissions B–55
B.5.14.6 Operational History....B–56
B.5.14.6.1 Historic Operational Experience: Spills and Leaks B–56
B.5.14.6.2 Historic Operational Experience: Excursions B–57
B.5.14.7 Requests for Detailed Information About All ISR Facilities....B–57
B.5.14.8 References B–58
B.5.15 Financial Surety....B–58
B.5.15.1 References B–59
B.5.16 Alternatives B–59
B.5.16.1 References B–61
B.5.17 Land Use B–61
B.5.17.1 Ownership Issues, Surface, and Mineral Rights....B–61
B.5.17.2 Amount of Land Affected and Type, Degree, and Duration of Potential Impacts B–62
B.5.17.3 Mitigation and Reclamation Issues....B–64
B.5.17.4 References B–65
B.5.18 Transportation....B–66
B.5.18.1 References B–67
B.5.19 Geology and Soils....B–68
B.5.19.1 Soil Disturbance Concerns B–68
B.5.19.2 References B–68
B.5.20 Groundwater Resources....B–69
B.5.20.1 General Concerns About ISR and Groundwater Contamination B–69
B.5.20.2 Importance of Water and Consumptive Use....B–73
B.5.20.2.1 Site Characterization B–77
B.5.20.2.2 Aquifer Exemption and Baseline Water Quality B–78
B.5.20.2.3 Control of Operational Impacts, Excursions of ISR Solutions, and History B–78

B.5.20.3 Aquifer Restoration and Decommissioning: Methods and Operational Experience B–82
B.5.20.4 Miscellaneous Groundwater Comments B–83
B.5.20.5 References B–84
B.5.21 Surface Water Resources B–85
B.5.21.1 Surface Water Resources and Ecology B–85
B.5.21.2 Impacts to Surface Drainages and Surface Water B–85
B.5.21.3 Wetlands B–88
B.5.21.4 General Water Resource Concerns B–88
B.5.21.5 Impacts of Operations and Aquifer Restoration on Surface Water..... ....B–89
B.5.21.6 References B–89
B.5.22 Ecology B–89
B.5.22.1 Concerns About the Sage-Grouse B–89
B.5.22.2 General Comments on Threatened and Endangered Species B–93
B.5.22.3 Concerns About Mitigation and Timing B–93
B.5.22.4 Habitat Loss and Fragmentation B–95
B.5.22.5 Comments on Migratory Birds B–96
B.5.22.6 General Vegetation Comments B–97
B.5.22.7 Traffic and Noise Impacts B–97
B.5.22.8 Impacts to Terrestrial Ecology and Wildlife Discussion B–98
B.5.22.9 References B–100
B.5.23 Meteorology, Climatology, and Air Quality B–101
B.5.23.1 Permitting and Regulations B–101
B.5.23.2 Climatology and Meteorology B–102
B.5.23.3 Baseline Air Quality B–103
B.5.23.4 Impact Assessment B–103
B.5.23.5 References B–109
B.5.24 Historical and Cultural Resources B–110
B.5.24.1 Potential Impacts to Cultural, Historical, and Sacred Places B–110
B.5.24.2 License Conditions To Address Potential Impacts to Historical and Cultural Resources B–111
B.5.24.3 General Historic and Cultural B–112
B.5.24.4 References B–115
B.5.25 Visual and Scenic Resources B–115
B.5.26 Socioeconomics B–116
B.5.26.1 Reference B–117
B.5.27 Public and Occupational Health B–117
B.5.27.1 Impacts to Members of the General Public B–117
B.5.27.2 Impacts from Off-Normal Operations or Accidents B–119
B.5.27.3 General B–119
B.5.27.4 References B–120
B.5.28 Waste Management B–120
B.5.28.1 General Waste Management Comments B–120
B.5.28.2 Scope of the Assessment of Waste Management Impacts B–122
B.5.28.3 Characteristics of Wastes Generated by ISR B–122
B.5.28.4 Waste Treatment and Disposal Methods B–123
B.5.28.5 Regulation of Wastes and Disposal Methods B–126
B.5.28.6 References B–127
B.5.29 Cumulative Effects B–128

B.5.29.1 General Comment: The SEIS Does Not Adequately Address Cumulative Effects B–128
B.5.29.2 Past, Present, and Reasonably Foreseeable Future Actions B–130
B.5.29.3 Specific Document Changes or Action Requests B–131
B.5.29.4 Significance B–132
B.5.29.5 Other B–134
B.5.29.6 References B–136
B.5.30 Environmental Justice B–136
B.5.30.1 Reference B–137
B.5.31 Best Management Practices B–137
B.5.31.1 Enforcement of Mitigation Measures and Best Management Practices B–137
B.5.31.2 Completeness of the Mitigation Measures and Best Management Practices B–140
B.5.31.3 General Comments Related to Best Management Practices and Mitigation Measures B–141
B.5.31.4 References B–142
B.5.32 Monitoring B–142
B.5.32.1 References B–143
B.5.33 Editorial B–144
B.5.33.1 Grammatical Editorial B–144
B.5.33.2 Technical Editorial B–144
B.5.33.3 Programmatic Editorial B–146
B.5.33.4 References B–147

TABLES

Table Page
B.3-1 Public Commenter Names with Affiliation and Comment Document Number B–4
B.3-2 Comment Document Number with Commenter Name and Affiliation B–5
B.3-3 Group Names, Individuals in Group, and Affiliation for Comment Letters Generated by Multiple Individuals or Organizations B–6

ABBREVIATIONS/ACRONYMS

ACL	alternate concentration limit
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act
BLM	U.S. Bureau of Land Management
BMP	best management practice
CAA	Clean Air Act
CBM	coal bed methane
CCPW	Campbell County Public Works
CCS	Center for Climate Strategies
CEQ	Council on Environmental Quality
CESQG	conditionally exempt small quantity generator
CFR	Code of Federal Regulations
CWA	Clean Water Act
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DSEIS	Draft Supplemental Environmental Impact Statement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
FSEIS	Final Supplemental Environmental Impact Statement
FWS	U.S. Fish and Wildlife Service
GCRP	U.S. Global Change Research Program
GEIS	Generic Environmental Impact Statement
HDPE	high-density polyethylene
HRI	Hydro Resources, Inc.
ISL	*In-Situ* Leach
ISR	*In-Situ* Recovery
LQD	Land Quality Division
MCL	maximum contaminant level
MIT	mechanical integrity test
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding

ABBREVIATIONS/ACRONYMS (continued)

NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOA	Notice of Availability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PRI	Power Resources International
PSD	Prevention of Significant Deterioration
PVC	polyvinyl chloride
RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act
RIS	Regulatory Issue Summary
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SERP	Safety and Environmental Review Panel
SGIT	Sage Grouse Implementation Team
SHPO	State Historic Preservation Office
SUNSI	Sensitive Unclassified Non-Safeguards Information
TCP	Traditional Cultural Property
TDS	total dissolved solids
TEDE	total effective dose equivalent
UCL	upper control limit
USACE	U.S. Army Corps of Engineers
UIC	Underground Injection Control
UMTRCA	Uranium Mill Tailings Radiation Control Act
USDW	underground source of drinking water
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WQD	Water Quality Division
W.S.	Wyoming Statute
WUS	waters of the United States
WYNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System

B PUBLIC COMMENTS ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE NICHOLS RANCH *IN-SITU* RECOVERY PROJECT IN CAMPBELL AND JOHNSON COUNTIES, WYOMING, AND NRC RESPONSES

B.1 OVERVIEW

On December 11, 2009, the U.S. Nuclear Regulatory Commission (NRC) staff published a notice in the Federal Register (FR) requesting public review and comment on the Draft Environmental Impact Statement for the Nichols Ranch *In-Situ* Uranium Recovery (ISR) Project in Campbell and Johnson Counties, Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach (ISL) Uranium Milling Facilities (SEIS) (74 FR 65808) in accordance with the *Code of Federal Regulations*, Title 10 Part 51 (10 CFR Part 51), Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions. The NRC staff initially established February 1, 2010, as the deadline for submitting public comments on the draft SEIS. The NRC staff subsequently extended this deadline to March 3, 2010 (75 FR 6066). Twenty documents (i.e., email, mail, and facsimiles) were submitted to NRC containing comments on the proposed Nichols Ranch ISR Project. In addition to the public comment period, the public also had the opportunity to request a hearing {June 16, 2008 [73 FR 34052]}. The deadline to request a hearing expired on August 15, 2008. No requests for a hearing were submitted.

B.2 PUBLIC PARTICIPATION

Public participation is an essential part of the NRC environmental review process. This section describes the public participation process during the NRC staff development of the SEIS. NRC conducted an open, public SEIS development process consistent with the requirements of the National Environmental Policy Act of 1969 (NEPA) and NRC regulations. The NRC staff met with Federal, State, and local agencies and authorities as well as public organizations as part of a site visit to gather site-specific information. Including an extension to the public comment period, NRC provided an 81-day public comment period for agencies, organizations, and the general public to review the draft SEIS and provide comments.

B.2.1 Notice of Intent To Develop the SEIS

The NRC staff published a Notice of Intent (NOI) to prepare the SEIS in the Federal Register (74 FR 39116) on August 5, 2009, in accordance with NRC regulations.

B.2.2 Public Participation Activities

As described in SEIS Sections 1.4.2 and 1.7.3, the NRC staff met with Federal, State, and local agencies and authorities during the course of an expanded visit to the proposed Nichols Ranch ISR Project site and vicinity. The purpose of this visit and these meetings was to gather additional site-specific information to conduct the Nichols Ranch ISR Project environmental review. As part of this information gathering effort, the NRC staff also contacted potentially interested Native American tribes and local authorities, entities, and public interest groups in person and via email and telephone. Additional opportunities for public participation in the licensing process for the proposed Nichols Ranch ISR Project are described in Section B.5.8 of this appendix.

B.2.3 Issuance and Availability of the SEIS

On December 11, 2009, in accordance with NRC regulations, the NRC staff published a Notice of Availability (NOA) of the draft SEIS in the Federal Register (74 FR 65808). In this notice, the NRC staff provided information on how to either access or obtain a copy of the SEIS. Electronic versions of the SEIS and supporting information were made accessible through the NRC Agencywide Documents Access and Management System (ADAMS) database on the NRC website (http://www.nrc.gov/reading-rm/adams.html). The public may examine and have copied, for a fee, the SEIS and other related publicly available documents from the NRC Public Document Room. Copies of the SEIS were also available publicly at the Campbell County and Johnson County public libraries.

B.2.4 Public Comment Period

In the publication of the NOA of the draft SEIS on December 11, 2009 (74 FR 65808), the NRC staff stated that public comments on the draft SEIS should be submitted by February 1, 2010. Members of the public were invited and encouraged to submit related comments electronically to the federal rulemaking website or send in comments by email or facsimile. On February 5, 2010, the NRC staff extended the public comment period to March 3, 2010 (75 FR 6066), in response to public requests for an extension submitted in comment letters and e-mails. The 81-day public comments period (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations. The NRC staff identified 493 comments from 20 documents commenting on the draft Nichols Ranch ISR SEIS.

B.3 COMMENT REVIEW METHODS

As previously discussed, the NRC staff received 493 comments from 20 documents (i.e., e-mail, mail, and facsimiles) during the comment period. Each of these comments are included in the following comment summaries and addressed in the responses provided. Each comment was individually identified and responded to systematically. This approach involved identifying individual comments from the source documents, consolidating comment information into a database, sorting comments by topic, and having appropriate NRC staff reviewing and responding to the comments.

NRC conducted the comment period for the draft Nichols Ranch ISR SEIS simultaneously with the comment period for two other draft SEISs for proposed ISR facilities: Lost Creek and Moore Ranch. Some commenters provided a single document that included comments for two or three of the proposed projects. Each document NRC received was screened to determine if it applied only to one project or to multiple projects. For documents that commented on multiple projects, document copies were provided to each individual project and treated independently from that point forward. Each document was given a unique number based on the order in which the documents were received. The prefix “N” was attached to the identification number to indicate that this document, or document copy if originally addressing multiple projects, was for the proposed Nichols Ranch ISR Project. For documents addressing multiple projects, commenters had specified which comments applied to the proposed Nichols Ranch ISR Project. Sometimes comments were specifically directed only to the proposed Nichols Ranch ISR Project. In other cases, the commenter stated that the same comment applied to multiple projects. Only comments regarding the proposed Nichols Ranch ISR Project, uniquely or jointly, were identified and processed for the Nichols Ranch ISR Project SEIS. Those comments that the commenter specified were for only Lost Creek or Moore Ranch were not tabulated and processed within the Nichols Ranch ISR SEIS.

NRC staff reviewed all comment documents and identified, marked, and consecutively numbered individual, unique comments in each document. Comment numbers followed a two-part numbering system separated by a hyphen. The part of the comment number left of the hyphen is the document number. The number right of the hyphen is a consecutive unique-count number for each comment identified in a specific comment document. Table B.3-1 lists all commenter names and their affiliations, the comment document number assigned to their comment letter, and the ADAMS Accession Number for the commenter letter. The reader can use this table to electronically search for comments submitted by specific individuals or to find individuals associated with comments described in Section B.5.

Table B.3-2 provides this same information only sorted by comment document number in the first column. A unique group name was assigned to each document signed by multiple individuals. Table B.3-3 identifies the individuals who compose each unique group and each individual's affiliation. Readers can use these tables to electronically search for specific individuals' comments or individuals associated with comments described in Section B.5.

In addition to the numbering, each unique comment was also assigned a topic category to facilitate sorting and reviewing comments on similar topics. Topic categories aligned with the topics addressed in Section B.5. Following the initial comment identification review, the identified comments were entered into a database for sorting by topic and distribution to the NRC staff for further consideration. The NRC staff then continued sorting and reviewing all comments within specific topic categories, developed comment summaries and responses for this appendix, and made changes to the draft SEIS, as appropriate, to address the public comments.

Based on the similarity of comments related to a specific topic, as appropriate, the NRC staff consolidated the same or similar comments within each topic to develop responses. This approach allowed multiple comments, the same or similar in nature, to be addressed with a single response to avoid duplication of effort and to enhance readability of this report. A response has been provided for each comment or group of comments. Each response indicates whether the draft SEIS was modified as a result of the comment.

B.4 MAJOR ISSUES AND TOPICS OF CONCERN

The majority of comments received specifically addressed items within the scope of the SEIS. Topics raised included a variety of concerns about the purpose, need, and scope of the SEIS; regulatory issues; NEPA-related concerns; the description of the ISR process; land use; groundwater; surface water; ecology; air; historical, cultural, and Native American concerns; socioeconomics; public health concerns; waste management; and cumulative effects. Other comments addressed topics and issues that are not applicable to the SEIS, including general support or opposition to uranium milling, legacy of past uranium mining and milling, evaluation of the NRC regulatory program or licensing process, comparison of the proposed Nichols Ranch ISR Project financial assurance to previous restoration funding, compensation requests for loss of private water supplies, environmental impacts at disposal facilities for radioactive byproduct material, and comments not specifically directed toward the SEIS (e.g., comments exclusively directed toward the GEIS).

Table B.3-1. Public Commenter Names with Affiliation and Comment Document Number

Last Name	First Name	Affiliation	Comment Document Number	ADAMS Accession Number
Anderson	Shannon	Powder River Basin Resource Council	N003	ML100271048 ML100271000 ML100270998
Currit	Richard	Wyoming State Historic Preservation Office	N006	ML100341217
Fettus	Geoffrey	Natural Resources Defense Council	N001	ML100271002 ML100270998
Group A	Group A	Group A	N013	ML100700124
Group B	Group B	Group B	N016	ML100690137
Group C	Group C	Group C	N017	ML100850378
Group D	Group D	Group D	N018	ML100621314
Jantz	Eric	New Mexico Environmental Law Center	N002	ML100271050 ML100271001
Jantz	Eric	New Mexico Environmental Law Center	N011	ML100710105
Jones	Steve	Wyoming Outdoor Council	N005	ML100271687 ML100271688 ML100271689
Loomis	Marion	Wyoming Mining Association	N019	ML100640056
Pugsley	Christopher	National Mining Association	N014	ML100690165
Ratner	Jonathan	Western Watershed Project	N004	ML100271047 ML100271003 ML100270999
Rushin	Carol	Environmental Protection Agency, Region 8	N015	ML100690166
Stewart	Robert	U.S. Department of the Interior	N007	ML100341216
Svoboda	Larry	Environmental Protection Agency, Region 8	N020	ML100890218
Thomas	Mike	Uranerz Energy Corporation	N008	ML100350583
Thomas	Mike	Uranerz Energy Corporation	N012	ML100690177
Viviano	Pam	Public	N009	ML100640097
Jones	Jim	Public	N010	ML100640098

Table B.3-2. Comment Document Number with Commenter Name and Affiliation

Comment Document Number	Last Name	First Name	Affiliation
N001	Fettus	Geoffrey	Natural Resources Defense Council
N002	Jantz	Eric	New Mexico Environmental Law Center
N003	Anderson	Shannon	Powder River Basin Resource Council
N004	Ratner	Jonathan	Western Watershed Project
N005	Jones	Steve	Wyoming Outdoor Council
N006	Currit	Richard	Wyoming State Historic Preservation Office
N007	Stewart	Robert	U.S. Department of the Interior
N008	Thomas	Mike	Uranerz Energy Corporation
N009	Viviano	Pam	Public
N010	Jones	Jim	Public
N011	Jantz	Eric	New Mexico Environmental Law Center
N012	Thomas	Mike	Uranerz Energy Corporation
N013	Group A	Group A	Group A
N014	Pugsley	Christopher	National Mining Association
N015	Rushin	Carol	Environmental Protection Agency, Region 8
N016	Group B	Group B	Group B
N017	Group C	Group C	Group C
N018	Group D	Group D	Group D
N019	Loomis	Marion	Wyoming Mining Association
N020	Svoboda	Larry	Environmental Protection Agency, Region 8

Table B.3-3. Group Names, Individuals in Group, and Affiliations for Comment Letters Generated by Multiple Individuals or Organizations

Group Name	Individuals in Group	Affiliation
Group A	Shannon Anderson	Powder River Resource Council
	Steve Jones	Wyoming Outdoor Council
Group B	Jay Tope	Public
	Wilma Tope	Public
Group C	Geoffrey Fettus	Natural Resources Defense Council
	Cori Lombard	Natural Resources Defense Council
Group D	Donald McKenzie	Wyoming Department of Environmental Quality-Land Quality Division
	Kelly Bott	Wyoming Department of Environmental Quality-Air Quality Division
	Tom Schroeder	Wyoming Department of Environmental Quality-Industrial Siting Division
	Mark Conrad	Wyoming Department of Environmental Quality-Water Quality Division
	Carl Anderson	Wyoming Department of Environmental Quality-Solid and Hazardous Waste Division
	John Emmerich	Wyoming Game and Fish Department

B.5 COMMENT SUMMARIES AND RESPONSES

Detailed comment responses are provided in this section. The structure of this section is based on the comment topics provided. Within each topic-specific subsection, the detailed presentation of comment and response information includes the applicable comment identification numbers, comment summaries, and the NRC staff response.

B.5.1 General Opposition

Comments: N001-002; N002-005; N011-022; N011-068
Some commenters found the GEIS (NRC, 2009) “wanting” and noted that the GEIS environmental analysis was deficient in several respects, but did not provide examples or citations. Another commenter stated the character of the data in the GEIS was misleading. One of the commenters stated that NRC should not rely on the GEIS for site-specific analyses.

***Response**: The NRC staff prepared the Nichols Ranch ISR SEIS consistent with its regulations under 10 CFR Part 51 that implement NEPA and its guidance for conducting environmental reviews as found in NUREG–1748 (NRC, 2003). Additionally, the GEIS, which this final SEIS supplements (see Section 1.4.1), provides a starting point for NRC NEPA analyses for site-specific license applications for new ISR facilities, such as the Uranerz Energy Corporation’s application for the Nichols Ranch ISR Project. The GEIS provides criteria for each environmental resource area to help determine the significance level for potential impacts (e.g., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to the site-specific review at the proposed Nichols Ranch ISR Project.*

NRC recognizes some commenters do not support the development of either the GEIS or the SEIS. NRC held a 103-day public comment period for the draft GEIS from July 28, 2008, through November 7, 2008, at which time members of the public were invited to provide

comments, including eight public scoping meetings. NRC considered and responded to comments received on the draft GEIS in Appendix G of the final GEIS [see NOA published in the Federal Register on June 5, 2009 (74 FR 27052)]. Therefore, comments on the GEIS are beyond the scope of the Nichols Ranch ISR SEIS.

Comments: N009-001; N010-001
Some commenters were adamantly opposed to granting a permit to the proposed project. Another commenter stated that the ISR process was an injustice to the people of Wyoming.

***Response**: NRC recognizes some commenters are not supportive of in-situ uranium milling. NRC has the responsibility for licensing and regulating uranium ISR facilities through the statutory requirements of the Uranium Mill Tailings Radiation Control Act of 1978 and the Atomic Energy Act of 1954 (AEA), as amended. These statutes require that NRC ensure source material, as defined in AEA Section 11(z) and byproduct material, as defined in AEA Section 11e.(2) is managed to conform with applicable regulatory requirements. NRC will not issue a license to a facility that does not comply with its statutory and regulatory requirements. These comments are beyond the scope of the SEIS.*

Comment: N010-006
One commenter stated that the long-term effects of ISR sites on the environment are unknown.

***Response**: NRC does not agree that long-term effects are unknown. The GEIS (NRC, 2009), which this SEIS supplements (see Section 1.4.1), provides information about the operating histories of a number of ISR facilities, and this informs the staff's determination of potential long-term impacts. Specifically, GEIS Section 2.11 discusses historical NRC-licensed ISR operations and references specific facilities in Wyoming, Nebraska, and New Mexico. This section describes the issues that have historically resulted in potential impacts at ISR facilities and provides a range of conditions that may be expected for each of the four phases of ISR activities considered in the GEIS. Specifically, the GEIS addresses spills and leaks, excursions, groundwater use, aquifer restoration, and socioeconomic effects. The NRC staff used this historical information in its generic evaluation of potential environmental impacts (including those that can have long-term effects) from construction, operations, aquifer restoration, and decommissioning of an ISR facility in specific geographic regions of the western United States. This SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions, depending on the similarities between Uranerz's proposed facility, activities, and conditions at the Nichols Ranch ISR Project site and those for the reference facility evaluated in the GEIS.*

No further changes have been made to the SEIS beyond the information provided in this response.

Comment: N017-003
One commenter was opposed to *in-situ* milling, and described it as "not a benign substitute for past uranium recovery," and suggested that NRC "…examine and present to the public a precise history of conditions at ISR uranium mining operations…" pre- and post-operation.

***Response**: NRC recognizes that some commenters do not support uranium milling. GEIS Chapter 2 provides information on uranium recovery using the ISR process. Information regarding operational experience at ISR facilities is discussed in Section 2.11 of the final GEIS. These comments are beyond the scope of the SEIS.*

Comment: N017-033
A commenter urged the withdrawal of both the draft SEIS and the final GEIS (NRC, 2009), on the basis of failing to meet the NEPA requirements. The commenter stated the document was legally deficient because it failed to address a number of substantive matters, take a hard look at the proposed action, consider a reasonable range of alternatives, and analyze cumulative impacts of ISR uranium mining in the region of the proposed action.

***Response**: NRC recognizes some commenters do not support the development of either the SEIS or GEIS. As previously noted, NRC held a 103-day public comment period for the draft GEIS from July 28, 2008, through November 7, 2008, which included eight scoping meetings. NRC considered and responded to comments received on the draft GEIS in Appendix G of the final GEIS [see NOA published in the Federal Register on June 5, 2009 (74 FR 27052)]. Therefore, comments on the GEIS are beyond the scope of the Nichols Ranch ISR SEIS.*

The Nichols Ranch ISR SEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and regulations in 10 CFR Part 51 which implement NRC's NEPA provisions. The GEIS, which this final SEIS supplements (see Section 1.4.1), provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities. The GEIS provided information on ISR technology and four geographic areas and then evaluated the potential impacts for various environmental resource areas from an ISR facility being located in one of these geographic areas. The NRC staff then used site-specific information to supplement the GEIS analysis when preparing the proposed Nichols Ranch ISR Project SEIS.

Chapter 2 of the SEIS describes the proposed action and a range of alternatives that NRC considers to be reasonable for this proposed licensing action. Chapter 5 analyzes the cumulative impacts from licensing the proposed Nichols Ranch ISR Project. SEIS Section 5.1.1 discusses past, present, and reasonably foreseeable future ISR mining activities within the Powder River Basin. Table 5-1 lists uranium recovery sites near the proposed Nichols Ranch project.

As discussed in the response to comment number N010-006, GEIS Section 2.11 discusses historical NRC-licensed ISR operations and references specific facilities in Wyoming, Nebraska, and New Mexico. This section describes the issues that have historically occurred at ISR facilities and provides a range of conditions that may be expected for each of the four phases of ISR activities. The cumulative impacts evaluation in SEIS Chapter 5 has been revised to clarify and improve the transparency of the analysis. No further changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

For detailed comments and responses on topics related to those expressed in some of the general opposition comments, see the following sections of this comment response appendix: NEPA Process (B.5.4); Purpose, Need, and Scope of the SEIS/GEIS (B.5.5); Public Involvement (B.5.8); and Cumulative Effects (B.5.29).

B.5.1.1 References

10 CFR Part 40. *Code of Federal Regulations*. Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

74 FR 27052, U.S. Nuclear Regulatory Commission. "Notice of Availability of Final Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register. Vol. 74, No. 107, pp. 27,052–27,054. June 5, 2009.

NRC (U.S. Nuclear Regulatory Commission). NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. August 2003.

B.5.2 General Support

Comment: N018-008
One commenter expressed general support for the development of the SEIS and stated that it was a "great improvement from prior versions."

***Response**: NRC recognizes some commenters support the development of the environmental review for the proposed Nichols Ranch ISR Project. However, these comments are beyond the scope of the SEIS.*

Comment: N019-001
One commenter expressed that the proposed Nichols Ranch ISR Project would benefit the surrounding area and the State of Wyoming through the addition of jobs, tax revenues, and domestically produced uranium to fuel current U.S. nuclear reactors.

***Response**: NRC recognizes some commenters support of the development of the proposed Nichols Ranch ISR Project. However, these comments are beyond the scope of the SEIS.*

B.5.3 General Environmental Concerns

Comments: N003-002; N005-002; N013-001
Several commenting organizations stated uranium exploration and production impacts many of their members because these individuals live, work, or recreate in areas where such activities are conducted.

***Response**: NRC acknowledges uranium milling activities may impact individuals who live, work, or recreate within and surrounding the proposed Nichols Ranch ISR Project site. The environmental review documented in this final SEIS addresses potential environmental impacts covering a variety of resource areas that can affect individuals. Because the comment was general in nature, no changes were made to the SEIS.*

B.5.4 NEPA Process

B.5.4.1 GEIS/SEIS

Comments: N011-022; N011-023; N011-025
One commenter characterized the NRC staff evaluation of the impacts from spills and leaks on water resources in both the GEIS (NRC, 2009) and the draft Nichols Ranch ISR SEIS as relying on incomplete and inaccurate data, thus resulting in a misleading impact evaluation in both documents. The commenter also stated NRC had not conducted the requisite site-specific analysis of impacts from spills and leaks at the proposed Nichols Ranch ISR Project, but rather simply stated the site-specific conditions at the proposed Nichols Ranch ISR Project site were consistent with the affected environment described in the GEIS and concluded the potential impacts would be SMALL.

Response*: The NRC site-specific analysis of the potential environmental impacts to water resources from spills and leaks is found in Section 4.5 of the Nichols Ranch ISR SEIS, which considers site-specific information provided in the license application. This section includes the evaluation of impacts on both potential surface water and wetlands resources and on near-surface groundwater resources from spills and leaks during the proposed operations for the Nichols Ranch ISR Project. This site-specific analysis determined that, for the Nichols Ranch ISR Project, the significance of potential impacts is expected to be SMALL. The site-specific determination draws on the evaluation found in GEIS Sections 4.2.4 and 4.3.4 wherein criteria are provided to evaluate the significance of impacts to surface water and wetlands. The evaluation criteria for surface water and wetlands resources include size of a spill, success of remediation, use of the surface water for domestic or agricultural purposes, proximity of the spill to surface water, and compliance with storm water and National Pollutant Discharge Elimination System (NPDES) permits issued by the State of Wyoming. The GEIS concluded that such impacts could range from SMALL to MODERATE, depending on site-specific conditions. For potential impacts to near-surface groundwater resources, the evaluation criteria included proximity of the shallow aquifer to the surface, use of the shallow aquifer for domestic or agricultural purposes, and connection of the shallow aquifer to other locally or regionally important aquifers. The GEIS concluded that impacts to near-surface aquifers could range from SMALL to LARGE, depending on site-specific conditions.*

As discussed previously the NRC staff conducted a site-specific evaluation of impacts to water resources from spills and leaks, applying the GEIS criteria at the proposed Nichols Ranch ISR Project in Section 4.5. That evaluation determined that such impacts are expected to be SMALL, given the proposed operations and site-specific conditions.

No changes were made to the SEIS beyond the information provided in this response.

Comments: N013-007; N013-008
One commenter asserted the Nichols Ranch ISR SEIS does not properly tier from the GEIS (NRC, 2009), because the final GEIS, which the Nichols Ranch ISR SEIS supplements, is merely a report and not a final NEPA document. To support this assertion, the commenter quoted a phrase from Chapter 1 of the draft SEIS (wherein the NRC states that the GEIS was published as a “final report” in May 2009) and comments at an NRC public meeting (wherein the NRC staff stated the GEIS did “not make a final binding decision”). The commenter further noted that had the final GEIS been a final NEPA document, it would have been issued with an official Record of Decision pursuant to the NRC regulations at 10 CFR 51.102(a).

***Response**: As the commenter stated, 10 CFR 51.102(a) requires that a Commission decision on any action for which a final EIS has been prepared shall be accompanied by or include a concise public record of decision. NRC considers actions subject to this regulatory requirement to include NRC decisions on specific applications to issue, renew or amend an NRC license. The Commission does not consider issuance of the GEIS to be a binding decision on any action that triggers the 10 CFR 51.102(a) requirement to prepare a public record of decision.*

NRC developed the GEIS to determine which impacts would be essentially the same for all ISR facilities and which ones would result in varying levels of impacts for different facilities, thus anticipating a further site-specific application to renew, amend, or issue an NRC license. NRC uses the GEIS as a starting point for conducting its NEPA review of a site-specific ISR license application. NRC evaluates site-specific data and information to determine whether an applicant's proposed activities and the characteristics at its site are consistent with those evaluated in the GEIS before determining which GEIS sections can be incorporated by reference, whether impact conclusions can be adopted in whole, and whether either additional data or analysis is needed to determine the environmental impacts for a specific resource area in the site-specific NEPA review.

NRC has always considered the license (if issued to an applicant), in addition to the entire publicly available record for a license application, as the agency's record of decision for a specific licensing action. These documents include the license application [including the applicant's Environmental Report, the Commission's Safety Evaluation Report (SER), and the Commission's final Supplemental Environmental Impact Statement (FSEIS)]. NRC evaluates this information to determine whether the license application complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the AEA), and the Commission's regulations before granting a request to renew, amend, or issue an NRC license. If licensed, NRC will publish a notice in the Federal Register announcing its issuance of an ISR license to Uranerz, and this notice will include the previous statement regarding NRC's record of decision for the Nichols Ranch ISR SEIS.

No further changes were made to the SEIS beyond the information provided in this response.

B.5.4.2 Adequacy of Impact Assessment

Comments: N005-002; N013-042; N013-043
One commenter noted that people live, work, and recreate near ISR facilities and that ISR projects in the State of Wyoming could significantly impact the environment from their construction, operation, aquifer restoration, and decommissioning. Another commenter stated generally that NRC should disclose the impact on a wide variety of resources and follows this comment with numerous specific comments on land use, water, waste disposal, wildlife, and socioeconomics and enforceable measures to mitigate the potential impacts. The commenter further stated NRC must fully disclose the true risk of ISR projects.

***Response** The Nichols Ranch SEIS discloses NRC's analysis of the proposed ISR project impact on various resource areas. Some of the comments on specific topics (N013-044 through N013-095) are addressed in this comment-response appendix in the sections identified next. The SEIS, in Sections 4.2, 4.5, 4.6, and 4.10, considers the potential impact to land, water and wildlife and the potential socioeconomic impact if NRC grants a license. The analysis of the potential environmental impacts on these resource areas considered the four ISR lifecycle phases (construction, operations, aquifer restoration, and decommissioning) of the Nichols Ranch ISR Project. To perform the review, NRC reviewed the license application,*

independently verified information, and conducted analyses. The potential impacts ranged from SMALL to MODERATE depending on the resource area and whether the applicant indicated that mitigative measures would be implemented. Site-specific mitigation measures are described by resource area in the SEIS, and Section B5.31 provides additional information on best management practices in response to public comment. NRC responses to comments regarding the topics of land use, water waste disposal, wildlife, and socioeconomics are provided in Section B5.17, Sections B5.20 and B5.21, Section B5.28, Section B5.22, and Section 5.26, respectively, of this comment-response appendix.

No further changes were made to the SEIS beyond the information provided in this response.

Comment: N011-039
One commenter stated the NRC analysis of groundwater impacts from restoration was insufficient and relied entirely on the GEIS framework (NRC, 2009). As a result, the commenter noted the NRC analysis was limited to impacts to consumptive use (i.e., water quantity).

***Response**: The analysis of groundwater impacts from aquifer restoration at the proposed Nichols Ranch ISR Project followed the GEIS framework (NRC, 2009), which considered consumptive groundwater use and impacts from waste management practices during the ISR aquifer restoration phase.*

SEIS Section 4.5.2.1.3 describes the potential environmental impact on groundwater resources during aquifer restoration, including impacts from groundwater consumptive use, waste management practices, and impacts on groundwater quality from transporting restoration fluids through shallow piping. The discussion of groundwater impacts has been expanded to include a discussion of well injection impacts and a discussion of groundwater gradient and lixiviant plume migration if a wellfield shutdown. The analysis of potential groundwater impacts relies on applicant-provided information, such as aquifer measurements (e.g., permeability) and the results from aquifer field tests that NRC staff reviews and considers in the site-specific safety evaluation. The groundwater safety evaluation informs the environmental review.

As discussed in the SEIS, the potential impact from deep well disposal is expected to be SMALL because of the aquifer characteristics of the proposed host formations for deep well disposal and adherence to the WDEQ UIC permit requirements for deep well injection. Finally, the NRC staff determined the potential overall impact on groundwater quality from aquifer restoration would be SMALL because the groundwater quality in the impacted aquifers would be restored to water quality standards that are protective of human health and the environment. The surrounding aquifers would not be impacted.

Comment: N013-096
One commenter stated the NRC analysis of environmental impacts from the proposed Nichols Ranch ISR Project is speculation at best, because the NRC analysis does not account for impacts that may occur after all project approvals (i.e., appropriate federal and state permits) have been obtained.

***Response**: The Nichols Ranch ISR SEIS was prepared in accordance with NRC regulations in 10 CFR 51.71(c) that require the status of compliance to be acknowledged in the EIS (see Table 1-2 of the SEIS). Under the AEA, NRC has statutory authority to issue licenses for the possession and use of AEA-regulated radioactive materials and particular activities involving this material. While NRC does not have the statutory authority to enforce other agency requirements, the other agencies have the necessary enforcement authority and would carry out*

the requirements of their regulations. NRC assumes that regulations that exist are applied, as appropriate, by other Federal, State, and local regulatory agencies. NRC also assumes that the licensee would comply with regulatory requirements, license and permit conditions issued by these agencies when evaluating the potential environmental impacts from issuing an NRC license. SEIS Table 1-2 shows the required permits and approvals for the applicant to obtain prior to construction and operation of the proposed Nichols Ranch ISR Project.

No changes were made to the SEIS beyond the information provided in this response.

Comment: N015-038
A commenter rated the draft Nichols Ranch ISR SEIS as "inadequate" under the commenter's responsibilities under NEPA and authority under Section 309 of the Clean Air Act (CAA). The commenter further indicated the SEIS did not meet the purposes of NEPA and, therefore, should be formally revised and made available for public comment in a supplemental or revised SEIS. The commenter indicated if its concerns were not addressed, then the commenter would consider elevating the issue for referral to the Council on Environmental Quality (CEQ) for resolution.

***Response**: NRC disagrees with the commenter and believes that the final Nichols Ranch ISR SEIS adequately addresses all public comments and does not need to be reissued for public comment. For further information on how the SEIS tiers from the GEIS and the process of determining impacts, refer to Section B5.5.2 of this comment-response appendix. NRC recognizes EPA's authority and responsibilities under NEPA and the CAA to rate draft environmental impact statements. The NRC staff has prepared the draft Nichols Ranch ISR SEIS consistent with its regulations under 10 CFR Part 51 that implement NEPA and its guidance for conducting environmental reviews as found in NUREG–1748 (NRC, 2003). Pursuant to 10 CFR 51.73, the NRC staff issued the draft Nichols Ranch ISR SEIS for public comment on December 11, 2009 (74 FR 65808), and the comment period on the document closed on March 3, 2010 (75 FR 6066). As discussed in Section B.2.4 of this comment-response appendix, 493 comments from 20 documents were received on the draft Nichols Ranch ISR SEIS, among which were additional comments raised by the commenter. Consistent with 10 CFR 51.91(a), the NRC staff considered and responded to all comments received.*

Comment: N017-005
One commenter expressed concern that the GEIS (NRC, 2009) and the draft Nichols Ranch ISR SEIS gave little attention to the recurring issues with uranium solution mines in the United States and other countries and the long history of evidence that environmental harms do occur. The commenter listed 10 environmental harms that the commenter asserted NRC failed to analyze in the draft SEIS, which included the potential for mining solutions to escape the production areas, adequate placement of monitor wells to detect potential excursions, the location of mine sites too close to water wells used for human consumption, high levels of uranium and other constituents in groundwater outside of the mining zone should an excursion occur, the inability to restore to premining "baseline" conditions at any commercial-scale ISL site, relevant regulatory agencies relaxing their cleanup standards for uranium and other contaminants to complete restoration, the adequacy of financial assurance, the chemical toxicity of uranium on the kidneys, restoration and decommissioning plans not being required, and the release of radon gas from injection well valves exceeding federal limits and, therefore, potentially contributing to unhealthy radon levels in areas where abandoned uranium mines have not been cleaned up. The commenter felt it was incumbent upon NRC to comprehensively address the environmental risks inherent in an expansion of the domestic uranium mining and

milling industry and to have sufficient protections in the licensing process to prevent a recurrence of previous environmental harms to the environment and public health.

***Response**: NRC evaluated historical information on NRC-licensed ISR operations (see GEIS Section 2.11) and considered this historical information to assess the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility in specific geographic regions of the western United States. The Wyoming East Uranium Milling Region, where the proposed Nichols Ranch ISR Project would be located, is one of these geographic regions (see GEIS Section 4.3). The final SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions to the extent that the applicant-proposed facility, activities, and conditions are consistent with the reference facility activities, information, and impact conclusions described in the GEIS.*

The SEIS considers excursions and groundwater quality impacts on production and surrounding aquifers in Section 4.5.2.1.2.2, which also discusses the placement of monitoring wells. In addition, Section 6.3.1 of the SEIS describes wellfield groundwater monitoring. The location of nearby wells used for various purposes is described in Section 3.5.2.3.4 of the SEIS. Section B5.9.8 of this comment-response appendix addresses the issue of groundwater restoration at ISR sites; the decommissioning and reclamation process and associated activities that would occur during this process are discussed throughout the SEIS. The potential release of radon gas at wellheads is considered in both the safety evaluation and as part of the public and occupational health and safety impacts in Section 4.13 of the SEIS. The adequacy of financial assurance is evaluated as part of the NRC safety evaluation rather than as part of the environmental review.

Comment: N017-007
One commenter asserted NRC had not taken a “hard look” at environmental impacts and that the draft SEIS added little, if anything, to the sufficiency of the NRC analysis of environmental impacts from the ISR process. The commenter stated the SEIS analysis mirrored the final GEIS (NRC, 2009) analysis and that the lack of a discernable difference between the GEIS environmental impact findings and those contained in the draft SEIS clearly indicated that no searching analyses were performed, as required under NEPA.

***Response**: As discussed in SEIS Section 1.4.1, the Nichols Ranch ISR SEIS supplements the GEIS, which provides a starting point for the NRC site-specific analysis of potential environmental impacts from the construction, operations, aquifer restoration, and decommissioning of the proposed Nichols Ranch ISR Project located in the Wyoming East Uranium Milling Region, one of the four geographic regions evaluated in the GEIS. SEIS Table 1-1 shows the range of potential environmental impacts expected in the Wyoming East Uranium Milling Region based on the GEIS analyses. As shown in SEIS Table 1-1, the GEIS concluded that the significance of potential impacts on certain resource areas (e.g., transportation, groundwater, noise) could range, depending on site-specific conditions.*

The SEIS evaluated potential impacts in Chapter 4 and relied on the description of the proposed facility at the Nichols Ranch ISR Project and associated activities in Chapter 2, the description of the affected environment at and in the vicinity of the proposed Nichols Ranch ISR Project in Chapter 3, and the resource area “significance” evaluation criteria identified in the GEIS to determine the significance of the potential environmental impact. Each resource area was assessed by comparing the site-specific conditions at the proposed Nichols Ranch ISR Project to those evaluated in the GEIS, in addition to considering new information that could contribute to the potential environmental impacts being beyond that considered in the GEIS. Table 2-3 of

the Nichols Ranch ISR SEIS summarizes the potential environmental impacts from implementing the proposed action at the Nichols Ranch ISR Project.

No further changes were made to the SEIS beyond the information provided in this response.

Comments: N017-008; N017-012
One commenter stated NRC should evaluate the potential impact of spills and that the failure to consider spills in the draft SEIS, and more notably in the GEIS (NRC, 2009), was disappointing. The commenter also stated the SEIS should have considered a reasonable range of the possible severity of spills in assessing the potential impacts to groundwater, surface water, and land.

***Response**: The NRC analyses of the potential environmental impacts to land use, surface water, and groundwater from spills associated with ISR operations for the proposed Nichols Ranch ISR Project are discussed in SEIS Sections 4.4.1.2 and 4.5.1.1.2. The GEIS considered these impacts in Sections 4.3.3.2, 4.3.4.1.2, and 4.3.4.2.2.1. Table 1-1 of the Nichols Ranch ISR SEIS summarized the range of potential impacts to these resource areas based on the GEIS analyses. As discussed in Section 1.4.1 of the Nichols Ranch ISR SEIS, the SEIS tiers and incorporates by reference from the GEIS to evaluate the site-specific environmental impacts. The Nichols Ranch ISR SEIS analysis determined the proposed facility, activities, and the site-specific conditions were comparable to the facility, activities, and conditions discussed in the GEIS, which included*

- *Engineering controls to detect pressure changes in the wellfield piping system*
- *Mechanical integrity testing of completed wells prior to their placement in service and subsequent retesting every 5 years*
- *Alarm systems for individual wells and in header houses*
- *Daily visual inspection of wellfield monitoring*
- *A spill response plan to address accidental spills*
- *Requirements to remediate affected areas and to remove contaminated soils for disposal offsite*
- *Near-surface aquifer at the proposed site is not an important source for local domestic or agricultural water supplies*
- *Near-surface aquifer is not hydraulically connected to other locally or regionally important aquifers.*

These systems and controls minimize the risk for a spill to occur, regardless of the spill severity. Furthermore, should a license be issued for ISR operations at the proposed Nichols Ranch ISR Project, Uranerz (the applicant) would take the necessary actions to respond to reported spills and incidents at the facility. NRC would also conduct periodic inspections to determine compliance with applicable regulatory requirements, license conditions, and approved procedures. Potential violations and allegations would be evaluated and addressed through either appropriate NRC enforcement or allegation programs.

No further changes were made to the SEIS beyond the information provided in this response.

Comment: N017-028
One commenter stated NRC has the duty to fully explain the science, technology, and techniques used in the ISR process and to fully analyze and assess the environmental impacts of each aspect of the process. The commenter believed that an environmental review is impossible without historical data on the success rates of the technologies used in the ISR process. Only by doing so, the commenter stated, can the NEPA "hard look" requirement be fulfilled.

***Response**: GEIS Chapter 2 (NRC, 2009) describes the ISR process used to evaluate the potential impacts from an ISR facility. All phases of the ISR-facility lifecycle are described, and information on the historical operating experience at ISR facilities is provided with respect to safety significance and issues of public concern such as spills, leaks, excursions, and aquifer restoration. GEIS Chapter 2 discusses key aspects of the ISR process common to NRC-licensed ISR facilities to build the foundation for the GEIS impact analyses. GEIS Chapter 2 discusses significant issues for proposed ISR sites and their potential environmental impacts rather than provide a detailed description of all aspects of every NRC-licensed facility. Detailed information regarding the specific technologies, equipment, and operational practices and parameters applicable to the proposed Nichols Ranch ISR Project are provided in the applicant's license application and summarized in Chapters 2 and 6 of the SEIS; explanation of how the information in the GEIS applies to the proposed Nichols Ranch ISR Project is also included. The NRC staff evaluated the adequacy of the license application with respect to operational safety and potential environmental impacts and determined that key aspects of the ISR process proposed for implementation at the Nichols Ranch ISR Project were similar to those described in the GEIS before incorporating by reference into the Nichols Ranch ISR SEIS relevant GEIS information.*

While NRC guidance discusses methods that are considered acceptable to staff, NRC does not prescribe technology or methods that an applicant must use nor is it necessary for NRC to proactively evaluate all available options in either GEIS or elsewhere before applications are received. Past experience suggests that ISR facilities use similar technology; by focusing on what is common, the GEIS provides a reasonable basis for supporting future ISR license application reviews. If an applicant submits an application that includes unproven technology or methods not analyzed in the GEIS, the NRC review may require additional details and performance data to verify that safety would be maintained and to use such information in the site-specific environmental review. However, the NRC staff has determined that the key aspects of the ISR process proposed for use at the Nichols Ranch ISR Project were consistent with those described in the GEIS.

No changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

Comments: N018-016; N018-019
A commenter stated that the proposed project was too early in the planning stage for NRC to adequately address potential site-specific environmental impacts and asserted that NRC rushed into the NEPA review. The commenter proposed that the SEIS be rewritten with more site-specific information and published again for public comment.

***Response:** The Nichols Ranch ISR SEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and is consistent with NRC's regulations in 10 CFR Part 51 which*

implements NRC's NEPA provisions. The environmental review of the proposed Nichols Ranch ISR Project site was initiated by Uranerz's submittal and NRC's acceptance of the license application for detailed technical review, as discussed in Section 1.6.1 of the final SEIS. NRC would not have accepted the application if sufficient site-specific information either had not been provided in the application or was otherwise not yet available. It is common during the review of a license application for NRC to make a request for additional information (RAI) from an applicant. In some cases, multiple rounds of RAIs are needed. This iterative process is designed to provide the applicant the necessary feedback to supplement the application in order to make it complete and accurate. NRC used information from the RAI responses in preparation of the FSEIS and SER. There is some overlap between the safety and environmental reviews (e.g., this can be seen in topics such as groundwater resources). The NRC staff conducting the environmental and safety reviews collaborates, as necessary, as it conducts these reviews in parallel. The staff has determined that (i) sufficient site-specific information was obtained and reviewed to justify the impact conclusions in this SEIS and (ii) the SEIS does not need to be republished for public comment.

B.5.4.3 Range of Reasonable Alternatives

Comments: N011-007; N013-005
One commenter noted while NEPA does not require NRC to consider every possible alternative to the proposed action, it does require NRC to consider all reasonable alternatives. The same commenter stated the failure to consider reasonable alternatives was a violation of NEPA. Another commenter noted that because NRC has no role in applicant business decisions, it prevents consideration of reasonable alternatives.

***Response**: The proposed Federal action and the purpose and need for the proposed Federal action define the range of reasonable alternatives. As a regulatory agency, the proposed Federal action for the Nichols Ranch ISR Project is the NRC decision of whether to grant or deny a license. The purpose and need for the proposed Federal action does consider the applicant goals and objectives to extract uranium from a particular location, which helps define the reasonable alternatives to the proposed Federal action.*

Reasonable alternatives considered in a site-specific environmental review depend on the proposed action and site conditions. As discussed in SEIS Section 2.1, NRC considered reasonable alternatives including the proposed action, the no-action alternative (i.e., not approving the license application), and a modified action (i.e., licensing only the Nichols Ranch Unit and not the Hank Unit).

As noted in NUREG–1508, underground mining would have more significant environmental impacts than ISR extraction, and the ore from underground mining would require processing at a conventional uranium mill to produce the final product. Significant quantities of tailings (residual rock materials after uranium removal) would be produced by conventional milling; these are normally disposed of onsite at the conclusion of the mill operating life (NRC, 1997). NUREG–0706, Final Generic Environmental Impact Statement on Uranium Milling (NRC, 1980), provides a detailed evaluation of the impacts associated with tailings disposal from conventional uranium milling. The environmental impacts of underground mining and conventional milling would be more significant than those from ISR milling at the proposed site. Therefore, underground mining and conventional milling are not evaluated in the Nichols Ranch ISR SEIS.

While the NRC staff considers reasonable alternatives to the proposed action in the environmental review, the only alternative within the NRC decisionmaking authority is to

approve or not approve the license application. NRC has no authority or regulatory control over applicant selection of uranium recovery technology to use at the applicant's selected site. NRC's regulatory authority is limited to evaluating the applicant request for a license to use ISR technology at the site. If NRC decides to grant the license request, the applicant must comply with the requirements of the license, NRC regulatory requirements, and any other relevant local, state, or federal requirements to operate its facility.

B.5.4.4 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

74 FR 27052, U.S. Nuclear Regulatory Commission. "Notice of Availability of Final Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register. Vol. 74, No. 107, pp. 27,052–27,054. June 5, 2009.

74 FR 65808, U.S. Nuclear Regulatory Commission. "Notice of Availability of Draft Environmental Impact Statement for the Nichols Ranch *In-Situ* Recovery (ISR) Project in Campbell and Johnson Counties, WY; Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register, Vol. 74, No. 237, pp. 65,808–65,810. December 11, 2009.

75 FR 6066, U.S. Nuclear Regulatory Commission. "Extension of Public Comment Period on the Draft Environmental Impact Statement for the Nichols Ranch *In-Situ* Recovery Project in Campbell and Johnson Counties, WY; Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." *Federal Register:* Vol. 75, No. 24. pp. 6,066–6,067. February 5, 2010.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. August 2003.

NRC. NUREG–1508, "Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mine Project, Crownpoint, New Mexico." ML082170248. Washington, DC: February 1997.

NRC. NUREG–0706, "Final Generic Environmental Impact Statement on Uranium Milling Project M-25." Washington, DC: ADAMS Nos. ML032751663, ML0732751667, ML032751669. September 1980.

B.5.5 Purpose, Need, and Scope of the SEIS/GEIS

B.5.5.1 Description of the SEIS/GEIS Purpose and Need

Comments: N011-001; N011-003; N011-004; N011-005; N011-054; N013-002; N013-003; N013-004; N013-006; N017-025
Commenters indicated the statement of purpose and need in the GEIS (NRC, 2009) was too narrow, which resulted in a limited analysis of reasonable alternatives in the Nichols Ranch ISR

SEIS. Two commenters stated that because of the construct of the purpose and need in the GEIS, the subsequent Nichols Ranch ISR SEIS was too narrow and limited the range of reasonable alternatives to either grant or deny the applicant's licensing request, and thus failed to satisfy the fundamental requirements of the NEPA. Other commenters further stated that by limiting the purpose and need scope, in essence, NRC is limiting the alternatives it will consider (to either license the proposed project or not). Commenters also stated that the alternatives analysis violated both the letter and spirit of NEPA and that if NRC had articulated a reasonable and legitimate purpose and need, the range of alternatives considered would likewise have been reasonable.

One commenter stated that similar to the GEIS, NRC fails to discuss the public purpose and need for the Nichols Ranch project, including whether the uranium produced is needed as a fuel source for domestic nuclear power plants.

Finally, a commenter stated that NRC should craft a statement of purpose and need in consultation with other involved Federal and State agencies that related the uranium recovery program to broad national objectives within NRC purview, such as "improving remediation of land and water impacts from the recovery of source or byproduct materials" or "ensuring the long-term isolation from the human and natural environment of harmful radionuclides and chemical toxins produced in the nuclear fuel cycle."

Response: *The statement of the purpose and need is found in Section 1.3 of this final SEIS and is derived from the proposed Federal action. Under the AEA, NRC has statutory authority to issue licenses for the possession and use of AEA-regulated radioactive materials and particular activities involving this material. Based on NRC's statutory authority, the proposed Federal action is NRC's decision whether to grant or deny a private party's licensing application to conduct ISR operations to extract uranium and produce yellowcake at a particular site. The purpose and need for the proposed Federal action does consider the applicant's goals and objectives to extract uranium from a particular location, which helps define reasonable alternatives to the proposed Federal action. As a result, NRC limits its analysis of alternatives to accomplishing the objective of extracting uranium from the applicant site and the No-Action alternative.*

The alternatives to the proposed action are discussed in Sections 2.2.3 and 2.2.4 of this final SEIS. Section 2.2.3 discusses the No-Action Alternative (i.e., denial of the license application), and Section 2.2.4 discusses Alternative 3 (Modified Action—No Hank Unit) in which only the Nichols Ranch Unit would be constructed and operated. Alternative mining and milling methods (conventional and heap leach discussed in Sections 2.3.1 and 2.3.2) and alternate lixiviants (discussed in Section 2.3.3) were considered in the Nichols Ranch ISR SEIS, but were not analyzed in detail. The evaluation of alternate sites analysis is limited to the occurrence of the subsurface ore body and could consider the placement of the wellfields. In response to public comments, an alternative that considered the construction and operation of only the Hank Unit (but not the Nichols Unit) as described in Section 2.3.4 was considered but eliminated from detailed analysis. Section 2.2.2 was added to this final SEIS to discuss alternative wastewater disposal options to the proposed action. Section 4.14.1.2 discusses the impacts from implementing alternative wastewater disposal options to the proposed action. NRC does not analyze the market conditions or business decision of a private entity to submit a license request as part of its licensing decision. An NRC licensing decision is based on both the safety evaluation and environmental review of the license application.

NRC performs an analysis of alternative energy production methods and alternative sites in its environmental reviews of nuclear power plant licensing actions. In those cases, the proposed action involves the decision of whether to grant or deny the license of an energy production facility, and the facility could perform this function at other locations. Even in these environmental reviews, NRC notes that the decision regarding energy policy and energy planning, including whether to implement energy options like solar power, conservation, or even nuclear power, are also made by the utility and State and Federal (non-NRC) decisionmakers, and NRC does not have authority to make these decisions. If NRC decides to renew or grant an operating license to a nuclear power plant the decision of whether to operate the nuclear power plant or an alternative is left up to the appropriate State, utility, and Federal entities.

In comparison, an ISR facility does not generate energy and is a fixed site based on the location of the ore body. As a result, alternative energy production methods and alternative site locations are not related to the proposed Federal action to decide whether to grant or deny an applicant license request to extract uranium from a particular site. NRC has not included an analysis of alternate geographic locations, alternative energy production methods, or market conditions in this final SEIS.

Sections 2.3.4, 2.2.2, and 4.14.1.2 were added to the final SEIS to discuss the alternative of only constructing and operating the Hank Unit, alternative wastewater disposal options to the proposed action, and the analysis of alternative wastewater disposal options, respectively, in response to public comments.

B.5.5.2 Use of the GEIS in Site-Specific Environmental Reviews

Comments: N002-004; N011-026; N011-039; N015-002; N018-015; N018-017; N018-018
Several commenters expressed concerns about how information from the GEIS (NRC, 2009) was incorporated into the draft Nichols Ranch ISR SEIS. One commenter stated a regional description of the affected environment could not substitute for a meaningful description and analysis of the impacts on the environment from the proposed Nichols Ranch ISR Project. Another commenter stated that because the Nichols Ranch ISR SEIS was one of three tiered from the GEIS, analysis of the relationship between the three SEISs and the GEIS was warranted; the commenter expressed concern about how information was incorporated from the GEIS. One commenter stated NRC had assured them that detailed site-specific information would be disclosed and analyzed in any site-specific NEPA document that tiered from the GEIS. However, the commenter noted the majority of statements and general analyses in the draft Nichols Ranch ISR SEIS appeared to have been copied and pasted from the GEIS with little regard to site-specific conditions or project plans. The commenter noted that verbatim statements inserted multiple times within the document without any additional detailed site-specific information led the reader to question how much information was used to prepared the draft Nichols Ranch ISR SEIS and whether that information was analyzed. Another commenter was concerned that the level of site-specific detail in the individual SEIS document did not provide adequate information to address potential environmental impacts. The commenter further noted their lack of specific comments was due to a lack of site-specific information in the SEIS. Another commenter was concerned that the SEIS relied too heavily on the GEIS framework for analyzing impacts and specifically noted impacts to water quality as an example.

***Response**: The relationship of the Nichols Ranch ISR SEIS to the GEIS is discussed in Sections 1.1 and 1.4 of this SEIS. The GEIS provides a starting point for NRC's NEPA analyses. The Nichols Ranch ISR SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions concerning potential environmental impacts.*

Chapter 3 of the SEIS describes each resource area (e.g., land use, geology and soils, water resources) at a regional level and then provides local and site-specific characteristics. The extent to which NRC incorporated GEIS impact conclusions depended on the consistency among the applicant's proposed facility, activities, and conditions at the proposed Nichols Ranch ISR Project site and the reference facility description, activities, regional conditions, and information or conclusions in the GEIS. NRC determinations regarding potential environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are discussed in Chapter 4 of this SEIS.

GEIS Sections 1.7.1 and 1.8 provide a general discussion of the NRC process for reviewing license applications for proposed new ISR uranium recovery projects. As discussed in GEIS Section 1.8, each site-specific environmental review will evaluate all information submitted in an applicant's Environmental Report to ensure that sufficient information to assess environmental impacts has been provided. The applicant's Environmental Report includes a detailed description and assessment of the proposed action, alternatives, site characterization information, and potential environmental impacts. If sufficient information were not provided, NRC would request additional information to ensure the information is complete. The GEIS does not relieve the applicant of the need to adequately document site-specific information in its application.

The NRC staff initially relies on applicant-provided information as well as information and conclusions from NRC's safety review. NRC staff confirms important attributes of the license application and Environmental Report through visits to the proposed site location and vicinity, independent research activities, and consultations with appropriate Federal, Tribal, State, and/or local agencies. If the NRC staff finds commonality between site conditions and those evaluated in the GEIS, the staff may incorporate by reference into the SEIS the applicable portions or conclusions from the GEIS. Whether or not the staff uses information from the GEIS in completing its site-specific environmental review, the conclusions in the site-specific environmental review documentation would be required to have sufficient technical basis.

GEIS Section 1.8.3 describes the process by which the NRC staff uses the GEIS to help determine the significance of site-specific environmental impacts. The GEIS provides criteria for each environmental resource area to help determine the significance level of potential impacts (e.g., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to site-specific conditions at the Nichols Ranch ISR Project to determine the significance of potential impacts. Finally, the NRC staff compared the conditions of the proposed Nichols Ranch ISR Project site and activities under review to the conditions and aspects identified and discussed in the GEIS to see whether the environmental impact conclusions for a particular resource area could be adopted in the SEIS. The NRC staff compared whether the GEIS impact significance conclusions for a specific resource area could be adopted in full, only in part, or not at all. Chapter 4 of the SEIS discusses the extent to which the GEIS conclusions could be adopted, including the supporting information and data that form the basis for that determination. Additionally, where the GEIS conclusions could be adopted only in part or not at all, the NRC staff also determined the significance of environmental impacts for those resource areas and provided the basis for that determination. For each resource area in Chapter 4 of the SEIS, the NRC staff provided a conclusory statement (i.e., the one identified by the commenter), which followed the site-specific information and analysis to indicate the extent to which new and significant information affected the ability to adopt impact conclusions from the GEIS. No changes were made to the SEIS beyond the information provided in this response.

B.5.5.3 Scope of the SEIS/GEIS

Comments: N001-005; N011-002; N011-045; N013-009; N013-010
Several commenters expressed concern over the scope of the SEIS and, similarly, the GEIS (NRC, 2009). One commenter stated that certain aspects of the GEIS, including its scope, appeared to be binding upon the SEIS. The commenter further noted that by improperly limiting the scope of the SEIS, NRC fails to analyze a number of impact areas. Another commenter stated additional comments on the GEIS were appropriate, given the GEIS did not apply to any federal plan or project and did not represent any final NRC regulatory or policy decision, which therefore made it impossible for any member of the public to meaningfully comment on the GEIS in a concrete context. The same commenter noted that despite many public comments on the GEIS urging NRC to consider the impacts of previous uranium mining and milling, NRC deemed contamination from past uranium mining and milling to be outside the GEIS scope. One commenter requested that the public have an opportunity to review the NRC proposed rulemaking on groundwater protection at ISR facilities and urged NRC to extend the draft SEIS comment period to allow NRC to promptly release its associated draft groundwater protection rule so it could be reviewed concurrently with the draft SEISs.

***Response**: As discussed in SEIS Section 1.4, the NRC staff considers the GEIS scope to be sufficient for the purposes of defining the scope of this SEIS. In so stating, NRC considers that topics determined to be within scope for the GEIS were also within scope for the SEIS. NRC made this determination based on its review of the applicant-provided information and as a result of meetings with Federal, State, and local agencies and contact with potentially interested Native American tribes and local authorities, entities, and public interest groups in person and via e-mail and telephone (see SEIS Sections 1.4.2 and 1.7.3).*

Concerning public involvement in the GEIS, NRC accepted public comments on the GEIS scope from July 24, 2007, to November 30, 2007, and held three public scoping meetings to aid in this effort. Additionally, NRC held eight public meetings to receive comments on the draft GEIS published in July 2008. Comments on the draft GEIS were accepted between July 28, 2007, and November 8, 2008. Comments received during scoping and on the draft GEIS are available through the NRC ADAMS database on the NRC website (http://www.nrc.gov/reading-rm/adams.html). Transcripts of the scoping meeting and draft GEIS comment meetings are available at http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html. A scoping summary report is provided in GEIS Appendix A. Based on public meeting transcripts and written comments received during the scoping and public comment period for the GEIS, the NRC staff considers that meaningful and extensive public comments were received on the GEIS.

With respect to the specific comment that contamination from past conventional mining and milling was outside the scope of the GEIS, the NRC noted in GEIS Appendix A that such contamination could be assessed as part of a site-specific cumulative impacts evaluation. Chapter 5 of this SEIS provides NRC site-specific cumulative effects analysis. In SEIS Table 5-1, past uranium recovery operations, including conventional mills within the Wyoming East Uranium Milling Region (where the proposed site is located) are identified. The cumulative impacts evaluation in SEIS Chapter 5 has been revised to clarify and improve the transparency of the analysis. Regarding the comment concerning the proposed rulemaking on groundwater protection, this SEIS is based on the regulations in effect at the time of writing. This has been clarified in SEIS Section 1.5. Section B.5.9.4 of this appendix describes the status of the proposed rulemaking on groundwater protection.

B.5.5.4 Reference

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.6 Scoping Process and Scoping Report

Comments: N011-047; N011-049; N011-050; N011-051
One commenter stated NRC did not conduct any public meetings regarding the scope of the Nichols Ranch ISR SEIS in contrast to what was done for the GEIS (NRC, 2009). The commenter stated that instead of public scoping meetings, NRC met with government agencies and groups it considered interested in the SEIS to determine scope. The commenter stated the failure to conduct public scoping prevented the public from raising issues, including the cumulative impact of past uranium mining and milling that the commenter stated should have been considered in the Nichols Ranch ISR SEIS. The commenter stated that the NRC failure to conduct public scoping meetings was a violation of NEPA and the NRC should issue another draft SEIS for public comment after conducting scoping meetings.

***Response**: NRC conducted a public scoping process for the ISR GEIS, from which the Nichols Ranch ISR SEIS is tiered. The scoping process included three public scoping meetings, one of which was in Casper, Wyoming. NRC considered public comments, along with information on ISR technology and regional information to identify the scope of the GEIS for ISR facilities. The process included identifying significant issues to be studied in depth in the GEIS to help evaluate potential environmental impacts to various resource areas and identify other regulatory and consultation requirements for ISR facilities.*

NRC considers the ISR GEIS to be a final environmental impact statement and that the environmental reviews for a specific license application are a supplement to the ISR GEIS. According to NRC regulations in 10 CFR 51.92(d), the NRC staff is required to prepare a supplement to a final environmental impact statement in the "same manner as the final environmental impact statement except that a scoping process need not be used." Furthermore, even if a scoping process is conducted, NRC regulations do not require the scoping process to include public scoping meetings [10 CFR 51.26(b)].

NRC staff interacted with multiple Federal, Tribal, State, and local agencies and/or entities during preparation of the Nichols Ranch ISR SEIS for consultation purposes and to gather information on potential issues, concerns, and environmental impacts related to the proposed Nichols Ranch ISR Project, as described in Section 1.7.3 of this SEIS. NRC staff used information from these interactions and other site-specific information to evaluate whether issues identified during the scoping process for the GEIS were adequate for the Nichols Ranch ISR environmental review and whether specific GEIS conclusions or findings were applicable to the Nichols Ranch ISR Project. This information was used to prepare the draft SEIS which was issued for public comment.

Comments received on the draft SEIS were considered in the development of this final SEIS. In particular, the cumulative impacts analysis in Chapter 5 of the Nichols Ranch ISR SEIS has been revised in response to public comments received on the draft SEIS and considers past uranium mining and milling.

B.5.6.1 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.7 SEIS/GEIS Methods and Approach

B.5.7.1 Consideration of Compliance History in Assessing Impacts

Comments: N011-029; N011-030
One commenter stated the NRC conclusion regarding groundwater impacts disregarded the operational history of other ISR operations that have used the same or similar leak detection and well-integrity programs as proposed for the Nichols Ranch ISR Project. The commenter provided the example of the Smith Ranch Project as support for their concern. The commenter stated actual operational data and NRC conclusions regarding the magnitude of impacts in both the GEIS and the Nichols Ranch ISR SEIS were fundamentally contrary to NEPA.

Response*: NRC conclusions regarding the potential environmental impacts to groundwater for the Nichols Ranch ISR Project are provided in SEIS Section 4.5.2.1. These impact conclusions are based on facility-specific process descriptions for the Nichols Ranch ISR Project and site-specific characteristics at the proposed site. In determining impact conclusions, the NRC staff reviewed information the applicant provided in its license application as amended (including the technical and environmental reports), information and data staff collected independently, and information and data provided in the GEIS (NRC, 2009a).*

GEIS Section 2.11.2 discusses leaks, spills, and excursions that have occurred at existing ISR facilities. Excursions and mechanical integrity failures have been reported for past and current ISR facilities, but in most cases they have been controlled and did not pose a threat to human health or the environment. Three ISRs are currently operating: two in Wyoming [Uranium One Irigaray and Christensen Ranch facility (formally owned by Cogema Mining, Inc.)] and the PRI Smith Ranch-Highland Uranium Project] and one in Nebraska (the Cameco Crow Butte Project). Excursion history and corrective action for all of these sites can be found in annual reports and correspondence between NRC and the applicants in ADAMS.

All ISR facilities have the potential for leaks, spills, and excursions, and the purpose of the oversight program is to help ensure that leaks, spills, and excursions are minimized. Oversight activities, including inspection activities, verify that ISR facility operations, aquifer restoration, and decommissioning activities are being conducted according to NRC regulations. NRC enforcement programs and policies effectively verify whether if applicants are in compliance with NRC regulations and take appropriate enforcement action if a licensed facility is not in compliance.

Surface containment of leaks and spills is required for all storage tanks (71 FR 77266). In addition, spill prevention plans are required of each ISR facility per 40 CFR Part 112. For chemicals stored at ISR facilities, concrete berms with containment equivalent to at least the volume of the tank are required. Spill reporting varies from state to state. NRC requires that a licensee report a spill within 24 hours if the spill meets the criteria in 10 CFR Parts 20 and

40.60. Otherwise, NRC typically requires, by license condition, that if a leak or spill meets State reporting requirements, it must also be reported to NRC. Leaks and spills must be characterized and cleaned up to regulatory requirements [see 10 CFR Part 40, Appendix A, Criterion 6(6)].

To detect and prevent excursions to the overlying and underlying aquifers, NRC issues a license condition that requires operators to perform mechanical integrity testing for all injection and production wells (NRC, 2003). This test is conducted every 5 years to ensure that the wells do not develop leaks. To ensure that excursions are identified early, excursion monitoring wells are installed. Horizontal excursion monitoring wells are placed in a perimeter ring surrounding the wellfield in the production aquifer. In addition, vertical excursion monitoring wells are installed in the overlying and underlying aquifers (NRC, 2003). The monitoring wells are usually sampled twice a month for excursion indicators. When excursion indicators exceed predetermined upper control limits (UCLs), it may signal that production fluids are moving out of the wellfield boundary. If an excursion is confirmed, the applicant must begin corrective actions to control the excursion and must continue corrective actions until the excursion is controlled. The location of the excursion monitoring wells, the choice of excursion indicators, and the process for determining UCLs are all reviewed before a license is approved.

Before uranium is recovered from an aquifer, EPA must declare the portion of the aquifer where production would occur, exempt as a USDW (see 40 CFR 146.4). In addition, if liquid byproduct material is to be disposed of via deep well injection, EPA must also declare the deep well-receiving aquifer exempt. The production aquifer exemption area would be restored to the standards in 10 CFR Part 40, Appendix A, whereas the injected byproduct materials fluid would remain in the exempted aquifer.

NRC performs an environmental review of an applicant's license application to determine the environmental effects of operating the proposed ISR facility. The Commission determined it would prepare a SEIS for each license application to fulfill its responsibilities under NEPA (see 10 CFR 51.20). NEPA requires that all Federal agencies consider environmental values in the conduct of their work. No changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

Comment: N011-040
One commenter stated that the NRC conclusion that impacts to groundwater from groundwater restoration would be SMALL was arbitrary and unreasonable. Additionally, the commenter requested NRC fully disclose the ISR industry groundwater restoration history and then reconsider impacts to groundwater, regionally and locally, based on that history.

***Response**: NRC conclusions regarding the potential environmental impacts to groundwater from groundwater restoration for the Nichols Ranch ISR Project are provided in Section 4.5.2.1.3. As discussed there, NRC analyzed impacts that could result from drawdown, leaks and spills from buried piping, and disposal of waste fluids via deep well injection and determined that such potential impacts would be SMALL. These impact conclusions are based on facility-specific process descriptions for the Nichols Ranch ISR Project and site-specific characteristics at the proposed site. In determining these impact conclusions, the NRC staff reviewed information the applicant provided in its license application as amended (including the Technical and Environmental Reports), reviewed information and data the staff independently collected, and considered information and data from the GEIS (NRC, 2009a).*

NRC published a summary of groundwater impacts from ISR operations at operating facilities that is available through the NRC ADAMS using the Accession Number ML091770402 (NRC, 2009b). ADAMS is available on the internet at http://www.nrc.gov/reading-rm/adams.html. No changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

B.5.7.2 Reliance on Regulatory Compliance to Limit Impacts

Comment: N013-016
A commenter stated that NRC failed to mention it does not have the authority to enforce any requirements imposed (on the licensee) by other agencies and that none of the other agency approvals have yet been granted. Thus, the commenter concluded that NRC could not rely on these requirements to reduce the impact of the proposed action.

Response*: As a matter of practice, the NRC staff assumes that existing regulations are applied, as appropriate, to an ISR facility. NRC expects licensee compliance with regulatory requirements and license conditions when evaluating the potential environmental impacts of an ISR project. While NRC does not have the statutory authority to enforce other agency requirements, the other agencies have the necessary enforcement authority and would carry out the requirements of their regulations. The NRC staff would conduct periodic inspections to determine compliance with applicable regulatory requirements, license conditions, and approved procedures. Potential violations and allegations would be evaluated and addressed through appropriate NRC enforcement or allegation programs. Enforcement actions can result in fines, corrective actions, or injunctive relief to address violations of regulatory requirements.*

Table 1-2 of the final Nichols Ranch ISR SEIS summarizes the status of the environmental approvals that would be required for the proposed Nichols Ranch ISR Project. No changes were made to the Nichols Ranch ISR SEIS in response to this comment.

B.5.7.3 Methods for Defining Use of Milling Regions

Comments: N018-009; N018-010
One commenter expressed concern about the study area splits for the two mining districts in Wyoming and believed the socioeconomic data are questionable because these data are traditionally collected by political subdivisions that are not congruent or coincidental with the mining districts analyzed in the Nichols Ranch ISR SEIS.

Response*: Delineation of the study areas in the GEIS (NRC, 2009a) and that were subsequently followed in the site-specific environmental reviews that tier from the GEIS were developed based on several factors: the location of both former and existing uranium milling sites and the location of potential new sites that reflect the geologic setting, the areas where the uranium recovery industry indicated the ISR technology would be used for uranium milling, and the location of historical uranium deposits.*

The commenter is correct that socioeconomic data are traditionally collected by political subdivisions that are not necessarily congruent with the study areas defined in the GEIS. However, because the proposed Nichols Ranch ISR Project is located in a sparsely populated area, census geographic units cover much larger areas and the data may not be available at a smaller scale. The SEIS includes site-specific analysis of socioeconomic factors for the proposed Nichols Ranch ISR Project site. The SEIS uses a region of influence limited to the proposed project site area (Campbell and Johnson Counties).

No change was made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

B.5.7.4 General Comments on GEIS Structure, Methods, and Approaches

Comments: N001-002; N002-005; N011-038; N011-053; N011-063; N011-064; N011-065; N011-067; N013-014; N013-020; N017-011; N017-020
Several commenters submitted comments on the draft SEIS for the Nichols Ranch ISR Project addressing solely the GEIS (NRC, 2009a).

***Response**: The draft GEIS was published with a* Federal Register *Notice of Availability July 28, 2008 (73 FR 43795). NRC held a 103-day public comment period for the draft GEIS from July 28, 2008, through November 7, 2008. During this comment period, members of the public were invited and encouraged to submit related comments online, via e-mail, via regular mail, or orally at one of eight public meetings held on the draft GEIS. NRC considered and responded to comments received on the draft GEIS and included these responses in Appendix G of the final GEIS, Notice of Availability, which was published on June 5, 2009 (74 FR 27052).*

Because the listed comments do not directly apply to the draft SEIS or provide any site-specific information related to the proposed Nichols Ranch ISR Project, they are not considered further here. Section 1.4.1 of the SEIS describes the relationship between the GEIS and the SEIS. Section 1.4.1 was revised to indicate that NRC responded to comments received on the GEIS submitted during the GEIS comment period and that those responses are contained in GEIS Appendix G.

Comment: N017-006
One commenter stated that NRC, in its final GEIS, provided little more than a cursory response to comments the commenter and others submitted on the draft GEIS. The commenter considered this minimal response meant that NRC did not fulfill its responsibility under NEPA, which requires that Federal agencies respond to comments the public or cooperating agencies submit. The commenter further stated the NRC responses to comments on the draft GEIS were conclusory and nonresponsive, thereby failing a basic requirement of NEPA and the agency duty to supplement, modify, or improve its analyses in response to comment.

***Response**: NRC disagrees with the commenter that the final GEIS responses to comments were inadequate. NEPA requires an agency to have a reasonable response to comments but does not require an agency to accept recommendations or suggestions of other agencies or commenters. An agency is not obligated to conduct new studies in response to issues raised in comments, nor is it obligated to resolve conflicts raised by opposing viewpoints. The standard requires that agencies identify opposing views found in the comments such that differences in opinion are readily apparent and there is a good faith, reasoned analysis in the response. NRC published the final GEIS on June 5, 2009 (74 FR 27052). The final GEIS included Appendix G, which was dedicated to identifying and summarizing comments submitted on the draft GEIS and the NRC responses to those comments. Pursuant to the NRC regulations under 10 CFR Part 51 that implement NEPA, and specifically 10 CFR 51.91(a), NRC responses took the form of*

(i) Modification of alternatives, including the proposed action
(ii Development and evaluation of alternatives not previously given serious consideration
(iii) Supplementation or modification of analyses
(iv) Factual corrections

(v) Explanation of why comments do not warrant further response, citing sources, authorities or reasons that support this conclusion

The NRC staff considers its response to comments on the draft GEIS, as documented in the main text and appendices to the final GEIS, to be consistent with NRC responsibilities under its NEPA implementing regulations under 10 CFR Part 51. No further modification to the Nichols Ranch ISR SEIS has been made beyond the information provided in this response.

B.5.7.5 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. Appendix A *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

40 CFR Part 112. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 112 "Oil Pollution Prevention." Washington, DC: U.S. Government Printing Office.

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 146 "Underground Injection Control Program: Criteria and Standards." Washington, DC: U.S. Government Printing Office.

71 FR 77266, U.S. Nuclear Regulatory Commission. "EPA proposed amendments to the SPCC rule." December 26, 2006.

73 FR 43795, U.S. Nuclear Regulatory Commission. "Notice of Availability of Draft Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register. Vol. 73, No. 145, pp. 43,795–43,798. July 28, 2008.

74 FR 27052, U.S. Nuclear Regulatory Commission. "Notice of Availability of Final Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register. Vol. 74, No. 107, pp. 27,052–27,054. June 5, 2009.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009a.

NRC. Memorandum from C. Miller to Chairman Jaczko, et al "Staff Assessment of Groundwater Impacts from Previously Licensed *In-Situ* Uranium Recovery Facilities." ML091770402. Washington, DC: NRC. July 10, 2009b.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. ML032250177. Washington, DC: NRC. June 2003.

B.5.8 Public Involvement

Comment: N002-002
One commenter stated the public comment period was insufficient to allow for meaningful participation, inconsistent with the purpose and intent of NEPA.

***Response**: Public participation is an essential part of the licensing process, and NRC encourages public involvement. NRC conducted an open, public SEIS development process consistent with the requirements of the NRC NEPA-implementing regulations. As described in SEIS Appendix B.2.4, NRC extended the initial comment period and the public was provided an 81-day comment period from December 11, 2009, to March 3, 2010, which exceeds the minimum 45-day comment period required under NRC regulations. No change was made to the SEIS beyond the information provided in this response.*

Comment: N014-015
One commenter stated if the SEIS provided a more detailed description of the licensing process to include the GEIS scoping and public comment meetings (NRC, 2009), the completion of the SER, and the license applicant meetings with NRC staff, this would provide members of the public and interested stakeholders with a better understanding of how focused the NRC licensing process is on transparency and public participation and how extensive the process is on the issues of protecting public health and safety and the environment on a site-specific basis.

***Response**: NRC provides multiple avenues for public observation or involvement in its licensing process and attempts to make the licensing and environmental review processes as transparent as possible. In the NRC license review process, when an application is received, reviewed for completeness, and accepted for detailed review, NRC formally dockets the application and publishes a notice in the Federal Register. The Federal Register notice announces the availability of the application and provides an opportunity for affected individuals or entities to request a hearing under the NRC formal hearing process. The NOA published in the Federal Register includes the relevant identifying information for the license application so that an interested member of the public can view the application either electronically through NRC ADAMS or in person by visiting the NRC Public Document Room.*

Section 1.4.2 of the SEIS describes the NRC staff's efforts to meet with the public, as well as tribes and Federal, State, and local agencies, to gather information for the development of this SEIS. This section also describes the public comment process for the draft SEIS and indicates that a Notice of Opportunity to request a hearing on the proposed Nichols Ranch ISR project was published in the Federal Register on June 16, 2008 (73 FR 34052). In response to the Notice of Opportunity, NRC did not receive any requests for a hearing. In addition to the opportunities provided through development of the SEIS, NRC provided opportunities for public input during the staff's safety review. Specifically, the staff held 10 meetings or teleconferences with the applicant from 2006 to 2010; all of these interactions included an opportunity for the public to listen to the meetings and ask questions.

This SEIS also describes the opportunities to provide input that occurred throughout the development of the GEIS, from which the Nichols Ranch ISR SEIS is tiered. As discussed in Section 1.4.1 of the SEIS, NRC accepted public comments on the scope of the GEIS from July 24, 2007, to November 30, 2007, and held three public scoping meetings, one of which was in the State of Wyoming. During the public comment period on the draft GEIS, NRC held eight public meetings to receive comments on the draft GEIS: three of these meetings occurred in the State of Wyoming.

Text was added to Section 1.4.2 of the SEIS to discuss the opportunities for public involvement that were part of the licensing review process.

Comments: N015-026; N015-035; N020-031
Several commenters requested interested stakeholders be involved in the review of any modeling protocol for assessing air quality impacts prior to supplemental work being performed. The same commenter asked whether there is a public participation process associated with the establishment of, and the NRC decision to approve, alternate concentration limits (ACLs).

Response*: NRC provides multiple avenues for public involvement in its licensing process in the review of an individual ISR facility. For new ISR license applications, such as the Nichols Ranch ISR application, NRC publishes a Notice of Intent in the* Federal Register *to prepare the site-specific SEIS and provides information on the scope of the SEIS. NRC also publishes the draft SEIS for public comment and addresses stakeholder comments on the draft in its final SEIS. NRC may also make a draft environmental assessment and accompanying draft finding of no significant impact available for public comment for any related ISR licensing actions that do not require an SEIS.*

A licensee must apply for a license amendment for an ACL. For major licensing actions that may include an amendment request for an ACL, a notice is published in the Federal Register *and on the NRC webpage providing an opportunity for the public to comment and an opportunity to request a hearing. Further, NRC performs a safety and an environmental review (typically an environmental assessment) as part of evaluating the adequacy of ACLs.*

No changes were made to the final SEIS beyond the information provided in this response.

B.5.8.1 References

10 CFR Part 2. *Code of Federal Regulations*, Title 10, *Energy*, Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders." Washington, DC: U.S. Government Printing Office.

73 FR 34052, U.S. Nuclear Regulatory Commission. "Notice of License Application Request of Uranerz Energy Corporation Nichols Ranch *In-Situ* Uranium Recovery Project, Casper, Wyoming, Opportunity to Request a Hearing and Order Imposing Procedures for Access to Sensitive Unclassified Non-Safeguards Information (SUNSI) for Contention Preparation." *Federal Register*: Vol. 73, No. 116. pp. 34052–34056. June 16, 2008.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.9 Regulatory Issues and Process

B.5.9.1 NRC as a Regulatory Authority

Comment: N014-010
One commenter asked for clarification about NRC and its statutory mission under the AEA and its approach to licensing as an independent regulatory agency. The commenter suggested that all references to NRC's statutory mission in the SEISs be revised with the following language:

"NRC must license facilities, including ISR operations, in accordance with the AEA and the Commission's implementing regulations to protect public health and safety from potential radiological and nonradiological hazards associated with AEA materials and operations."

***Response**: NRC was created after Congress passed the Energy Reorganization Act in 1974. This Act, along with the AEA of 1954, provides the foundation for NRC's regulatory authority. As an independent regulatory agency, NRC reports directly to Congress. Independent agencies can be distinguished from executive agencies by their structural and functional characteristics. NRC has the responsibility to license and regulate uranium ISR facilities through the statutory requirements of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 and the AEA, as amended. These statutes require that NRC ensure source material, as defined in AEA Section 11(z), and byproduct material, as defined in AEA Section 11e.(2), is managed to conform with applicable regulatory requirements. The text within the SEIS is correct. No changes were made to the SEIS beyond the information provided in this response.*

B.5.9.2 NRC Policies and Practices

Comments: N013-055; N013-056
One commenter stated NRC fails to discuss why averaging for baseline water quality conditions is allowed under NRC regulations. The commenter expressed concern that some livestock and domestic wells are completed within the ore zone and that averaging could prevent those aquifers from being restored to a level that would allow these groundwater sources to be used for the same premilling purposes.

***Response**: NRC regulations at 10 CFR Part 40, Appendix A, Criterion 7A state that licensees are required to establish baseline water quality that is used to set the site-specific (wellfield) groundwater protection standards as specified in 10 CFR Part 40, Appendix A, Criterion 5B(1). NUREG–1569, the Standard Review Plan for In-Situ Leach Uranium Extraction License Applications (NRC, 2003a), allows water quality at individual wells within a wellfield to be averaged as an acceptable method to establish the required baseline water quality in the wellfield. This average baseline water quality is used to establish (i) restoration standards that must be met as required in 10 CFR Part 40, Appendix A, Criterion 5B(5) and (ii) restoration success.*

NUREG–1569 allows wellfield averaging because the ISR process tends to homogenize water quality in a wellfield. However, the applicant will not necessarily average groundwater quality data for an entire wellfield. For example, the applicant states in Section 5.7.8.6 of the approved application that if water quality data vary significantly within a wellfield, the wellfield will be divided into subzones and restoration standards will be calculated for each wellfield subzone.

Section 3.5.2.3.4 of the SEIS discusses domestic and livestock wells that are located within and near both the Nichols Ranch Unit and the Hank Unit of the proposed Nichols Ranch ISR Project. There are no domestic wells within the Nichols Ranch ISR Project proposed licensed area. The nearest domestic well is 1 km [0.6 m] from the Hank Unit proposed licensed boundary. There are several livestock wells located within the Hank Unit proposed licensed boundary. The applicant has committed to abandon domestic and livestock wells within the wellfields that may be impacted by operations (Uranerz, 2007). The applicant has also committed to restore the wellfield ore zone aquifers (Uranerz, 2007) to average baseline water quality. When the wellfield is restored to its Commission-approved baseline water quality standard, it will have the same water quality and preoperational use as it did prior to operations.

No changes were made to the SEIS beyond the information provided in this response.

Comment: N014-018
One commenter stated that the SEIS language indicates that NRC would be reviewing and approving all wellfield packages rather than just initial wellfield packages. The commenter went on to note that, in the commenter's opinion, if NRC were to review and approve all wellfield packages, this would be contrary and detrimental to the Commission's policy supporting performance-based licensing, and that NRC staff should continue to allow Safety and Environmental Review Panels (SERPs) to review and approve wellfield packages under traditional performance-based licensing as has been done in the past.

***Response**:*
NRC agrees with the need to clarify its position on review and approval of wellfield hydrologic data packages. Historically, NRC reviewed and approved all wellfield packages. During the mid-1990s, the Commission adopted a performance-based approach to licensing. A performance-based regulatory approach is one that establishes performance and results as the primary basis for regulatory decision making, and this approach incorporates the following attributes: (i) measurable (or calculable) parameters (i.e., direct measurement of the physical parameter of interest or of related parameters that can be used to calculate the parameter of interest) exist to monitor system, including both facility and licensee performance; (ii) objective criteria to assess performance are established based on risk insights, deterministic analyses, and performance history; (iii) licensees have flexibility to determine how to meet established performance criteria in ways that would encourage and reward improved outcomes; and (iv) a framework exists in which the failure to meet a performance criterion, while undesirable, would not in and of itself constitute or result in an immediate safety concern.

Current Commission policy allows the applicant to use an in-house Safety and Environmental Review Panel (SERP) to review and approve wellfield packages under performance-based license conditions. The SERP is composed of at least three members: one with expertise in management, one with expertise in operations, and the radiation safety officer (RSO). NRC staff, however, has determined that a new licensee with no record of performance must submit its first wellfield package to NRC for review and approval. After NRC approval of an initial wellfield package, a licensee would have a template on which to model future packages. In wellfields where particular geologic features (e.g. faults, thin/missing aquitards) or groundwater flow behavior (e.g., unconfined aquifer, leakage across aquitards) require the characterization of local field data and testing to determine whether ISR operations can meet regulatory requirements, the staff may require review and approval of additional wellfield packages. As a result of the safety review for the proposed Nichols Ranch ISR Project, NRC has determined the hydrogeological conditions of the Nichols Ranch Project that would impact excursion control and capture require NRC to impose a license condition whereby NRC will review and approve the Production Area Pump Test reports for the first wellfields at the Nichols Ranch and Hank Units.

The discussion in Section 6.3.1.2 of the final Nichols Ranch ISR SEIS was revised to clarify this issue.

B.5.9.3 Adequacy of NRC Regulations and Practices

Comments: N011-043; N013-067
A commenter stated that the NRC staff recognizes that "class of use" is an inappropriate restoration goal and referred to the NRC Regulatory Issue Summary issued in 2009, which concluded that Criterion 5B does not provide for restoration to "class of use" standards and also

concluded that NUREG–1569's discussion of groundwater restoration to "preoperational class of use" is not an appropriate standard for evaluating license applications (RIS 2009-05). Another commenter wanted to know whether the aquifers would be restored to a quality level that would allow them to be used for domestic and stock wells in the future.

***Response**:*
The commenter is correct that in the past, NRC has applied "class of use," a state designation under the Safe Drinking Water Act, as a secondary restoration goal to approve ISR restoration. The phrase "class of use" referred to in the GEIS as a standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2003a). NRC has determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC has notified licensees and applicants in Regulatory Information Summary (RIS) 09-05, dated April 29, 2009, that the restoration standards listed in NUREG–1569, Section 6.1.3(4) are not consistent with those listed in 10 CFR Part 40, Appendix A and licensees and applicants must commit to achieve the restoration standards in Criterion 5B(5).

The standards in 10 CFR Part 40, Appendix A, Criterion 5B(5) state the concentration of a hazardous constituent must not exceed (i) the Commission-approved background concentration of that constituent in ground water, (ii) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed or, (iii) an alternative concentration limit established by the Commission. An ACL is not a primary restoration goal and will only be considered after a licensee has demonstrated that primary restoration goals are not practically achievable at a specific site. Only ACLs that present no significant hazard may be proposed by the licensees for Commission consideration. The Commission may establish a site-specific ACL for a hazardous constituent as provided in 5B(5) if it finds that (i) the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and (ii) the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. NRC requirements for application, review, and establishment of a site-specific ACL are discussed in Appendix C*. In addition, ACL application review procedures for NRC staff are available in the following documents: January 1996 Staff Technical Position: Alternate Concentration Limits for Title II Uranium Mills, NUREG–1620, and NUREG–1724.*

As described in Section 2.2.1.2.4.1 of the SEIS, before ISR operations can begin, the portion of the aquifer where ISR extraction will occur must be declared an exempt aquifer. The criteria EPA use for an aquifer exemption is found in 40 CFR 146.4. The regulation states that an aquifer or a portion thereof may be determined to be an "exempted aquifer" if it meets the following criteria: (i) it does not currently serve as a source of drinking water; and (ii) it cannot now and will not in the future serve as a source of drinking water, or (iii) the total dissolved solids content of the groundwater is more than 3,000 and less than 10,000mg/l and it is not reasonably expected to supply a public water system. Therefore, any domestic well within the ISR production zone aquifer must be abandoned and may not be used as a source of drinking water in the future. The federal regulation of exempt aquifers is enforced by EPA, which has the responsibility to ensure that an exempted aquifer is not used as a source of drinking water. If stock wells are located in the production zone aquifer and the aquifer is restored to the groundwater protection standards in Appendix A, Criterion 5B(5), these wells will be suitable for their preoperational use after restoration.

No changes were made to the SEIS beyond the information provided in this response

Comments: N014-012; N014-013
One commenter noted that the NRC discussion of regulatory programs applicable to ISR operations outside the context of the AEA should be expanded to demonstrate how highly regulated the ISR industry is in the United States. The same commenter further noted the NRC should specify all of the regulatory programs that apply to ISR operations and not limit the discussion in the final SEIS to only 10 CFR Part 51 regulations. A commenter noted the SEIS states that ISR operations are subject to the AEA and NEPA with no mention of other statutory programs such as the SDWA, National Historic Preservation Act (NHPA), and the Endangered Species Act, as implemented in accordance with various State programs. Commenters stated that the final SEIS should clarify the extent of the regulatory oversight for ISR operations. Commenters noted that multiple agencies oversee ISR operations, often resulting in two or even three layers of financial assurance for each ISR project; a commenter stated this more than assures that adequate site-specific decommissioning and decontamination would be performed.

***Response**: NRC has to comply with all applicable Federal environmental laws and regulations, including its own regulations (in Title 10 of the Code of Federal Regulations) and those promulgated by other federal agencies, so long as compliance would not be inconsistent with other statutory requirements. GEIS Section 1.6 (NRC, 2009a) identifies agencies involved in a uranium ISR facility, and Section 1.7 discusses the licensing and permitting process for an ISR facility. Section 1.6 of the Nichols Ranch ISR SEIS discusses the status of licensing and permitting and associated consultations that pertain to the ISR licensing review at the proposed Nichols Ranch ISR Project. The SEIS was prepared in accordance with NEPA requirements and the NRC-implementing regulations at 10 CFR Part 51.*

Furthermore, GEIS Appendix B summarizes other Federal statutes, implementing regulations, and Executive Orders potentially applicable to the proposed Nichols Ranch ISR Project licensing review. The agencies responsible for implementing these programs describe regulatory programs applicable to ISR operations, and readers should consult the responsible agencies for clarification of their regulations and programs. ISR applicants are ultimately responsible for understanding and complying with all Federal, State, and local permits and regulations whether described in the GEIS or not.

No changes were made to the SEIS beyond the information provided in this response.

Comment: N017-026
One commenter stated that for NRC to craft an appropriate “Purpose and Need for Agency Action,” the agency must work with its Federal colleagues at EPA, U.S. Department of Energy (DOE), and U.S. Department of the Interior (DOI) to develop a regulatory framework for uranium recovery cleanup and licensing that protects public health and the environment. The commenter asserted that the NRC has refused to issue a draft groundwater protection rule for nearly 5 years and that it is past time for NRC to develop a coherent set of protective environmental requirements for ISR processes; the commenter stated that developing a draft groundwater rule would be a start.

***Response**: NRC has announced it is working on a rulemaking specific to groundwater protection at ISR facilities but has not yet completed that rulemaking. The analysis in the Nichols Ranch ISR SEIS is based on existing regulations at the time the final SEIS is published. NRC reviews applications using regulations in place at the time of review.*

As background, COMJSM-06-001 (NRC, 2006) directed the staff to focus on eliminating dual regulation of groundwater by NRC and EPA. The Commission stated that the NRC should

retain its jurisdiction over the wellfield and groundwater under its AEA authority, but should defer active regulation of groundwater protection programs to either EPA or to the EPA-authorized state through the EPA UIC program. The status of ongoing rulemaking activities is provided on the NRC public website at www.nrc.gov. Because no proposed rule is available to discuss, no changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

B.5.9.4 Applicable Rulemaking Efforts

Comment: N011-044
One commenter stated NRC has an *ad hoc* approach to ISR regulation and asserted that the "class of use" restoration standard used in both the GEIS and the Nichols Ranch ISR SEIS indicated a fundamental problem with the NRC regulatory framework. The commenter was also concerned that the GEIS (NRC, 2009a) would become the proxy for ISR regulations. The commenter stated NRC does not have regulations specifically relevant to ISR operations but rather has adapted some of the conventional milling regulations to apply to ISR operations and "filled in the remaining gaps with license conditions," the standard review plan for ISR facilities, and the GEIS.

***Response**: NRC has announced it is working on a rulemaking specific to groundwater protection at ISR facilities but has not yet completed that rulemaking. The analysis in the Nichols Ranch ISR SEIS is based on existing regulations at the time the final SEIS is published. The NRC reviews applications using regulations in place at the time of the review.*

As background, COMJSM-06-001 (NRC, 2006) directed the staff to focus on eliminating dual regulation of groundwater by the NRC and the EPA. The Commission stated that the NRC should retain its jurisdiction over the wellfield and groundwater under its AEA authority, but should defer active regulation of groundwater protection programs to either EPA or to the EPA-authorized state through the EPA UIC program. The status of ongoing rulemaking activities is provided on the NRC public website at www.nrc.gov.

B.5.9.5 NRC NEPA Process Implementation

Comment: N001-007
One commenter stated that absent a sense of the timing, scope, and coverage of the NRC proposed *in-situ* leach groundwater rule and associated NEPA process, an early February 2010 date for the close of the comment period on the draft Nichols Ranch ISR SEIS placed a tremendous burden on the public and arbitrarily separated two documents that should be considered together.

***Response**: NRC is currently working on a proposed rulemaking specific to groundwater protection at ISR facilities. At the time of this writing, this rulemaking effort is still in progress and no proposed rule has been submitted for public comment.*

The analysis of the Nichols Ranch ISR SEIS is based upon the current regulations in 10 CFR Part 40. Until and if the proposed rulemaking is made final, license applications will continue to be reviewed and approved in accordance with current regulations.

Section B.5.9.4 of this appendix provides additional detail on this rulemaking effort.
Section B.5.13 of this appendix discusses extension of the public comment period on the draft Nichols Ranch ISR SEIS in response to public comments.

No changes were made to the SEIS beyond the information provided in this response.

Comment: N017-002
One commenter noted that without vigorous compliance with NEPA requirements and adherence to strict environmental protections, the environmental history of uranium mining could be repeated.

***Response**: NRC understands and recognizes there are serious legacy issues resulting from decades of mining activities from the 1940s through the 1970s when waste from uranium mines was not cleaned up after mines were shut down. NRC regulation of ISR facilities includes ensuring ISR operators take necessary measures to confine mobilized uranium and other constituents within the wellfield where the facility is operating, ensuring monitoring programs are in place to provide early detection of any migration of process fluids away from the wellfield, and ensuring the public is protected by enforcing necessary corrective actions to prevent uranium from contaminating adjacent water sources.*

The Nichols Ranch ISR SEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003b) and is consistent with NRC regulations at 10 CFR Part 51 that implement NEPA. Because the comment was general in nature, no changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

B.5.9.6 NRC Licensing Process

Comment: N014-009
One commenter requested a more complete description of the NRC licensing process be provided for those not familiar with that process. The commenter stated the process included NRC review of the entire license application (including the technical and environmental reports), NRC RAIs, and a public participation process. The commenter further stated the SEIS should clarify the link between the NRC environmental and safety reviews.

***Response**: SEIS Section 1.6 discusses in general the NRC licensing process for the proposed Nichols Ranch ISR Project. This section refers to GEIS Section 1.7.1 (NRC, 2009a), which contains a more complete discussion of the NRC licensing process. Further, as stated in SEIS Section 1.6.1, the NRC detailed technical review of the Nichols Ranch ISR Project license application contains two parallel reviews: a safety review and an environmental review. The safety review focuses on assessing compliance with the applicable requirements of 10 CFR Parts 20 and 40 and Appendix A to Part 40, while the environmental review is conducted in accordance with the regulations in 10 CFR Part 51. The results of these two detailed reviews support the NRC licensing decision. GEIS Figure 1.7-1 provides a general flow diagram of the NRC licensing process, including the safety and environmental reviews.*

It is common during the detailed technical review of a license application for NRC to request additional information from the applicant to ensure the application is complete. In some cases, multiple rounds of RAIs are needed. For applications that are not complete, this iterative process is designed to provide the applicant the necessary feedback to supplement the application so it is complete and accurate. The public participation process for this SEIS is discussed in Section 1.4.2 of the Nichols Ranch ISR SEIS.

As the commenter indicates, there is some overlap between the safety and environmental reviews. This is most clearly seen in topics such as groundwater resources and protection and radiological dose to workers and members of the public. The NRC staff conducting the

environmental and safety reviews collaborates, as necessary, as it conducts these reviews in parallel.

Throughout the SEIS, NRC has used the term "license application" to be inclusive of all aspects of the application, including the applicant's Technical Report and Environmental Report and the responses to NRC RAIs. The reference sections following Chapters 2, 3, 4, 5, and 6 of the SEIS reflect the reliance on all aspects of the application, as described previously.

No further changes were made to the SEIS beyond the information provided in this response.

B.5.9.7 Consideration of ISR Facility Safety Record and Compliance History

Comments: N009-002; N010-002; N013-019; N013-050; N016-009, N017-001
A number of commenters expressed views on the safety record and compliance history of ISR facilities, and some recommended specific factors be evaluated in the SEIS. Several commenters noted that currently operating ISR facilities in Wyoming have histories of leaks, spills, and excursions. One commenter expressed the opinion that these currently operating ISRs seemed to be more experimental facilities than truly operational facilities. Another commenter wanted to know how NRC would address the issues of past leaks, spills, and excursions at operating facilities and recommended NRC develop a strong range of mitigation measures that would prevent or minimize these problems. One commenter expressed the opinion that uranium mining has had a "dreadful environmental history" and is likely to be repeated without meaningful oversight.

***Response**: Operations at an ISR facility have the potential to affect water resources. NRC reviews each license application following the detailed review procedures in NUREG–1569 to evaluate whether the facility can be constructed and operated in compliance with applicable NRC regulations. This includes review of design specifications for effluent control systems for liquids and solids, review of the applicant's proposed groundwater and surface water monitoring programs, and review of the effects from accidents to ensure the applicant has procedures in place to respond to postulated accident conditions (including leaks in lixiviant piping). If a license is granted, NRC oversight of operations, including inspection activities, verifies that compliance is being maintained during the operation, aquifer restoration, and decommissioning phases. NRC has existing enforcement programs and policies that effectively verify whether licensees are in compliance with NRC regulations and NRC takes appropriate enforcement action if a licensed facility is not in compliance.*

Before uranium is recovered from an aquifer, EPA must declare a portion of an aquifer where production will occur exempt as a USDW (59 FR 47384). In addition, if liquid byproduct material is to be disposed of via deep well disposal, EPA must also declare the receiving aquifer exempt. The production aquifer exemption area would be restored to the standards in 10 CFR Part 40, Appendix A, whereas the injected byproduct material fluid would remain in the deep well-exempted aquifer.

GEIS Section 2.11.2, from which the Nichols Ranch ISR SEIS is tiered, discusses spills, leaks, and excursions that have occurred at existing ISR facilities. Excursions and mechanical integrity test (MIT) failures have been reported for past and current ISR facilities, but in most cases they have been controlled and did not pose a threat to human health or the environment. Three ISRs are currently operating: two in Wyoming [the Uranium One Irigaray and Christensen Ranch facility (formally owned by Cogema Mining, Inc.) and the PRI Smith Ranch–Highland Uranium Project), and one in Nebraska (the Cameco Crowe Butte Project]. Excursion

history and corrective action for all of these sites can be found in annual reports and correspondence between the NRC and the licensees in the NRC Public Document Room.

To detect and prevent excursions to the overlying and underlying aquifers, NRC issues a license condition that requires operators to perform MITs for all injection and production wells (NRC, 2003a). This test is conducted every 5 years to ensure that the wells do not develop leaks. To ensure that excursions are identified early, excursion monitoring wells are installed. Horizontal excursion monitoring wells are placed in a perimeter ring surrounding the wellfield in the production aquifer. In addition, vertical excursion monitoring wells are installed in the overlying and underlying aquifers (NRC, 2003a). The monitoring wells are usually sampled twice per month for excursion indicators. When excursion indicators exceed predetermined upper control limits (UCLs), it may signal that production fluids are moving out of the wellfield boundary. If an excursion is confirmed, the licensee must begin corrective actions to control the excursion and must continue corrective actions until the excursion is controlled. The location of the excursion monitoring wells, the choice of excursion indicators, and the process for determining the UCLs are all reviewed before a license is approved.

Surface containment of spills is required for all storage tanks (40 CFR Part 112). In addition, spill prevention plans are required of each ISR facility (59 FR 47384). For chemicals stored at ISR facilities, concrete berms with a containment equivalent to at least the volume of the tank are required. Spill reporting varies from state to state. NRC requires that a licensee report a spill within 24 hours if it meets the criteria in 10 CFR Parts 20 and 40.60. Otherwise NRC requires, by license condition, that if a spill meets State reporting requirements, it must also be reported to NRC. Spills must be characterized and cleaned up to regulatory requirements [see 10 CFR Part 40, Appendix A, Criterion 6(6)].

If an applicant proposed the use of surface impoundments (including ponds), they would be designed to have sufficient capacity to hold the anticipated volume of liquids and would be operated and maintained to prevent overtopping from normal operations, rainfall, and equipment malfunctions. Monitoring wells (both upgradient and downgradient) would be installed in addition to requiring a liner under each surface pond (NRC, 2008). The liner must be constructed of materials that have sufficient physical properties and strength to withstand the anticipated physical stresses and environmental conditions. Liners are typically constructed with leak detection systems to identify and repair leaks. The leak detection systems would be checked for the presence of liquids on a regular basis.

No changes were made to the SEIS beyond the information provided in this response.

B.5.9.8 Groundwater Restoration Criteria and Methods

Comments: N009-005; N010-005; N011-016; N011-033; N015-030; N017-021

One commenter noted NRC has not restored groundwater to baseline values for all groundwater constituents in any ISR wellfield to date. Multiple commenters asserted that restoration has only been accomplished by lowering the standards. Two commenters stated restoration to either background levels or MCL standards has been aspirational rather than a reality, and all regulators, whether NRC or Agreement States, have allowed for ACLs rather than restoration of all parameters. The commenter asserted that restoration standards have been a moving target for all ISR sites and that NRC has made it nearly impossible for a reader to analyze environmental impacts because of the lack of a detailed and comprehensive history of ISR restoration operations and the failure to restore the groundwater quality of contaminated

aquifers. The commenter asserted that the issuance of waivers and (aquifer) exemptions should be part of the analysis and that NRC must analyze the impact of the waivers and exemptions from meaningful standards in a comprehensive way. The commenter stated that by not doing this, both the GEIS (NRC, 2009a) and SEIS fail the NEPA "hard look" standard.

***Response**: The commenters are correct that, to date, restoration to background water quality for all constituents has not proven to be practically achievable at licensed NRC ISR sites (NRC, 2005, 2004, 2003c). In the past, NRC has applied "class of use," a state designation under the SDWA, as a secondary restoration goal to approve these restorations. The "class of use" standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2003a). The "class of use" standard was therefore neither treated nor approved as an ACL by NRC.*

NRC has since determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC has notified licensees and applicants in Regulatory Information Summary (RIS) 09-05 (NRC, 2009b) that the restoration standards listed in NUREG–1569, Section 6.1.3(4) are not consistent with those listed in 10 CFR Part 40, Appendix A, and the licensee must commit to achieve the restoration standards in Criterion 5B(5).

NRC requires submission of a license amendment for a licensee to request establishment of an ACL for any constituents that do not meet the primary baseline standards. NRC performs a safety evaluation and an environmental review to evaluate the request for the license amendment after the licensee demonstrates it is not practically achievable to restore the wellfield to either background or MCLs for a particular constituent.

No changes were made to the SEIS beyond the information provided in this response.

Comments: N011-015; N011-034; N011-037
One commenter asserted that the NRC practice of averaging poor groundwater quality with good groundwater quality to characterize preextraction groundwater quality misrepresents the impacts from groundwater restoration. The commenter stated NRC tied groundwater restoration in the Nichols Ranch ISR SEIS to the average of poor groundwater quality in the immediate ore zone with good groundwater quality outside the ore zone but within a mine area. The commenter stated SEIS Tables 3-4 and 3-5, which summarize the water quality in the Nichols Ranch and Hank Units, respectively, gave the impression that the groundwater in the aquifer within the proposed mine boundary exceeded EPA and Wyoming water quality standards for several constituents, but elsewhere in the SEIS the NRC disclosed that there were wells with good quality water. The commenter asserted that the practice of averaging good groundwater quality with poor groundwater quality is incomplete and misleading and skewed the impact analysis to minimize potential groundwater impacts from ISR projects in general and the Nichols Ranch ISR Project in particular. The commenter stated that NRC uses a "mathematical artifice" that inflates premining contaminant levels within a proposed project boundary to create the impression that baseline groundwater conditions are poor and that restoration is possible. Finally, the commenter stated that if groundwater quality in and outside of an ore zone were analyzed separately and not averaged, then the adverse impact on groundwater outside of the ore zone would be substantially larger.

***Response**: The commenter is referring to the need to establish a baseline for groundwater quality in the proposed license area before ISR operations begin. As part of the site characterization to obtain a license, the applicant is required to determine the average*

preoperational water quality for all aquifers in, above, below, and outside the proposed area. However, this general preoperational average is not the same as the average baseline water quality of the uranium-bearing aquifer for a specific wellfield. The average baseline water quality for a specific wellfield is determined only from water quality measured in wells installed within the production ore zone aquifer in each licensed wellfield, and it is this specific average that is used to determine groundwater restoration target values in individual wellfields. NUREG–1569 provides guidance on establishing baseline water quality. Contrary to the comment, this average baseline water quality does not include wells "outside the ore zone."

No changes were made to the SEIS beyond the information provided in this response.

Comments: N011-041; N011-042
One commenter stated it appears NRC evaluates groundwater restoration impacts assuming that if baseline groundwater quality is not achieved, "class of use" quality would be achievable and that this analysis ignores NRC regulations governing ISR groundwater restoration that make no mention of "class of use" as a restoration standard. The commenter stated that NRC regulations mandate that groundwater must be restored to background or the MCLs listed in 10 CFR Part 40, Appendix A, Criterion 5D.

***Response**: The commenter is correct that NRC has used "class of use," a state designation under the SDWA, as a restoration goal. The "class of use" standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2003a). NRC has determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC notified licensees and applicants in RIS 09-05 (NRC, 2009b) that the restoration standards listed in NUREG–1569, Section 6.1.3(4) are not consistent with those listed in 10 CFR Part 40, Appendix A. NRC requires licensees to commit to achieve the restoration standards in Criterion 5B(5). A licensee can apply for a license amendment for an ACL only after showing that restoration to the background level or MCL is not practically achievable for a particular constituent. NRC reviews the ACL request using the criteria articulated in 10 CFR Part 40, Appendix A, Criterion 5B(6). The State designation of "class of use" for an aquifer can be one of the factors that is considered during NRC review of the ACL request. The additional 10 CFR 40, Appendix A, Criterion 5B(6) ACL requirements are presented in Appendix C.*

No changes were made to the SEIS beyond the information provided in this response.

Comments: N013-052; N013-053
One commenter stated NRC assumes groundwater would be restored to "acceptable limits" but then fails to disclose what the limits might be. The commenter stated that the past history of ISR sites demonstrates that it would be difficult, if not impossible, to restore a wellfield to its premining water quality condition. The commenter was particularly concerned about mobilized heavy metals, including uranium and its progeny radioisotopes, thorium, radium, and radon, in addition to the nonradioactive constituents, arsenic, vanadium, zinc, selenium, and molybdenum. The commenter stated that NRC failed to disclose how these elements would be returned to premining conditions or if that was impossible, what ACLs would be allowed, and, therefore, what water quality impacts would result from these operations.

***Response**: NRC regulations in 10 CFR Part 40, Appendix A, Criterion 5B(5) establish hazardous constituent standards for groundwater restoration. The regulations require that groundwater be restored so the concentration of a hazardous constituent does not exceed (i) the Commission-approved background concentration of that constituent in groundwater; (ii) the*

respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an alternate concentration limit established by the Commission. These primary standards of either background or MCL are the acceptable restoration standards for hazardous constituents in a wellfield. Under Criterion 5B(5), requests for ACLs would only be considered after an applicant has demonstrated that restoring the hazardous constituent at issue to background or MCL values is not practically achievable at a specific wellfield.

The commenter is correct that the ACL secondary standard does not set an initial "acceptable limit" for a constituent. Licensees may propose a constituent ACL that presents no significant hazard for a specific site for Commission consideration. The Commission may establish a site-specific ACL for a hazardous constituent as provided in 10 CFR Part 40, Appendix A, Criterion 5B(5) if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions and determining the constituent would not pose a substantial present or potential future hazard to human health or the environment as long as the ACL is not exceeded. The NRC requirements for application, review, and establishment of a site-specific ACL for a constituent are discussed in Appendix C of this SEIS. In addition, NRC staff ACL application review procedures are described in the following documents: January 1996 Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills (NRC, 1996); NUREG–1620 (NRC, 2003d); and NUREG–1724 (NRC, 2000).

In an application for an ACL, the NRC staff would review proposed limits for heavy metals, including uranium and its progeny radioisotopes, thorium, radium, and radon, in addition to the nonradioactive constituents, arsenic, vanadium, zinc, selenium, and molybdenum. The ACL process evaluates whether the proposed restoration standard for a particular hazardous constituent is as low as reasonably achievable, after considering various factors including practicable corrective actions and determining the constituent would not pose a substantial present or potential future hazard to human health or the environment as long as the ACL is not exceeded. Appendix C of the SEIS, Alternate Concentration Limits, further discusses the ACL process.

No changes were made to the SEIS beyond the information provided in this response.

Comments: N009-004; N010-004; N015-005; N015-028; N015-029; N015-032; N016-007; N016-008

Several commenters were concerned with the potential establishment of ACLs as groundwater restoration targets before adequate restoration is complete and stated the draft SEIS did not fully assess the operational requirements and constraints associated with restoration activities. One commenter noted the SEIS should evaluate methods that could be used to meet restoration goals for all constituents mobilized during the ISR process. Another commenter noted that although the SEIS acknowledged the water quality goal in the portion of the aquifer where extraction occurs is pre-ISR baseline conditions, the discussion concluded by stating that the demonstration of restoration must comply with the requirements in 10 CFR Part 40, Appendix A, which allows for restoration target values that do not meet the pre-ISR baseline. The commenter noted that although EPA standards in 40 CFR Part 192 allow NRC to use this practice, ACLs are above baseline or MCL values. Another commenter asked what the definition of "reasonable restoration efforts" meant and whether this implied an additional year, 5 more years, 10 years, or perhaps more. This commenter noted at the end of restoration in 2004, at the Highland A-Wellfield, most parameters were above the baseline, with several exceeding over 2,500 percent; uranium and selenium were 7,060 and 7,000 percent above the baseline from the start of operations. The commenter noted this was accepted as restored.

***Response**: Under NRC regulations, the licensee must restore the groundwater quality in the production zone aquifer to the water quality standards listed in 10 CFR Part 40, Appendix A, Criterion 5B(5). Specifically, under Criterion 5B(5), the concentration of a hazardous constituent must not exceed (i) the NRC-approved background concentration of that constituent in groundwater; (ii) the respective MCL value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an alternate concentration limit the NRC established.*

Under Criterion 5B(6), requests for ACLs would only be considered after a licensee has demonstrated that restoring the constituent at issue to background or MCL values is not practical to achieve at a specific site. Licensees may propose only ACLs that present no significant hazard for NRC consideration. NRC may establish a site-specific ACL for a hazardous constituent if it finds that the proposed limit is as low as reasonably achievable after considering practicable corrective actions, and that the constituent would not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. Additional 10 CFR Part 40, Appendix A, Criterion 5B(6) requirements for ACLs are discussed in Appendix C of the SEIS. In addition, ACL application review procedures for NRC staff are described in the following documents: January 1996 Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills; NUREG–1620 (NRC, 2003d); and NUREG–1724 (NRC, 2000).

To determine whether a licensee has undertaken "reasonable restoration efforts," NRC would consider the aquifer restoration methods applied and their efficacy to achieve restoration goals at a specific site. If NRC concludes practicable corrective actions were not applied, the licensee would be required to continue restoration efforts until this has been demonstrated. Historically, NRC has not applied a time limit to the length of restoration at its licensed ISR sites.

The commenter is correct that Mine Unit A at PRI Highlands ISR was approved for restoration with several constituents at concentrations above the accepted background primary standard using a "class of use" secondary restoration standard for this licensee. In the past, NRC has allowed "class of use," a state designation under the SDWA, as a secondary restoration goal. The "class of use" term, referred to in the GEIS (NRC, 2009a) as a standard for restored groundwater quality, was based on restoration standards provided in NUREG–1569 (NRC, 2003a). NRC has determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC has notified licensees and applicants in RIS 09-05 (NRC, 2009b) that the restoration standards listed in NUREG–1569, Section 6.1.3(4) are not consistent with those listed in 10 CFR Part 40, Appendix A, and licensees and applicants must commit to achieve the restoration standards in Criterion 5B(5).

Appendix C, Alternate Concentration Limits, of the SEIS discusses the ACL process.

No changes were made to the SEIS beyond the information provided in this response.

Comment: N011-017; N017-023
Commenters stated standards have been repeatedly relaxed because no aquifer has ever been returned to baseline (i.e., premining conditions). One commenter cited an NRC memorandum to the Commission which stated that more than 60 percent of the constituents in three ISR mining facilities located in Nebraska and Wyoming had been returned to their preoperational concentrations, implying that 40 percent of measured constituents could not be restored to baseline conditions, and further stated, "concessions to the licensee were made." The

commenter also referred to a study by Southwest Groundwater Consulting that evaluated restoration at *in-situ* uranium mines located in south Texas. This study found that mining operations in south Texas were consistently unable to meet original restoration standards and more lenient amended restoration standards were routinely granted.

***Response**: The commenter is correct that NRC-approved restorations to date have not met the restoration goal to achieve background water quality for all constituents. In the past, NRC has applied "class of use," a State designation under the SDWA, as a secondary restoration goal to approve these restorations. The term "class of use," referred to in the GEIS (NRC, 2009a) as a standard for restored groundwater quality, was based on restoration standards provided in NUREG–1569 (NRC, 2003a). NRC has determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC has notified licensees and applicants in RIS 09-05 (NRC, 2009b) that the restoration standards listed in NUREG–1569, Section 6.1.3(4) are not consistent with those listed in 10 CFR Part 40, Appendix A, and licensees and applicants must commit to achieve the restoration standards in Criterion 5B(5).*

Under Criterion 5B(5), the concentration of a hazardous constituent must not exceed (i) the NRC-approved background concentration of that constituent in groundwater; (ii) the respective MCL value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an alternate concentration limit the NRC established. Under Criterion 5B(6), requests for ACLs would only be considered after a licensee has demonstrated that restoring the constituent at issue to background or MCL values is not practical to achieve at a specific site. Licensees may propose only ACLs that present no significant hazard for NRC consideration. NRC may establish a site-specific ACL for a hazardous constituent if it finds that (i) the proposed limit is as low as reasonably achievable after considering practicable corrective actions and (ii) the constituent would not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. Additional 10 CFR Part 40, Appendix A, Criterion 5B(6) requirements for ACLs are discussed in Appendix C of the SEIS. In addition, ACL application review procedures for NRC staff are described in the following documents: January 1996 Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills; NUREG–1620 (NRC, 2003d); and NUREG–1724 (NRC, 2000).

In the past, the "class of use" standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2003a). The "class of use" standard was therefore neither treated nor approved as an ACL by NRC. In the future, the State designation of "class of use" for an aquifer may be one of the factors that is considered during NRC review of an ACL request.

NRC is aware that restoration of aquifers in Texas has not achieved the primary background restoration standard for some constituents. Texas, however, is an agreement state and has regulatory authority over ISR facilities, and would set the restoration standards for a particular ISR facility in Texas. NRC does not review or approve Texas regulatory decisions at a particular ISR facility. NRC's oversight of the Texas program consists of periodic reviews of the State's entire regulatory program for AEA materials. States have some flexibility in how they implement their regulatory program as long as NRC finds the State program is adequate to protect public health and safety and compatible with NRC's regulatory program.

No changes were made to the SEIS beyond the information provided in this response.

B.5.9.9 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. Appendix A *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

40 CFR Part 112. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 112 "Oil Pollution Prevention." Washington, DC: U.S. Government Printing Office.

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 146 "Underground Injection Control Program: Criteria and Standards." Washington, DC: U.S. Government Printing Office.

40 CFR Part 192. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 192 "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings." Washington, DC: U.S. Government Printing Office.

59 FR 47384, U.S. Environmental Protection Agency. " National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule." Federal Register. Vol. 59, p. 47384. September 15, 1994.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009a.

NRC. "Regulatory Information Summary (RIS) 09-05, Uranium Recovery Policy Regarding: (1) The Process For Scheduling Licensing Reviews of Applications For New Uranium Recovery Facilities And (2) The Restoration Of Groundwater At Licensed Uranium *In-Situ* Recovery Facilities." ADAMS No. ML083510622. April 29, 2009b.

NRC. Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities." Revision 3. Washington, DC: November 2008.

NRC. Memorandum from A. Vietti-Cook, Secretary to L. Reyes, Executive Director for Operations. Subject: Staff Requirements – COMJSM-06-0001–Regulation of Groundwater Protection at *In-Situ* Leach Uranium Extraction Facilities." ML060830525. March 24, 2006.

NRC. "Technical Evaluation Report: Review of Cogema Mining Inc.'s Irigaray Mine Restoration Report, Production Units 1 Through 9," Source Materials License SUA-1341, ADAMS No. ML062570181. 2005.

NRC. "Review of Power Resources, Inc's A- Wellfield Ground Water Restoration Report for the Smith Ranch –Highland Uranium Project," ML041840700. June 29, 2004.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. Washington, DC: NRC. ML032250177. June 2003a.

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. August 2003b.

NRC. Letter and Attachments from D. Gillen, Branch Chief, U.S. Nuclear Regulatory Commission, to M. Griffin, Manager, Crow Butte Resources, Inc. Subject: License Amendment 15, Crow Butte Resources *In-Situ* Leach facility, License No. SUA-1534, Wellfield #1 Restoration Acceptance (40-8943). ML030044055. February 12, 2003c.

NRC. NUREG–1620, "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978." Revision 1. Washington, DC: NRC. ML032250190. June 2003d.

NRC. NUREG–1724, "Standard Review Plan for the Review of DOE Plans for Achieving Regulatory Compliance at Sites With Contaminated Ground Water Under Title I of the Uranium Mill Tailings Radiation Control Act". Revision 1. Washington, DC: NRC. ML003731007. June 2000.

NRC. Staff Technical Position Alternate Concentration Limits for Title II Uranium Mills. Washington DC: NRC. ML9604050096. January 1996.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.10 Credibility of NRC

Comments: N001-006; N011-010
Several commenters questioned NRC's credibility in their submitted comments. A commenter asserted NRC turned a "blind eye" to the cumulative impact from the project and its potential effect on climate change. The commenter referred to the GEIS analysis (NRC, 2009) and asserted that NRC made sweeping pronouncements about potential impacts. The commenter stated NRC evaded performing meaningful analysis of impacts to surface waters at the proposed site because the analysis disregarded the close proximity of coal bed methane mining operations in the vicinity of the proposed site. The commenter further asserted NRC had evaded performing meaningful analysis of cumulative impacts. Another commenter stated the groundwater protection rule had "fallen off the table" for the benefit of an industry that wished to proceed with materials licensing under a less-than-protective regulatory framework.

Response*: With regard to the general comment made regarding NRC's credibility, NRC is an independent federal agency that has no ownership of any nuclear or ISR facility. NRC regulates licensees by conducting a thorough and independent review of each application for a license consistent with its congressional mandate and NRC regulations for safety and environmental*

review. Once a license is granted, NRC enforces its regulations and license conditions by conducting regular inspections of operating facilities. If inspections detect noncompliance, fines and other punitive measures can be taken depending on the severity of the infraction.

With regard to the specific comments that are related to the commenter's views of NRC's credibility, it should be noted that (i) the analysis of cumulative impacts in Chapter 5 of the final Nichols Ranch ISR SEIS was revised in response to public comments; (ii) Section 3.5.1.6 was added to the final SEIS to discuss CBM operations in the area, (NRC staff notes that all of the active outfalls for CBM operations are located outside and hydrologically downgradient of the proposed Nichols Ranch ISR Project; therefore, they would be unlikely to impact water quality at the site); (iii) Section 5.5.1 of the SEIS discusses the cumulative effect on surface water from both the proposed licensing of the Nichols Ranch ISR Project and the other activities occurring in the area, including CBM operations; and (iv) the status of the proposed rule with new standards applicable to ISL facilities is discussed in Section B.5.9.4 of this comment response appendix.

As noted previously, Section 3.5.1.6 was added to the final SEIS to provide additional detail on CBM operations in the area.

B.5.10.1 Reference

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.11 Federal and State Agencies

B.5.11.1 Roles of Federal, Tribal, State, and Local Agencies

Comment: N007-001
One commenter noted that the Wyoming State Office of the U.S. Bureau of Land Management (BLM) had provided comments on the NRC draft GEIS (NRC, 2008) and that the roles and responsibilities of NRC and BLM under different regulatory frameworks are duly recognized.

***Response**: NRC coordination with BLM during the preparation of this SEIS is discussed in Section 1.7.3.1 of the Nichols Ranch ISR SEIS, which was revised to more clearly recognize BLM's responsibilities and NRC's coordination with BLM on this review.*

Comments: N007-002; N014-008
Two commenters stated the SEIS should reflect finalization of the Memorandum of Understanding (MOU) between NRC and BLM. One commenter further noted although NRC did not recognize BLM as a cooperating agency on the draft Nichols Ranch ISR SEIS, the MOU would allow the two agencies to work more closely on ISR uranium recovery projects in states where NRC has the licensing authority and BLM has administrative responsibilities for surface management or minerals. The same commenter also stated the intent of the MOU is to improve interagency communications; facilitate the sharing of special expertise and information; and coordinate the preparation of studies, reports, and environmental documents. Finally, the same commenter further encouraged NRC to coordinate with the BLM Buffalo, Wyoming, Field Office on site-specific conditions to be included in the NRC license for the proposed Nichols Ranch ISR Project.

***Response**: SEIS Section 1.7.3.1 discusses NRC coordination with BLM during the preparation of the SEIS. As the commenter indicated, the MOU between NRC and BLM was finalized November 30, 2009 (NRC, 2010a). BLM was not a cooperating agency on the Nichols Ranch ISR SEIS.*

Comment: N014-008
One commenter requested that tables in the SEIS detailing applications or requests that have been or would be filed by the applicant for the Nichols Ranch ISR Project be updated in the final SEIS. The MOU formalizes the types of interactions and coordination already occurring between NRC and BLM.

***Response**: NRC contacted the applicant on April 29, 2010 and on October 4, 2010, and asked for an updated status for the approvals identified in Table 1-2 in the draft SEIS (NRC, 2010b; Uranerz, 2010b). The applicant reviewed and updated the information (Uranerz, 2010a, 2010b). Table 1-2 was updated to reflect the current status of permits and applications for the proposed project.*

Comment: N008-019
One commenter stated industrial safety aspects associated with the use of hazardous chemicals are now regulated by the Wyoming Occupational Safety and Health Administration (OSHA) and not by the Wyoming State Mine Inspector.

***Response**: Sections 3.12.3 and 4.13.1.2.3 of the Nichols Ranch ISR SEIS have been modified to reflect this change in regulatory oversight.*

Comment: N014-019
One commenter stated WDEQ conducts detailed reviews of all ISR wellfield packages in Wyoming. Additionally, the commenter considers that the NRC review of one or more wellfield packages is unnecessary and duplicative.

***Response**: To confirm that the hydrogeology of a proposed site is suitable to ISR operations and these operations will not impact the public health, safety and environment, NRC may require that a licensee provide some or all wellfield packages for NRC review and approval prior to lixiviant injection. Because these comments address details about the NRC licensing and the State of Wyoming permitting processes, NRC considers the comments to be beyond the scope of this SEIS. No changes were made to the SEIS.*

B.5.11.2 Effects of Changes to Federal or State Regulations on the SEIS

Comments: N018-002; N018-003; N018-004; N018-005; N018-006
One commenter noted EPA has made revisions to the National Ambient Air Quality Standards (NAAQS) for lead and nitrogen dioxide and has proposed revisions to the primary sulfur dioxide NAAQS and the 8-hour standard for ozone. Additionally, the commenter stated the State of Wyoming has not adopted all NAAQS, as is stated in the SEIS. The commenter clarified that the State of Wyoming has developed stricter standards for annual and 24-hour sulfur dioxide, but has not yet entered into rulemaking to revise the standards for annual fine particulate or 24-hour fine particulate. However, the commenter stated that the SEIS should still note these standards.

***Response**: SEIS Section 3.7.2 has been revised to reflect the EPA revisions to the NAAQS for lead and nitrogen oxide. This section has also been modified to reflect the stricter Wyoming*

standards for annual and 24-hour sulfur dioxide. Finally, as necessary, NRC has reanalyzed air quality impacts in Chapter 4 to reflect these EPA and Wyoming standards.
NRC does not reflect the proposed standards in the SEIS. The SEIS is written to reflect the regulations in effect at the time of its writing. Should the proposed standards be finalized, NRC would reference the final air quality standards in future environmental reviews, as appropriate.

Comment: N018-007
One commenter noted Table 1-2 in Section 1.6.2 should be revised to include the air quality permit Uranerz obtained for the proposed Nichols Ranch ISR Project.

***Response**: WDEQ has approved and issued an air quality permit for the proposed Nichols Ranch ISR Project (Uranerz, 2009). SEIS Table 1-2 was revised accordingly.*

B.5.11.3 Clarification of Other Federal/State Regulations and Practices

Comment: N006-007
One commenter stated the proposed Nichols Ranch ISR Project is subject to the requirements of NHPA Section 106 because it is a Federal undertaking per 36 CFR 800.16(y). The commenter referenced Section 5.9 of the draft SEIS and stated that the requirements of Section 106 apply regardless of land ownership and that minimization/mitigation of adverse effects is required.

***Response**: NRC agrees with the commenter that the proposed Nichols Ranch ISR Project is a Federal undertaking per 36 CFR 800.16(y) and is, therefore, subject to the requirements of NHPA Section 106. A Federal undertaking is defined as a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval.*

The section that the commenter references, analyzes cumulative impacts to historic and cultural resources within the vicinity of the proposed Nichols Ranch ISR Project. The discussion of cumulative impacts includes Federal undertakings as well as non-Federal projects and activities, per 36 CFR 800.16(y). Note that NHPA Section 106 may not apply to all projects or activities discussed in this section of the SEIS. No changes were made to the SEIS beyond the information provide in this response.

Comment: N007-014
One commenter stated the SEIS incorrectly states that a Storm Water Pollution Prevention Plan would be in place before project operations begin. The commenter requested that NRC correct this to state the plan must be in place before the “first dirt” is turned in the construction phase.

***Response**: NRC acknowledges a Storm Water Pollution Prevention Plan must be in place before the first dirt is turned in the construction phase, per WDEQ regulations. However, the commenter is incorrect in their interpretation of the draft SEIS language. The draft SEIS says a storm water management plan would be implemented in accordance with WDEQ, which is a correct statement. The Executive Summary and Section 4.5.1.1.2 of the SEIS were revised to change the plan description from “storm water management plan” to “Storm Water Pollution Prevention Plan” to be consistent with the WDEQ terminology. However, no additional changes were made to the SEIS beyond the information provided in this response.*

B.5.11.4 References

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties." Washington, DC: U.S. Government Printing Office.

NRC. "Notice of Availability of a Memorandum of Understanding Between the Nuclear Regulatory Commission and the Bureau of Land Management." Federal Register. Vol. 75. p. 1088. January 8, 2010a.

NRC. E-mail from B. Balsam, Project Manager, U.S. Nuclear Regulatory Commission, to M. Thomas, Environmental, Safety, and Health Manager, Uranerz Energy Corporation. Subject: Request: Updates to Nichols Ranch SEIS Table 1-2. ML101190181. April 29, 2010b.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities—Draft Report for Comment." Washington, DC: NRC. June, 2008.

Uranerz. E-mail from M.P. Thomas, Uranerz, Energy Corporation to B. Balsam, Project Manager, Office of Federal and State Materials and Environmental Management Programs. "Updates to Nichols Ranch SEIS Table 1-2." ML101190200. April 29, 2010a.

Uranerz. E-mail from M.P. Thomas, Uranerz, Energy Corporation to I. Wu, Project Manager, Office of Federal and State Materials and Environmental Management Programs. "Nichols Ranch SEIS Table 1-2." ML102800050. October 6, 2010b.

Uranerz. 2009. "Uranerz Receives Air Quality Permit for ISR Mine Construction." <http://www.uranerz.com/s/NewsReleases.asp?ReportID=368879&_Type=News-Releases&_Title=Uranerz-Receives-Air-Quality-Permit-for-ISR-Mine-Construction> (6 May 2010). 2009.

B.5.12 Cooperating Agencies and Consultations

Comment: N007-005
One commenter stated NRC should consult with the Fish and Wildlife Service (FWS) to discuss potential impacts of the project on bald and golden eagles, per the rule permitting eagle takes published September 11, 2009 (74 FR 46836). The commenter also noted that Chapter 1 of the SEIS, which contains a list of agency consultations, should be revised to include consultation with FWS regarding eagle take permit requirements.

Response*: NRC acknowledges consultation with FWS concerning the eagle take permit rule is appropriate for the proposed Nichols Ranch ISR Project. NRC contacted FWS on March 15, 2010, to discuss whether an eagle permit would be appropriate for the proposed Nichols Ranch ISR Project (NRC, 2010). FWS concluded that NRC does not need to further pursue consultation regarding bald eagles and would not need to obtain an eagle take permit at this time. Accordingly, Section 4.6.1.1.3 has been updated to reflect this new information. Because NRC did not need to enter into consultation with FWS regarding an eagle take permit, this consultation will not be added to the description of agency consultations in Section 1.7. However, the memorandum summarizing the teleconference with FWS (NRC, 2010) has been added to Appendix A of the final SEIS and Section 4.6.1.1.3 has been updated to reflect the information described in this comment response.*

Comment: N013-097
One commenter stated NRC needed to coordinate and consult with other agencies and specifically noted BLM was not a cooperating agency on the Nichols Ranch ISR SEIS. The commenter stated BLM would have to do its own NEPA analysis and, therefore, the impacts would not be looked at holistically.

***Response**: SEIS Section 1.7.3 discusses NRC coordination with other agencies during the preparation of the SEIS and describes NRC's coordination with BLM staff during the document preparation. In addition, the U.S. Department of the Interior (DOI) of which BLM is an agency within provided comments on the draft SEIS (see commenter ID N007) and recognized in its comment letter that, while BLM is not a cooperating agency for this SEIS, NRC and BLM have established a memorandum of understanding to work closely together in reviewing proposed ISR projects in states where NRC has primacy for licensing.*

NRC recognizes BLM will conduct its own NEPA analysis when approving the applicant's Plan of Operations according to BLM's regulatory requirements. BLM can use the information in NRC documents to prepare its environmental review. The NRC staff can also be a cooperating agency or comment on BLM's environmental review documents. SEIS Section 1.7.3 was updated to reflect coordination and consultation activities that have occurred since the draft SEIS was issued.

Comments: N020-007; N020-008; N020-009
One commenter suggested a reference to coordination with the tribes should be included in Section 1.7.2 of the SEIS. The commenter also suggested that the discussion of the NHPA in Section 1.7.2 should identify which parties have been determined to be consulting parties under 36 CFR 800.2(c). The commenter stated that no rationale is provided for the selection of the nine tribes contacted for consultation.

***Response**: NRC agrees that a reference to coordination with tribes as well as identification of consulting parties under 36 CFR 800.2(c) should be included in SEIS Section 1.7.2. These changes have been made in the final SEIS. Regarding the selection of the tribes contacted, an explanation of how these nine tribes were selected is described in SEIS Section 1.7.3.1. NRC contacted the Wyoming State Historic Preservation Office (WY SHPO) and the BLM Buffalo Field Office to obtain a list of tribes with known interest in the Pumpkin Buttes Traditional Cultural Property. The BLM provided a list of tribes on February 21, 2008, via e-mail (BLM, 2008), and as a result, the nine tribes in SEIS Section 1.7.3.3 were identified. No changes were made to the SEIS in response to this portion of the comment beyond the information provided in this response.*

Comments: N020-033; N020-034
One commenter stated that because NHPA consultation is ongoing, completion of the consultation process should be documented in the final SEIS. The commenter also stated that the final SEIS should include a more detailed discussion of resolution of the identified adverse historic and cultural effects in accordance with 36 CFR 800.6.

***Response**: The commenter is correct that Section 106 consultation under the NHPA is ongoing for the proposed Nichols Ranch ISR Project. The commenter should note that Section 106 consultation must be completed "prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license" [36 CFR 800.1(c)]. Therefore, NRC must complete Section 106 consultation before it issues a license, though not necessarily before it issues the final SEIS. Regarding the resolution of adverse effects (36 CFR 800.6), the*

final SEIS Executive Summary; Sections 1.7, 3.9, 3.10, 4.9, and 4.10, and Appendix A have been updated to document updates to the Section 106 process between publication of the draft and final SEIS.

B.5.12.1 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties." Washington, DC: U.S. Government Printing Office.

74 FR 46836. "Eagle Permits; Take Necessary To Protect Interests in Particular Localities." Federal Register: Volume 74, No. 175, pp. 46,836–46,879. September 11, 2009.

BLM. E-mail from C. Crago, Archaeologist, BLM Buffalo Field Office, to R. Linton, Project Manager, U.S. Nuclear Regulatory Commission. Subject: Reply to Request for Assistance – Native American Consultation Pumpkin Buttes. ML091600074. February 21, 2008.

NRC. Memorandum from B. Balsam, Project Manager, U.S. Nuclear Regulatory Commission to File. Subject: Summary of Teleconference with Pedro Ramirez, Wyoming Field Office, U.S. Fish and Wildlife Service, Regarding Eagle Take Rule for the Proposed Nichols Ranch ISR Project (Docket No. 040-09067) and the Proposed Moore Ranch ISR Project (Docket No. 040-09073). ML100760621. March 25, 2010.

B.5.13 SEIS Schedule

Comments: N001-001; N002-001; N003-001; N004-001; N005-001
Several commenters requested the comment period on the Nichols Ranch ISR SEIS be extended to provide interested stakeholders sufficient time to review the SEIS adequately. Some commenters referred to the large size of the draft Nichols Ranch ISR SEIS and the need for more time to read and collect referenced information. Commenters also noted the comment period overlapped with seasonal holidays in December, thus reducing the time to review the document.

***Response**: On December 11, 2009, the NRC staff published a Federal Register notice (74 FR 65808) requesting public review of and comment on the Draft Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming, Supplement 2 to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. In publishing the NOA for the draft SEIS, the NRC staff stated that the public comment period closed on February 1, 2010. On February 5, 2010, the NRC staff published a notice in the Federal Register (75 FR 6066) extending the public comment period to March 3, 2010, in response to public requests for extension received via comment letters and e-mail. The 81-day period for public comment (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations. By letter and e-mail, 20 documents containing 493 comments were submitted on the draft Nichols Ranch ISR SEIS.*

B.5.13.1 References

74 FR 65808, U.S. Nuclear Regulatory Commission. "Notice of Availability of Draft Environmental Impact Statement for the Nichols Ranch *In-Situ* Recovery (ISR) Project in Campbell and Johnson Counties, WY; Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register, Vol. 74, No. 237, pp. 65,808–65,810. December 11, 2009.

75 FR 6066, U.S. Nuclear Regulatory Commission. "Extension of Public Comment Period on the Draft Environmental Impact Statement for the Nichols Ranch *In-Situ* Recovery Project in Campbell and Johnson Counties, WY; Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register, Vol. 75, No. 24, pp. 6,066–6,067. February 5, 2010.

B.5.14 ISR Process Description

B.5.14.1 Overview

Comment: N008-001
One commenter stated that uranium is not technically leached from solution, but removed.

Response*: NRC agrees with this comment. SEIS text in the Executive Summary was revised to accurately describe this uranium milling process.*

Comment: N018-057
One commenter noted the identification and characterization of wastes is the responsibility of the operator.

Response*: SEIS Sections 2.2.1.6, 3.13, and 4.14 discuss operator obligations regarding waste management and the impacts from managing anticipated waste streams. Because the SEIS discussion is appropriate, no changes were made to the SEIS beyond the information provided in this response.*

B.5.14.2 Preconstruction and Construction

Comments: N007-007; N007-017
One commenter stated the well installation techniques were not fully explained and recommended that well casings be cemented back to ground surface to protect groundwater. Another commenter requested clarification of whether analysis has been completed regarding the potential for the lixiviant to corrode existing steel-cased wells, jeopardize the integrity of the wellbore, and increase the potential for groundwater contamination.

Response*: GEIS Section 2.3.1.1 (NRC, 2009a) describes well drilling and construction at ISR facilities. Standard drilling techniques, such as mud rotary drilling, are used to develop wellfields at ISR facilities. Geologic units above the aquifer of interest at ISR facilities are typically sealed with steel, fiberglass, or polyvinyl chloride (PVC) casing grouted in place to prevent groundwater leakage from and to overlying aquifers. The annular space between the well casing and geologic units above the aquifer of interest is typically grouted to ground surface with a mixture of cement, bentonite, and water. The applicant selects inert casing materials with respect to the lixiviant, based on the depth of the well and anticipated well pressures. PVC and fiberglass casings are generally used in wells less than 300 m [1,000 ft] deep (NRC, 2003).*

Wells deeper than 300 m [1,000 ft] or those subjected to high-pressure grouting techniques are subject to collapse. In these instances, steel or fiberglass casing is generally used. Oxidizing lixiviants have the potential to corrode steel-cased wells and compromise wellbore integrity. Periodically all injection and production wells at ISR facilities undergo mechanical integrity testing (MIT) to verity that the well casing is sound (i.e., does not leak). MITs are designed to detect and mitigate the potential for groundwater contamination from casing degradation and damage.

Construction and testing of injection, production, and monitoring wells at the Nichols Ranch and Hank Units are described in SEIS Section 2.2.1.2.4.4. The applicant proposes the use of fiberglass, PVC, or high-density polyethylene (HDPE) well casing. These casing materials are inert to the proposed lixiviant to be used at the proposed Nichols Ranch ISR Project. The lixiviant is described in SEIS Section 2.2.1.3.1.1 and consists of a dilute carbonate/bicarbonate solution fortified with oxygen or hydrogen peroxide. The applicant has not proposed the use of existing steel-cased wells as injection or production wells at either unit during ISR operations. The Nichols Ranch Unit ore zone is approximately 91 to 210 m [300 to 700 ft] below ground surface, and the Hank Unit ore zone is approximately 61 to 180 m [200 to 600 ft] below ground surface (SEIS Section 3.4.1). To strengthen and stabilize the well casing, each well will be sealed with neat cement slurry and/or sand-cement grout meeting Wyoming State requirements. The applicant also proposes to use a cement slurry and/or sand–cement grout to seal and plug the annulus of the hole to prevent the vertical migration of solutions. In response to public comments, SEIS Section 2.2.1.2.4.3 of the SEIS was revised to describe the drilling technique to be used to develop wellfields at the proposed project and to clarify that the annular space between the well casing and geologic units above the ore-bearing aquifer would be sealed and plugged to ground surface to prevent vertical migration of solutions.

Comment: N008-012
A commenter stated they may use PVC or HDPE pipelines, whereas SEIS Section 4.5.1.1.1 states that PVC would be used.

***Response**: SEIS Section 2.2.1.2.4.4 identifies a variety of materials that could be used for the wellfield distribution pipelines, including HDPE and PVC. All references to pipeline materials have been revised in SEIS Section 4.5.1.1.1 to reflect the potential range of compositional materials.*

Comment: N018-033
One commenter recommended the use of portable tanks and closed loop mud systems to reduce the amount of surface disturbance created by digging and reclaiming hundreds of mud pits.

***Response**: Mud pits are commonly used during drilling activities to control the spread of fluids, minimize the potential area of soil contaminated by used drilling fluids and cuttings, and enhance evaporation (SEIS Section 4.5.2.1.1). Section 4.4.1.1 of the SEIS identified that mud pits would be constructed by removing the topsoil from a designated pit area, placing it in a separate location, then excavating the subsoil to the desired depth and depositing it next to the pit area. After drilling was complete and the mud pit was no longer needed (typically within about 30 days from the initial excavation), the excavated subsoil would be used to fill in the pit and the topsoil would be replaced on top. Given the brief period of time each mud pit is used, the limited size of each construction area, and the implementation of best management practices to restore and revegetate the topsoil in the filled-in pits, the SEIS concluded that the potential environmental impacts to soils from mud pits would be SMALL. The NRC staff*

acknowledge that, as an alternative to excavated mud pits, the use of portable tanks and closed loop mud systems is a viable construction technique that would further mitigate the environmental impact of soil disturbance in the project area for the large number of wells (approximately 834) that the applicant proposes to drill in developing Wellfields 1 and 2. However, the difference in technology would not affect the conclusion that the proposed drilling activities would be expected to have a small impact on soils in the proposed project area. No changes were made to the SEIS beyond the information provided in this response.

B.5.14.3 Operations

Comment: N008-007
The applicant noted draft SEIS Section 2.1.1.6.1 states there would be uranium particulate emissions from yellowcake drying. The applicant stated that because a rotary vacuum dryer would be used, there would be zero to near-zero particulate emissions from yellowcake drying.

***Response**: The applicant is correct that rotary vacuum drying produces near-zero particulate emissions under normal operations (i.e., nonaccident conditions). In response to this comment, SEIS Section 2.2.1.6.1 was revised to accurately characterize the yellowcake drying particulate emissions for the proposed action.*

Comments: N013-057; N013-068
One commenter stated that the SEIS does not fully disclose what chemicals would be injected into the aquifer and wanted to know whether a plan has been established. The commenter asserted that the impact analysis related to this issue must be improved in the final SEIS.

***Response**: The lixiviant chemistry to be used at the proposed Nichols Ranch ISR Project is described in SEIS Section 2.2.1.3.1.1. The applicant plans to use a lixiviant solution composed of dilute carbonate/bicarbonate solution fortified with oxygen or hydrogen peroxide to oxidize the uranium in the ore-bearing aquifer. In addition, a small amount of chlorine (approximately 3 mg/L) or sodium hypochlorite may be added during injection to prevent bacterial plugging of the wells. Carbon dioxide would be added to keep the pH around neutral and provide another source of carbonate and bicarbonate ions. The text describing the lixiviant chemistry in SEIS Section 2.2.1.3.1.1 has been clarified in response to this comment.*

B.5.14.4 Aquifer Restoration

Comment: N008-006
The applicant commented that during aquifer restoration monitoring, sampling would be limited to the production wells that were used to determine baseline restoration target values. The commenter suggested that the description in Section 2.1.1.4.4 of the draft SEIS may lead the reader to believe that all production wells would be sampled before and after milling.

***Response**: NRC acknowledges that the comment is consistent with the information describing the proposed action in the applicant's environmental and technical report (Uranerz, 2007). SEIS Section 2.2.1.4.4 was revised to clarify that sampling would be limited to the production wells that were used to determine baseline restoration target values for monitoring during aquifer restoration.*

Comment: N015-034
One commenter requested the SEIS explain at what point in the process NRC would make the decision to set ACLs.

***Response**: NRC does not decide when to set ACLs. The applicant would make an internal determination that the concentrations of hazardous constituents are as low as reasonably achievable and would submit a license amendment request to NRC to establish ACLs for those constituents that do not meet the standards in 10 CFR 40, Appendix A, Criteria 5B(5) i and ii. This amendment request would be evaluated based on the standards in 10 CFR 40, Appendix A, Criterion 5B(6).*

Under Appendix A, Criterion 5B(6), requests for ACLs would only be considered by NRC after a licensee has demonstrated that restoring the constituent at issue to background or MCL values is not practical to achieve at a specific site. To determine whether a licensee has undertaken "reasonable restoration efforts," NRC would consider the aquifer restoration methods applied and their efficacy to achieve restoration goals at a specific site. If NRC concludes reasonable efforts were not applied, the licensee would be required to continue restoration efforts until this has been demonstrated before a request for an ACL could be submitted. Additional 10 CFR Part 40, Appendix A, Criterion 5B(6) requirements for ACLs are discussed in Appendix C of the SEIS. In addition, ACL application review procedures for NRC staff are described in the following documents: January 1996 Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills; NUREG–1620 (NRC, 2003d); and NUREG–1724 (NRC, 2000).

No changes were made to the SEIS beyond the information provided in this response.

Comment: N020-012

One commenter requested a more detailed discussion of aquifer restoration activities, including groundwater transfer (including discussion of why it is acceptable to transfer water from one aquifer to another), groundwater sweep, and groundwater treatment.

***Response**: SEIS Chapter 2 describes aquifer restoration activities. Note that groundwater transfer during aquifer restoration does not involve the transfer of water from one aquifer to another. During this process groundwater is exchanged between one area of the production aquifer (beginning restoration) and another area of the production aquifer (beginning ISR operations). This process is efficient and conserves groundwater consumption during restoration activities. The descriptions of the aquifer restoration activities were modified in SEIS Chapter 2 to provide clarification and additional detail.*

B.5.14.5 Gaseous or Airborne Particulate Emissions

Comments: N015-015; N015-016; N015-023; N020-015; N020-028
One commenter stated the air quality analyses was not adequate because detailed emission inventories for drill rig engines, fugitive dust, and facility operations are not presented. The commenter indicated the emission inventories are needed so that it can evaluate compliance with CAA regulations could be evaluated. Additional detailed comments from the same commenter requested clarification of how fugitive dust and diesel emissions were estimated on p. 2-23 of the draft SEIS and that a detailed emission inventory should be provided in the impact analysis discussion in draft SEIS pages 4-43 to 4-45.

***Response**: The draft SEIS included emissions estimates for fugitive dust but did not provide detailed drilling rig or operational emissions estimates. In response to public comments, the staff updated the SEIS with additional information on the fugitive dust calculations and provided emissions estimates for diesel-powered drilling and construction equipment. Diesel emissions calculations are summarized in a new Appendix D in the final SEIS. The staff also provided more details regarding emissions from facility operations in SEIS Section 2.2.1.6.1. Section 4.7 of the final SEIS, the air quality impact analysis, was revised to incorporate by reference the revised emissions information that was added to Section 2.2.1.6.1. The more detailed emissions estimates support the conclusions in the GEIS and SEIS that ISR facilities are not major sources of airborne emissions, and draft SEIS impact conclusions were not changed.*

B.5.14.6 Operational History

B.5.14.6.1 Historic Operational Experience: Spills and Leaks

Comment: N011-021
One commenter stated the water resource impact analysis relies heavily on the leak and spill surveys presented in two documents that are incomplete and inaccurate. The two documents the commenter identified are the GEIS (NRC, 2009a) and the NRC memorandum Staff Assessment of Groundwater Impacts from Previously Licensed *In-Situ* Uranium Recovery Facilities (NRC, 2009b).

***Response**: NRC conclusions regarding the potential environmental impacts to water resources for the proposed Nichols Ranch ISR Project are provided in SEIS Sections 4.5.1 and 4.5.2. In determining impact conclusions, NRC staff reviewed information the applicant provided in its license application as amended (including the Technical and Environmental Reports), information and data NRC independently collected and information, and data from the GEIS and the NRC memorandum (NRC, 2009b). The intent of the GEIS and NRC memorandum is not to provide an exhaustive listing of site-specific information, but rather to provide an accurate understanding of the types and magnitudes of impacts that have been encountered at NRC-licensed facilities. No changes were made to the SEIS beyond the information provided in this response.*

Comment: N011-024
One commenter stated that for water resource impacts, NRC acknowledges the record of ISR operations spills and leaks to a certain extent. The commenter provided the example of the Smith Ranch Project as support for their concern over the limited explanation.

***Response**: NRC conclusions regarding the potential environmental impacts to water resources for the proposed Nichols Ranch ISR Project are provided in SEIS Sections 4.5.1 and 4.5.2. These impact conclusions are based on facility-specific process descriptions for the Nichols Ranch ISR Project and site-specific characteristics at the proposed site. In determining impact conclusions, the NRC staff reviewed information the applicant provided in its license application as amended (including the Technical and Environmental Reports), information and data NRC independently collected, and information and data provided in the GEIS (NRC, 2009a). GEIS Section 2.11 presents an historical discussion of ISR operations (including the Smith Ranch Project), and Section 2.14 references specific facilities in Wyoming, Nebraska, and New Mexico. The information in these sections of the GEIS was intended to inform the reader about issues that have historically resulted in potential impacts at ISR facilities and provide a range of conditions that may be expected for each of the four ISR phases. No changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.*

B.5.14.6.2 Historic Operational Experience: Excursions

Comment: N013-051
One commenter stated the SEIS Section 4.5.2.1.2.2 discussion on historical groundwater impacts from excursions and the two-page document it references do not provide the data or detailed basis for determining that in the cases examined, none resulted in environmental effects.

***Response**: The commenter is referring to the memorandum entitled Safety Assessment of Groundwater Impacts from Previously Licensed In-Situ Uranium Recovery Facilities; dated July 10, 2009 (ADAMS Accession No. ML091770402). This memo summarizes an accompanying document, Data on Groundwater Impacts at the Existing ISR Facilities (ADAMS Accession No. ML091770385).*

These documents were developed in response to Commission direction in a staff requirements memorandum to assess the available data on groundwater impacts at uranium recovery facilities. The staff reviewed all data available in ADAMS on groundwater issues at existing ISR sites with a focus on groundwater restoration, excursions, and MIT failures. In all cases, the data indicate that the impacts were investigated and chemical constituents were found to be either at levels protective of human health and safety or the environment, or corrective actions were performed to reduce the concentration of chemical constituents to levels protective of human health and safety or the environment, or the excursion status for a well was short-lived with a low potential for risk as determined by previous non-site-specific studies (e.g., NUREG/CR-6733, NUREG/CR-3967, and NUREG-3709). However, if an excursion were to occur at a licensed site, NRC would evaluate the potential impact upon receipt of the licensee's wellfield restoration report.

B.5.14.7 Requests for Detailed Information About All ISR Facilities

Comment: N004-002
One commenter stated that its organization had not received all of the reports and analyses it requested.

***Response**: NRC staff considers this request to be beyond the scope of the SEIS.*

Comment: N011-036
One commenter stated instead of disclosing the average groundwater concentrations, the SEIS should provide all groundwater sampling data and written lab reports, including details like constituent concentrations and sampling data and locations. The commenter also stated if this information was not available, the SEIS should disclose that fact.

***Response**: As described in NRC guidance (NRC, 2003), an applicant, in support of its license application, should provide site baseline information including groundwater quality at and in the vicinity of the site. An NRC-accepted list of constituents to be sampled for determining baseline water quality is provided in this guidance, as are methods for the applicant to propose a list of constituents that is tailored to a particular location. NRC guidance states that to determine background groundwater quality conditions, at least four sets of samples, spaced sufficiently in time, should be collected and analyzed for each constituent. The applicant provided this summary groundwater quality information, as discussed in SEIS Section 3.5.2.3.3 and Chapter 6 of the SEIS discusses the information to be collected as part of the groundwater*

monitoring program. Detailed information, such as the type the commenter requested, that shows constituent concentrations and sampling data and locations, is provided in the applicant's Environmental and Technical Reports (Uranerz, 2007).

No changes were made to the SEIS beyond the information provided in this response.

B.5.14.8 References

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009a.

NRC. Memorandum from C. Miller, Director, Office of Federal and State Materials and Environmental Management Programs, to G. Jaczko, Chairman, U.S. Nuclear Regulatory Commission, et al. Subject: Staff Assessment of Groundwater Impacts from Previously Licensed *In-Situ* Uranium Recovery Facilities. ML091770402. July 10, 2009b.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. Washington, DC: NRC. ML032250177. June 2003.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.15 Financial Surety

Comment: N014-021
One commenter requested the SEIS financial assurance discussion be more descriptive, noting that financial assurance is a key component of ISR facility licensing and has been a contentious issue in the past. The commenter provided examples of additional topics to be discussed, such as (i) the types of financial assurance instruments available to licensees; (ii) how financial assurance cost estimates are developed; (iii) when a financial assurance cost estimate needs to be approved and posted with the agency; and (iv) when the cost estimate is to be updated. The commenter considered financial assurance an excellent example of a mitigation measure to protect against licensee potential financial difficulties.

***Response**: The Nichols Ranch ISR SEIS discusses financial assurance in Section 2.2.1.8, which references NRC financial assurance requirements in 10 CFR Part 40, Appendix A, Criterion 9 and GEIS Section 2.10 (NRC, 2009) that provide the detail the commenter requested. Furthermore, the NRC staff reviews financial surety in detail as part of its safety evaluation, which is conducted in parallel with the environmental review. Section 2.2.1.8 of the Nichols Ranch ISR SEIS has been modified to direct the reader to 10 CFR Part 40, Appendix A and to GEIS Section 2.10 for further details about financial assurance.*

Comment: N017-024
One commenter stated the draft SEIS failed to analyze the applicant financial assurance and decommissioning plans and it lacked a comparison of the current applicant financial assurance and decommissioning plans with previous restoration funding in terms of dollars, plan, and likely results.

***Response**: The Nichols Ranch ISR SEIS discusses financial assurance in Section 2.2.1.8, stating an initial surety estimate is required to cover the first year of operation and NRC and WDEQ would require annual revisions to the surety estimate to reflect existing operations and planned construction or operations the following year. The discussion in Section 2.2.1.8 also notes a detailed review of the initial surety estimate is part of the NRC safety evaluation. The commenter request for a comparison to previous restoration funding is beyond the purpose and scope of the SEIS; therefore, no changes were made to the SEIS beyond the information provided in this response.*

B.5.15.1 References

10 CFR Part 40. Appendix A *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.16 Alternatives

Comments: N011-006; N017-027
Two commenters stated NRC should reevaluate the alternatives analyzed in both the GEIS and the Nichols Ranch ISR SEIS because the SEIS did not evaluate a reasonable range of alternatives. A commenter stated that the scope of the SEIS (and the GEIS) forestalled viable alternatives by assuming that uranium mining will occur, the ISL process will be used, and that the proposed location for the Nichols Ranch ISR Project is appropriate, and that this does not satisfy the rigorous exploration regulations required. Another commenter stated that the SEIS did not evaluate a true phased development alternative that would require each wellfield to be restored and reclaimed prior to proceeding to the next wellfield.

***Response**: NEPA requires Federal agencies to consider alternatives to their proposed Federal actions as well as to their environmental impacts. Alternatives can be divided into two classes: primary alternatives, which are alternatives that can substitute for the agency-proposed action to accomplish the action in another manner, and secondary alternatives, which allow the proposed action to be carried out in a different manner. The previous comments concern both primary and secondary alternatives to the proposed Federal action.*

Reasonable alternatives for a particular Federal action are defined by the proposed Federal action and the purpose and need for the proposed Federal action. As a regulatory agency, the proposed Federal action for the site is an NRC decision to grant or deny the license application of a private party. The purpose and need for the proposed Federal action does consider the applicant goals and objectives to extract uranium from a particular location, which helps define reasonable alternatives to the proposed Federal action.

Reasonable alternatives considered in a site-specific environmental review depend on the proposed action and site conditions. As discussed in Section 2.1 of the final SEIS, NRC considered reasonable alternatives, including the No-Action Alternative, not approving the license application, the alternative of approving the application, and an alternative that

considered licensing only the Nichols Ranch Unit, but not the Hank Unit. Section 2.2 of the final SEIS discusses of alternatives that were considered but were eliminated from detailed study and the reasons for their elimination. These alternatives included conventional mining and milling, conventional mining and heap leaching, alternate lixiviants, and licensing the Hank Unit but not the Nichols Ranch Unit. These alternatives were eliminated from detailed study because they would cause greater environmental impacts than the proposed action. Section 2.2.2 of the final SEIS discusses alternative wastewater disposal options.

While the NRC staff considers reasonable alternatives to the proposed action in the environmental review, the only alternative within NRC's decisionmaking authority is to approve or not approve the license application. NRC has no authority or regulatory control over the applicant selection of uranium recovery technology to be used at the site. NRC's regulatory authority is limited to evaluating the applicant's request for a license to use ISR technology at the site. If NRC decides to grant the license request, the applicant must comply with the license, NRC regulatory requirements, and any other relevant local, State or Federal requirements to operate its facility.

Section B.5.5.1 discusses the relationship between the statement of purpose and need and the development of alternatives for evaluation in the SEIS. With respect to the comment that the GEIS range of alternatives should be reevaluated, the final GEIS was published on June 5, 2009 (74 FR 27052). Refer to Section B.5.7.9 of this appendix for more specific details on the NRC assessment of GEIS-specific comments.

Comment: N011-008
One commenter noted NRC considered the alternative of not licensing the Hank Unit but did not consider the reasonable alternative of not licensing the Nichols Ranch Unit, because of the potential impacts on groundwater and surface water. The commenter noted that because the proposed Nichols Ranch ISR Project site is located near an ephemeral stream and the applicant is proposing to install injection and production wells in this area, an alternative that excluded the Nichols Ranch Unit should have been considered to mitigate surface water impacts. The commenter further noted the proposed production aquifer is under artesian conditions, therefore potentially complicating a complex hydrological system. The commenter also noted that altering the footprint of the proposed facility could potentially reduce the potential for surface water impacts and impacts to shallow groundwater, in addition to eliminating impacts on the Pumpkin Buttes Traditional Cultural Property. The commenter stated NRC failed to consider these and potentially other reasonable alternatives.

Response**:** *In response to public comments, the alternative of only licensing the Hank Unit but not the Nichols Ranch Unit was considered but was eliminated from detailed analysis because it would have had greater ecological and cultural resource impacts than either the proposed action or if only the Nichols Ranch Unit were licensed. Under this alternative, the central processing plant and supporting structures (e.g., administrative buildings) would be located at the Hank Unit. The Hank Unit is located within a 3.2 km [2-mi] radius of nine Greater sage-grouse leks, and because of their close proximity, the applicant would not be able to reasonably maintain the best management practices discussed in SEIS Section 4.6.1.1.3 to mitigate potential impacts to sage-grouse {for example, limiting human activity within 1 km [0.6 mi] of a lek}. Furthermore, there would be a cultural resources impact to the viewshed of the five identified TCPs including the Pumpkin Buttes TCP. Finally, because BLM administers 113 ha [280 ac] of the surface rights at the Hank Unit, the applicant would be required to adhere to specific BLM requirements regarding building and structure placement in accordance with the Programmatic Agreement.*

The placement of wellfield infrastructure (wells, pipeline) is dictated in part by the location of the subsurface ore body; therefore, alternatives regarding well and pipeline placement are limited. With respect to the commenter's concern regarding potential surface water impacts, the applicant has proposed to avoid well installation in the ephemeral drainages to minimize potential damage from erosion and to wellfield infrastructure from peak flows as discussed in the safety evaluation report. The applicant has stated that if a well had to be installed in an ephemeral drainage, appropriate erosion protection controls such as grading and contouring, culvert installation, low-water crossings constructed of stone, water contour bars, and designated traffic routes would be implemented to minimize the potential impact.

Section 2.2.4 was added to the final SEIS to discuss the alternative of licensing only the Hank Unit and why this alternative was not considered for detailed analysis.

Comments: N015-001; N015-010
A commenter stated that the consideration of only Class I UIC injection wells as the waste disposal method was inadequate. The commenter noted other waste disposal alternatives should have been considered in the SEIS, such as (i) treatment and disposal via a Class V injection well; (ii) treatment and discharge to surface waters under a NPDES permit; and (iii) other potential wastewater disposal methods, such as land disposal and evaporation ponds.

***Response*:** *In response to public comments, the final Nichols Ranch ISR SEIS was revised to expand the discussion of alternative wastewater disposal options that the license applicant did not propose. Section 2.2.2 of the final SEIS discusses the previously referenced waste disposal options, Table 2-3 compares the options, and Section 4.14.1.2 discusses the potential impacts from implementing the alternative wastewater disposal options. If licensed, the licensee would have to request a license amendment before using one of these alternative wastewater disposal options. NRC would perform an environmental and safety review on the proposed wastewater disposal method before deciding whether to grant a license amendment request.*

B.5.16.1 References

74 FR 27052, U.S. Nuclear Regulatory Commission. "Notice of Availability of Final Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Federal Register. Vol. 74, No. 107, pp. 27,052–27,054. June 5, 2009.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.17 Land Use

B.5.17.1 Ownership Issues, Surface, and Mineral Rights

Comment: N008-008
The applicant commented they have surface use agreements with all the landowners within the proposed project area, whereas the SEIS Section 3.2 states agreements have been formed with most of these landowners.

***Response**: SEIS Section 3.2 was revised in response to this comment to reflect the current status of surface use agreements at the proposed Nichols Ranch ISR Project.*

Comment: N018-014
One commenter indicated the Industrial Siting Council may require a permit for the ISR facility.

***Response**: As indicated in SEIS Section 1.6.2, a new uranium in-situ recovery milling site would need several WDEQ permits. NRC acknowledges the proposed Nichols Ranch ISR Project may require a permit from the WDEQ Industrial Siting Council. This council works with the Industrial Siting Division to determine whether a Section 109 Permit pursuant to Wyoming Statute (W.S.) § 35-12-109 of the Industrial Development Information and Siting Act would be required. According to this Division, permits are required of all projects with a construction cost of $175.5 million or more, and some business types need the permit regardless of the construction cost. Because the WDEQ has not yet determined whether such a permit would be required, no changes were made to the SEIS beyond the information provided in this response.*

B.5.17.2 Amount of Land Affected and Type, Degree, and Duration of Potential Impacts

Comment: N013-033
One commenter indicated that well spacing, fencing, and other issues related to wellfields were not discussed in land use impacts.

***Response**: The land use description and construction-related impacts are presented in SEIS Sections 3.2, 4.2.1, and 4.2.3.1. Well spacing is discussed in the SEIS, but as the spacing ranges from 15 to 46 m [50 to 150 ft], the overall effect on the construction impact analysis is small. Of the total disturbed area, approximately 24 to 32 ha [60 to 80 ac] would be fenced off at the Nichols Ranch Unit central processing plant and 12 to 16 ha [30 to 40 ac] at the Hank Unit satellite plant, thus restricting access to these portions of land to cattle grazing and other activities for the duration of the proposed project. The land disturbance in the wellfields caused by drilling; grading; trenching; and construction of header houses, pipelines, trenches, and eventual fences is considered at the scale of an entire wellfield, and further information on these impacts can be found in SEIS Section 4.2. Additionally, SEIS Section 4.6.1.1.1 addresses terrestrial ecology habitat loss impacts.*

Because this response addresses the comment by providing confirmation and clarification with information already included in the SEIS and consistent with the analysis of the GEIS, no changes were made to the SEIS beyond the information provided in this response.

Comments: N013-044; N013-045
A commenter indicated the construction of all the facilities would require large amounts of land and impacts to the land use would be significant. This commenter requested the SEIS describe in greater detail the amount of impacted land.

***Response**: A detailed description of construction activities of all the facilities proposed for this project, including wellfields, number of wells, and their spacing, are provided in SEIS Section 2.2.1.2. The land use description and construction-related impacts are presented in SEIS Sections 3.2, 4.2.1, and 4.2.3.1.*

Information presented in these sections described the total land area for the proposed Nichols Ranch ISR Project as approximately 1,365 ha [3,371 ac]. Of this, approximately 120 ha [300 ac] of land, or 8.8 percent of the total surface area, would be affected by the proposed ISR construction and operations. The Nichols Ranch Unit and the Hank Unit, located approximately 6.8 km [4.2 mi] apart, would have approximately 24 to 32 ha [60 to 80 ac] or 1.7 to 2.3 percent

of the total land surface fenced, preventing grazing and other activities at any given time during the proposed project life. The wellfields and associated disturbance areas would also represent small percentages of the total land surface: approximately 3.3 percent or 46 ha [113 ac] for the Nichols Ranch Unit and approximately 4.6 percent or 63 ha [155 ac] for the Hank Unit. For this project, the noncontiguous Nichols Ranch Unit and Hank Unit wellfields would not be fenced.

Based on the small percentage of land that would actually be affected by the proposed project and the approximate 9 month to 1 year duration of construction per unit, the NRC staff concluded the impacts from the construction of the proposed project would be temporary and SMALL.

No changes were made to the SEIS beyond the information provided in this response.

Comments: N016-013; N016-014; N016-015
One commenter indicated potential decrease in land value due to increased traffic and noise, and decreased water availability, along with potential compensation for such land value decrease.

***Response**: NRC acknowledges land values may change if an ISR facility is built. The SEIS includes impact analyses for transportation in Section 4.3, noise in Section 4.8, water resources in Section 4.5, and socioeconomics in Section 4.11. However, NRC would consider it speculation at this time as to whether the value would either increase or decrease if the proposed Nichols Ranch ISR Project was built. In addition, compensation to land owners is not a socioeconomic factor that is generally considered in NRC environmental reviews because ISR applicants need to reach agreements separately with each individual landowner to obtain consent to access, explore, construct, and operate their ISR facilities and find appropriate mitigation or compensation measures for impacts. These impacts, mitigation, and compensation measures are to be defined and implemented between the landowners and the ISR operator and are not negotiated by NRC staff. As documented in SEIS Sections 3.2 and 4.5.2.1.2.2, the applicant formed surface use agreements with all proposed project area landowners. Also, the applicant indicated these agreements addressed potential impacts to access and free-flowing wells. Because the SEIS discussion is appropriate, no changes were made to the SEIS beyond the information provided in this response.*

Comments: N018-028
One commenter indicated that the construction design should account for natural features of the land (i.e., topography and drainage) so natural drainage would not be disrupted.

***Response**: The applicant has committed to use best management practices to ensure site construction will be designed and conducted to minimize disruption to and avoid blockage of natural surface water drainage features (Uranerz, 2007). For the proposed Nichols Ranch ISR Project, the NRC staff finds that, based on the information the applicant provided on its limited construction area, its limited and intermittent number of surface water and wetlands features on site, and its implementation of best management practices, the potential impacts to natural surface water drainage features and to wetlands associated with the construction of roads, the installation of power lines, the construction of wells and pipelines, building of the plant, and the related vehicular traffic are SMALL, which is consistent with the GEIS (NRC, 2009) findings.*

For example, during construction of the proposed Nichols Ranch ISR Project, two new 0.32-km [0.2-mi]-long access roads would be constructed entirely in uplands, and sedimentation and erosion control devices would be placed during construction to minimize sediment transfer to

surface waters. Additional temporary access roads would cross ephemeral channels at the natural streambed elevation and at shallow-water locations perpendicular to flow at two locations on the Nichols Ranch Unit and at three locations on the Hank Unit. Thus, the applicant does not expect that fill material would be needed for these roads. (Uranerz, 2007)

The applicant would also use proper sedimentation and erosion control measures (e.g., grading and contouring, placement of hay bales, culvert installation, sedimentation breaks, or placement of water contour bars, and berms) to minimize sedimentation into the channels and to reseed disturbed soil. (Uranerz, 2007)

Due to the topography of the land surface immediately above the ore bodies, if wells needed to be drilled in ephemeral channels, appropriate erosion protection controls will be applied to minimize damage to the drainage. Controls included grading and contouring, culvert installation, low-water crossing constructed of stone, water contour bars, and designated traffic routes. (Uranerz, 2007)

PVC pipelines that would need to bisect ephemeral channels would be buried perpendicular to the channels during the dry season with excavating equipment. Excavated native soil would be used to backfill the trenches to restore the preexisting grade of the natural channel. Reseeding and mulching would be implemented to stabilize the soil. (Uranerz, 2007)

Finally, the central processing plant and satellite facility would be constructed away from ephemeral channels and above peak flow elevation. The applicant has also committed in its application to construct a ditch and berm on the upgradient side of both the central processing plant and satellite facility to divert flow around the structures.

No changes were made to the Nichols Ranch ISR SEIS beyond the information provided in this response.

Comment: N018-029
One commenter indicated that concentrated runoff that could cause erosion should be avoided by appropriately designing roads, pipelines, and other structures.

***Response**: As detailed in the NRC staff response to related comment N018-028, the NRC staff finds that for the proposed Nichols Ranch ISR Project, the applicant information on construction design and planned construction activities would account for the presence and characteristics of the natural features of the land so that natural drainage would not be disrupted and surface runoff from roads, pipelines, corridors, and other structures would not be concentrated to potentially cause additional erosion.*

Because this response refers to the detailed response provided for related comment N018-028 and because confirmation and clarification is provided in this response with information already in the SEIS, no changes to the Nichols Ranch ISR SEIS were made beyond this response.

B.5.17.3 Mitigation and Reclamation Issues

Comment: N013-046
One commenter requested the estimated time for reclamation be discussed.

***Response**: A detailed description of construction activities of all facilities proposed for the Nichols Ranch ISR Project, including the estimated schedule, is provided in SEIS Section 2.2.1.*

This schedule also shows the estimated time for operations, decommissioning, and reclamation of the two Nichols Ranch Unit wellfields and the two Hank Unit wellfields. The estimated wellfields and site reclamation efforts are estimated at 3 years from approximately 2016 to 2019 at the Nichols Ranch Unit and for 2 ½ years from 2018 to 2020 at the Hank Unit.
This response addresses the comment by providing confirmation and clarification with information already included in the SEIS. Therefore, no changes to the SEIS were made beyond this response.

Comment: N014-016
The commenter states the draft SEIS structure indicates aquifer restoration is separate from the surface reclamation stage of an ISR facility lifecycle. The commenter seeks clarification on whether 10 CFR 40.42, Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas, can be applied to groundwater restoration. The commenter also seeks clarification on the timeline in which a decommissioning plan is required to be submitted to NRC.

***Response**: According to the Commission decision regarding Hydro Resources, Inc. (HRI) (NRC, 2000), the NRC staff is required to review a decommissioning plan prior to issuing a license. NUREG–1569 Section 6.5 (NRC, 2003) contains staff guidance for reviewing decommissioning plans. SEIS Sections 6.1 through 6.4 address the decommissioning/restoration activities to be included in the application, including groundwater restoration, soils reclamation, building decommissioning, and post-decommissioning surveys. Therefore, the intent of the aforementioned Commission decision and NUREG–1569 is to review a decommissioning plan that addresses full facility build-out for the life of the facility.*

Unlike other facilities, the precise as-built conditions for an ISR facility are unknown prior to operations because continued exploration may result in alterations to proposed wellfields. Such alterations affect the required wellfield infrastructure. Therefore, a more detailed decommissioning plan would be required 12 months prior to decommissioning a facility or a portion thereof. This plan would comply with 10 CFR 40.42. Regarding financial assurance, the Commission stated in the HRI decision that a surety is not required prior to licensing, but one is required prior to operations.

As stated in letters to licensees dated July 7, 2008 (NRC, 2008), the timeliness and decommissioning regulations apply to ISRs; therefore, alternate schedules must be submitted if restoration/decommissioning would require more than 2 years. Because the timeliness in decommissioning rule applies to not only entire facilities but portions thereof, restoration schedules apply to individual wellfields. This response is considered sufficient to address the comment; therefore, no change was made to the SEIS.

B.5.17.4 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, “Standards for Protection Against Radiation.” Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Washington, DC: NRC. May 2009.

NRC. Letter from K. McConnell, Deputy Director, U.S. Nuclear Regulatory Commission, to M. Collings, President, Power Resources, Inc. Subject: Compliance with 10 CFR 40.42's Timely Decommissioning Requirements. ML081480259, ML081480293, ML081490589, and ML081490590. July 7, 2008.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. Washington, DC: NRC. ML032250177. June 2003.

NRC. Commission Memorandum and Order in the Matter of Hydro Resources, Inc. CLI-00-08. ML003718672. May 25, 2000.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.18 Transportation

Comment: N013-076
One commenter wanted to know the impacts of transporting solid waste byproduct material to the disposal site.

***Response**: Final SEIS Section 2.2.1.6.3 was revised to include that up to five byproduct material shipments would occur annually. The impact analyses in final SEIS Section 4.3.1.2 were revised to state that the transportation of byproduct material poses a small potential for environmental impact in the event of an accident. This conclusion is based on the low number of shipments expected annually and the risks relative to concentrated yellowcake product shipments that were evaluated in the SEIS and the GEIS (NRC, 2009).*

Comment: N018-012
One commenter, referring to Sections 3.2.2 and 3.3.2, stated transportation routes would be determined by the Wyoming Department of Transportation District Engineer.

***Response**: While the comment is not specific, NRC staff has interpreted the comment as referring to sections in the GEIS (NRC, 2009) that describe the affected environment for transportation in the Wyoming milling regions. This is because there are no such discussions in the draft Nichols Ranch ISR SEIS Section 3.2.2 and there is no Section 3.3.2 in the SEIS. While the comment period for the GEIS has ended, NRC staff understands that individual states can specify routes that are acceptable to them for hazardous material transportation. For yellowcake shipments that travel through multiple states, NRC licensees and their carriers are required to comply with all applicable State laws, in addition to the applicable NRC transportation regulations in 10 CFR Part 71 and the U.S. Department of Transportation regulations in 49 CFR 171 to 189. Because the comment was not specific to the material in the draft SEIS, no changes to the draft SEIS were made in response to the comment.*

Comments: N018-038; N018-053
One commenter suggested the transportation impacts were trivialized because the SEIS did not account for hauling all waste generated from all phases including construction, operations, restoration, and decommissioning. The commenter also expressed (referring to the Executive

Summary, p. xxiii, in particular) the volume of contaminated soil that would need to be shipped offsite for disposal could be significant. The commenter also indicated the SEIS did not provide waste volumes for decommissioning wastes.

Response*: Sections 2.2.1.7 and 4.3 of the draft SEIS discussed of the estimated magnitude of traffic generated by the proposed action. Section 4.3, in particular, includes tabulated estimates of traffic generated for each phase of the proposed project. The traffic estimates in Section 4.3 include shipments of both and municipal solid wastes. In response to this and other comments, annual and cumulative waste volume estimates for the decommissioning phase were added to Section 2.2.1.6.3 (solid waste) and decommissioning waste shipment estimates were added to Section 2.2.1.7 (transportation). The decommissioning waste volumes were based primarily on information submitted in the applicant surety estimate (Uranerz, 2007), which includes a complete accounting of decommissioning costs, including costs to excavate contaminated soil and ship the soil to a licensed facility for disposal as byproduct material. The staff also added an estimate of the contaminated soil volumes that could be generated in wellfields from leaks and spills during operations based on information included in an existing licensee-approved surety estimate (PRI, 2007). Because a significant proportion of the decommissioning waste is from wellfields and the wellfields are planned to be decommissioned using a phased approach over a 5-year period, the expected annual average daily waste transportation equates to approximately one shipment per day. NRC staff calculated that the annual average daily shipping activity for decommissioning activities is comparable to the applicant's estimate for truck traffic during construction and operations that was summarized in the draft SEIS in Section 2.1.1.7 (referring to approximately six trucks per week). Because the proposed decommissioning activities do not overlap with construction or operations phases, the overall magnitude of expected average annual daily traffic generated by the proposed action has not changed based on the addition of more detailed estimates generated in response to these comments. As mentioned previously in this comment response, SEIS Sections 2.2.1.6.3 and 2.2.1.7 were revised.*

B.5.18.1 References

10 CFR Part 71. *Code of Federal Regulations*, Title 10, *Energy*, Part 1, "Packaging and Transportation of Radioactive Material." Washington, DC: U.S. Government Printing Office.

49 CFR Parts 171 to 189. *Code of Federal Regulations,* Title 49, *Transportation.* Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

Power Resources International (PRI). Letter from J. McCarthy, Environmental, Health, and Safety Manager, Power Resources International, to G. Janosko, Branch Chief, U.S. Nuclear Regulatory Commission. Subject: Smith Ranch: 2007–2008 Surety Estimate Revision. ML072210876. June 29, 2007.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.19 Geology and Soils

B.5.19.1 Soil Disturbance Concerns

Comment: N007-012
One commenter suggested pipeline installation should be done with a plowing technique utilizing specialized equipment, rather than conventional trenching, to reduce surface disturbance, reduce the interim reclamation level of effort, and potentially increase reclamation success.

***Response**: During decommissioning, all buried pipelines would be excavated using conventional trenching techniques (Uranerz, 2007). SEIS Section 2.2.1.4.4 describes the applicant's commitment to segregate topsoils and subsoils during excavation and to backfill trenches with subsoil first followed by topsoil. NRC staff notes that the plowing technique described by the commenter would reduce surface disturbance during pipeline installation because it does not rely on traction for propulsion, thereby reducing the potential impact to surface grasses and soils. However, NRC cannot require the applicant to use this potential mitigation measure. The NRC staff has reviewed the proposed site construction activities and determined the potential impacts to vegetation and geology and soils as SMALL because of the relatively short duration of ISR activities at a given wellfield (approximately 5–6 years refer to SEIS Figure 2-1) and the fact that the applicant would reseed soil and place it in areas where the soil had been stripped. Once the vegetation has become reestablished in reclaimed areas, the land could be returned to a condition that could support the preextraction land uses of wildlife habitat and livestock grazing.*

No further changes were made to the SEIS beyond the information provided in this response.

Comments: N018-031; N018-083
One commenter suggested additional detail be provided regarding restoration of surface soils disturbed by site activities.

***Response**: SEIS Sections 3.4.3 and 4.4 discuss surface soils, while Sections 2.2.1.5.5, 3.6.1.1, and 4.6 discuss revegetation. The SEIS currently contains discussions of both short- and long-term measures that would be taken to preserve the soil profile and restore vegetative cover. Additional details may be included in the site reclamation plan, which the licensee would submit at least 12 months before any planned final site decommissioning begins. Because the discussion in the SEIS is considered appropriate, no changes were made to the SEIS.*

B.5.19.2 References

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.20 Groundwater Resources

B.5.20.1 General Concerns About ISR and Groundwater Contamination

Comments: N011-031; N011-032; N011-035; N014-011; N017-004; N017-022
Several commenters raised concerns about the NRC assessments for operational impacts of ISR activities on groundwater by noting that the assessments are not consistent with existing data. A few commenters asked for clarification on groundwater restoration standards. A commenter pointed out that for cases in which baseline levels are not recovered after restoration, potential effects on surrounding USDWs are not evaluated in the SEIS. Another commenter expressed disbelief on proper contamination containment after aquifer restoration, allegedly based on historical data. A commenter asked for additional information on historical analysis of aquifer restoration at ISR sites. Several commenters disagreed with the NRC assessment that the impact to groundwater is small and temporary after restoration and noted aquifers used for ISR operations have never been restored to baseline/premining conditions. One commenter asserted that NRC's characterization of restoration history implies impacts are smaller than they actually are.

***Response**: NRC licensees are required to return water quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in the regulations the concentration of a hazardous constituent must not exceed—(a) The Commission approved background concentration of that constituent in the groundwater; (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (c) An alternate concentration limit is established by the Commission.*

To establish the preoperational nonradiological and radiological groundwater baselines within the proposed permit boundaries and adjacent properties, the applicant would be required to collect samples over a period of at least 1 year, from at least four sets of groundwater samples sufficiently spaced in time. To establish the baseline water quality for a specific wellfield within the license area, an acceptable set of samples should include all wellfield perimeter monitor wells, all lower and upper aquifer monitor wells, and at least one production/injection well per acre in each wellfield. Baseline samples are collected with a sampling density of not less than one for every 16,187 m^2 [4 ac]. The applicant has proposed to sample one well per 1.6 ha [4 ac]. Because the applicant is required to collect baseline water quality before ISR operations begin, the baseline sampling procedure outlined previously would provide adequately unbiased preoperational groundwater quality measures at a proposed ISR site. Wellfield groundwater monitoring at the proposed Nichols Ranch ISR Project, including preoperational and baseline wellfield groundwater sampling, is described in Section 6.3.1 of the SEIS.

All ISR restorations approved to date under NRC regulations have met approved restoration standards. In the past, NRC has allowed "class of use," a state designation under the Safe Drinking Water Act, as a secondary restoration goal. The text "class of use," referred to in the GEIS as a standard for restored groundwater quality, was based on restoration standards provided in NUREG-1569. The NRC has determined that the primary and secondary restoration standards in NUREG-1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B (5). The NRC has notified licensees and applicants in Regulatory Information Summary, RIS 09-05, dated April 29, 2009 (NRC, 2009b), that the restoration standards listed in NUREG-1569, Section 6.1.3(4) are not consistent with those listed in 10 CFR Part 40, Appendix A and licensees and applicants and licensees must commit to achieve the restoration standards in Criterion 5B (5). These standards state the

concentration of a hazardous constituent must not exceed (a) the Commission approved background concentration of that constituent in groundwater; (b) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed or; (c) an alternative concentration limit established by the Commission. An ACL is not a primary restoration goal and will only be considered after a licensee has demonstrated that primary restoration goals are not practically achievable at a specific site. ACLs that present no significant hazard may be proposed by the licensees for Commission consideration. The Commission may establish a site-specific ACL for a hazardous constituent as provided in 5B(5) if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. A discussion of the NRC requirements for application, review and establishment of a site-specific ACL is presented in Appendix C. In addition, ACL application review procedures for NRC staff are available in the following documents: January 1996 Staff Technical Position: Alternate Concentration Limits for Title II Uranium Mills, NUREG-1620, and Standard Review Plan for the Review of DOE Plans for Achieving Regulatory Compliance at Sites With Contaminated Ground Water Under Title I of the Uranium Mill Tailings Radiation Control Act, NUREG-1724.

Examples of successfully completed restoration or delayed restoration activities are discussed in GEIS Section 2.11.5 (NRC, 2009a). The process to establish an ACL is detailed in Appendix C of the SEIS. Additional costs incurred because of groundwater restoration delays would be addressed in financial sureties NRC review annually.

Based on past examples of successful restoration and remediation activities under NRC regulations and aquifer restoration standards, the GEIS concluded the potential impacts on groundwater resources at ISR facilities could range from SMALL to MODERATE based on site-specific conditions. The analysis conducted for the safety evaluation and incorporated into Section 4.5.2 of the SEIS concluded the potential impact on groundwater resources from the Nichols Ranch ISR Project would be SMALL.

Because the discussion in the SEIS is considered appropriate, no changes were made to the SEIS.

Comments: N013-047; N013-048, N013-049
One commenter stated the SEIS conclusion that ground and surface water impacts would be SMALL to MODERATE was based on flawed assumptions that the applicant would implement practices to avoid or remediate spills, leaks, and excursions, and the commenter requested these be corrected in the final SEIS. The commenter further noted that the SEIS failed to discuss what practices would be used to avoid or remediate spills, leaks, and excursions.

***Response**: As a matter of practice, NRC staff assumes regulations would be applied, as appropriate, to an ISR facility. NRC expects licensee compliance with regulatory requirements and license conditions when evaluating the potential environmental impacts of an ISR uranium recovery facility. As described in GEIS Section 1.7.1 (NRC, 2009a), NRC staff would conduct periodic inspections to determine compliance with applicable regulatory requirements, license conditions, and approved procedures. Potential violations and allegations would be evaluated and addressed through the appropriate NRC enforcement or allegation programs. Enforcement actions can result in fines, corrective actions, or injunctive relief to address regulatory requirements violations. The impact analyses presented in SEIS Section 4.5 and GEIS Chapter 4 are informed by historical information presented in GEIS Chapter 2. Depending on*

the affected resource area and the phase in the facility lifecycle, potential impacts may range from SMALL to LARGE. Based on site-specific information, NRC staff has determined surface water and groundwater impacts for the proposed Nichols Ranch ISR Project would be SMALL.

An applicant is required to obtain construction and industrial storm water (NPDES) permits from the state (through WDEQ) prior to commencing ISR activities. As part of this permit, the applicant would implement best management practices (BMPs) such as a spill prevention and cleanup plan to minimize potential impacts on soil and groundwater due to leaks and spills on the ground surface (GEIS Sections 7.4 and 4.3.4.2.1).

If the facility was licensed, the applicant would be required to establish a detection monitoring program to protect underground sources of groundwater from potential spills and leaks, in compliance with 10 CFR Part 40, Appendix A, Criterion 7A and 40 CFR 144.54. Once a facility is licensed, the applicant is also required to implement corrective actions to prevent movement of any spills or leaks into USDWs, in compliance with 40 CFR 144.55.

To comply with these regulations, the applicant would conduct mechanical integrity tests (MITs) of each well to check for leaks or cracks in the casing (detailed information on MITs is provided in GEIS Section 2.4.1.3), in compliance with 40 CFR 146.8, and install meters and control valves in individual well lines to monitor and control flow rates and pressures for each well to maintain water balance and to aid in identifying leaks (detailed discussion is provided in GEIS Section 2.3.1.1). The applicant would measure and record pipeline pressure to monitor for potential leaks and spills that might result from failure of fittings and valves (this process is detailed in GEIS Section 2.4.1.2). The applicant would implement corrective actions to prevent movement of spills or leaks into USDWs. Under these circumstances, potential impacts on surface water and groundwater due to spills and leaks could range from SMALL to MODERATE.

The applicant stated in their license application that measures to minimize potential impacts include proper well construction procedures and well testing procedures, including the verification of well casing integrity and proper cementing of the Class I injection wells. Monitoring wells completed in the aquifers above and below the ore zone at the proposed Nichols Ranch ISR Project would be routinely sampled for excursions of lixiviant. If a well casing failure were to occur, the applicant would be required to clean up any contamination in a USDW. To protect surface water, each injection and production well would be equipped with a monitoring device that would sound an alarm if a change in flow pressure indicated a potential leak as described in Section 6.3.3 of the SEIS.

As shown in Table 1-2 of the SEIS, the applicant is preparing a construction and industrial storm water (NPDES) permit application for submittal to WDEQ prior to commencing ISR activities. To comply with the WDEQ permit, the applicant would implement BMPs including a spill prevention and cleanup plan to minimize potential impact on surface water and groundwater from leaks and spills on the ground surface. GEIS Section 7.4 also discusses BMPs that have been used at ISR facilities (NRC, 2009a).

No changes were made to the SEIS beyond the information provided in this response.

Comments: N016-005; N016-006
A commenter expressed concern regarding the proposed schedules for completion of the ISR phases at the proposed Nichols Ranch ISR Project and noted that the SEIS states that production at each unit could range from 1.25 to 2.5 years. However, at another Wyoming site

(Power Resources), the licensee had estimated 3 years, but in actuality production lasted for about 10 years. The commenter also noted that at the end of 10 years of aquifer restoration, the groundwater quality was similar to what the groundwater quality had been at the end of the operations phase even though the licensee had estimated restoration would have taken five years. The commenter stated this was reflective of the ISL history in Wyoming and this was not addressed in the SEIS.

***Response**: The commenter is correct that historically ISR production operations have required a longer production schedule than originally estimated. NRC, however, does not regulate or limit the production schedule for a wellfield at a licensee's facility. In general, a licensee determines its production schedule for a particular wellfield based on economics and other factors (e.g., liquid effluent disposal capacity, recovery efficiencies), which may vary as production progresses. The applicant estimated that the total production time for the Nichols Ranch Unit would be 3–4 years and the Hank Unit would be 4–5 years. The shorter timelines presented by the commenter were for the individual production areas within each unit, as shown in Figure 3.12 of the applicant's technical report (Uranerz, 2007). NRC staff considers the time periods provided for production reasonable initial estimates.*

Furthermore, NRC regulations require that a licensee initiate wellfield restoration immediately after production is complete [10 CFR 40.42 (d)] and set an initial restoration duration of less than 24 months. If the licensee cannot meet those regulatory timeframes, it must submit documentation for noncompliance and request a NRC-approved alternate schedule. Ultimately, a licensee will have to submit a license renewal in 10 years from the date the license was issued and NRC staff will scrutinize the compliance and operational history of the facility.

Uranerz estimated a time period of 4 years for restoration of the Nichols Ranch Unit and 6 years for the restoration of the Hank Unit. NRC regulations require that restoration activities must restore the production aquifer to the groundwater protection standards in 10 CFR Part 40, Appendix A, Criterion 5B(5), no matter the actual duration of the restoration. GEIS Section 2.5 and Section B.5.9.8 of this appendix provide additional information on groundwater restoration at ISR sites.

No change was made to the SEIS beyond the information provided in this response.

Comments: N016-012; N013-072
One commenter wanted to know how ISR milling could be conducted safely at a location where the aquifer was unconfined. Another commenter stated NRC should not license an ISR project at a location where the aquifer is unconfined unless the NEPA analyses demonstrate that water resource impacts can be prevented through enforceable and effective mitigation measures.

***Response**: The commenters are correct that the production zone F Sand aquifer at the Hank Unit is an unconfined aquifer. An unconfined aquifer is one where the water level is below the overlying aquitard as described in SEIS Section 4.5.2 and shown in Figure 4-1. At the Hank Unit, the water levels in the F Sand fall below the base of the overlying aquitard in the northern portion of the Hank Unit and slightly above in the southern portion. The term "unconfined aquifer" does not mean the overlying aquitard, which acts as the top confining layer to the production ore zone, is missing. At the Hank Unit, the overlying GF aquitard, which confines the top of the F Sand production zone, is continuous across the entire site. Aquifer testing at the Hank Unit has not indicated leakage from either the overlying G Sand or the underlying B Sand. Specifically, the applicant provided the results of two multiwell pumping tests (URZHF-1 and*

URZHF-5) that included pumping the F Sand coupled with monitoring the F Sand, the overlying G Sand aquifer, and the underlying B Sand aquifer (Uranerz, 2007). Neither test indicated a hydraulic connection (drawdown) between the F Sand and the G Sand or B Sand.

The reason for specifically addressing the unconfined F Sand aquifer is that the groundwater flow behavior of an unconfined aquifer is different than a confined aquifer where the water level in the aquifer rises above the overlying aquitard. This difference can impact the ability of the licensee to prevent and control excursions. It can also affect the ability of the groundwater to sweep all parts of the aquifer, which impacts the effectiveness of the restoration. To ensure operations can be conducted safely in the F Sand unconfined aquifer at the Hank Unit, NRC will require a site-specific license condition that the applicant perform a hydrogeologic test to quantify the unconfined groundwater flow behavior of the F Sand aquifer. NRC will require another license condition for the licensee to provide the Production Area Pump Test reports from the Nichols Ranch ISR Project, including the first production area at the Hank Unit, for NRC review and approval before operations may begin. The report for the Hank Unit will describe the F Sand unconfined aquifer characteristics and communication of the wellfield production wells with monitoring wells in the aquifer. This information will enable NRC staff to evaluate the ability of the licensee to conduct ISR operations in the F Sand safely and with minimal impact on the environment.

License conditions are enforceable and therefore similar to the "enforceable and effective mitigation measures" the commenter suggests. SEIS Section 4.5.2.1 was modified to clarify on the construction, operations, aquifer restoration, and decommissioning impacts at the Hank Unit.

B.5.20.2 Importance of Water and Consumptive Use

Comment: N007-015
One commenter requested the SEIS explain the source and volume of water used for drilling wells and identify any impacts to the aquatic environment.

***Response**: As noted in SEIS Section 4.5.2.1.1, most water used for construction, including well drilling at the proposed Nichols Ranch ISR Project, would be pumped from wells screened in surficial aquifers, which are described in SEIS Section 3.5.2.2. As described in SEIS Section 4.5.2.1.1, the consumptive water use during well drilling would be SMALL based on the limited nature of groundwater use during the construction phase (dust suppression, mixing cements, and drilling support) and the applicant's implementation of WYPDES permit requirements and BMPs to protect soils and shallow groundwater. The volume of drilling fluids and muds used during well installation would be limited, and BMPs would be used to prevent, identify, and correct potential impacts to soils and surficial aquifers at the proposed Nichols Ranch ISR Project. Drilling fluids and muds would be placed in mud pits to control the spread of the fluids, minimize the area of soil contamination, and enhance evaporation. Section 4.5.2.1.1 of the SEIS was revised to clarify the potential impact on groundwater from well construction.*

Comments: N007-016; N016-011; N020-041
One commenter noted Uranerz has confidential surface water agreements in place with landowners addressing mitigation if a free-flowing well is impacted by the proposed Nichols Ranch ISR Project and wanted to know how long this mitigation would be in place. This commenter also wanted to know whether other wells would likely be impacted, what the mitigation plan for these wells would be, and what happens if water levels do not recover. Another commenter wanted to know what would happen if the ISR activity decreased the flow

rate of area wells; specifically, whether and how local landowners would be compensated. Another commenter requested clarification on whether the applicant would certify water well agreements with potentially impacted landowners including those outside the ore zone perimeter.

***Response**: As noted in SEIS Section 4.5.2.1.2.2, the applicant indicated that flowing wells located within the 3 m [10 ft] drawdown contour could be impacted, which includes wells located outside of the ore zone perimeter. Within an 8-km [5-mi] radius of the Nichols Ranch Unit, 10 flowing wells screened within the A Sand (i.e., the ore zone aquifer at the Nichols Ranch Unit) could be affected by ISR operations (Uranerz, 2007). The applicant has "confidential surface use agreements in place with the landowners" that detail mitigation measures that would be implemented if production from a free-flowing well was impacted by the proposed Nichols Ranch ISR Project. The compensation terms and duration of surface use agreements are negotiated between the applicant and landowners. Uranerz has agreed to work with the landowners if a well were to be affected by drawdown during ISR operations; potential actions the applicant could take include installing pumps in artesian/flowing wells that ceased flowing or drilling a new well for the landowner (Uranerz, 2007). SEIS Section 4.5.2.1.2.2 was revised to clarify the predicted drawdown impacts and the coverage area for surface use agreements.*

Comments: N009-003; N010-003
One commenter stated the NRC should not grant a license for the proposed Nichols Ranch ISR Project because of the large consumptive water uses during ISR operations and restoration that would deplete an important and valuable water resource along with other competing uses (oil drilling, coal-bed methane) in a drought prone area. Another commenter stated ISR's large consumptive water use should be considered a significant impact for the same reasons stated by another commenter.

***Response**: Analyses and estimates of consumptive water used during ISR operations at the proposed Nichols Ranch ISR Project are described in SEIS Section 4.5.2.1.2.2. Assuming a production rate of 13,250 Lpm [3,500 gpm] and a 1 percent bleed rate, a groundwater withdrawal rate of 133 Lpm [35 gpm] was estimated during ISR operations at the Nichols Ranch Unit. Assuming a production rate of 9,470 Lpm [2,500 gpm] and a 3 percent bleed rate, a groundwater withdrawal rate of 284 Lpm [75 gpm] was estimated during ISR operations at the Hank Unit. The additional consumptive groundwater use that would accompany aquifer restoration would increase these withdrawal rates. As noted in Section 4.5.2.1.2.2, the projected consumptive groundwater use of water at the proposed Nichols Ranch ISR Project during operations and aquifer restoration is a small fraction of the water currently stored in the ore-bearing aquifers (i.e., the A Sand at the Nichols Ranch Unit and the F Sand at the Hank Unit) in the Powder River Basin. After production and restoration are complete and groundwater withdrawals cease at the Nichols Ranch and Hank Units, groundwater levels would recover, as discussed in Section 4.5.2.1.2.3 of the SEIS. Thus, the potential long-term (approximately 10 years) environmental impact from consumptive groundwater use during operations and aquifer restoration at the Nichols Ranch ISR Project would be SMALL. SEIS Sections 4.5.2.1.2.2 and 4.5.2.1.2.3 were revised to clarify the potential impact from consumptive groundwater use during operations and aquifer restoration.*

The cumulative impact on groundwater resources considering the proposed Nichols Ranch ISR Project, oil and gas production, and coalbed methane (CBM) production are evaluated in Section 5.5.2 of the SEIS. As described in Section 5.5.2, the cumulative impact on the same aquifer resulting from the interaction between ISR and CBM activities would be unlikely because CBM production and ISR activities are conducted in different aquifers that are separated

stratigraphically by approximately 120 m [400 ft]. No further oil and gas development is expected within 80 km [50 mi] of the proposed Nichols Ranch ISR Project. Furthermore, oil wells are completed at greater depths than the targeted aquifers for ISR operations. As mentioned in Section 3.2.3, oil and gas production in the region typically occurs at approximately 1,220 to 4,116 m [4,000 to 13,500 ft]. Therefore, the proposed Nichols Ranch ISR Project would have a SMALL incremental impact on groundwater resources when added to the SMALL to MODERATE cumulative impact from other past, present, and reasonably foreseeable future actions including oil and gas and CBM production. SEIS Section 5.5.2 was revised to clarify the cumulative impact on groundwater resources.

Comments: N013-064; N013-065
One commenter wanted to know how many previously existing wells in the proposed project area and within the ore-bearing zone would need to be abandoned and whether the well owners be compensated. This same commenter asked that if wells needed to be redrilled into another formation, what the water quality and quantity of that formation would be.

***Response**: SEIS Section 3.5.2.3.4 details all permitted wells within the Nichols Ranch and Hank Units and within a 4.8-km [3-mi] radius of each unit. Within the Nichols Ranch Unit, nine existing wells were identified, excluding aquifer testing and monitoring wells. All of these wells are used for stock watering. Several of these wells are completed in the ore-bearing sands and would need to be abandoned or converted to monitoring wells. Six permitted wells were identified within 0.8 km [0.5 mi] of the Hank Unit, and all of these wells are used for stock watering. Several of these wells are completed in the ore-bearing sands and would need to be abandoned or converted to monitoring wells. The applicant has committed to mitigate the impact to owners who may experience loss of use of any wells (Uranerz, 2007). Owners of wells that need to be abandoned would have to negotiate the compensation or well replacement terms with the applicant to their satisfaction.*

NRC does not regulate the installation, groundwater yield, or appropriate use of new water wells. Replacement water wells would require a permit from the Wyoming State Engineers Office (WSEO), which sets the yield and acceptable use of groundwater for wells completed in a particular aquifer.

No changes were made to the SEIS beyond the information provided in this response.

Comment: N018-022
One commenter stated that the Fort Union Formation is pumped heavily for CBM production, whereas SEIS Section 3.5.2.4 states this formation is not extensively used.

***Response**: SEIS Section 3.5.2.4 notes that the Fort Union Formation is an important aquifer for regional water supply. SEIS Section 3.5.4.2 also notes, based on the applicant's survey and NRC's confirmation of water wells located within a 4.8-km [3-mi] radius of the proposed Nichols Ranch ISR Project, that water supply wells are generally completed within 300 m [1,000 ft] of the ground surface in the Wasatch Formation. Based on this survey, the Fort Union Formation is not extensively used for local water supply, because sufficient groundwater is available from the overlying Wasatch Formation. SEIS Section 3.4.1 notes the Fort Union Formation is the target formation for CBM extraction operations in the Powder River Basin and in the vicinity of the proposed Nichols Ranch ISR Project. In response to this comment, Section 3.5.2.4 of the SEIS was revised to clarify that the Fort Union Formation is not extensively used for water supply but is the target formation for CBM extraction operations.*

Comment: N020-038
One commenter noted regulatory agencies should have the opportunity to review confidential agreements with landowners regarding free-flowing water supply wells, with assurance that details of individual contracts would not be divulged to other landowners, to ensure that information regarding potential environmental impacts is not being withheld from the regulatory agencies.

***Response**: As noted in SEIS Section 4.5.2.1.2.2, the applicant has "confidential surface use agreements in place with the landowners" detailing mitigation measures that would be implemented if the proposed Nichols Ranch ISR Project impacted a free flowing well. The terms and duration of surface use agreements are negotiated between the applicant and landowners. NRC has no involvement in this process and does not review these agreements. However, in their license application Uranerz has agreed to work with the landowners if a well is affected by drawdown; potential actions could include installing pumps in artesian/flowing wells that cease flowing or drilling a new well for the landowner (Uranerz, 2007).*

Confidential agreements between the applicant and landowners regarding free-flowing water supply wells are negotiated to mitigate potential impacts on these wells from the proposed action, such as the potential loss of water supplies. Other environmental impacts, including the potential to contaminate water and land from ISR activities, are addressed in SEIS Chapter 4. NRC has no regulatory authority to determine how landowners may choose to be compensated for loss of private water supplies and the content of the confidential agreements is beyond the scope of the SEIS.

As previously stated, the WSEO issues permits for and regulates the use of all water supply wells in Wyoming. All WSEO water well permits and well completion reports are available to the public for review.

No changes were made to the SEIS beyond the information provided in this response.

Comment: N020-040
One commenter wanted to know how the aquifer exemption buffer zones mentioned in SEIS Section 4.5.2.1.2.2 would be determined and how these would be monitored and enforced.

***Response**: EPA issues the aquifer exemption status. The EPA criteria for an aquifer exemption are found in 40 CFR 146.4. The regulation states that an aquifer, or a portion thereof, may be determined to be an "exempted aquifer" if it meets the following criteria: (i) it does not currently serve as a source of drinking water; and (ii) it cannot now and would not in the future serve as a source of drinking water; or (iii) the TDS content of the groundwater is more than 3,000 and less than 10,000 mg/L, and it is not reasonably expected to supply a public water system. A USDW, as defined in 40 CFR 144.3, is an aquifer or its portion that (i) supplies any public water system; or (ii) contains a sufficient quantity of groundwater to supply a public water system; and (i) currently supplies drinking water for human consumption; or (ii) contains fewer than 10,000 mg/L TDS; and (iii) is not an exempted aquifer.*

EPA establishes the boundaries of the exempt aquifer zone. EPA does not legally distinguish an aquifer exemption buffer zone within this boundary. This term is used by NRC and the licensee to describe the distance from the monitoring well ring of a wellfield to the aquifer exemption boundary, but has no legal interpretation. The concept of a buffer zone is useful as it is the distance an excursion detected at the monitoring well ring would have to travel to impact a USDW. During operations, NRC and EPA, or the state with UIC primacy under EPA, monitor

operations in the exempt zone to ensure no excursions impact surrounding USDW and the exempt zone is not used as a domestic water supply. After an ISR is restored, decommissioned, and the NRC license is terminated, EPA or the state with UIC primacy regulates and monitors the exempt zone to ensure it does not contaminate surrounding USDW and has the responsibility to ensure that an exempted aquifer is not used as a source of drinking water.

In response to this comment, text and GEIS references were added to SEIS Section 4.5.2.1.2.2 to describe the EPA role in granting aquifer exemptions and the criteria used to determine the aquifer exemption at ISR facilities.

B.5.20.2.1 Site Characterization

Comments: N013-057; N013-071
One commenter stated the SEIS does not fully disclose the aquifer confinement conditions at the site and does not provide project site permeabilities of the aquitards. The commenter asserts the impact analysis related to this issue must be improved in the final SEIS.

***Response**: The aquifer confinement conditions for both the Nichols Ranch and Hank Units of the proposed Nichols Ranch ISR Project are described in SEIS Section 3.5.2, and permeabilities for the aquitards underlying the ore-bearing units are presented in SEIS Section 3.5.2.3.2. SEIS Section 4.5.2 has been revised to clarify the hydrologic characteristics of the production units at the proposed Nichols Ranch ISR Project. Furthermore, the ore-bearing A Sand at the Nichols Ranch Unit is a confined aquifer. At the Hank Unit, the water levels in the F Sand fall below the base of the overlying aquitard in the northern portion of the Hank Unit and slightly above in the southern portion. Thus, the F Sand varies from confined to unconfined conditions at the Hank Unit. The term unconfined aquifer does not mean that the overlying aquitard, which acts as the top confining layer to the production ore zone, is missing. At the Hank Unit, the overlying aquitard (GF aquitard), which confines the top of the F Sand production zone, is continuous across the entire site. Aquifer testing at the Hank Unit has not indicated leakage from either the overlying G Sand or the underlying B Sand. Specifically, Uranerz presented the results of two multiwell pumping tests (URZHF-1 and URZHF-5 multiwell tests) that included pumping of the F Sand coupled with monitoring of the F Sand the overlying G Sand aquifer, and the underlying B Sand aquifer (Uranerz, 2007). Neither test indicated a hydraulic connection (drawdown) between the F Sand and the G Sand or B Sand. Thus, the applicant provided field test data and groundwater modeling to demonstrate it could monitor, prevent, and capture excursions from the unconfined aquifer in the "F Sand" production zone (Uranerz, 2010). By license condition, aquifer confinement would be further verified at each of the wellfields during the required wellfield multiwell pumping tests and the data would be submitted as part of wellfield data packages and NRC would review before each wellfield would begin operation.*

Comment: N018-020
One commenter recommended removing references to the Hell Creek Formation in the SEIS because the Lance and Hell Creek Formations are the same, and the name "Lance Formation" is used in Wyoming.

***Response**: NRC agrees with the comment. SEIS Section 3.5.2.1 was revised accordingly.*

Comment: N018-021
One commenter noted some samples of deep water from the Madison Formation have measured total dissolved solids (TDS) values less than 1 ppm [10,000 mg/L].

***Response**: NRC accepts the comment. Text has been added to the SEIS to note the presence of freshwater at some locations within the Madison Formation.*

B.5.20.2.2 Aquifer Exemption and Baseline Water Quality

Comment: N013-054
One commenter stated the SEIS does not discuss how baseline water quality conditions have been developed.

***Response**: The average baseline water quality for a specific wellfield is determined from water quality measured in wells installed within the production ore zone aquifer in each licensed wellfield. The average baseline water quality in a specific wellfield is used to determine the restoration target values for the ore zone aquifer within wellfield. This average baseline water quality, therefore, does not include "wells outside the ore zone." The baseline water quality conditions for the proposed Nichols Ranch ISR Project have not yet been established but would be part of the preoperational testing performed after production and monitoring well installation at the site. Section 6.3.1.1 of the SEIS details how the baseline water quality would be established at the proposed Nichols Ranch ISR Project.*

No changes were made to the SEIS beyond the information provided in this response.

Comment: N020-023
One commenter noted the description for aquifer exemption designation is incomplete in the SEIS.

***Response**: EPA issues an aquifer exemption. The EPA criteria for an aquifer exemption is found in 40 CFR 146.4. The draft SEIS included 40 CFR 146.4(a) and (b) in the description of aquifer exemption criteria. The regulation states that an aquifer, or a portion thereof, may be determined to be an "exempted aquifer" if it meets the following criteria: (i) it does not currently serve as a source of drinking water; and (ii) it cannot now and would not in the future serve as a source of drinking water; or (iii) the TDS content of the groundwater is more than 3,000 and less than 10,000 mg/L, and it is not reasonably expected to supply a public water system. A USDW, as defined in 40 CFR 144.3, is an aquifer or its portion which (i) supplies any public water system; or contains a sufficient quantity of groundwater to supply a public water system; and (ii) currently supplies drinking water for human consumption; or (iii) contains fewer than 10,000 mg/L TDS; and (iii) is not an exempted aquifer. Section 4.5.2.1.2.3 of the final SEIS was revised to reflect this regulation.*

B.5.20.2.3 Control of Operational Impacts, Excursions of ISR Solutions, and History

Comment: N013-062
One commenter stated the SEIS does not fully disclose impacts to stock and domestic water wells within the proposed project area.

***Response**: Figures 3-6 and 3-7 in Section 3.5.2 of the SEIS identify the locations of stock and domestic wells within and near the proposed Nichols Ranch and Hank Units, respectively. Section 4.5.2.1.2.2 of the SEIS describes the projected drawdown and water consumption in these wells based on modeling performed by the applicant and confirmed by the NRC staff. Section 4.5 of the SEIS also describes mitigation measures that would be used to protect water resources and minimize the potential impact on surface water and groundwater and identifies the standards for groundwater restoration. SEIS Sections 6.2 and 6.3 describe plans for*

monitoring radiological and physicochemical parameters to ensure public health and safety during all phases of the proposed project.

No changes were made to the SEIS beyond the information provided in this response.

Comments: N013-063; N020-037
Two commenters stated the SEIS does not fully disclose impacts from excursions outside the proposed project area. Another commenter wanted to know what protection or assurances from potential contamination would be afforded to landowners with domestic wells in close proximity of the Nichols Ranch and Hank Units acknowledging these wells are not within the production aquifer.

***Response**: SEIS Section 4.5.2 describes impacts to groundwater resources within and up to 6.4 km [4 mi] beyond the boundary of the proposed Nichols Ranch ISR Project area. Included in the impact analysis are (i) discussion of the projected drawdown of aquifer levels from pumping; (ii)consumptive use of water during the project lifetime; (iii) the potential impact from excursions of lixiviant-laden water which occur horizontally within the ore-bearing aquifer; and (iv) potential vertical excursions from the production aquifer to either overlying or underlying aquifers.*

To avoid excursions to USDW outside the exempted aquifer, the applicant would be required to install and sample monitoring wells biweekly in a ring surrounding the production aquifer and in the overlying and underlying aquifers. Mechanical integrity testing of all production and injection wells to detect leaks is required prior to and periodically during the operation. Section 6.3.1 of the SEIS describes the applicant's proposed wellfield groundwater monitoring plans and requirements both prior to operations and after the facility became operational if it was licensed. This program would be further refined and informed by the required aquifer testing and baseline water quality assessments prior to initiating ISR operations. Section 6.3.2 describes wellfield and pipeline flow and pressure monitoring the applicant would conduct to monitor pipeline and well pressures during operations to detect system leaks. The applicant must also establish operational procedures to identify potential excursions. If excursions or leaks are detected, both NRC and WDEQ must be notified within 24 hours. Once an excursion is confirmed by additional sampling, the applicant must implement corrective actions, which involve modifying the injection and recovery rates in the affected area, until the excursion is mitigated. Sampling of the well on excursion will also be increased to every 7 days. A written report describing the excursion event, corrective actions taken, and the corrective action results must be submitted to NRC within 60 days of the excursion confirmation. If an excursion is not corrected within 60 days of its confirmation, the applicant must stop injecting lixiviant into the wellfield until the excursion is retrieved or provide an increase in the surety amount to NRC's satisfaction to cover the projected cost of correcting or cleaning up the excursion (NRC, 1998, 2003).

No changes were made to the SEIS beyond the information provided in this response.

Comment: N013-069
One commenter wanted to know how an impact analysis could be accomplished without specifying what constituents would be injected into the aquifer.

***Response**: The impact analysis is based on known constituents that would be injected into the aquifer. The applicant has stated that the lixiviant will be composed of varying concentrations and combinations of sodium carbonate, sodium bicarbonate, oxygen, and carbon dioxide added*

to native groundwater. NRC staff notes this composition of lixiviant with oxygen has been used in ISR operations in Wyoming for many years.

A small amount of chlorine or sodium hypochlorite may be added to the injection solution to prevent bacterial plugging of the injection wells. Carbon dioxide is added to adjust pH and to provide another source of the carbonate-bicarbonate ions. Sodium carbonate and sodium bicarbonate may be used to adjust the carbonate-bicarbonate concentration. SEIS Section 2.2.1.3.1.1 describes the lixiviant chemistry and the expected impacts from lixiviant use. No changes were made to the SEIS beyond the information provided in this response.

Comment: N013-070
One commenter mentioned the SEIS stated hydrochloric acid or other chemicals may be added to the lixiviant mix and wanted to know where the impact analysis was for the use of these chemicals.

Response*: Although hydrochloric acid and other controlled chemicals are used in the ISR production process, they are not used in the alkaline carbonate/bicarbonate groundwater lixiviant solution planned for injection into the ore-bearing aquifers at the proposed Nichols Ranch ISR Project. The applicant proposes to inject a lixiviant solution similar to that discussed in GEIS Section 2.4.1.1 (NRC, 2009a). It will be composed of varying concentrations and combinations of sodium carbonate, sodium bicarbonate, oxygen, and carbon dioxide added to native groundwater. The applicant has not indicated that it would use hydrochloric acid in the lixiviant to be injected. The addition of hydrogen chloride (HCl) or any change in the type of chemicals used in the lixiviant to be injected would require the licensee to convene its Safety and Environmental Review Panel (SERP) to conduct an assessment of the possible adverse impact of this action. If the SERP finds an adverse impact is possible, the licensee would be required to submit a license amendment to NRC for review and approval. NRC staff reviews all SERP decisions to ensure the SERP review process is being implemented correctly. SEIS Section 2.2.1.3.1.1 was revised to clarify the actual lixiviant chemistry.*

Comment: N015-036
One commenter stated the SEIS description of previous excursions at ISR facilities is not adequate and should be expanded to include adequate detail about the cause of these excursions and a thorough analysis of the potential impacts to SDWA-protected aquifers outside the exempted uranium recovery zone and on groundwater restoration estimates.

Response*: Excursions at ISRs may be caused by an imbalance in the injection and production rates in the production aquifer that enables fluids to move away from the production zone, causes leaks in well casing, and causes leakage through overlying and underlying aquitards. To detect an excursion outside the production zone or to overlying and underlying aquifers, the licensee is required to use a monitoring well ring around the production aquifer and monitoring wells in the overlying and underlying aquifer. These monitoring wells are sampled biweekly for excursion parameters. If an excursion is detected and confirmed by sampling, corrective actions must be taken to retrieve the excursion; these involve modifying the injection and recovery rates in the affected area until the excursion is mitigated. Sampling of the well on excursion will also be increased to every 7 days. A written report describing the excursion event, corrective actions taken, and the corrective action results must be submitted to NRC within 60 days of the excursion confirmation. If an excursion is not corrected within 60 days of its confirmation, the licensee must stop injecting lixiviant into the wellfield until the excursion is retrieved or provide an increase in the surety amount to NRC's satisfaction to cover the projected cost of correcting or cleaning up the excursion (NRC, 1998, 2003).*

Potential impacts to nonexempted portions of production aquifers and surrounding aquifers at the ISR site would depend on the frequency and longevity of excursions, if they were to occur. The applicant must establish and maintain groundwater monitoring programs for early detection of vertical and horizontal excursions, have procedures to analyze excursions, determine how to control and remediate excursions to ensure public health and safety, and report excursions to NRC during operation, restoration, and postrestoration periods [GEIS (NRC, 2009a) Section 2.4.1.4; NUREG–1569 (NRC, 2003) Section 5.7.8.3]. The applicant is required to establish an excursion monitoring system and corrective action plans in compliance with 10 CFR Part 40, Appendix, A Criterion 7A; 40 CFR 144.54; and 40 CFR 144.55.

As noted in NUREG–1910, the applicant would acquire more geologic and hydrogeological information during construction and operations to determine the location for production, injection, and monitoring wells at the wellfields on the proposed site. Once the exact location of production, injection, and monitoring wells is finalized and additional hydrogeological data are acquired, more site-specific assessments of the potential impact from excursions on groundwater resources can be made. However, at the time the SEIS was prepared, the applicant had not finalized the wellfield designs that would require WDEQ approval.

GEIS Section 2.11 discusses historical operation of ISR uranium milling facilities, which includes a discussion of excursions in Section 2.11.4. In addition, NRC staff evaluated groundwater impacts from three previously licensed ISR uranium recovery sites in 2009, in response to direction from the Commission (NRC, 2009c). The staff acknowledged that certain parameters can require a long time to reach preextraction concentration levels and that in most cases excursions were reported and controlled. The staff concluded that in all cases there was no threat posed to human health or to the surrounding aquifers.

Excursions from the exempted aquifer that migrate into nonexempted aquifers would result in an environmental impact during ISR operations and restoration. The impact would be SMALL if the excursions are temporary and recoverable. The applicant would establish and maintain excursion monitoring, control, and remediation (corrective action) programs at the ISR site.

With respect to restoration cost estimates for excursions, the applicant is required to return groundwater quality in the exempted production aquifer to the NRC-approved restoration standards in compliance with 10 CFR Part 40, Appendix A, Table 5C. The applicant is required to provide financial sureties, as part of license application, to cover costs associated with restoration and remediation at the ISR facility, in compliance with 10 CFR Part 40, Appendix A, Criterion 9. NRC reviews financial sureties annually and additional costs associated with potential restoration delays due to excursions are covered by revised financial sureties, which require NRC approval. Additional information on financial sureties is provided in Section B.5.15 of this appendix, and Section 2.2.1.8 of the final SEIS, discussing financial surety, was revised in response to public comments.

Comment: 018-032
One commenter requested the SEIS reiterate that WDEQ is to be notified of any spills or releases of chemicals or petroleum products and explain how soils, groundwater, and surface water impacted by any such spills or releases would be restored.

***Response**: NRC agrees that spills or releases of chemicals or petroleum products into the waters of Wyoming or that threaten to enter the waters of Wyoming must be reported to WDEQ. The SEIS surface water and groundwater impact sections have been modified to reiterate the WDEQ notification requirements.*

If a spill occurred in the wellfield or process plants, mitigative measures would be taken to contain the spill and to mitigate potential impacts on the environment. Proper notification of plant and corporate management would be made, along with properly contacting NRC and WDEQ if applicable, as described in the Section 3.5 of the application. Spills would be most likely to occur from leaking pipelines and fittings. If a pipeline leak or spill occurred in the plants, the spill or leak would be contained within the building with all spilled material draining to the plant sump where it would either be pumped back into the process circuit or sent to the deep disposal well. The plants at both the Nichols Ranch and Hank Units will have a concrete foundation with concrete curbed side walls. The height of the concrete side walls would be such that the curbed foundation would contain from 3 to 5 times the volume of the largest tank in the unit and would contain flow from a ruptured pipeline long enough for the automatic shutdown system to engage.

Wellfield spills would be contained using methods that are (i) developed for process flow alarm responses, automatic shutdowns, and corrective action for such events; and (ii) documented in standard operating procedures. The spill area would be surveyed to identify any contaminated soil; any identified contaminated soil would be removed for disposal according to NRC and WDEQ regulations. If process vessels or tanks that contain or have contained radioactive materials have to be entered for any reason such as cleaning, inspection, or repairs, a radiation work permit would be issued that detailed special air sampling, protective equipment, and increased exposure surveillance requirements.

B.5.20.3 Aquifer Restoration and Decommissioning: Methods and Operational Experience

Comment: N015-031
One commenter stated the SEIS does not evaluate the potential effects that nonattainment of baseline groundwater restoration would have on surrounding USDWs.

Response*: The licensee must restore all groundwater to the groundwater protection standards listed in 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards state the concentration of a hazardous constituent must not exceed (i) the Commission-approved background concentration of that constituent in groundwater, (ii) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed, or (iii) an alternative concentration limit established by the Commission.*

An ACL does indicate that baseline water quality was not achieved during restoration. However, an ACL is considered protective of surrounding USDWs because of the stringent requirements to request and receive NRC approval for an ACL, which are described in 10 CFR Part 40, Appendix A, Criterion 5B(6). An ACL is not a primary restoration goal and will only be considered after a licensee has demonstrated that primary restoration goals are not practically achievable at a specific site. Only ACLs that present no significant hazard may be proposed by the licensees for Commission consideration. The Commission may establish a site-specific ACL for a hazardous constituent as provided in Criterion 5B(5) if it finds that (i) the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and (ii) the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. NRC requirements for application, review, and establishment of a site-specific ACL are discussed in Appendix C. In addition, ACL application review procedures for NRC staff are available in the following documents: January 1996 Staff Technical Position: Alternate Concentration Limits for Title II Uranium Mills;

NUREG–1620; and NUREG–1724, Standard Review Plan for the Review of DOE Plans for Achieving Regulatory Compliance at Sites With Contaminated Ground Water Under Title I of the Uranium Mill Tailings Radiation Control Act.

In summary, the licensee is required to restore groundwater quality in the exempted portion of the aquifer to one of the aforementioned NRC-approved groundwater quality standards, which must be shown not to compromise public health and safety or impact USDWs.

Because the SEIS discussion is considered appropriate, no changes were made to the SEIS beyond the information provided in this response.

Comment: N015-033
One commenter stated the SEIS should evaluate whether the 6-month postrestoration stability period for this proposed action is sufficient to achieve baseline values or MCLs and prevent any long-term contaminant remobilization.

***Response**: In response to comments from WDEQ and NRC staff, the applicant extended the length of the stability monitoring program to 1 year, which will include four sampling events on a quarterly basis (Uranerz, 2010). SEIS Section 2.1.1.1.4.4 was updated in response to this comment.*

Comment: N020-014
One commenter stated the SEIS should include an analysis of the potential impacts of delaying aquifer restoration because the deep disposal well capacity is insufficient to meet the disposal needs.

***Response**: The draft SEIS was based on the applicant's initial proposal that it would apply for a permit to drill two deep disposal wells After the DSEIS was published, in response to comments raised by the NRC staff conducting the safety review, the applicant provided additional information (Uranerz, 2010) to further support it proposal that two wells would be sufficient to support planned activities. The applicant also committed to providing additional storage capacity in the event one or both wells became inoperable, and it provided contingency plans and supporting analyses that evaluated potential impacts to the aquifer if the facility needed to be temporarily shut down. While the applicant's capacity estimates and contingency measures were still based on its initial commitment to drill two deep disposal wells, its most recent plans have indicated it is applying for a permit to drill as many as four deep disposal wells at each unit and has committed to use these additional permitted wells if additional capacity is needed. NRC will require by license condition that the applicant maintain adequate disposal capacity.*

B.5.20.4 Miscellaneous Groundwater Comments

Comment: N018-013
A commenter noted that the State of Wyoming Constitution gives control of the "waters of the State," both surface and ground, to the State Engineer and that water any projects used would be required to obtain the necessary permits (GEIS Sections 3.2.4 and 3.3.4).

***Response**: This comment relates to information provided in GEIS Sections 3.2.4 and 3.2.5. The text in these sections states that water resources are described in terms of surface waters, wetlands, "Waters of the United States," and groundwater. The commenter noted that the State of Wyoming has jurisdictional control over the waters of the state. The final SEIS, Section 1.6.2,*

Table 1-2, identifies required environmental approvals and their status for the proposed Nichols Ranch ISR Project including permits related to both surface water and groundwater.

No changes were made to the SEIS beyond the information provided in this response.

B.5.20.5 References

10 CFR Part 40. Appendix A *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

40 CFR Part 144. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 144, "Underground Injection Control Program." Washington, DC: U.S. Government Printing Office.

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 146 "Underground Injection Control Program: Criteria and Standards." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009a.

NRC. Regulatory Information Summary (RIS) 09-05, Uranium Recovery Policy Regarding: (1) The Process For Scheduling Licensing Reviews of Applications For New Uranium Recovery Facilities And (2) The Restoration Of Groundwater At Licensed Uranium *In-Situ* Recovery Facilities. ADAMS No. ML083510622. April 29, 2009b.

NRC. "Memorandum from C. Miller to Chairman Jaczko, et al. "Staff Assessment of Groundwater Impacts from Previously Licensed *In-Situ* Uranium Recovery Facilities." ML091770402. Washington, DC: NRC. July 10, 2009c.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. Washington, DC: NRC. ADAMS No. ML032250177. June 2003.

NRC. "Environmental Assessment for Renewal of Source Material License No. SUA–1534. Crow Butte Resources Incorporated Crow Butte Uranium Project Dawes County, Nebraska." Docket No. 40-8943. Washington, DC: NRC. February 1998.

Uranerz. Letter from M. Thomas, Environmental, Safety, and Health Manager, Uranerz Energy Corporation, to R. Linton, Project Manager, U.S. Nuclear Regulatory Commission. Subject: Responses to the Open Issues to the Safety Evaluation Report for the Nichols Ranch ISR Project License Application. ADAMS No. ML100740134. February 24, 2010.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. Accession Nos. ML080080594. ML083230892. ML091000572. ML090850289. ML090850370. ML090970719. ML090850597. ML090840186. ML090820583. ML091610148. November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, and May 2009. Casper, Wyoming. 2007.

B.5.21 Surface Water Resources

B.5.21.1 Surface Water Resources and Ecology

Comment: N018-084
One commenter agreed with the SEIS conclusion of minimal impact to aquatic resources. The commenter stated the rationale for this conclusion was that the proposed mitigation measures, compliance with applicable regulations and permits, and use of BMPs should reduce construction and operation impacts to surface waters.

***Response**: NRC acknowledges this comment. Due to the general nature of the comment, no changes were made to the SEIS.*

B.5.21.2 Impacts to Surface Drainages and Surface Water

Comments: N013-057; N011-062
One commenter noted NRC did not address how livestock grazing would impact surface water contamination and erosion and how livestock may be affected by the ISR project. The commenter asserts the impact analysis related to this issue must be improved in the final SEIS.

***Response**: Impact to surface water resources due to livestock grazing (erosion or surface water contamination) are expected to be insignificant for ISR-related activities during construction, operations, and restoration because surface water flow in the channels is ephemeral and there will be no permitted process discharges associated with the Nichols Ranch ISR facility. The potential impact on livestock grazing is also expected to be SMALL since only a small area (24 to 32 ha [60 to 80 ac]) of the facility would be fenced to grazing at any given time over the life of the project as discussed in SEIS Section 4.2.1.*

Spills or discharge to surface water features during construction, operations, and restoration that may have a direct or indirect impact on livestock are regulated by NRC and under a WDEQ WYPDES permit. The applicant is required to obtain the WYPDES permit from WDEQ if any discharges to surface water are expected before ISR operations begin. Section 5.5.1 of the SEIS was revised in response to this comment.

Comment: N013-028
One commenter stated that water quality impacts related to CBM discharges in ephemeral drainages should be included in the analyses of impacts of uranium wells in the same ephemeral drainages.

***Response**: The potential for surface water quality impacts related to CBM discharges was considered in both the safety and environmental review of the proposed Nichols Ranch ISR Project. In response to NRC RAIs regarding CBM water discharges, the applicant stated the Hank and Nichols Ranch Units have not been impacted by CBM-produced water discharges because there has not been any surface discharge in the Hank Unit area and only one surface discharge has occurred in the western edge (a downgradient location) of the Nichols Ranch Unit prior to any baseline activities. The applicant has stated that no CBM discharge to ephemeral drainages in either the Nichols Ranch Unit or the Hank Unit has or will be permitted by WDEQ in the wellfield areas. At the Hank Unit, no surface discharge would occur because the CBM operator is removing the CBM produced water, transferring it to a large storage tank, then pumping it to a location some 56 km [35 mi] from the proposed Nichols Ranch ISR Project.*

Therefore, no impacts are expected to the surface or surficial aquifer groundwater quality from CBM discharges in the wellfield.

Currently, WDEQ will only issue WYPDES-permits for discharge of CBM water in the proposed Nichols Ranch ISR Project area to non-discharging impoundments, not directly to the ephemeral channels. WDEQ also requires CBM water end-of-pipe effluent concentrations entering these impoundments to meet downstream irrigation standards. Discharge from the WYPDES impoundments is permitted only during significant runoff events where the produced water is diluted by natural runoff. Any discharge beyond overtopping during heavy precipitation constitutes a violation of the WYPDES permits. Uranerz has agreed to notify NRC if WYPDES permitted CBM water impoundments such as ponds or basins are installed in or within 402 m [¼ mi] of the Hank Unit. Currently, only one additional CBM water impoundment is planned inside the proposed Nichols Ranch Unit license area. This impoundment has not yet received any CBM-produced water.

Based on the WDEQ WYPDES permit requirements and the necessity to maintain available freeboard in the impoundments, impacts from CBM-produced water on surface drainages are not expected. Uranerz, however, will monitor surface water quality during operations. Uranerz has three surface water self-samplers in place: one at the Hank Unit and two at the Nichols Ranch Unit. Additionally, surface water sampling would be conducted whenever surface water is present, including any areas where CBM-produced water may be discharged to the surface. Because the SEIS discussion is considered appropriate, no changes were made to the SEIS beyond the information provided in this response.

Comments: N013-057; N013-058; N013-059; N013-060; N013-061; N018-024; N018-025; N018-026; N018-027

One commenter stated surface water impacts to ephemeral drainages are of particular concern to their organization because some of their members live downstream from the proposed project. The commenter stated locating wells within an ephemeral drainage presents unique challenges with regard to spills, leaks, and erosion, and serious risks to water quality and soil ecology. The commenter requested the SEIS describe the impacts associated with locating wells with ephemeral drainage and describe how a spill within an ephemeral drainage would be cleaned up. The commenter asserted the impact analysis related to this issue must be improved in the final SEIS. Another commenter noted that wells placed in an ephemeral channel may lead to increased erosion (with or without protective structures), increased risk of breached structures, and potentials for releases of processed fluids to ephemeral channels. The commenter also pointed out that runoff and erosion from roads, culverts, and ephemeral channels could cause accelerated channel alterations.

***Response**: As discussed in SEIS Section 4.5.1, Uranerz noted its well construction plan construct would avoid channels and washes when possible; however, avoidance would not always be possible due to the nature of the land surface immediately above the ore bodies. In responses (March 2009 and February 2010) to NRC requests for additional information (RAIs) and open issues, Uranerz recognized that the magnitude of the peak flows and velocities for the tributaries that cross the wellfields in the proposed Nichols Ranch Unit license area may present an erosion risk to the site and damage wellfield infrastructure. Uranerz proposed to minimize damage from erosion and to wellfield infrastructure from peak flow events by avoiding well installation in the ephemeral drainages. Uranerz stated if it is necessary to install such wells, appropriate erosion protection controls would be applied to minimize damage to the drainage. Such controls would include grading and contouring, culvert installation, low-water crossings constructed of stone, water contour bars, and designated traffic routes.*

If wells are to be placed near or within a stream, Uranerz would use appropriate well and wellhead protection (Uranerz, 2007). Such protection measures would include installing the well within high water marks or installing adequate structural wellhead protection, such as cement blocks, protective steel casings, and other measures, to protect the wells during potential flood conditions. Uranerz would use best management practices such as rip rap and rock to protect embankments, culverts, and drainage crossings in accordance with WDEQ-LQD Rules and Regulations Chapter 3. In responses to NRC open issues dated February 2010, Uranerz stated that these practices would also be applied to any wells or infrastructure to be located in the 25-year floodplain of Cottonwood Creek at the proposed Nichols Ranch Unit and for the 25-year floodplain for Dry Willow Creek at the Hank Unit.

Also as discussed in SEIS Section 4.5.1, Uranerz would mitigate potential spills of petrochemicals such as oil and gasoline by conducting routine vehicle maintenance and inspection. Uranerz would also develop and implement an emergency response plan to minimize the risk of chemicals being introduced to waterways. The applicant stated that the Nichols Ranch Unit central processing plant and Hank Unit satellite facility would be constructed on concrete slabs with a protective berm erected around the perimeter to limit the potential for any chemical spill to escape the area. Although the operational facilities are located away from surface water, inadvertent spills, leaks, and other discharges could potentially affect surface water during operations. Spills of either petroleum products or hazardous chemicals into surface waters would be reported to WDEQ. The applicant would also train personnel in proper handling and transport of hazardous materials to avoid spills. As part of the monitoring program proposed in the license application and described in Section 6.2.4, Uranerz would monitor the surface water quality quarterly at the same locations sampled for the preoperational baseline (Section 3.5.1.4), if surface water is present. The application includes surface water sampling of locations upstream and downstream the proposed ISR operations at both the Nichols Ranch and Hank Units.

The applicant would use diversion ditches and culverts to prevent excessive erosion and control runoff (Uranerz, 2007, Section 5.4). In areas where runoff is concentrated, the applicant committed to use energy dissipaters to slow the flow of runoff to minimize erosion and sediment loading in the runoff. The applicant would implement BMPs to reduce erosion impacts in accordance with storm water management plans developed as part of NPDES permits. The applicant is committed to implementing soil erosion mitigation in accordance with WDEQ Rules and Regulations, Chapter 3, Environmental Protection Performance Standards. The applicant is also committed to (i) constructing roads to minimize erosion through practices such as surfacing with a gravel road base; (ii) constructing stream crossings at right angles with adequate embankment protection and culvert installation; and (iii) providing adequate road drainage with runoff control structures and revegetation (Uranerz, 2007, Section 5.3).

SEIS Section 4.5.1 has been modified to add detail to the description of impacts and mitigation measures associated with potential well construction near and within ephemeral drainages at the proposed Nichols Ranch ISR Project. Section 6.2.4 of the SEIS has been revised to better describe the proposed surface monitoring program by the applicant.

Comment: N020-039
One commenter stated the water pumped from wells during aquifer tests would need to meet regulatory standards for surface water prior to release directly into ephemeral drainages but this was not stated in the SEIS.

***Response**: A WDEQ temporary discharge permit would regulate temporary wastewater discharges from hydrostatic testing of pipes, tanks, or other vessels; construction dewatering; and well pump tests. Well pump tests in uranium-bearing zones would also need to comply with WDEQ monitoring and effluent limits for total radium and uranium. WDEQ also regulates isolated wetlands and associated mitigation measures. Section 4.5.2.1.1 of the SEIS notes that "…some water may be pumped from aquifers for hydrologic tests such as pumping tests. This water should be discharged to the surface in accordance with approved permits from the State of Wyoming that Uranerz would obtain prior to any release." Table 1-2 of the final SEIS lists the permit status at the site. Section 4.5.2.1.1 has been modified to clarify that appropriate permits are required for all surface discharges, including those in ephemeral drainages.*

B.5.21.3 Wetlands

Comment: N020-024
One commenter stated the draft SEIS does not adequately address jurisdictional determination of wetlands and waters required pursuant to the Clean Water Act (CWA). The commenter stated no approved jurisdictional determination has been completed for the proposed Nichols Ranch ISR Project to determine jurisdiction over water bodies on the site.

***Response**: As described in SEIS Section 3.5.1.5, a survey for potential jurisdictional wetlands and others waters of the United States (WUS) in the vicinity of the proposed Nichols Ranch ISR Project was conducted by TRC Environmental Corporation on behalf of the applicant in 2006. The U.S. Army Corps of Engineers (USACE)-certified wetland delineator identified four potentially jurisdictional wetlands in the southeast portion of the Nichols Ranch Unit and no jurisdictional wetlands on the Hank Unit. Because the wetlands are located outside of the proposed construction area and would be avoided by all phases of the proposed Nichols Ranch ISR Project, the applicant did not pursue an Individual Permit or a Nationwide Permit under Section 404 of the Clean Water Act (CWA). If it is determined in the future that any disturbance to potential jurisdictional wetlands could occur, the applicant would initiate consultation with USACE prior to disturbance to ensure the appropriate permits were obtained.*

In response to this comment, SEIS Sections 3.5.1 and 4.5.1 have been revised to provide more detail on the completed wetlands survey and potential impacts to wetlands.

B.5.21.4 General Water Resource Concerns

Comment: N013-027
One commenter expressed concern with the process WDEQ used to permit discharge water.

***Response**: As described in SEIS Section 1.6.2, WDEQ has regulatory authority over surface discharges and establishes the processes to be used for obtaining the necessary permits. NRC does not have a role in establishing the permitting process. No changes were made to the SEIS in response to this comment.*

Comment: N018-001
One commenter noted the draft SEIS does not contain the most recent hydrological information submitted to WDEQ-LQD, because this information was submitted to WDEQ-LQD after the printing of the draft SEIS.

***Response**: The commenter is correct in that additional hydrological information was made available after the publication of the draft SEIS. Uranerz provided additional information to the*

NRC on February 24, 2010 (Uranerz, 2010), related to open issues in the safety evaluation. This information has been incorporated into the final SEIS hydrology analysis, as appropriate. Based on specific hydrological information WDEQ received from Uranerz, WDEQ has granted the NRC staff permission to view the application information for the proposed Nichols Ranch ISR Project on its secure website for the NRC environmental review. However, no new information from this website was incorporated into the SEIS. The final SEIS Section 3.5.2.3 has been revised to reflect the updated hydrological data discussed previously that has become available since the publication of the draft SEIS.

B.5.21.5 Impacts of Operations and Aquifer Restoration on Surface Water

Comment: N011-027
One commenter stated the SEIS impact analysis does not address the close proximity of surface water sources and wetlands. In addition, this commenter considered this an example where the GEIS (NRC, 2009) promised site-specific analyses and the draft SEIS incorporates the GEIS analyses without providing site-specific analyses.

Response*: SEIS Section 4.5.1 discusses potential impacts to surface water and wetlands impact for the proposed Nichols Ranch ISR Project. As noted in the SEIS, the wetlands are not expected to be impacted, because they lie outside the proposed construction area and would be avoided by all ISR project phases. As stated in the SEIS, the impact analyses focus on the ephemeral channels and washes on and in the vicinity of the site. The SEIS analyses identify that potential impacts to these ephemeral channels and washes can result from road construction, erosion, stormwater runoff, and accidental environmental releases. The SEIS impact analyses address site-specific proposed road construction. Project-specific mitigation and plans for addressing erosion, storm water runoff, and environmental releases are also included in the SEIS analyses. Because the discussion in the SEIS is considered appropriate, no changes were made to the SEIS in response to this comment.*

B.5.21.6 References

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Washington, DC: NRC. May 2009.

Uranerz. Letter from M. Thomas, Environmental, Safety, and Health Manager, Uranerz Energy Corporation, to R. Linton, Project Manager, U.S. Nuclear Regulatory Commission. Subject: Responses to the Open Issues to the Safety Evaluation Report for the Nichols Ranch ISR Project License Application. ML100740134. February 24, 2010.

Uranerz. “Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application,” Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.22 Ecology

B.5.22.1 Concerns About the Sage-Grouse

Comments: N008-004; N013-082
Two commenters noted an incorrect statement in SEIS Section 1.7.3.5 that described the property as part of a larger region of the state dedicated as a "core breeding area" for Greater sage-grouse.

***Response**: NRC agrees with the commenters on the need to clarify the statement regarding sage-grouse breeding areas. The proposed project area lies outside a core breeding area. Current maps created by WGFD and reviewed by the Governor's Sage-Grouse Implementation Team (SGIT) were used to update Figure 3-8 in Section 3.6 of the SEIS.*

Section 1.7.3.5 of the SEIS was revised and clarified in response to these comments.

Comment: N008-015
A commenter, the applicant, noted that because no sage-grouse leks are located within the proposed project area, there would be no need for delays in project activities in accordance with sage-grouse mitigation measures. However, the applicant has committed to minimizing activities as mitigation measures for sage-grouse.

***Response**: While the proposed project is not located within a core population area, no leks are physically located within either of the two units of the proposed Nichols Ranch ISR Project, nine leks are located within 3.2 km [2.0 mi] of their boundaries. Therefore, WGFD and BLM guidelines would still need to be followed.*

On March 5, 2010, FWS published a finding in the Federal Register that listing of the Greater sage-grouse species was warranted, but precluded by higher priority listing actions (75 FR 13909). Effectively, the species has been put on the Federal list of candidate species, which contains plants and animals that are proposed for listing under Endangered Species Act (ESA) Section 4. WGFD revised its Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats in April 2010 (WGFD, 2010) in response to the FWS rule listing the sage-grouse as candidate species. Wyoming BLM issued an instructional memorandum on March 5, 2010, to supplement BLM's previous National Sage-Grouse Habitat Conservation Strategy published in 2004 (BLM, 2004, 2010) also in response to the species' listing as a candidate species. On August 18, 2010, the Governor of Wyoming signed Executive Order (EO) 2010-4, updating the previous EO regarding the protection of sage-grouse, which identifies stipulations regarding development activities within core and noncore areas. The stipulations include applying a 0.4 km [0.25 mi] no surface occupancy measure and a 3.2 km [2.0 mi] seasonal activity buffer around active leks (EO 2010-4). However, NRC is not bound by WGFD recommendations or BLM guidelines and does not have the statutory authority to impose wildlife mitigation measures upon a licensee. The applicant would negotiate mitigative measures with the agency with statutory authority. Section 3.6.3 of the SEIS was revised to provide current information regarding the Greater sage-grouse.

Comment: N012-009
A commenter suggested the discussion of sage-grouse survey activities in SEIS Section 3.6.1.2.2 be revised to describe additional monitoring other Federal and State agencies conducted.

***Response**: NRC staff agrees with this comment. SEIS Section 3.6.1.2.2 was revised to include additional information regarding sage-grouse monitoring BLM and WDEQ conducted.*

Comments: N013-080; N013-083; N013-085; N018-078
Several commenters expressed several concerns regarding potential impacts to Greater sage-grouse and their habitat. Some commenters suggested that NRC provide additional information regarding sage-grouse occurrences in the proposed project areas and recommended the applicant implement certain protective measures. Other commenters would like NRC to ensure the applicant implements mitigation measures.

***Response**: NRC recognizes that sage-grouse are a species of great concern in Wyoming and has consulted with stakeholders as described in Section 1.7.3 of the SEIS. Sections 3.6.3 and 4.6.1.1.3 of the SEIS have been updated since the draft SEIS was published to identify the Greater sage-grouse status as a Federal candidate species. SEIS Section 3.6.3 describes sage-grouse surveys both the applicant and Federal and State agencies conducted; this section was revised to describe the FWS rule listing the sage-grouse as a candidate species, the revised WGFD Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats, and the BLM revised National Sage-Grouse Habitat Conservation Strategy (75 FR 13909; WGFD, 2010; BLM, 2010). SEIS Chapter 4 discusses the potential impacts to sage-grouse including habitat loss and displacement, behavior changes due to human presence, and alteration of plant communities that could support sage-grouse. The applicant Environmental Report Section 3.5.3.3 states that proposed project activities and vehicular traffic will be minimized and there would be limited hours of construction in areas located between 0.4 km and 3.2 km [0.25 mi and 2.0 mi] of an occupied lek on a seasonal basis.*

NRC is not bound by either the WGFD's recommendations or BLM's guidelines and does not have statutory authority to impose wildlife mitigation measures upon a licensee. NRC can enforce mitigation measures in license conditions or in the license application. Mitigative measures would also be negotiated between the applicant and the agency with statutory authority and could be enforced by the appropriate regulatory authority.

Comment: N013-084
One commenter stated that to prevent the listing of sage-grouse on the Endangered Species List, sage-grouse habitat in core areas should be protected and impacts to wildlife must be minimized.

***Response**: As explained in SEIS Section 3.6.3, the proposed Nichols Ranch ISR Project is not located in a core area, which is an area identified by the State of Wyoming as high quality habitat for sage-grouse nesting and brood rearing and necessary to maintain sage-grouse populations. On March 5, 2010, FWS published in the Federal Register a finding that listing of the sage-grouse was warranted, but precluded by higher priority listing actions (75 FR 13909). Effectively, the species has been put on the Federal list of species that are candidates for listing under the Endangered Species Act Section 4.*

Although there are no regulations regarding the protection of the sage-grouse, the WGFD, in cooperation with the Wyoming Governor's Sage Grouse Implementation Team (SGIT), has developed guidelines for various industries operating in different locations within Wyoming. NRC staff has been working with SGIT and its subcommittees to better define the State agency roles with respect to developing guidelines for the ISR uranium recovery industry. In addition, the WGFD recently issued an update to Recommendations for Development of Oil and Gas Resources Within Important Habitats (WGFD, 2010), which contains revised guidelines for sage-grouse protection that would be applied to the uranium extraction industry. These guidelines address (i) standard mitigation practices (for all wildlife); (ii) specific best management practices for sage-grouse; and (iii) stipulations for development in sage-grouse

core areas that WGFD would be monitor. In Section 3.5.3.3. of the Environmental Report (Uranerz, 2007), the applicant has stated that proposed project activities and vehicular traffic will be minimized and there would be limited hours of construction in areas located within 0.4 km and 3.2 km [0.25 mi and 2.0 mi] of an occupied lek on a seasonal basis.

Section 4.6.1.1.3 of the SEIS discusses mitigation measures that the applicant discussed in its license application for the proposed Nichols Ranch ISR Project to limit potential impacts to the Greater sage-grouse; this section was updated to reflect the current State and task force guidelines.

Comments: N017-014; N017-017
One commenter suggested extra care should be taken to protect sage-grouse and its habitat and minimize potential impacts because the commenter had identified 20 leks within 8 km [5 mi] of the proposed Nichols Ranch ISR Project boundary.

***Response**: NRC recognizes that sage-grouse are a species of great concern in Wyoming and has consulted with stakeholders as described in SEIS Section 1.7. SEIS Section 4.6.1.1.3 describes the potential impacts to sage-grouse and discusses the following mitigative measures the applicant commits to implement: (i) minimize or delay project activity and vehicular traffic within 0.15 km [0.25 mi] of active leks between the hours of 8:00 p.m. and 8:00 a.m. during the March 1 to May 15 strutting period; (ii) minimize or delay project activity within 1.6 km [2.0 mi] of active leks between March 15 and July 15; (iii) avoid constructing overhead power lines or high-profile structures within 0.15 km [0.25 mi] of leks to minimize raptor predation; and (iv) minimize removal of vegetation, where possible, and revegetate disturbed areas as soon as practicable following project completion. Section 3.6.3 of the SEIS was revised to acknowledge the FWS rule that listed the sage-grouse as a candidate species, the revised WGFD Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats, the Governor of Wyoming signed EO 2010-4, and the BLM revised National Sage-Grouse Habitat Conservation Strategy (75 FR 13909; WGFD, 2010; BLM, 2010; State of Wyoming, 2010). The WGFD recommendations and Governor's EO suggest that disruptive activities should be prohibited or restricted seasonally from distances of 0.15 km [0.25 km] to 1.6 km [2.0 mi] of an occupied lek located in a noncore area. As shown in SEIS Figure 3-8, the proposed project is not located within 8 km [5 mi] of a sage-grouse core area. NRC is not bound by either the WGFD's recommendations or BLM's guidelines and does not have statutory authority to impose wildlife mitigation measures upon a licensee. NRC can enforce mitigation measures in license conditions or in the license application. Mitigative measures would also be negotiated between the applicant and the agency with statutory authority and could be enforced by the appropriate regulatory agency.*

Comment: N013-093
One commenter noted that they provided comments on the GEIS (NRC, 2009) related to impacts on sage-grouse from CBM operations, and these studies should be considered as applicable to ISR uranium recovery facilities.

***Response**: SEIS Section 4.6.1 discusses of potential impacts to sage-grouse populations. Several developments have occurred with regard to sage-grouse since the publication of the draft SEIS in December 2009. The SEIS, including Section 5.6 covering potential cumulative impacts to sage-grouse habitat and populations, was updated with respect to these developments.*

B.5.22.2 General Comments on Threatened and Endangered Species

Comment: N007-003
One commenter noted FWS plans to reopen the comment period on the proposed rule to list the mountain plover as a threatened species and that the ESA requires Federal agencies to confer with the FWS on any action that is likely to jeopardize the continued existence of any species proposed for listing.

***Response**: The mountain plover is known to occur throughout the State of Wyoming; however, it was not observed within the proposed project area during the baseline wildlife surveys Uranerz conducted. As noted in Section 3.5.3.3 of the 2007 Uranerz Environmental Report (Uranerz, 2007), no mountain plovers were seen during the two surveys or during opportunistic observations from April through July 2006. In addition, there are no BLM or Wyoming Natural Diversity Database (WYNDD) records that suggest mountain plovers exist within the proposed project area. The closest reported BLM sighting of mountain plover is approximately 6.4 km [4.0 mi] from the proposed project area. Environmental Report Section 3.5.3.3 states that the closest reported BLM sighting of mountain plover as of 2006 was approximately 6.4 km [4.0 mi] from the proposed project area (Uranerz, 2007). NRC staff confirmed that although mountain plovers are known to reside in the area of the proposed site, no confirmed or unconfirmed observations have been recorded at the proposed site (WYNDD, 2010). SEIS Sections 3.6.3 and 4.6.1.1.3 were updated to reflect this information. Based on currently available information, NRC staff expects that the proposed Nichols Ranch ISR Project would have a SMALL impact to mountain plovers. Section 6.3.1 of the Environmental Report states Uranerz will conduct annual wildlife monitoring at the proposed project site (Uranerz, 2007), including annual raptor and sage-grouse surveys between late April and early May, which is also the breeding season for the mountain plover. The mountain plover is protected by the Migratory Bird Treaty Act (MBTA), which prohibits direct mortality and the destruction of active nests. Should mountain plovers or plover nests be observed, Uranerz would consult with FWS and would obtain any applicable permits from the appropriate agencies.*

Comment: N008-002
The applicant stated that the FWS has determined that the proposed Nichols Ranch ISR Project area has been block-cleared for the black footed ferret, and therefore the proposed action would have no effect on black-footed ferrets.

***Response**: SEIS Section 3.6.3 clarifies that no black-footed ferrets have been identified on the proposed Nichols Ranch ISR Project site and that the FWS relieved the requirement, or "block cleared," black-footed ferret surveys from being conducted in black-tailed prairie dog habitat within the State of Wyoming. However, this block clearance does not relieve Federal agencies of the need to assess a proposed action's effect on the species' survival and recovery. SEIS Section 4.6 concludes that overall, impacts to protected species from construction activities are anticipated to be SMALL. Because the block-cleared status does not automatically mean there would be no impacts and the SEIS discussion is appropriate, no changes to the SEIS were made in response to this comment.*

B.5.22.3 Concerns About Mitigation and Timing

Comment: N007-004
One commenter encouraged NRC and project planners to develop and implement protective measures should mountain plovers occur within the proposed project area and provided a list of potential protective measures.

***Response**: The mountain plover is known to occur throughout the State of Wyoming but has not been observed within the proposed Nichols Ranch ISR Project area. Should mountain plovers or plover nests be observed within the proposed Nichols Ranch ISR Project area, Uranerz would consult with FWS, develop and implement protective measures, and would obtain any applicable permits from the appropriate agencies. Because mountain plovers are not a concern for the Nichols Ranch ISR Project at this time, no changes were made to the SEIS.*

Comment: N007-008
One commenter recommended a wildlife protection mitigation strategy that mud pits be fenced on three sides while drilling is underway and the fourth side be fenced after the rig is moved until the mud pit is reclaimed.

***Response**: The commenter was focusing on text in Section 2.1.1.2.4.4 of the draft SEIS that dealt with the general construction of mud pits during wellfield construction. Specific use of fencing is not discussed in this section. However, it is described in the Executive Summary under Ecological Resources in final SEIS Section 4.6.1.2. Section 4.7.1.2.1.1 of the Environmental Report states that mitigation plans such as speed limits and fencing will help reduce big game conflicts associated with the proposed Nichols Ranch ISR Project. WGFD specifies fencing construction techniques to minimize impediments to big game movement. Because the SEIS states fencing techniques would be implemented as WGFD specified, no changes were made to the SEIS beyond the information provided in this response.*

Comment: N007-013
One commenter suggested electrical lines from power drops to the individual wells should be buried to mitigate wildlife impacts.

***Response**: Although NRC recognizes that burying additional electrical lines could mitigate environmental impacts, NRC cannot require additional electrical lines to be buried unless it falls under NRC's statutory authority to regulate AEA radioactive materials or activities, to protect public health and safety and common defense and security at a site. BMPs, mitigation measures, and management actions that avoid or reduce environmental impacts can be included in the license application or as license conditions on the NRC license; however, NRC can only impose license conditions within the limits of the authority Congress granted related to protecting public health and safety from radiological hazards and common defense and security. As stated in Section 4.10.1.1.2, electrical lines within 1.6 km [1.0 mi] of the base of the Pumpkin Buttes TCP) would be buried in accordance with the PA between BLM and the WY SHPO to mitigate adverse effects to the Pumpkin Buttes TCP. This requirement would be imposed upon the proposed Nichols Ranch ISR Project (specifically at the Hank Unit) as a requirement of applicable permits obtained from the BLM. NRC will not impose license conditions to require burial of electrical lines on the Nichols Ranch Unit which is not subject to the BLM PA. No changes were made to the SEIS beyond the information provided in this response.*

Comment: N008-014
The applicant stated the noxious weed mitigation measures of applying herbicides and washing vehicles would be performed on an as-needed basis.

***Response**: NRC staff acknowledges the need to clarify the SEIS statement regarding applying herbicides and washing vehicles on an as-needed basis. In response to this comment, SEIS Section 4.6.1.1.1 was revised accordingly.*

Comments: N018-079; N018-080; N018-081; N018-082
One commenter recommended the applicant conduct additional wildlife surveys prior to new disturbance, conduct winter bald eagle and raptor nest surveys, review BLM and/or FWS raptor nest records, and avoid raptor nests during restricted time periods.

***Response**: As discussed in response to comment N007-0011, raptor nest inventories and three specific bald eagle winter roost site surveys were conducted for the proposed project. In addition, NRC staff reviewed the BLM Environmental Assessment for Yates Petroleum Corporation, All Day Plan of Development (BLM, 2008) and has incorporated information from that EA into the final SEIS. Section 6.3.1 of the Environmental Report, states that Uranerz would follow an annual raptor monitoring and mitigative plan to minimize conflicts between active nest sites and proposed project-related activities. Section 6.4.2 of the SEIS explains that the planned wildlife monitoring would be conducted during the proposed project. In the unlikely event that Uranerz determines it necessary to disturb a raptor nest, Uranerz would develop a mitigation plan and consult with WDEQ, the Wyoming Game and Fish Department (WGFD), and the FWS. At that time, Uranerz would obtain any applicable permits from the appropriate agencies. The applicant has agreed to implement mitigative measures to protect Greater sage-grouse leks, which would also benefit raptor nests.*

Other permitting agencies with statutory authority may require additional surveys and information. NRC's statutory authority is limited, so it can only require the licensee to implement the commitments it makes as part of the license application or license. Because this response provides information that is considered sufficient to address some comments and the remaining comments extend beyond NRC regulatory authority, no changes were made to the SEIS beyond the information provided in this response.

B.5.22.4 Habitat Loss and Fragmentation

Comment: N013-081
One commenter requested NRC discuss potential impacts to wildlife and provide enforceable mitigation measures.

***Response**: SEIS Section 4.6 discusses the potential impacts to wildlife from the proposed project during each phase of the ISR process. NRC also discusses possible mitigation measures in the SEIS and GEIS (NRC, 2009). NRC can impose site-specific license conditions for the proposed Nichols Ranch ISR Project, but only within the limits of the legislative authority granted by Congress. As a result of this limited authority, NRC can only require a licensee to implement the wildlife mitigation measures or other commitments it makes as part of its license application or license. State and other Federal agencies would also establish permit conditions for the proposed Nichols Ranch ISR Project based upon their statutory and regulatory authority. WGFD has the lead for the protection of wildlife in Wyoming. To obtain permits, the applicant may be required to consult with the appropriate agencies, or be required to develop a mitigation plan.*

NRC believes that the wildlife analyses are supported by sufficient technical bases. Because the SEIS discussion is considered appropriate, no changes were made to the SEIS beyond the information provided in this response.

Comments: N013-087; N013-088; N013-089; N013-090; N018-076
One commenter expressed concerns regarding landscape-related impacts to habitat for sage-grouse. Specifically, the commenter is concerned about the length of time required (decades) for sagebrush vegetation to be reclaimed, the lack of sagebrush seed in the seed mixtures used for revegetation, and the spread of weeds (as a result of land development) that would inhibit the reestablishment of sagebrush. Another commenter suggested that the removal of sagebrush would reduce forage for pronghorn and deer and that restoration projects should strive to restore sagebrush and native plant species.

***Response**: NRC explains in SEIS Section 4.6 that the proposed project construction and operations would result in disturbing 121 ha [300 ac] of land, incrementally, for up to 10 years through the life of the proposed ISR facility. SEIS Section 4.6 also discusses the potential vegetation impacts and increased potential for nonnative plant species and describes revegetation of native grasses and plants that would occur during the decommissioning stage.*

NRC acknowledges that in arid environments, natural revegetation could take many years and certain vegetative communities, such as sagebrush, could be difficult to reestablish through artificial plantings. However, temporary and permanent revegetation by the applicant in a phased (sequential) schedule would increase the rate at which an area is able to recover from disturbance. Section 2.2.1.5.5 describes revegetation practices to be conducted in accordance with WDEQ-LQD regulations. As stated in Section 4.6.1.1.1, the applicant has committed to mitigation measures, including vehicle washing and herbicide application, as necessary, to control the introduction and spread of noxious weeds (Uranerz, 2007). For the revegetation plan, NRC recognizes that sagebrush is not included in the applicant's proposed seed mixture as described in SEIS Section 2.2.1.5.5; however, WDEQ-LQD and the private landowners approve the seed mixtures of native plants and grasses, which may vary in species composition. At the time of decommissioning, the applicant would submit an updated reclamation plan for approval, following review and approval by appropriate State and Federal agencies. Further, as stated in SEIS Section 2.2.1.5.5, WDEQ-LQD has the authority to determine the final revegetation for all the land within the proposed project area. Overall, the applicant's plan for revegetation with native plants would increase the rate at which a disturbed area is returned to a state similar to preconstruction, and this would help to restore wildlife forage to the proposed project area. Finally, SEIS Section 4.6.1.1.1.2 concludes that the impacts on sage-grouse and big game as a result of habitat loss would be small, because the disturbed habitat acreage would be SMALL (in comparison to the habitat needs of big game) and any disturbed habitat would be revegetated (to lessen impacts on smaller wildlife, such as sage-grouse).

The staff made minor changes to the text in Sections 2.2.1.5.5 and 4.6.1.1.1 to clarify the nature of the revegetation seed mixtures (native plants) and emphasize the phased nature of revegetation.

B.5.22.5 Comments on Migratory Birds

Comment: N007-011
One commenter identified several issues concerning bald eagles. This commenter disagreed with the SEIS statement that nests do not occur onsite, provided different information

concerning the intensity of roost surveys, and identified several documented occurrences of eagle roosts in the area.

***Response**: As stated in Section 3.6.1.2.3 of the draft SEIS, raptor nest inventories were conducted in April and May 2006 to determine the presence of raptor nests within the proposed project area (i.e., within permit boundaries of the Hank and Nichols Ranch Units). Follow-up productivity surveys for nests determined to be active were conducted in June 2006. One active golden eagle (Aquila chrysaetos) nest was observed in a cottonwood tree within the Nichols Ranch Unit during these Uranerz wildlife surveys.*

Additionally, in January and February 2007, three specific bald eagle winter roost site surveys were conducted, which included land within a 0.6-km [1-mi] radius of the proposed Nichols Ranch ISR Project site {i.e., 0.6-km [1-mi] from the permit boundaries of the Hank and Nichols Ranch Units}. As a result of these roost surveys, no communal roosts were identified on the proposed Nichols Ranch ISR Project site. However, several bald eagles (Haliaeetus leucocephalus) exhibited an affinity for certain areas adjacent to the proposed project area during the survey. One adult bald eagle was observed perched in a cottonwood tree along Dry Willow Creek, just north of the Hank Unit, during two of the three winter surveys. The Environmental Report (Uranerz, 2007) also describes bald eagles observed flying over or in the vicinity of the Nichols Ranch Unit during two of the three winter surveys.

Information the commenter cited indicates the presence of bald eagle roosts within the Hank Unit that BLM recorded after the Uranerz surveys were conducted. NRC staff reviewed BLM (2008) the commenter referenced. According to the information provided in this EA, potential bald eagle roosts have been recorded that are within the Hank Unit, specifically near the southeast corner of the Hank Unit. SEIS Section 3.6.3 was revised to include this additional information on eagle roosts and nests.

B.5.22.6 General Vegetation Comments

Comment: N008-013
The applicant stated that no woodlands are present within the proposed license boundaries of either the Nichols Ranch or Hank Units. This was in response to a statement in SEIS Section 4.6.1.1.1.1 that the clearing of wooded lands may have long-term impacts.

***Response**: As explained in SEIS Section 4.6.1.1.1.1, NRC staff described the potential impacts as analyzed in the GEIS (NRC, 2009) as a starting point to analyze site-specific conditions. The SEIS statement regarding wooded lands, not woodlands, is part of the discussion describing the GEIS conclusions for potential impacts to vegetation during the construction phase. SEIS Section 3.6.1 describes the vegetation at the proposed project including trees and shrubs, which are woody plants. The description of wooded land is generic and does not specify the type or density of woody plants that may be present. Because this SEIS statement remains valid in the context of the description of potential vegetation impacts, no changes were made to the SEIS in response to the comment.*

B.5.22.7 Traffic and Noise Impacts

Comment: N013-092
One commenter stated NRC failed to assess potential to wildlife impacts from diesel generator noise.

***Response**: SEIS Section 4.6 discusses potential wildlife impacts from noise (including generator noise), which may cause habitat avoidance, reduced breeding efficiency, and possible alteration of wildlife habitats because of animals' reactions. SEIS Section 4.8 discusses potential environmental noise impacts at the Nichols Ranch ISR Project.*

For example, the seasonal noise guidelines WGFD developed (WGFD, 2010) were identified as a means to mitigate the potential impact to wildlife, as discussed in Section 4.6.1.1.3 of the final SEIS. Though specific types of disturbance and magnitude of disturbance varies between oil and gas development and ISR uranium milling, the WGFD guidelines that provide seasonal distance buffers for noise, vehicular traffic, and human proximity provide a valuable gauge for determining impacts on wildlife from the proposed Nichols Ranch ISR Project. Additionally, the most recent version of the WGFD recommendations published in April 2010 specifically directs in-situ *uranium development to follow stipulations specified for oil and gas development for the Greater sage-grouse (Centrocercus urophasianus) protection measurements. Because this information is presented in the SEIS, no change was made to the Nichols Ranch ISR SEIS beyond the information provided in this response.*

B.5.22.8 Impacts to Terrestrial Ecology and Wildlife Discussion

Comments: N013-037; N018-077
Two commenters expressed concern for impacts to migration corridors for pronghorn and mule deer and suggested allowing hunting for big game would help manage pronghorn and mule deer.

***Response**: NRC understands that mule deer and pronghorn are abundant in the proposed Nichols Ranch ISR Project area and discusses local and regional occurrences of big game. SEIS Section 3.6.1.2.1 explains there are no crucial pronghorn ranges within the proposed project area; the nearest crucial range is approximately 63 km [39 mi] south of the proposed project area. In addition, the proposed project area lies within habitat designated as winter/yearlong and yearlong range for mule deer. There are no crucial mule deer ranges within the proposed project area, and the nearest mule deer crucial winter range occurs approximately 77 km [48 mi] southwest of the proposed project area. Section 4.6.1.1.2 addresses potential impacts to big game. In addition, the ecology cumulative effects section of the SEIS has generally been revised. Overall, impacts to big game are expected to be SMALL.*

SEIS Section 1.7.3.5 explains that WGFD is responsible for controlling all game in Wyoming. SEIS Section 3.2 explains that private entities own more than 91 percent of the land, and approximately 9 percent of the land is U.S. Government-owned and BLM-administered. NRC does not have regulatory authority to require that the licensee allow hunting activities during operations. The licensee can make arrangements with the private landowners or consult with WGFD regarding hunting arrangements. No changes were made to the SEIS in response to this comment.

Comments: N013-086; N017-013; N017-019
Two commenters stated the NRC should take a hard look at sage-grouse and other wildlife and habitat impacts and explore alternatives or requirements that would reduce or eliminate adverse environmental impacts. One commenter asserted that the SEIS failed to disclose the habitat impacts of this project at a site-specific level or cumulatively.

***Response**: NRC believes that the wildlife impact analyses are supported by sufficient technical bases. Since publication of the draft SEIS in December 2009, FWS listed the sage-grouse as a*

candidate species (March 2010). Subsequently, Wyoming BLM made amendments to the National Sage-Grouse Habitat Conservation Strategy, and Sage Grouse Implementation Team (SGIT) continues to discuss an evaluation process for sage-grouse impacts. and outline recommended development stipulations. SGIT emerged from the Governor's Sage Grouse Summit in 2008 with the mission to develop conservation efforts to protect the sage-grouse and prevent the need to list the species under the Endangered Species Act. The proposed Nichols Ranch ISR Project is not located in a core area as described in SEIS Section 3.6.3. SEIS Section 4.6.1.1.3 and the Uranerz Environmental Report Section 3.5.3.3 describe the potential impacts to sage-grouse and discuss the following mitigative measures the applicant commits to implement: (i) minimize or delay project activity and vehicular traffic within 0.15 km [0.25 mi] of active leks between the hours of 8:00 p.m. and 8:00 a.m. during the March 1 to May 15 strutting period; (ii) minimize or delay project activity within 1.6 km [2.0 mi] of active leks between March 15 and July 15; (iii) avoid constructing overhead power lines or high-profile structures within 0.15 km [0.25 mi] of leks to minimize raptor predation; and (iv) minimize removal of vegetation, where possible, and revegetate disturbed areas as soon as practicable following project completion. However, NRC does not have the statutory authority to impose wildlife mitigation measures at a licensed facility. SEIS Section 4.6.1.1.3 also discusses proposed mitigation measures that Uranerz would implement to limit impacts to sage-grouse.

The cumulative effects discussion presented in Chapter 5 of the SEIS has been revised to improve the transparency and clarity of the analysis and provide a more detailed discussion of potential cumulative effects for critical resource areas. Section 5.6.1 of the final SEIS discusses the cumulative impacts to ecological resources and their respective habitats from the proposed Nichols Ranch ISR Project and other projects occurring in the area (grazing and herd management, hunting, and mineral exploration). No changes were made to the SEIS beyond the information provided in this response.

Comment: N013-091
One commenter stated NRC failed to assess potential to wildlife impacts from overhead power lines.

***Response**: SEIS Section 4.6 does discuss potential impacts from overhead power distribution including those to raptors and other avian species. Because this information is already presented in the SEIS, no change was made to the Nichols Ranch ISR SEIS beyond the information provided in this response.*

Comment: N017-009
One commenter expressed a concern of potential wildlife impacts from selenium contamination.

***Response**: NRC acknowledges that wildlife may be temporarily exposed to contamination from spills and leaks in SEIS Section 4.6.1.2. Proposed operations that could involve spills of process solutions containing dissolved selenium would be conducted at the central processing plant, wellfields, the satellite ion exchange facility, and header houses and along pipelines that connect wellfields, header houses, and the central plant. As described in the study cited by the commenter (Ramirez and Rogers, 2000), prior studies have associated selenium with food chain bioaccumulation and adverse impacts to migratory and aquatic birds involving impaired reproduction and mortality. The process solution the applicant proposes to pump from the ore zone aquifer would contain selenium. Selenium occurs naturally in the host rock of the ore zone, and it would be mobilized (i.e., dissolved into the groundwater), along with the uranium and other constituents, by the proposed lixiviant injection into the ore zone aquifer. This solution would then be circulated through the processing circuit, and a portion would be diverted*

as wastewater (thereby causing selenium and other constituents mobilized by the lixiviant injection to be present in wastewater).

Regarding the potential for spills at the central processing plant, the applicant proposes a facility design that would contain any spills within a curbed area that drains to a sump (Uranerz, 2007). For spills that may occur in wellfields, header houses, and pipelines, the applicant proposes to utilize alarmed operational pressure monitoring and daily visual inspection as means to detect leaks or other off-normal operating conditions (Uranerz, 2007). While some leaks and spills would inevitably occur, the staff expects these would be localized and temporary events based on the proposed detection measures. After a leak or spill has been identified, the applicant proposes to conduct the necessary corrective actions, document the location of the event, sample affected areas, and remediate areas that exceed regulatory limits. The applicant's proposed design and control measures would not eliminate wildlife exposures to process solutions containing selenium, and direct ingestion of spilled solutions by waterfowl (and perhaps other species) may have incidental impacts to individuals within those waterfowl populations. However, the staff considers the applicant's measures would limit the magnitude, spatial extent, and duration of spills, leaks, and other potential wildlife exposures to process solutions containing selenium to a degree that would mitigate potential impacts to wildlife populations.

The report referenced by the commenter is field study of the Highland ISR facility located in Converse County, Wyoming. This study reports elevated environmental concentrations of selenium where land was irrigated with wastewater for a period of approximately 9 years (Ramirez and Rogers, 2000). Land application is a regulated waste disposal method that irrigates land with treated wastewater (stored in surface impoundments) using agricultural irrigation equipment to facilitate the evaporation of water either directly or by plant transpiration. As water evaporates from the soil, it leaves behind constituents that were dissolved in the water, including selenium, as solid deposits thereby creating the potential for buildup of these constituents in soil over time. The proposed Nichols Ranch Project does not involve the use of land application or surface impoundments in its proposed wastewater disposal method;, therefore, the NRC staff considers the levels of selenium deposition and buildup evaluated in the study cited by the commenter and the magnitude of the resulting wildlife exposures to soils and wastewater are not applicable to the proposed operations of the Nichols Ranch ISR Project. The applicant's proposed use of underground injection using deep disposal wells is designed to isolate wastewater deep below the land surface and therefore reduce the potential for wildlife impacts relative to other available wastewater treatment and disposal options, such as evaporation ponds or land application. Because the potential impacts to wildlife from leaks and spills are discussed in the SEIS and the commenter does not provide new information to consider, no changes were made to the SEIS.

B.5.22.9 References

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B.5.23 Meteorology, Climatology, and Air Quality

B.5.23.1 Permitting and Regulations

Comments: N020-001; N020-020
One commenter, referring to Executive Summary, page xx (environmental impacts from air quality) and Section 3.7.2, Air Quality, p. 3-42 of the draft SEIS, noted these sections state without providing a basis, that the proposed project would not be subject to Title V of the CAA and Prevention of Significant Deterioration (PSD) requirements, respectively.

Response*: As stated in Section 4.7, the proposed Nichols Ranch ISR Project would not be a major source of emissions. NRC bases this conclusion on a condition in the WDEQ-approved construction air permit (WDEQ, 2009) that requires the applicant to obtain a minor source operation permit pursuant to Wyoming Air Quality Standards and Regulations Chapter 6, Section 2(a)(iii). According to the language of that requirement, such a permit applies to facilities that are not subject to the provisions of the Wyoming Air Quality Standards and Regulations Chapter 6, Section 3, which contains regulations for the state operating permit program required under Title V of the CAA. In addition, NRC staff calculated mobile nonroad emissions from construction equipment that WDEQ air permitting does not address, and these emissions were also found to be well below major source threshold levels.*

Concerning the PSD requirements, the enforcement of this program applies to major stationary sources of emissions or any other source that has the potential to emit more than 227 t [250 T] per year of any pollutant. As stated in the previous paragraph, WDEQ has classified the applicant as a minor source. Further, as stated in Section 4.7, the NRC staff concludes the estimated emissions from the proposed project would not affect attainment with ambient air quality standards in the region surrounding the proposed site areas or PSD increments in Class I or Class II areas closest to the proposed Nichols Ranch ISR Project areas. Should WDEQ determine that some or even all of the aforementioned regulatory programs apply to the proposed action, then the applicant would need to comply with any applicable permitting requirements WDEQ has the authority to enforce.

In response to these and other comments, the staff also updated the discussion of proposed air emissions in Section 2.2.1.6.1 of the SEIS and provided, in a new Appendix D, supporting calculations of mobile nonroad diesel emissions from well drilling activities and construction equipment. The staff also updated portions of the air impact analysis (Section 4.7) and the Executive Summary to reflect this additional information and provide additional supporting bases for air impact conclusions. The commenter should be aware that the Executive Summary is a brief summary of the impact findings and does not normally contain a detailed description of supporting bases. The complete basis for impact conclusions are documented in the impact analysis in Section 4.7.

In response to the comment regarding the PSD requirements, upon review, NRC staff found the statement went beyond a description of the affected environment, and it was deleted from SEIS Section 3.7.2, Air Quality.

B.5.23.2 Climatology and Meteorology

Comments: N011-009; N011-011; N013-011; N013-013; N015-006
One commenter expressed concern about the greenhouse gas emissions from the proposed Nichols Ranch ISR Project and the impact of these emissions on climate change. Another commenter stated the SEIS failed to consider climate change impacts in a complete manner. This commenter suggested climate change was important enough to warrant its own section in the SEIS that discussed the topic in detail. Another commenter suggested the draft SEIS ignores climate change impacts based on what was stated as the imprecise nature of the science. The commenter noted the exact extent and timing of climate change is not certain, but many adverse impacts have already been documented and such impacts will continue into the future. Citing draft guidance from CEQ (2010) (to help Federal agencies improve their consideration of greenhouse gas emissions and climate change in evaluations of proposals for Federal actions), the commenter stated that despite the evolving nature of climate change science, Federal agencies have an obligation to consider both greenhouse gas emissions emitted from proposed projects and the impacts the action has on natural resources that climate change could also affect.

***Response**: As one commenter noted, the state of climate change science is evolving. NRC staff acknowledges this changing state and the evolving Federal role in evaluating the potential environmental impacts of Federal actions. The NRC approach to evaluating potential climate change impacts from NRC licensing actions is also evolving as more information becomes available that NRC staff can use to evaluate potential impacts.*

To address these and other comments regarding the need to consider and evaluate the potential impact of greenhouse gas emissions on the global climate, NRC staff has calculated

annual and cumulative carbon dioxide emissions from applicant use of diesel construction equipment during construction and decommissioning of the production wellfields and facilities. Because operating ISR facilities are not major sources of carbon dioxide or other greenhouse gas emissions, NRC staff expects construction equipment emissions (including well drilling rigs) produced during both construction and decommissioning phases to represent the majority of greenhouse gas emissions from the proposal. The emissions estimates are documented in Appendix D and are summarized in Section 2.2.1.6 in the final SEIS. The NRC staff also evaluated potential climate impacts from the calculated construction equipment emissions from the proposed facility in Section 4.7. The cumulative air impact analysis in Chapter 5 was also updated to evaluate the impact of the emissions and projected climate changes in the context of other past, present, and reasonably foreseeable future actions. This impact analysis evaluated available information on greenhouse gas emissions and potential impacts to global climate change (CCS, 2007; GCRP, 2009; NCDC, 2010a–c) to evaluate the potential effect of (i) the proposed emissions; (ii) projected climate changes on the proposed facility; and (iii) the projected climate changes on the potential environmental impacts of the proposed facility. The staff concluded the proposed emissions were a small percentage of state and national emissions and the impact would be SMALL. The staff also concluded the small magnitude of projected changes in climate over the proposed operating period of the facility would not impact the facility nor significantly change the potential impacts from the facility.

B.5.23.3 Baseline Air Quality

Comment: N020-022
One commenter, referring to the description of the affected environment for air quality in Section 3.7.2, p. 3-42, noted the proposed project is 185 km [115 mi] from Wind Cave National Park, which is the nearest CAA Class I PSD Area, and 109 km [68 mi] from Cloud Peak Wilderness area, which is a Sensitive Class II Area. The commenter requested the SEIS identify all nearby Class I and II Areas.

***Response**: In response to these comments, NRC staff verified the commenter information and added the recommended PSD sites to Section 3.7.2 of the final SEIS.*

B.5.23.4 Impact Assessment

Comment: N011-020
Referring to the Chapter 5 (cumulative impact analysis) discussion of climate change in the draft SEIS, a commenter suggested the draft SEIS failed to consider the impacts of climate change by not disclosing all greenhouse gas emissions. The commenter noted the emissions for the proposed site discussed in the draft SEIS are incomplete because they do not include the emissions from other nuclear fuel cycle facilities such as facilities involved in uranium conversion, uranium enrichment, and nuclear fuel fabrication.

***Response**: NRC focused on evaluating CO_2 emissions for the life of the proposed facility and compares this with other forms of extraction in the area. The primary source of CO_2 emissions from ISR facilities are combustion engine emissions from construction equipment (including drill rigs). NRC staff estimated annual and cumulative CO_2 emissions over the life of the facility from the proposed Nichols Ranch ISR Project for construction and decommissioning activities and documented these in Appendix D of the final SEIS.*

Section 5.7 of the final SEIS describes projects occurring within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project, which include up to six other operating or planned ISR

facilities (see Table 5-1) that would generate emissions comparable to emissions projected for the proposed project. ISR facilities commonly use a phased approach to well drilling and wellfield construction; therefore, all seven facilities would not undergo construction concurrently. To estimate the potential annual contribution of the seven facilities to local air emissions, the NRC staff considered the emissions results in Appendix D of this SEIS.

Evaluation of environmental impacts from other nuclear fuel cycle facilities is beyond the scope of the current licensing action regarding whether or not to grant a license to the proposed Nichols Ranch ISR Project. NRC evaluates the potential safety and environmental impacts of other nuclear fuel cycle facilities when those facilities are proposed or their licenses are amended. Because the requested information is beyond the scope of the current licensing action, no changes were made to the SEIS in response to the comment.

Comments: N011-012; N011-013; N011-014; N011-018
One commenter provided a number of comments related to climate change and the potential impacts of climate changes on the potential environmental impacts from the proposed Nichols Ranch ISR Project. They provided a report from the U.S. Global Change Research Program entitled "Global Climate Change Impacts in the United States" (Karl, et al., 2009) as the technical basis for predictions of climate change in the region where the facility is proposed. The commenter suggested the report shows climate changes in the region have the potential to impact the proposed facility and, therefore, NRC should evaluate such impacts in the SEIS. Specifically, they asked that if the region where the proposed project is located is expected to have reduced snowpack and spring runoff and disruption of precipitation over the next decades NRC should also evaluate whether potable water sources outside the ore zone should be sacrificed in exchange for extracting uranium. The commenter clarified by footnote that the term "sacrificed" referred to an assumption that groundwater would be restored to a poor quality baseline standard. They also requested that if climate change was expected to increase the precipitation in the region, NRC should disclose and evaluate how increased soil saturation, flooding, and aquifer recharge would interact with project impacts.

***Response**: With regard to future changes in climate altering the potential impacts of the proposed action, the staff evaluated the report the commenter cited, and found that the projected changes in climate over the 10-year time scale of the licensing period for the proposed facility were limited in degree and unlikely to significantly change the intensity of the potential impacts evaluated in the final SEIS. For example, the projected changes in precipitation for a high-emissions scenario were discussed for the latter part of this century (years 2080 through 2090) as 10 to 15 percent above current values for the area of Wyoming where the proposed site would be located. Changes during the next 10 years would be expected to be much less than the values reported for the end of the century. The staff could not identify information in that report to suggest that over the next 10 years there would be the types of changes the commenter indicated (e.g., soil saturation, flooding, recharge effects). Projected temperature changes are also cited in the report as long-term consequences. The cited report includes projected changes in average temperature for year 2020 as ranging from a slight decrease in the present temperature to a maximum of approximately 2 degrees higher than present temperatures. The resource area that would be expected to be the most sensitive to small changes in ambient temperature would be the local ecology. Potential changes to the regional ecology from a rise in average temperature (including invasive species, fire, erosion, desertification) would occur whether the site were licensed or not, but localized effects could be exacerbated to some degree by proposed site activities and the changes in the ambient temperature. In response to these comments, NRC staff added discussion of the potential*

impacts from projected changes to climate in Section 5.7 (Cumulative Air Quality Impacts) of the final SEIS.

In Section 5.7.1.4 of the final SEIS, the NRC staff determined that the overall effect of projected climate change on the proposed Nichols Ranch ISR Project facility would be SMALL. The small, predicted increases in temperatures and precipitation over the next decade would have no effect on the proposed Nichols Ranch ISR Project facility in any of the ISR phases.

Regarding the portion of a comment that suggested potable water sources outside the ore zone would be sacrificed based on an assumption about restoration water quality, that portion of the comment was marked as two separate groundwater restoration comments (N011-015 and NO11-016) that are discussed in Section 5.9.8, Groundwater Restoration Criteria and Methods.

Comments: N015-004; N015-014; N015-017; N015-019; N015-024; N015-025; N020-002; N020-003; N020-029; N020-030

One commenter stated the draft SEIS lacked information on air pollutant emissions and the impact analysis is inadequate to assess the impacts of those emissions. This commenter stated they could not find supporting information for the statement in the Executive Summary that the air emissions would be below the NAAQS. The commenter also stated it was unclear what mitigation the Executive Summary was referring to for air quality impacts. The commenter stated ISR projects will likely result in a deterioration of air quality due to emissions from drill rig engines, fugitive road dust, and uranium processing activities. The commenter suggested that projects similar in scope require hundreds of wells and multiple deep injection wells and without a complete air quality analysis such activity is likely to have significant adverse local air quality impacts. They were particularly concerned about the air emissions from the truck-mounted diesel drilling rigs and the drilling of hundreds of wells for the proposed Nichols Ranch ISR project. They requested a screening analysis be conducted for air emissions to identify far field impacts, including visibility parameters for Class I and sensitive Class II air sheds. The commenter also requested a near field air analysis be conducted to evaluate direct air impacts.

***Response**: In response to this and other comments, NRC staff reviewed the applicable sections of the draft SEIS and added more detailed information on emissions from drilling rigs, construction equipment, and unpaved roads (i.e., fugitive road dust) to the final SEIS in Section 2.2.1.6.1.1 and Appendix D. NRC staff added information to the Executive Summary, which includes a reference to mitigation (WDEQ-approved construction air permit) that is discussed in Chapter 4 of this SEIS, Section 3.7.2 on nearby Class I and Class II areas that could potentially be impacted by emissions generated by the proposed action; information was also added to Section 4.7 to clarify NRC staff approach to evaluating impacts and improve the transparency of the NRC staff bases for impact conclusions.*

NRC staff estimates of annual nitrogen oxide and particulate emissions from drilling rigs and construction equipment are approximately 19.9 t/yr and 0.91 t/yr [22 and 1 T/yr], as discussed in Appendix D. NRC staff estimated nitrogen oxide emissions could be as high as 30.8 t/yr [34 T/yr] if the applicant drilled all eight deep disposal wells in 1 year; however, this would be a 1-year maximum as no additional deep disposal wells would need to be drilled in later years.

The applicant estimates of fugitive road dust exceed 90.1 t/yr [100 T/yr] (assuming no dust controls would be applied). The NRC staff reviewed these calculations and conducted additional calculations using the same EPA methods used by the applicant but applying different assumptions. The staff concluded, in particular, that if no carpooling of employee commuting is assumed, and both incoming and outgoing traffic is considered, the untreated road dust

emissions could be higher by about a factor of two from the applicant's estimates. However, the applicant has proposed and WDEQ has required (WDEQ, 2009) dust suppression measures to limit potential dust impacts so actual emissions would be expected to be substantially lower than either the applicant's or the NRC staff's estimates. The application of these measures would reduce emissions to levels that would not destabilize local air quality or change the current attainment status.

NRC staff concludes the emissions from the proposed Nichols Ranch ISR project would not change the current attainment status of the region surrounding the site nor would the emissions be likely to destabilize the local air quality and, therefore, additional detailed quantitative air analyses are not warranted to support the evaluation of nonradiological air impacts. Short-term and intermittent visible air emissions are possible to the local area surrounding the site when vehicles travel on unpaved roads. Such impacts would be reduced but not eliminated by road treatments the applicant proposed and required by WDEQ (2009).

The scope of the air impact analysis in Section 4.7 is intentionally limited to consideration of nonradiological air quality impacts. This is because, as noted in the draft SEIS, NRC regulates radiological air emissions. These are addressed in Section 4.13 as a public and occupational health and safety topic, whereas the State and EPA regulates nonradiological emissions, evaluated separately in Section 4.7.

Comment: N015-018
One commenter indicated the proposed project may adversely impact nearby Federal Class I areas that require special protection of air quality and air quality related values such as visibility.

***Response**: The mobile nonroad diesel emissions from construction and mobile fugitive road dust emissions from all phases are the emissions from the proposed action that have the greatest potential to impact nearby Prevention of Significant Deterioration areas based on NRC staff understanding of the types and magnitudes of emissions associated with ISR facilities and the information the applicant provided on this specific proposal. As discussed in Section 2.1.1.1.6.1.1, the applicant estimated fugitive road dust emissions could exceed 90.7 t/yr [100 T/yr] if not controlled; however, the applicant proposes to control these emissions by water application or other means of road treatment.*

All the other emissions information the staff reviewed, including the staff nonroad diesel construction equipment emissions estimates (final SEIS Section 2.2.1.6.1.1 and Appendix D), support the conclusion that NRC staff expects the proposed action would not be comparable to, nor considered, a major source of emissions {e.g., a stationary source that emits or has the potential to emit 90.7 t/yr [100 T/yr] of an air pollutant to 9.1 t/yr [10 T/yr] of any individual hazardous air pollutant or 22.7 t/yr [25 T/yr] of any combination of hazardous air pollutants as defined in CAA Sections 501 and 112}. While NRC staff recognize that the stationary source requirements, by definition, do not apply to mobile sources of emissions, these requirements apply to the same types of air pollutants emitted by the mobile sources the applicant proposed and the threshold values are the levels of emissions that trigger a substantial increase in the requirements that must be met to ensure the protection of air quality. The staff concludes that such emissions (i.e., well below the major source thresholds) in an area with meteorology favorable for dispersion would be unlikely to impact air quality in the nearest Class 1 area to the proposed action. The Class 1 area, Wind Cave National Park, is located about 185 km [115 miles] east of the proposed Nichols Ranch ISR Project site. Cloud Peak Wilderness Area, the closest Class II area to the proposed action, located about 109 km [68 mi] northwest of the proposed Nichols Ranch ISR Project site, is also unlikely to be impacted by the magnitude of

proposed emissions-generating activities. In addition to the magnitude of emissions and distance, the predominant wind direction at the proposed site is from the southwest and therefore would carry emissions to the northeast, away from the Class II area.

While the NRC staff emissions analysis, within the context of CAA regulations, supports the assessment of potential environmental impacts that is required by NEPA, as amended, the authority to enforce CAA regulations in Wyoming rests with the WDEQ, and it is responsible for making applicability and compliance decisions regarding the regulations that implement the CAA. In that role, the WDEQ has evaluated the applicant's permit application and has issued Uranerz an air quality construction permit (WDEQ, 2009). This permit requires the applicant to obtain an operating permit that satisfies the Wyoming Air Quality Regulation in Chapter 6, Section 2(a)(iii). As stated in that requirement, this type of operating permit is for facilities that are not subject to the major stationary source requirements of the Wyoming Air Quality Regulations in Chapter 6, Section 3. Section 1 refers to the required Section 2 operational permit as a minor source permit to operate. This information indicates the WDEQ has concluded the proposed Nichols Ranch ISR Project facility is not considered a major source of emissions. This permit condition supports the NRC staff conclusion that the facility is not likely to be considered a major source of emissions as defined by the CAA. The permit also requires the applicant to limit fugitive road dust emissions from the haul road from the proposed Hank Unit satellite facility to the proposed Nichols Ranch Unit central processing plant and the proposed access road to the central processing plant by treating with water or chemical dust suppressants. This permit condition further supports the NRC staff conclusion that the fugitive dust emissions would be mitigated by control measures the applicant proposed in its license application. Should the air quality in the nearby Class I areas degrade in the future, WDEQ has the authority and would be expected to take appropriate corrective actions to reestablish attainment air quality in these protected areas.

In response to this and other comments about the potential impacts of air emissions, NRC staff updated the discussion of proposed air emissions in final SEIS Section 2.2.1.6.1 and provided supporting calculations of mobile nonroad diesel emissions from well-drilling activities and construction equipment in Appendix D. NRC staff also updated the air quality impact analysis discussion in SEIS Section 4.7 to reflect the updated emissions information.

Comment: N015-037
A commenter suggested NRC expand the discussion of greenhouse gas emissions and climate change in the draft SEIS. Specifically, they requested NRC staff consider the projected regional climate changes and the project contribution to these changes. They also requested NRC staff quantify the annual and cumulative greenhouse gas emissions and discuss the link between greenhouse gas emissions and climate change. A discussion of mitigation measures for greenhouse gas emissions was also requested.

***Response**: To address these and other comments regarding the need for NRC staff to consider and evaluate the potential impact of greenhouse gas emissions on the global climate, NRC staff has calculated annual and cumulative carbon dioxide emissions from the applicant's use of diesel construction equipment during construction and decommissioning phases of the production wellfields and facilities. Because operating ISR facilities are not major sources of carbon dioxide or other greenhouse gas emissions, NRC expects the construction equipment emissions (including well drilling rigs) produced during both construction and decommissioning phases to represent the majority of greenhouse gas emissions from the proposal. The emissions estimates are documented in Appendix D and summarized in Section 2.2.1.6.1. The staff also added an evaluation of potential climate impacts from the calculated construction*

equipment emissions from the proposed facility in Section 4.7. The cumulative air impact analysis was also updated to evaluate the impact of the emissions in the context of other past, present, and reasonably foreseeable future actions. The revised impact analyses include discussion of the current understanding of the link between greenhouse gas emissions and global climate change. Based on the nature of the emissions (e.g., construction equipment) and the lack of available carbon dioxide emissions control technology for such equipment, Section 5.7.1.5 was added to discuss general mitigation measures that could be implemented to reduce fuel consumption and therefore the greenhouse gas emissions at the proposed Nichols Ranch ISR Project.

Comments: N020-025; N020-026
Referring to the draft SEIS, Section 4.7, Air Quality Impacts, page 4-43, one commenter noted no project-specific emissions estimates were provided in the draft SEIS. They noticed the draft SEIS references GEIS Section 2.7.1 (NRC, 2009a), which includes emissions estimates for the Crownpoint ISR facility from a 1997 NRC Final EIS (NRC, 1997). The commenter indicated the draft SEIS did not discuss how that facility, and therefore its emissions estimates, relate to the proposed facility. The commenter also suggested the referenced emissions estimates from 1997 were not current and should be updated.

***Response**: In response to this and other comments about the potential impacts of air emissions, NRC staff updated the discussion of proposed air emissions in the draft SEIS, Section 2.2.1.6.1 and provided supporting calculations of mobile nonroad diesel emissions from well-drilling activities and construction equipment in Appendix D. NRC staff also updated the air quality impact analysis discussion in SEIS Section 4.7 to reflect the updated emissions information. Text was also added to SEIS Section 4.7 to compare attributes of the Crownpoint facility and the proposed action to establish a more transparent basis for adopting the GEIS air impact analyses in the SEIS.*

Comment: N020-027
Referring to draft SEIS, Section 4.7, Air Quality Impacts, p. 4-43, one commenter expressed that while air quality impacts are discussed, neither the draft SEIS nor GEIS (NRC, 2009a) have an air impact analysis.

***Response**: While the comment was not specific regarding the type of impact analysis that was the commenter expected, some additional clarification regarding some of the limitations that affect the content of Section 4.7 may be informative. First, Section 4.7 of the draft SEIS describes the potential impacts to nonradiological air quality based on the NRC staff review of the proposed action that was summarized in draft SEIS Chapter 2 and the affected environment that was summarized in SEIS Chapter 3. The NRC staff's approach to documenting the impact analyses in Chapter 4 is to avoid repetitive discussions of information that was discussed in prior chapters by referencing and summarizing previously discussed information. This approach may have contributed to an appearance of incompleteness. In response to the commenter, NRC staff has reviewed the section and incorporated additional references and discussion of referenced information to add transparency to the support for the analysis and the bases for conclusions. Another factor that limits the scope of the air impact analysis is that the analysis in Section 4.7 is intentionally limited to consideration of nonradiological air quality impacts. As noted in the SEIS, NRC regulates radiological air emissions, which are addressed in Section 4.13 as a public and occupational health and safety topic, whereas the State and EPA regulate nonradiological emissions and are best evaluated separately in Section 4.7. The staff evaluation of potential nonradiological impacts in draft SEIS Section 4.7 is further limited because, as stated in that section, the proposed Nichols Ranch ISR Project facility will not be a*

major emitter of nonradiological air pollutants and, consistent with the NRC NEPA-implementing regulations at 10 CFR Part 51, Appendix A (Item 7), the level of information considered in detail reflects the depth of analysis required for sound decisionmaking.

In response to this and other comments, NRC staff reviewed the applicable sections of the draft SEIS and added more detailed information on emissions to Section 2.2.1.6.1.1 and Appendix D. Information was also added to Section 3.7.2 on nearby Class I and Class II areas that could potentially be impacted by emissions the proposed action generates. Information was also added to Section 4.7 to clarify the NRC staff approach to evaluating impacts and improve the transparency of the NRC staff bases for impact conclusions. The additional emissions information confirms the proposed Nichols Ranch ISR Project would be a minor source of nonradiological emissions, which NRC staff conclude would be unlikely to change the current attainment status of the region surrounding the site, nor would the emissions be likely to destabilize the local air quality. Short-term and intermittent visible air emissions are possible to the local area surrounding the site, (e.g. when vehicles travel on unpaved roads).

B.5.23.5 References

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NRC. NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities. Washington, DC: NRC. May 2009a.

NRC. "Uranium Recovery Policy Regarding: (1) The Process for Scheduling Licensing Reviews of Applications for New uranium Recovery Facilities and (2) The Restoration of Groundwater at Licensed Uranium *In-Situ* Recovery Facilities." Regulatory Information Summary 2009-05. ML083510622. May 29. 2009b.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. Washington, DC: NRC. June 2003.

NRC. NUREG–1508, Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mine Project, Crownpoint, New Mexico. ML082170248 Washington, DC: February 1997.

WDEQ. Letter from D. Finley, Administrator, Wyoming Department of Environmental Quality, to M. Thomas, Uranerz Energy Corporation. Subject: Re: Permit No. CT-8644. October 2, 2009.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.24 Historical and Cultural Resources

B.5.24.1 Potential Impacts to Cultural, Historical, and Sacred Places

Comment: N008-003
The applicant stated the entire area encompassed by the proposed Nichols Ranch ISR Project area has been surveyed for cultural resources. This was in response to a statement in SEIS Section 1.7.2 that documented that the WY SHPO indicated a cultural resource survey had not been conducted for the entire "area of potential effect."

***Response**: The applicant is correct in that the proposed Nichols Ranch ISR Project area has been surveyed (Uranerz, 2007). The SEIS statement reflects initial WY SHPO input to NRC concerning the proposed action, which occurred early in the review process. SEIS Section 1.7.2 was revised to remove the confusing text and incorporate WY SHPO comments.*

Comment: N008-017
The applicant stated site 48CA5391 would not be impacted. The applicant stated the site was not located within a proposed wellfield, but rather a potential horizontal monitoring well location, and that this type of well could be relocated away from site 48CA5391.

***Response**: The January 2010 revision of the applicant's Environmental Report (Uranerz, 2007) stated this site was located within or near the projected wellfield and indicated that mitigation would be implemented. SEIS Sections 4.9.1.1 and 4.9.3.1 were revised to describe the site location based on the information from the Environmental Report (Uranerz, 2007).*

B.5.24.2 License Conditions To Address Potential Impacts to Historical and Cultural Resources

Comment: N014-017
One commenter stated that the final SEIS should clarify what license conditions would be imposed on the licensee concerning required mitigation measures to reduce or eliminate environmental impacts. The commenter specifically requested such conditions be identified for cultural resources, given that cultural and historic resource preservation is a critical issue in the vicinity of the proposed Nichols Ranch ISR Project.

***Response**: NRC can only impose license conditions for a proposed ISR facility within the limits of the authority granted by Congress. State and other federal agencies can also establish permit conditions based on their statutory and regulatory authorities. NRC can rely on mitigation measures the applicant includes in its license application or includes as a license condition or those imposed by other State and federal agencies in evaluating the potential environmental impact of the proposed project.*

The NRC license for the proposed Nichols Ranch ISR Project, if approved, could contain license conditions to reduce or eliminate adverse impacts to cultural and historic resources at the Nichols Ranch ISR Project site. No specific license conditions have been agreed upon for inclusion in the license, if approved, at this time. Therefore, the SEIS can only identify mitigation measures that either: (1) may be incorporated into the NRC license as license conditions, (2) that are requirements other agencies established through permits that ISR facilities must obtain, (3) mitigation measures the applicant committed to follow in their license application, or (4) mitigation measures that are not enforceable but that the applicant could voluntarily abide by to further reduce environmental impacts to a given resource area.

Specifically concerning cultural resources, no identified Traditional Cultural Property (TCP) will be directly affected by the proposed construction activities at the site. The applicant's license application stated that sites located near proposed construction areas will be marked, fenced, and avoided. However, there will be an adverse effect to the visual setting of five TCPs. The mitigation of adverse effects is currently being addressed through consultation among the WY SHPO, BLM, NRC, the applicant, and interested Native American tribes. The NRC developed a draft Memorandum of Agreement (MOA), which was forwarded to interested parties by letter dated July 22, 2010, for review and comment. After July 22, four additional TCPs were identified through consultation with Native American Tribes. NRC is currently working with the interested parties to revise the draft MOA to address impacts to the visual setting of the five TCPs. If the MOA is finalized, and NRC approves the license application, a license condition could specifically require compliance with the MOA. In response to other comments and newly available information, Section 4.9.1 of the final SEIS has been updated to provide more details on the Section 106 consultation process and MOA development. Additionally, the response to Comment N012-007 in Section B.5.24.3 contains information about commitments that Uranerz has made in its license application to mitigate impacts to cultural resources. Mitigation measures in a license application are subject to a general license condition in ISR licenses. No changes to the SEIS were made beyond the information provided in this response.

B.5.24.3 General Historic and Cultural

Comment: N006-001
One commenter noted that the 50-year cutoff for possible inclusion on the National Register of Historic Places (NRHP) as described in the SEIS on p. 3-43 is not a hard and fast rule that precludes younger sites from inclusion.

***Response**: This commenter is correct in that the 50-year threshold is not a hard and fast rule. SEIS Section 3.9.1 was revised to recognize the possible inclusion of younger sites into the NRHP.*

Comment: N006-002
One commenter requested that the SEIS be revised to indicate that the Pumpkin Buttes were determined eligible for the NRHP under Criteria A, B, and D, not Criteria A, B, and C.

***Response**: This commenter is correct in identifying which criteria determined Pumpkin Buttes eligibility for the NRHP. In response to this comment, SEIS Section 3.9.2.3 was revised to accurately identify the appropriate criteria.*

Comment: N006-003
One commenter requested that language in SEIS Section 4.9.1.1 be clarified to clearly state that for a property to be eligible as a TCP it must be eligible under one of the four criteria set for in 36 CFR 60.4 for NRHP eligibility.

***Response**: NRC agrees with the commenter on the need to clarify the discussion on TCP eligibility criteria. SEIS Section 4.9.1.1 was revised to indicate that TCP eligibility is based on the four criteria identified in 36 CFR 60.4.*

Comment: N006-004
One commenter suggested that the SEIS language addressing discovery situations be reworded to indicate that the applicant “shall” stop work upon discovery of previously undocumented historical or cultural resources.

***Response**: NRC agrees that this statement should be revised to provide reader clarification. Section 4.9.1.1 has been revised accordingly.*

Comment: N006-005
One commenter stated that the Wyoming Attorney General’s Office is not a signatory or participant to any agreement document for cultural and historic resource protection and therefore the reference to the office on this matter should be deleted.

***Response**: NRC agrees with the commenter in that the Wyoming Attorney General’s Office would not be a signatory on a cultural and historic resource protection agreement document. In response to this comment, SEIS Section 4.9.1.1 was revised accordingly.*

Comments: N006-006; N012-001; N012-002; N012-003; N020-035
Several commenters state that Uranerz cannot become a signatory to the existing PA between BLM and WY SHPO, because this document contains standard mitigation measures for BLM undertakings and that language in the SEIS indicating that Uranerz could sign the PA should be removed. One commenter stated that it is unclear whether the PA should serve as an MOA with respect to resolving adverse effects and that if so, the information presented on the PA

does not demonstrate that the PA satisfies 36 CFR 800.6(c) requirements pertaining to developing of a PA for resolution of adverse effects. One commenter suggested that the development of a MOA for the proposed action would be a more appropriate path to mitigate adverse effects to cultural resources.

***Response**: NRC acknowledges Uranerz cannot become a signatory to the existing PA between BLM and WY SHPO. Additionally, the PA is not intended to serve the function of resolving adverse effects to identified cultural resources. Pertaining to the commenter assessment that an MOA specific to the proposed Nichols Ranch ISR Project should be developed, NRC has developed a draft MOA for signature among the NRC, Uranerz, WY SHPO, BLM, and interested tribes as part of the Section 106 consultation process. Once finalized, this MOA would address mitigation to the Pumpkin Buttes TCP and other affected cultural resources, as appropriate. The SEIS Executive Summary, Sections 1.7, 2.4, 3.9, 3.10, 4.9, and 4.10, and Appendix A have been revised accordingly.*

Comment: N008-009
A commenter stated historical and cultural investigations include consultations with State and Federal agencies, whereas SEIS Section 3.9 only mentions tribal consultations.

***Response**: NRC interactions regarding historical and cultural resources were not limited to tribal consultations. SEIS Sections 1.7.3, 3.9.1, and 4.9.1 address such interactions. SEIS Section 3.9 was revised to clarify that interactions extended beyond tribal consultations.*

Comment: N008-016
A commenter stated archaeological sites 48CA6146, 48CA6147, and 48CA6148 are not eligible for NRHP listing, whereas portions of the SEIS state these three sites are eligible. This commenter requested SEIS Section 4.9 and Table 3-11 be updated to reflect the correct status.

***Response**: The 2010 revision of the applicant's Environmental Report (Uranerz, 2010b) provided updated information consistent with the NRHP eligibility status of the referenced sites described in this comment. SEIS Sections 3.9.2 and 4.9 were revised to reflect the updated eligibility status for the three sites.*

Comment: N012-004
A commenter noted an inconsistency in the number of different types of archeological sites reported in SEIS Section 3.9.2 and the information presented in SEIS Table 3-10.

***Response**: SEIS Section 3.9.2 was revised to provide consistent information concerning the numbers of the various types of archeological sites.*

Comment: N012-005
A commenter requested SEIS Section 3.9.2.2 be revised to indicate that 5 rather than 4 Class III surveys have been conducted and that 25 rather than 23 archeological sites should be identified for the Hank Unit.

***Response**: The 2010 revision of the applicant Environmental Report (Uranerz, 2010b) provided updated information that concurs with the information described in this comment. SEIS Sections 3.9.2.2 and 4.9.1.1 were revised to incorporate this updated information.*

Comment: N012-007
A commenter suggested SEIS Section 4.9.1 be revised to reflect seven cultural resource mitigation measures identified in the Uranerz mine permit application that was submitted to the WDEQ.

***Response**: The mitigation measures the applicant identified were submitted to NRC on February 24, 2010, as part of a letter responding to open issues in the safety review for the proposed Nichols Ranch ISR Project (Uranerz, 2010a). This letter contained revisions to the cultural portions of the Technical Report and Environmental Report. Uranerz Section 2.4.4 (2010b) states Uranerz would comply with seven specific mitigation measures. Further, Section 2.4.4 identifies nine additional mitigation measures Uranerz would follow that have been adapted from the PA between BLM and WY SHPO for the Pumpkin Buttes TCP (BLM, 2009). Section 4.9 of the final SEIS has been updated to reflect those mitigation measures identified in the Technical Report and Environmental Report revisions discussed previously.*

Comment: N012-008
A commenter suggested removing language in Section 4.10.1.1.1 regarding mitigation for actions outside a 3.2-km [2-mi] radius of the Pumpkin Buttes TCP so the SEIS is consistent with previous sections. These previous sections identify visual effects as being limited to an area within the 3.2-km [2-mi] radius of the Pumpkin Buttes TCP, for which mitigation measures are identified in the PA between BLM and WY SHPO.

***Response**: The commenter is correct in that the Programmatic Agreement (PA) between BLM and WY SHPO stipulate mitigation measures that must be complied with within a 3.2-km [2-mi] radius of the Pumpkin Buttes TCP. However, the NRC assessment of impacts to visual resources must account for the entire proposed Nichols Ranch ISR Project site, and is therefore not limited to an assessment of impacts within a 3.2-km [2-mi] radius of the Pumpkin Buttes TCP. Section 4.10.1 of the SEIS explains that an overall visual impact assessment for the proposed Nichols Ranch ISR Project is contained in Section 4.10.1.1, followed by a separate discussion specific to the Pumpkin Buttes TCP for the Nichols Ranch and Hank Units in Sections 4.10.1.1.1 and 4.10.1.1.2, respectively. NRC staff acknowledges that the draft SEIS Section 4.10.1.1.1 does not explicitly state that mitigation in accordance with the PA would not apply to activities within the Nichols Ranch Unit. Additionally, draft SEIS Section 4.10.1.1.1 implies that mitigation strategies stipulated in the PA would be applied to the Nichols Ranch Unit. NRC understands this statement is incorrect because compliance with the PA would only apply to the 3.2-km [2-mi] radius surrounding the Pumpkin Buttes TCP and would, therefore, not require Uranerz to perform mitigation within the Nichols Ranch Unit—only the Hank Unit. However, the applicant could voluntarily agree to implement these mitigation measures in the Nichols Ranch Unit in their license application or MOA. Section 4.10.1.1.1 of the final SEIS has been revised to clarify these issues.*

Comment: N020-032
One commenter stated the transition between the GEIS (NRC, 2009) summary and SEIS site-specific information in SEIS Section 4.9.1.1 was abrupt and confusing.

***Response**: NRC acknowledges the commenter statement. In response to this comment, SEIS Section 4.9.1.1 was revised to clarify that connection and create a smoother transition between the GEIS and SEIS information.*

B.5.24.4 References

36 CFR Part 60. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 60, "National Register of Historic Places." Washington, DC: U.S. Government Printing Office.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties." Washington, DC: U.S. Government Printing Office.

BLM. Programmatic Agreement Between the Bureau of Land Management and Wyoming State Historic Preservation Officer Regarding Mitigation of Adverse Effects on the Pumpkin Buttes TCP from Anticipated Federal Minerals Development. ML092640122. 2009.

NRC. NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities. Washington, DC: NRC. May 2009.

Uranerz. Letter from M. Thomas, Environmental, Safety, and Health Manager, Uranerz Energy Corporation, to R. Linton, Project Manager, U.S. Nuclear Regulatory Commission. Subject: Responses to the Open Issues to the Safety Evaluation Report for the Nichols Ranch ISR Project License Application. ML100740143. February 24, 2010a.

Uranerz. Nichols Ranch ISR Project USNRC Source Material License Application. Technical Report. Casper, Wyoming. Revisions submitted February 2010b. ML100740131. 2010b.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.25 Visual and Scenic Resources

Comment: N007-013
One commenter suggested all electrical lines from power drops to individual wells (excluding primary delivery lines) should be buried to reduce impacts to visual resources.

Response*: Although NRC recognizes that burying additional electrical lines could mitigate environmental impacts, NRC cannot require additional electrical lines to be buried. BMPs, mitigation measures, and management actions that avoid or reduce environmental impacts can be imposed through license conditions on the NRC license; however, NRC can only establish license conditions within the limits of the authority Congress granted. The SEIS can only specify mitigation that either (i) the applicant has committed to in its license application to the NRC; (ii) would be required under other State or Federal permits or processes; or (iii) could potentially reduce environmental impacts, but Uranerz did not commit to in its application; or (iv) is not required as a part of any other Federal or State permit. As stated in Section 4.10.1.1.2, electrical lines within 1.6 km [1.0 mi] of the base of the Pumpkin Buttes TCP would be buried in accordance with the PA between BLM and WY SHPO to mitigate adverse effects to the Pumpkin Buttes TCP. This requirement would be imposed upon the proposed*

Nichols Ranch ISR Project (specifically at the Hank Unit) as a requirement of applicable permits obtained from BLM. No changes were made to the SEIS beyond the information provided in this response.

B.5.26 Socioeconomics

Comment: N013-094
One commenter stated the socioeconomic discussion in the SEIS was much better than what was presented in the GEIS (NRC, 2009).

***Response**: The NRC acknowledges the comment is the expressed opinion of the commenter. Because the comment was general in nature, no changes were made to the SEIS.*

Comment: N013-095
One commenter requested the final SEIS include a detailed discussion on taxes and royalties.

***Response**: SEIS Section 7.3 and GEIS (NRC, 2009) Sections 4.3.10.1, 4.4.10.1, and 4.5.10.1 discuss royalty information. The SEIS tiers and incorporates by reference relevant information from the GEIS. The GEIS sections noted above describe how local finance would be affected by ISR construction through additional taxation and the purchase of goods and services. It also provides information regarding how taxes are imposed on mineral extraction within the State of Wyoming. SEIS Section 3.11.5 discusses the Wyoming* ad valorem *tax and Section 7.3 discusses the Wyoming severance tax. SEIS Section 3.11.5 was revised to provide information concerning uranium extraction contribution to the severance tax relative to other resources such as natural gas, coal, and oil.*

Comments: N018-009; N018-010
One commenter expressed concern about the study area splits for the two mining districts in Wyoming and believed the socioeconomic data are questionable because these data are traditionally collected by political subdivisions that are not congruent or coincidental with the mining districts analyzed in the Nichols Ranch ISR SEIS.

***Response**: The delineation of the study areas in the GEIS (NRC, 2009) and subsequently observed in site-specific environmental reviews were established based on the location of both former and existing uranium milling sites and the location of potential new sites, based on where the uranium recovery industry has indicated it would use the ISR technology to develop uranium deposits. NRC also considered the location of historical uranium deposits when determining how to establish mining district boundaries.*

The SEIS uses a Region of Influence (ROI) limited to the proposed project area (Campbell and Johnson Counties) where the most of the ISR facility workers would live. Socioeconomic data pertaining to the counties in the GEIS and the SEIS were both derived from U.S. Census Bureau and State agency data, resources that typically standardize their collection methods.

The commenter is correct that socioeconomic data are traditionally collected by political subdivisions that are not necessarily congruent with the mining districts defined in the GEIS. However, because the proposed Nichols Ranch ISR Project is located in a sparsely populated area, census geographic units cover much larger areas. No change was made to the Nichols Ranch ISR SEIS in response to this comment.

Comment: N018-011
One commenter expressed concern that the socioeconomic analysis used 10-year-old U.S. Census Bureau data.

***Response**: The GEIS (NRC, 2009) used 2000 U.S. Census Bureau data, which are based on the actual count. SEIS Sections 3.11 and 4.11 use the latest U.S. Census Bureau American Community Survey estimates, which are based on sample data collected over a 3-year time period. The estimates represent the average characteristics of population and housing, including 2010 U.S Census Bureau information. Because the SEIS provided updated socioeconomic data, no changes were made to the SEIS.*

B.5.26.1 Reference

NRC. NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities. Washington, DC: NRC. May 2009.

B.5.27 Public and Occupational Health

B.5.27.1 Impacts to Members of the General Public

Comment: N008-020
The applicant stated that the existence of new access roads built for the proposed project would not lead to a greater opportunity for public access after decommissioning and, therefore, would not result in a potential increase in public exposure to any residual radioactivity, because the proposed project area is located almost entirely on private land and only accessible through private land.

***Response**: NRC acknowledges the current status of the private land and access the commenter described. However, NRC would classify the private landowner, and anyone permitted to access the area by that landowner, as members of the public. Therefore, some portion of the public would have a greater opportunity to access areas where project activities were conducted.*

To ensure the safety of the workers and the public during decommissioning, NRC requires licensed facilities to submit a decommissioning plan for review. The plan would include details of the radiation safety program that would be implemented during decommissioning to ensure that the public would be adequately protected and that their doses are compliant with 10 CFR Part 20, Subpart C and Subpart D limits. The decommissioning of the proposed Nichols Ranch ISR Project and any subsequent NRC approval for release of the site for unrestricted access would have to be in conformance with the NRC radiation protection standards for decommissioning of uranium recovery facilities. Therefore, any potential radiation dose to members of the public would also be in conformance with standards established for protecting public health and safety.

Comment: N015-027
One commenter that requested the SEIS include an analysis for the potential use of evaporation ponds and further requested that this analysis include radon emission estimates and comparison to applicable CAA requirements, which could be significant.

***Response**: The draft SEIS did not evaluate the use of evaporation ponds, because evaporation ponds were not included in the applicant proposal and that proposal was the focus of the NRC*

staff environmental review. However, in response to this and other comments, additional information was provided in SEIS Sections 2.1.1.2 and 4.14.1.2 to discuss and evaluate potential environmental impacts of options for liquid wastewater disposal that were not proposed by the applicant. That evaluation of wastewater disposal options includes consideration of the use of evaporation ponds and how the potential environmental impacts compare with the applicant proposal and other liquid waste management options. The waste management options are discussed at a general level of detail with regard to radon emissions because there are various implementation options that an applicant could present that would affect the amount of radon emitted from a specific proposal. Additional information is discussed in the following paragraphs to address the commenter concern that radon emissions from evaporation ponds, if used in a modified proposed action, could lead to significant environmental impacts.

The amount of radon that might be emitted if an evaporation pond or ponds were added to the current Nichols Ranch ISR Project can be approximated from radon emissions information provided in the applicant proposal (Uranerz, 2007). To calculate the emission estimates, the applicant used NRC accepted methods (NRC, 1987) to estimate the annual activity of radon that would be transferred to production fluids from the decay of radium in the ore body. This approach considered variables such as the average production flow rate (i.e., the amount of lixiviant that would be circulated annually through the ore body and pumped to the surface) and the radium content of the ore body. Assuming the radon is in secular equilibrium with the radium in the ore body and all radon in the pumped lixiviant were allowed to escape to the open air, the highest annual radon-222 emissions approximately 28 TBq/yr [755 Ci/yr] for the combined operations of Nichols Ranch Unit and the Hank Unit wellfields.

The amount of this potential total annual radon emission that could be released from an evaporation pond would be proportional to the amount of lixiviant (and, therefore, dissolved radium) that is diverted from the processing circuit as process bleed (1.0 percent of the production flow rate from the applicant proposal) or approximately 0.28 TBq/yr [7.6 Ci/yr].

The highest dose at the site boundary for the Nichols Ranch Unit is 0.04 mSv (4 mrem) per year total effective dose equivalent (TEDE) at the west boundary, which is 4 percent of the 1 mSv (100 mrem) per year dose limit for a member of the public as specified in 10 CFR 20.1301. For the Hank Unit, the highest dose at the site boundary is 0.11 mSv (11 mrem) per year TEDE at the east boundary, which is 11 percent of the 1 mSv (100 mrem) per year public dose limit. The maximum exposed nearby resident (Pumpkin Butte Ranch) located approximately 2 km [1 mi] east of the proposed Hank Unit is calculated to be 0.01 mSv (1 mrem) per year, which is 1 percent of the 1 mSv (100 mrem) per year regulatory limit. The NRC staff considers this calculation sufficient to demonstrate that potential public health impacts from radon releases would be small, and additional analyses or comparisons with other regulatory requirements are not necessary to support this conclusion. A licensed facility would also be required to have an NRC-approved environmental monitoring program for radon emissions in place that would report measured radon values to NRC for review on a semi-annual basis. Annual NRC inspections would also verify that applicant safety programs are compliant with NRC regulations in 10 CFR Part 20 and any conditions of their license, thereby providing additional confidence that the facility would be operated safely and within the bounds described in the applicant's proposal.

Radon emissions associated with the applicant's proposal are evaluated in SEIS Sections 4.13.1.2.1. The use of evaporation ponds is presently not part of the applicant's proposal for Nichols Ranch ISR Project. Should the applicant decide in the future to change its proposed approach to wastewater management, it would be required by NRC to amend its

proposal and that amendment would be reviewed for potential environmental impacts as well as for compliance with NRC safety requirements.

B.5.27.2 Impacts from Off-Normal Operations or Accidents

Comment: N020-006
One commenter stated the consequences of failure should follow procedures based on occupational health and safety impacts, premised on the handling and storage procedures being followed.

***Response**: This comment was written based on the summary provided in the Executive Summary. Analysis and discussion of procedures used in normal operations and accident conditions are provided in SEIS Sections 4.13.1.2.2 and 4.13.1.2.4, as well as its reference to GEIS Sections 4.3.11.2.2 and 4.3.11.2.4 (NRC, 2009). Because this analysis was already included, no changes were made to the SEIS.*

B.5.27.3 General

Comment: N014-020
One commenter suggested the SEIS should be more specific as to the technologies and processes employed at ISR facilities that provide additional protection of public and occupational health and safety. The specific examples the commenter cited include downflow ion-change columns and vacuum dryers, which provide additional protections by limiting or eliminating potential public and worker exposure to radon gas and yellowcake dust.

***Response**: These types of equipment are discussed in the SEIS as well as the GEIS (NRC, 2009) and are part of the analysis in which the radiological impacts to the public and workers are evaluated as SMALL. Because these topics are already addressed, no changes were made to the SEIS.*

Comment: N014-022
One commenter suggested the NRC staff discussion of radiation protection issues should reference comparisons of potential radiation dose to natural background levels and should not be limited to comparison to NRC dose limits.

***Response**: Because NRC dose limits are well below natural background levels of radiation, a comparison of public dose from an ISR facility that is generally well below dose limits would be even further below natural background levels of radiation. The public generally perceives a marked difference from radiation exposure from man-made sources than that from natural background radiation levels. NRC requires that worker and public radiation doses be quantified as effective dose equivalent in mrem per year, which is intended to normalize doses by the expected health risk. This is achieved for different types of radiation and different body tissues by using weighting factors for radiation (alpha, beta, gamma, neutrons) and for body tissues (bone marrow, reproductive organs, lens of the eyes) to convert the radiation absorbed by a person to a common scale (in units of mrem) for determining compliance with NRC radiation protection requirements and for assessing the potential for harm or detriment. When this method is used, if a person is exposed to the same dose from background radiation or from releases from ISR facilities, there is no difference in the expected health effects. NRC staff understands that members of the public can perceive involuntary man-made risks as more hazardous than voluntary natural risks. Because the SEIS discussion is considered*

appropriate, no changes were made to the SEIS beyond the information provided in this response.

B.5.27.4 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

NRC. Methods for Estimating Radioactive and Toxic Airborne Source Terms for Uranium Milling Operations, Regulatory Guide 3.59, Washington, D.C., March 1987.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.28 Waste Management

B.5.28.1 General Waste Management Comments

Comments: N013-073; N015-003; N015-013
Two commenters stated the SEIS waste disposal impact analysis was limited and should be improved. One commenter stated the potential impact analyses should discuss (i) treatment of the liquid effluent stream to applicable Wyoming Groundwater Class of Use standards prior to injection or discharge; (ii) evaluation of radioactive contaminant removal; (iii) arrangements for offsite commercial, licensed land disposal of the treatment residue; (iv) use of evaporation ponds with double liners and leak detection systems; and (v) costs to remove other potentially harmful nonradiological constituents before injection.

Response*: The waste disposal impact analyses in the SEIS have been revised in several areas. SEIS Section 2.2.1.3.2 was revised to provide estimates of liquid effluent generated during operations from the proposed project. Section 4.5.2.1.1 has been modified to clarify that appropriate permits are required for all surface discharges, including those in ephemeral drainages. Section 3.13.1 was modified to indicate that the projected life of the Campbell County landfill is at least 30 years. Section 3.13.3 was revised to indicate that the applicant would have to handle and dispose of hazardous wastes, including used oil and spent batteries, in accordance with applicable local, State, and Federal regulations. Section 2.2.1.6.3 was revised to include conditionally exempt small-quantities-generator requirements and the consequences if the site fails to meet the requirements. Responses to comments on waste management that did not result in SEIS revisions are located throughout this SEIS Appendix, specifically in Section B.5.32.*

Comment: N018-034
One commenter asked whether soils and other media contaminated by spills and other releases would be transported to solid waste disposal or treatment facilities in Wyoming.

***Response**: NRC noted in SEIS Section 4.14 that ISR facilities generate radiologically contaminated wastes, including contaminated soils, structures, and liquids that are classified as byproduct material. NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material before ISR operations begin. The existing facilities that NRC licensed to accept byproduct material for disposal are the Pathfinder-Shirley Basin uranium mill tailings impoundment in Mills, Wyoming, and the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico. Additionally, two sites in Utah and one in Texas are licensed by NRC Agreement States to accept byproduct material for disposal. Because the information provided in the SEIS about the disposal of contaminated materials generated by the proposed Nichols Ranch ISR Project is sufficient to support the evaluation of environmental impacts, no changes were made to the SEIS in response to this comment.*

Comments: N018-035; N018-036; N018-037; N018-039; N018-040
One commenter indicated that only estimates of solid wastes for the operations phase are provided and estimates for all phases are needed to determine whether adequate landfill capacity exists. The commenter further stated that waste volume estimates should include an allowance for unknown quantities, such as contaminated soil resulting from spills. The commenter also stated that landfill operators should be contacted to verify the landfills can handle the projected waste volumes from the proposed Nichols Ranch ISR project.

***Response**: As stated in Sections 2.2.1.6.3, 3.13.2, and 4.14, the proposed operations would annually generate (for an estimated 8 years) approximately 540 to 770 m^3 [700 to 1,000 yd^3] and decommissioning activities would cumulatively generate (over a 5-year period) approximately 941 m^3 [1,230 yd^3] plus 2,074 t [2,288 T] of nonhazardous solid waste [i.e., nonradioactive solid waste (general trash), construction and demolition debris, or byproduct material that complies with NRC unrestricted release limits]. The total amount of nonhazardous solid waste that would be generated by all phases of the proposed project would be about 7,957 m^3 [10,400 yd^3] as stated in Section 5.14. The applicant has proposed disposing of nonhazardous solid wastes in a sanitary landfill located near Gillette, which is approximately 74 km [46 mi] north-northeast of the proposed project site. The NRC staff spoke a representative of the Campbell County Landfill, which is located in Gillette, Wyoming. The landfill is well below capacity, with a new cell under construction and planned, respectively, for municipal waste and for construction and demolition waste. The landfill can continue to receive solid and construction/demolition wastes at its present rate (over 100 tons per day) for approximately 30 years (CCPW, 2009, 2010). The discussion in SEIS section 3.13.2 has been modified to address the landfill's available capacity.*

If soils, construction material, piping, or other media become contaminated with byproduct material, then that media would be handled, stored, and disposed of in the same manner as byproduct material and would not be handled by the Campbell County Landfill. Sections 2.2.1.6.3 and 5.14 contain estimates of contaminated soils and materials. Because the information provided in the SEIS about the disposal of contaminated materials generated by the proposed action is sufficient to support the evaluation of environmental impacts, no changes were made to the SEIS in response to this comment.

Comments: N018-054; N018-055; N018-060; N018-061; N018-068
One commenter identified specific portions of the SEIS they wanted revised in response to the following comments they provided: N018-035, N018-036, N018-039, N018-046, N018-047, N018-048, N018-049, and N018-050.

***Response**: Comments identifying portions of the SEIS to revise in response to other comments do not require a response here, other than to indicate that they have been addressed in the following comment responses: N018-035, N018-036, N018-039, N018 046, N018-047, N018-048, N018-049, and N018-050.*

Comment: N018-062
One commenter stated that the SEIS did not clearly state whether construction and demolition wastes from the site would be disposed of in the Campbell County Landfill.

***Response**: SEIS Section 3.13.1 regarding the disposal of construction and demolition wastes was revised to clarify that construction and demolition waste would be disposed of at the Campbell County Landfill.*

Comment: N018-063
One commenter stated WDEQ does not approve hazardous waste disposal facilities and transportation, whereas SEIS Section 3.13.1 states WDEQ does perform those functions.

***Response**: NRC staff agrees with this comment. SEIS Section 3.13.3 was revised accordingly.*

B.5.28.2 Scope of the Assessment of Waste Management Impacts

Comment: N015-011
One commenter stated the wastewater analysis is not accurate, because volumes and disposal methods for liquid wastes other than bleed water and elution circuit bleed are not included.

***Response**: SEIS Section 2.2.1.3.2 provides estimates of liquid effluent generated during operations of the proposed project. The estimates of production bleed are 150 Lpm [40 gpm] for the Hank Unit and 280 Lpm [75 gpm] for the Nichols Ranch Unit. For both operational units, the applicant estimates 3.8 to 7.6 Lpm [1 to 2 gpm] of miscellaneous plant wastewater that includes liquids from process drains, well development water, pumping test water, elution circuit bleed, and washdown water. Groundwater restoration discharge would contribute an estimated 83 to 340 Lpm [22 to 90 gpm]. SEIS Section 2.2.1.3.2 was revised to include these groundwater restoration liquid effluent estimates.*

Comment: N020-005
One commenter wanted to know how waste management impacts were quantified or what thresholds were designated for the impacts classifications.

***Response**: SEIS Section 4.14 discusses waste management impacts. NRC did not designate quantitative thresholds for the various impact classifications. In the SEIS, impacts were often assessed in terms of the capacity or availability of treatment or disposal facilities. SEIS Sections 2.2.1.6 and 3.12 discuss the expected amounts of various wastes the proposed action generated. Because the SEIS discussion is considered appropriate, no changes were made to the SEIS beyond the information provided in this response.*

B.5.28.3 Characteristics of Wastes Generated by ISR

Comment: N014-014
One commenter stated that the discussion of waste management should be revised to clarify the differences between byproduct material and other wastes.

***Response**: The NRC staff agrees that the discussion of waste management should clearly distinguish between byproduct materials and non-byproduct wastes. SEIS Section 2.1.1.1.6 has been restructured to discuss wastes generated at the proposed Nichols Ranch ISR Project in four categories: (i) liquid byproduct material; (ii) other liquid wastes; (iii) solid byproduct materials; and (iv) other solid wastes. Sections 3.13 and 4.14 of the SEIS have also been revised to distinguish byproduct materials from other wastes.*

Comment: N020-004
A commenter requested clarification of the term "other solid wastes" and noted that some construction materials, such as organic solvents, paints, used oil, and paint thinners, may be classified as hazardous wastes subject to regulation under the Resource Conservation and Recovery Act (RCRA).

***Response**: The Executive Summary and Sections 2.2.1.6 and 3.13 of the final SEIS have been modified to more clearly describe waste generation and disposal during the construction phase of the proposed Nichols Ranch ISR Project.*

B.5.28.4 Waste Treatment and Disposal Methods

Comments: N015-007; N015-008; N015-009; N015-012; N013-077; N013-079
One commenter expressed concern over the deep well disposal of liquid wastes because of the wastewater composition (radioactive and nonradioactive components) and potential impacts to the receiving strata and other USDW. Another commenter was concerned that the disposal wells may not have the capacity to handle all wastewaters produced that are intended for disposal via well injection. This commenter also wanted to know what would happen to the waste in a failed well.

***Response**: The applicant has identified deep well disposal as its preferred liquid waste disposal option. The Safe Drinking Water Act (SDWA) grants EPA the primary authority to regulate underground injection and protect current and future sources of drinking water. EPA implements this responsibility through its UIC program. EPA has authorized the State of Wyoming to administer the UIC programs in accordance with EPA regulations. The applicant has submitted an application for a permit for up to eight Class I UIC wells, and this permit must be in place before any NRC-licensed uranium ISR facility can begin operations. The permit application is available for viewing through the WDEQ's web site (see https://gem.trihydro.com/default.aspx). For WDEQ to issue a UIC permit, no exposure pathway can exist through drinking water. The UIC review process verifies that the injected fluids are isolated from the accessible environment, including potential sources of drinking water. The terms of the UIC permit would dictate the concentrations of components (radioactive and nonradioactive) and injection rates allowable for the proposed well. If the applicant is unable to obtain a Class I UIC permit, an amendment to its NRC license application would be required to accommodate another disposal method. NRC would conduct a full safety and environmental review and offer a hearing opportunity for any proposed license amendment.*

The applicant's application for a Class I UIC permit, which can be viewed through the WDEQ's website, describes well design, controls, and monitoring in more detail. Among the measures the application describes are the following: mechanical integrity would be demonstrated before subsurface injection begins, and at least once every five years thereafter during the life of the well. A specific and detailed procedure for mechanical integrity testing would be submitted to the WDEQ for approval prior to conducting the initial test, and the results of that test would be submitted and approved before subsurface injection could begin. Further, Uranerz would

monitor and continuously record the injection rate. Continuous pressure monitors would be installed on the injection tubing and on the well annulus, and any leakage in either the casing or the tubing would cause the well to be shut down automatically. Useable water quality in the area would be monitored by the required wellfield monitor wells associated with the ISR operations. Uranerz would submit quarterly reports and annual reports to WDEQ. The annual report would discuss any significant events for the year, such as mechanical integrity tests, and any noncompliance with permit conditions (Uranerz, 2010).

Failures of Class 1 injection wells are rare as concluded by EPA in a report on the risks associated with Class 1 underground injection wells (EPA, 2001). The report includes detailed discussions of the technology, regulatory oversight, potential failures, and associated risks of Class 1 injection wells. Considering operational performance data, EPA noted that most failures of well mechanical integrity are internal failures, detected by continuous annulus monitoring systems or the aforementioned mechanical integrity tests, and the wells are shut in until they are repaired. EPA's study of more than 500 Class I nonhazardous and hazardous wells showed that loss of mechanical integrity contributed to only 4 cases of significant wastewater migration (none of which affected a drinking water source) over several decades of operation. EPA attributed this performance to the rigorous requirements for monitoring and for ensuring that the well materials are compatible with the wastewater injected. EPA further notes the inclusion of redundant safety systems in Class 1 wells requires that multiple systems fail without detection before well failure occurs. Should a failure occur, the approved geology of the injection and confining zones would limit the movement of wastewaters so that nearby underground sources of drinking water would be protected. The information in the EPA study and the preceding discussion in this comment response support the NRC practice whereby satisfactory completion of the WDEQ permitting process prior to starting operations and compliance with all NRC license conditions are sufficient to conclude the proposed deep disposal wells would not impact underground sources of drinking water.

The text in Chapters 2, 3, and 4 was modified to indicate the applicant's permit application status for the Class I deep disposal wells.

Comment: N013-078
One commenter indicated preference for deep well injection over evaporation ponds or land application as a waste water disposal option.

***Response**: Because the comment was general in nature, no changes were made to the SEIS.*

Comments: N013-074; N013-075; N018-047; N018-048; N018-049; N018-051; N018-052; N018-058; N018-065; N018-066; N018-067; N018-069; N018-070; N018-072; N018-073; N018-074
Commenters indicated that, to adequately assess waste management impacts, the SEIS needs to describe the volume of solid radioactive byproduct material generated, including decommissioning wastes and wastes resulting from spill or other releases, and the capacity of the solid radioactive byproduct material disposal sites being considered. One commenter also stated that byproduct materials must not be hazardous to be acceptable for disposal at the Pathfinder Mines disposal site in Carbon County, Wyoming.

***Response**: NRC has expanded the discussions in Chapters 2, 3, 4, and 5 to include more information about the types of wastes generated, including decommissioning wastes (which includes an estimate for contaminated soils). The discussion of solid waste management in SEIS Section 2.2.1.6.3 identifies three potential NRC-licensed facilities for the disposal of*

(radioactive) byproduct material (Pathfinder-Shirley Basin in Mills, Wyoming; Energy Solutions in Clive, Utah; White Mesa in Blanding, Utah). In addition, discussion of waste management impacts in the SEIS indicates that NRC requires applicants to have a radioactive byproduct material disposal agreement in place prior to operations. The applicant has not yet developed an agreement with a licensed disposal site, but the NRC requirement to have an agreement in place is reflected in a license condition for the proposed Nichols Ranch ISR Project. Such an agreement would account for radioactive byproduct material generated throughout the life of the project, including decommissioning. Considering the disposal options currently available and the NRC's requirement for a disposal agreement, the NRC staff concludes that the potential waste management impacts associated with the generation of byproduct material would be SMALL. The environmental impacts of disposing a specified amount of byproduct material at any potential byproduct material disposal facility would be covered in the environmental impact statement or environmental assessment as part of licensing that disposal facility. Section 5.14 states that the cumulative impacts of disposing of solid byproduct material from several ISR facilities would be SMALL, and this conclusion is based on the existence of several available disposal sites, as well as the NRC's requirement for the applicant to have an agreement in place with a disposal site. No modifications have been made to the SEIS beyond this comment response.

Comment: N018-064
One commenter suggested that the Campbell County Landfill operator should be contacted to determine whether used oil or spent batteries can be managed at that site.

***Response**: The applicant would need to comply with Wyoming regulations in handling hazardous wastes such as used oil and car batteries. The Campbell County Landfill's Recycling Center accepts used oil and car batteries, as well as other hazardous wastes. The SEIS text in Sections 2.2.1.6.3, 3.13.2, and 4.14.1.1.2 has been modified to include additional information concerning hazardous waste disposal.*

Comment: N020-013
One commenter mentioned that evaporation ponds used for storage of byproduct material are considered a source of radon and subject to requirements of 40 CFR Part 61, Subpart W, and approval of construction is required under 40 CFR Part 61, Subpart A. These requirements should be included in the SEIS if evaporation ponds are included.

***Response**: The applicant is not proposing to use evaporation ponds. However, the staff has included a discussion of evaporation ponds and associated requirements as an alternative wastewater disposal option under the proposed action in Section 2.2.2.1 of the SEIS.*

Comments: N020-016; N020-017
One commenter wanted to know the basis for the apparent conclusion that spent resin, pipes and fittings, tank sediments, and some types of domestic trash (e.g., oil, batteries) would be considered nonhazardous wastes. This commenter also stated empty chemical containers must be cleaned to dispose of them as nonhazardous waste.

***Response**: Under WDEQ regulations that implement the RCRA hazardous waste program, the applicant is responsible for identifying and properly managing any hazardous wastes it generates as part of its proposed activities. The applicant would need to manage and dispose of any hazardous wastes, such as organic solvents, paints, used oil, paint thinners, empty chemical containers, tank sediments/sludges, chemical wastes, and spent batteries, in accordance with local, State, and Federal regulatory requirements. The NRC staff modified text*

in SEIS Sections 2.2.1.6.3, 3.13.2, and 4.14.1.1.2 to clarify the discussion of hazardous waste types.

Comment: N020-021
One commenter expressed concern over the lack of detail about the target formations for the proposed Class I deep disposal wells.

***Response**: In September 2010, the applicant submitted a permit application for eight Class I wells to be drilled (four each in the Nichols Ranch Unit and in the Hank Unit) for the proposed Nichols Ranch ISR Project, depending on the production rates and the capacity of each deep disposal well. The application states that the fluid would be injected in the Cretaceous Teckla, Teapot, and Parkman sandstones at depths of approximately 2,326 to 2,652 m [7,630 to 8,700 ft] below ground surface at the Nichols Ranch Unit and depths of approximately 2,360 to 2,652 m [7,740 to 8,700 ft] below ground surface at the Hank Unit. Relevant text in Chapters 2, 3, and 4 was modified to include this new information.*

B.5.28.5 Regulation of Wastes and Disposal Methods

Comment: N008-011
A commenter stated that National Pollutant Discharge Elimination System (NPDES) permits are not required for deep disposal wells, whereas Section 3.13.3 in the SEIS states these permits are required.

***Response**: NRC agrees with the comment. SEIS Section 3.13.3 was revised to accurately identify appropriate permit information.*

Comments: N018-041; N018-044; N018-045; N018-059
One commenter expressed concern that the proposed handling and disposal of hazardous wastes is not consistent with pertinent local, state, and federal regulations. The commenter also indicated that regulate used oil storage and spent battery generation and disposal the State of Wyoming, which may require a permit.

***Response**: The NRC staff modified text in SEIS Sections 2.2.1.6.3, 3.13.2, and 4.14.1.1.2 to include more detail on the types of wastes generated by the proposed project and the need for compliance with pertinent State and Federal regulations governing hazardous waste handling and disposal.*

Comments: N018-042; N018-043
One commenter noted that the Wyoming Solid Waste Program encourages applicants to consider developing onsite recycling plans during the construction, operation, restoration, and decommissioning phases of facilities. This commenter also noted that a solid waste permit may be required depending on the volume and location of solid waste accumulated onsite before transportation to a disposal facility.

***Response**: SEIS Section 1.6.2, as well as relevant sections in Chapters 2, 3, and, 4 explain that, in addition to the NRC license, ISR facilities must obtain permits or authorizations from Federal, Tribal, and State agencies for activities requiring permission from regulatory authorities. Because the SEIS discussions are considered appropriate, no changes were made to the SEIS beyond the information provided in this response.*

Comments: N018-046; N018-056
One commenter expressed concern that the SEIS contains no references to the role the State of Wyoming plays in authorizing byproduct material disposal facilities and that the byproduct material waste is defined as solid waste by Wyoming statute and subject to the State regulatory requirements.

***Response**: Concerning the definition of byproduct material as "solid waste" and the State of Wyoming regulatory authority thereof, the NRC agrees that such waste would be subject to Wyoming solid waste regulations if it meets NRC criteria for unrestricted release. However, NRC regulates byproduct material (i.e., waste that does not meet NRC criteria for unrestricted release) under 10 CFR Part 40. This is not "solid waste" according to 40 CFR 261.4(a)4. Because Wyoming is a nonagreement state, NRC retains jurisdiction over byproduct material. However, a discussion of construction and authorization of additional byproduct material disposal facilities goes beyond the scope of this document. No modifications of the SEIS have been made beyond this response.*

Comment: N020-018
One commenter expressed concern that the SEIS discussion of conditionally exempt small quantity generator (CESQG) did not fully explain the requirements for this exemption or the consequences if the site fails to meet the requirements.

***Response**: SEIS Section 2.2.1.6.3 was revised to better explain the types and quantities of solid wastes, including hazardous wastes, that would be generated at the proposed site and to describe the requirements for CESQGs. As discussed in that section, if the facility fails to meet the requirements, it would lose its conditionally exempt status and be fully regulated as either a small-quantity generator or a large-quantity generator.*

Comment: N020-019
One commenter stated the ISR facility may be subject to the Emergency Planning and Community Right-to-Know Act and Toxic Substances Control Act and requested that the SEIS discuss the extent to which the ISR facility would comply with these regulations.

***Response**: SEIS Section 4.13.1.2.3 identifies the primary regulations applicable to the use and storage of chemicals and includes the topics the commenter mentioned. NRC, though not the regulatory authority for either of these laws, expects its licensees to comply fully with these and all other applicable regulations. SEIS Sections 1.5 and 1.6 discuss the role of other Federal, Tribal, State, and local agencies in regulating and permitting an ISR facility. Because the SEIS discussion is considered appropriate, no changes were made to the SEIS beyond the information provided in this response.*

B.5.28.6 References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Washington, DC: U.S. Government Printing Office.

40 CFR Part 61. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 61, "National Emission Standards for Hazardous Air Pollutants (NESHAPS)." Washington, DC: U.S. Government Printing Office.

40 CFR Part 144. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 144, "Underground Injection Control Program." Washington, DC: U.S. Government Printing Office.

40 CFR Part 261. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 261, "Identification and Listing of Hazardous Waste." Washington, DC: U.S. Government Printing Office.

CCPW. Memo to file from C. Pineda, U.S. Nuclear Regulatory Commission. "Summary of Teleconference with Mark Swan, Environmental Services Manager, Campbell County Public Works, Concerning Landfill Capacity for the Proposed Nichols Ranch ISR Project." ML102600569. Gillette, Wyoming: Campbell County Department of Public Works. September 17, 2010.

CCPW. E-mail from M. Swan, Environmental Services Manager, Campbell County Public Works to I. Yu, Project Manager, Office of Federal and State Materials and Environmental Management Programs. "Campbell County Landfill Information." ML092710186. Gillette, Wyoming: Campbell County Department of Public Works. September 18, 2009.

EPA. "Class 1 Underground Injection Control Program: Study of the Risks Associated with Class 1 Underground Injection Wells." EPA 816-R-01-007. Washington, DC: EPA. March 2001.

Uranerz. "Nichols Ranch ISR Project Application For Wyoming Underground Injection Control Permit For Class I Non-Hazardous Injection Wells," Casper, Wyoming. Prepared by Hydro-Engineering, LLC & Lyn George (Consulting Geologist), September, 2010. Available at WDEQ's web site: https://gem.trihydro.com/default.aspx (accessed 27 September 2010). 2010.

B.5.29 Cumulative Effects

B.5.29.1 General Comment: The SEIS Does Not Adequately Address Cumulative Effects

Comments: N001-003; N002-003; N011-055; N011-061; N013-038; N013-041; N017-032
Several commenters expressed concern that the draft SEIS did not adequately address cumulative effects. For example, several commenters noted the SEIS listed of other EISs different agencies prepared, but with no associated meaningful analysis. Two commenters stated there was not enough time to meaningfully evaluate the cumulative impact analysis during the public comment period on the draft SEIS because that analysis referenced environmental reviews other Federal agencies were performing and the commenter needed more time to review to review supporting documents. Other commenters expressed concern that cumulative impacts were presented as conclusory statements with an inadequate basis. Another commenter expressed concern that the SEIS considered only Federal actions in the analysis of cumulative impacts. Finally, commenter noted that because certain actions (i.e., CBM operations) would be occurring in the same geographic area as certain proposed ISR projects, serious and transparent agency consultation should occur.

Response*: The discussion of cumulative impacts in Chapter 5 of the final SEIS for the proposed Nichols Ranch ISR Project was revised in response to public comments. The NRC staff believes that the information presented in Chapter 5 of the SEIS is valid and relevant to the*

assessment of potential cumulative effects. The cumulative impact analysis was based on publicly available information on existing and proposed projects, information from the GEIS (NRC, 2009), general knowledge of the conditions in Wyoming and in the nearby communities, and reasonably foreseeable actions that could occur by resource area. Because the primary activities in the vicinity of the proposed Nichols Ranch ISR Project are mineral mining (including CBM, conventional, and coal; see SEIS Figure 5-2) and oil and gas development, the analysis focused on these activities; however, the analysis also considered information contained in GEIS Tables 5.2-4 and 5.2-5., which identify other activities occurring within the Powder River Basin.

The cumulative impacts analysis was revised to clearly define the geographic scope for the analysis of each resource area, the timeframe considered in the analysis, and the cumulative impact on the various resource areas from both federal and private actions. Section B.5.13 of this comment-response appendix discusses the extension of the public comment period in response to public comments.

Comments: N011-046; N011-048; N011-052; N011-053; N011-054
Several commenters expressed concern that the cumulative effects analysis presented in the GEIS (NRC, 2009) was inadequate and used to constrain the scope of the cumulative effects analysis in the SEIS. For example, one commenter noted the SEIS does not consider the cumulative impacts of past uranium mining and milling combined with the current proposed project. One commenter noted that the GEIS deferred conclusions on the potential cumulative impacts to the site-specific SEIS. Because the site-specific cumulative effects analysis presented in the SEIS is based heavily on information presented in the GEIS, the commenter concluded the SEIS does not address the NEPA requirements with respect to cumulative impacts.

***Response**: The relationship between the GEIS and the site-specific supplemental EISs is described in SEIS Section 1.4.1. GEIS Section 5.4 discusses approaches for conducting a site-specific cumulative effects analysis and provides tables of other activities or projects occurring in each geographic region. The cumulative impacts analysis in the SEIS considered the how the impacts from the proposed Nichols Ranch Project could contribute to cumulative impacts when its impacts overlap those of other past (e.g., past uranium mining and milling projects), present, or reasonably foreseeable future actions.*

Uranium recovery sites in the vicinity of Nichols Ranch ISR Project are listed in Table 5-1. Locations of nearby uranium recovery projects (conventional and ISR uranium recovery facilities), in addition to BLM pasture allotments and crop land, are illustrated in Figure 5-1. Figure 5-2 shows the location of oilfields, coalfields, CBM project areas, uranium occurrences, and uranium facilities with respect to the proposed Nichols Ranch ISR Project, and Figure 5-3 shows other energy development projects within an 80-km [50-mi] radius of the proposed project site. The cumulative effects analysis in SEIS Section 5 was revised to improve the transparency and clarity of the analysis and provide a more detailed discussion of potential cumulative effects for critical resource areas such as Land Use (SEIS Section 5.2), Groundwater (SEIS Section 5.5.2), Ecological Resources (SEIS Section 5.6), Air Quality (SEIS Section 5.7), and Socioeconomics (SEIS Section 5.11).

Comment: N018-023
The commenter noted Section 5.5.2 did not mention impacts to the aquifers used for deep disposal.

***Response**: Potential impacts to groundwater resources and the effects from waste management practices at the site are described in SEIS Sections 4.5.2 and 4.14. The cumulative impact on groundwater resources from the proposed action are considered in Section 5.5.2 of the SEIS. The deep disposal of process water is considered in this section of the SEIS as well.*

No further changes were made to the SEIS beyond the information provided in this response.

B.5.29.2 Past, Present, and Reasonably Foreseeable Future Actions

Comments: N009-006; N010-007
Two commenters stated that no studies have been conducted to identify the cumulative effects of locating multiple ISR facilities closely together.

***Response**: The cumulative impacts analysis presented in SEIS Chapter 5 includes consideration of past, present, and reasonably foreseeable uranium recovery operations, both for conventional mining and milling and ISR technologies. All known uranium recovery sites within approximately 80 km [50 mi] of the proposed Nichols Ranch ISR Project are listed in SEIS Table 5-1, which also includes the distance and direction from the proposed project site. NRC regulates these facilities and the potential environmental impacts from these facilities are (or would be) evaluated in accordance with NRC NEPA requirements in 10 CFR Part 51. In addition, the cumulative effects analysis in SEIS Chapter 5 has been revised to improve the clarity and transparency of how past, present, and reasonably foreseeable future actions were evaluated for each resource area.*

Comments: N011-056; N011-057; N011-058; N011-059; N011-060; N013-022; N013-023; N013-024; N013-025; N013-026; N017-031
Several commenters expressed concern over the possible cumulative effects that could result from past, present, and reasonably foreseeable future actions associated with other resource extraction operations in the Powder River Basin, such as CBM production, oil and gas production, and coal mining. For example, several comments noted the SEIS should disclose the types and amounts of contaminants released from CBM operations into aquifers and surface waters and provide a detailed analysis of the incremental impacts from the proposed Nichols Ranch ISR Project. Other commenters stated the SEIS should include an analysis of the potential for cross-contamination from wells associated with CBM, oil and gas, and coal mining operations.

***Response**: Potential impacts to groundwater resources and the effects of waste management practices at the site are described in SEIS Sections 4.5.2 and 4.14. SEIS Chapter 5 includes a discussion of other past, present, and reasonably foreseeable future actions associated with groundwater extraction within the groundwater resource study area {80-km [50-mi]} considered in the analysis of cumulative impacts as discussed in SEIS Section 5.5.2. These activities include both oil and gas and CBM development in addition to the consideration of other ISR facilities. Furthermore, as described in SEIS Section 1.7, NRC has entered into an MOU with BLM to keep current on issues that develop with respect to these operations on public lands. The analysis of cumulative impacts on groundwater in SEIS Chapter 5 has been revised to*

clarify the technical basis for the cumulative impact conclusions within the groundwater resource study area.

Comments: N011-066; N017-029
Several commenters expressed concern that the cumulative impacts analysis presented in SEIS Chapter 5 did not consider impacts from past uranium mining or milling.

***Response**: The cumulative impacts analysis presented in SEIS Section 5 includes a discussion of past and present uranium recovery operations, both for conventional mining and milling and ISR technologies. All known past, present and future uranium recovery sites in the vicinity of the proposed Nichols Ranch ISR Project are listed in Table 5-1, which also includes the distance and direction from the proposed project site. Within approximately 94 km [58.5 mi] of the proposed Nichols Ranch Project, there are 17 ISR facilities that were licensed (no longer in operation), are currently licensed, or are planned to be licensed in addition to two conventional uranium mines located within an approximate 80 km [50 mi] radius. NRC has regulatory authority for the radiological aspects of these facilities, and the potential environmental impacts from these facilities are (or would be) evaluated in accordance with NRC's NEPA requirements in 10 CFR Part 51. In addition, the cumulative effects analysis in SEIS Chapter 5 has been revised to improve the clarity and transparency of how past, present, and reasonably foreseeable future actions relating to uranium recovery were considered.*

Comments: N015-020; N015-021; N015-022
Several commenters noted specific cumulative impacts from multiple ISR facilities with respect to the ambient air quality, including effects on NAAQS pollutants such as nitrogen oxides, particulate matter, and ozone. In addition, one commenter noted the development of multiple ISR facilities could result in air emission levels that could adversely affect the Air Quality Related Values such as visibility in Class I and sensitive Class II areas.

***Response**: The analysis of the cumulative impact to air quality in the final SEIS was revised in response to public comments to consider operating or planned ISR facilities located within an 80 km [50 mi] radius of the proposed Nichols Ranch ISR Project in addition to a consideration of CBM activities, coal mining, and oil and gas exploration occurring within the Powder River Basin. The analysis of nonroad combustion engine emission estimates in SEIS Appendix D considered the emissions from well drilling, construction equipment, and the use of reclamation equipment. Ambient air quality is discussed in SEIS Section 3.7 and potential impacts to air quality are discussed in Section 4.7. The potential cumulative effect on visual resources is discussed in SEIS Section 5.10.*

B.5.29.3 Specific Document Changes or Action Requests

Comments: N007-020; N013-029; N013-030; N013-031
Several commenters expressed concern that the estimated number of CBM wells in the Powder River Basin identified in the SEIS was inaccurate or too low.

***Response**: NRC staff agrees with the commenters. Section 5.1.1.3 of the SEIS was revised to more accurately reflect the number of CBM wells located in Campbell and Johnson Counties.*

Comment: N018-071
One commenter noted that the SEIS does not consider cumulative effects on available capacity for different waste streams.

***Response**: The analysis of cumulative impacts in Chapter 5 of the SEIS was revised in response to public comments. The cumulative impact analysis from waste management activities in Section 5.14 considers the potential cumulative impact on disposal capacity by waste stream (e.g., byproduct material, nonhazardous solid waste). NRC regulations in 10 CFR Part 40, Appendix A, Criterion 2 require that a licensee have an agreement in place for byproduct material disposal prior to commencing uranium recovery operations. In addition, the applicant would be expected to comply with applicable State and Federal regulations for disposing of solid and hazardous waste. The disposal of liquid effluent via deep well injection is regulated through the State-permitting process for Class I wells. WDEQ evaluates the suitability and capacity of the applicant-proposed formation for disposal. The applicant must have a permit for Class I wells prior to operations.*

B.5.29.4 Significance

Comments: N007-021; N013-032; N013-040; N017-030
Several commenters requested greater detail of how NRC determined the magnitude of cumulative impacts. Specific issues raised include whether cumulative impacts were evaluated at both a geographic and temporal scale, and whether groundwater impacts could be classified as large because the groundwater in the mining areas would never be the same.

***Response**: The NRC staff believes that the information presented in SEIS Chapter 5 is valid and relevant to the assessment of potential cumulative effects. Section 5.1.2 identifies the temporal scale for the analysis as extending from 2007 to 2020 for all resource areas, which is based on the estimated production life of the proposed Nichols Ranch ISR facility. This period represents the time that NRC initially received the license application from the applicant (2007) through expected license termination (2020) after aquifer restoration and decommissionsing. The geographic scale varies by resource category and is clearly identified for each resource area throughout SEIS Chapter 5. The cumulative effects analysis presented in SEIS Chapter 5 has been revised to improve the transparency and clarity of the analysis, including a more detailed discussion of how impact significance was determined for potential cumulative effects for critical resource areas such as Land Use (SEIS Section 5.2), Groundwater (SEIS Section 5.5.2), Ecological Resources (SEIS Section 5.6), Air Quality (SEIS Section 5.7), and Socioeconomics (SEIS Section 5.11). Additional information on groundwater restoration criteria can be found in B.9.8 and groundwater resources in B.20 of Appendix B.*

The NRC staff determined that the impact on groundwater at the Nichols Ranch ISR Project would be SMALL as discussed in SEIS Section 5.5.2. The NRC staff then considered the cumulative impact on groundwater resources within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project and concluded the impact would be MODERATE. Based upon a BLM report for the Buffalo Planning Area, in which the Nichols Ranch Project is centrally located, the primary types of actions leading to this moderate finding are energy development activities including CBM development and oil and gas production. However, the cumulative impacts on groundwater resulting from the interaction between ISR activities and CBM activities and oil and gas production could occur, but are not likely because CBM and oil and gas production and ISR activities are conducted in stratigraphically separate aquifers separated by hundreds to thousands of feet from the ore production zone in which uranium extraction would occur at the proposed Nichols Ranch ISR Project. Other ISR projects that could also extract

uranium from deposits within the Wasatch Formation are also located within an 80-km [50-mi] radius of the proposed Nichols Ranch ISR Project; however, these deposits are discontinuous and the occurrence of uranium is highly localized. Furthermore, the Wasatch Formation, in which the extraction zone is located, does not constitute a regional aquifer. Rather it is a sedimentary formation that contains local water-saturated lenses that can be locally productive but not hydraulically interconnected with other sand lenses because of the considerable clay content of the Wasatch Formation (ENSR, 2006). Given the heterogeneity of the geology in the Powder River Basin, the target aquifers at the proposed Nichols Ranch ISR Project would unlikely cover an 80-km [50-mi] radius. For these reasons, the NRC staff determined that the incremental impact from operation of the proposed Nichols Ranch ISR Project would be SMALL.

Comments: N013-036; N013-086
Commenters noted the SEIS needs to provide information on the wide variety of impacts that may affect sage-grouse habitat.

***Response**: SEIS Sections 4.6.1 and 5.6 covering the potential cumulative impacts to terrestrial ecology, vegetation, wildlife, aquatic ecology, and protected species include a discussion of potential impacts to sage-grouse habitat and populations. Since the publication of the draft SEIS in December 2009, several developments have occurred with regard to Federal, State, and local regulation of activities that may affect habitat and sage-grouse populations.*

In December 2009, FWS listed the sage-grouse as a candidate species (March 2010). Subsequently, Wyoming BLM made amendments to the National Sage-Grouse Habitat Conservation Strategy, and the Wyoming Governor's Sage Grouse Implementation Team (SGIT) continues to discuss an evaluation process for sage-grouse impacts. Although there are no regulations regarding the protection of the sage-grouse, WGFD, in cooperation with SGIT, has developed guidelines for various industries operating in different locations within Wyoming. NRC staff has been working with SGIT and its subcommittees to better define the State agency roles with respect to developing guidelines for the ISR uranium recovery industry. In addition, WGFD recently issued an update to its Recommendations for Development of Oil and Gas Resources Within Important Habitats (WGFD, 2010), which contains revised guidelines for sage-grouse protection that would be applied to the uranium extraction industry. These guidelines address (i) standard mitigation practices (for all wildlife), (ii) specific best management practices for sage-grouse, and (iii) stipulations for development in sage-grouse core areas that WGFD would monitor. The SEIS was revised throughout to keep the discussion current with recent developments.

Comment: N017-010
One commenter addressed the potential significance of cumulative impacts associated with spills, noting even small spills might be cumulatively significant for soil and groundwater resources.

***Response**: GEIS (NRC, 2009) Sections 2.11.2, 4.2.3, and 4.2.4 correctly characterize the approach NRC used to regulate and inspect ISR facilities and implement corrective actions to minimize both the likelihood and the impacts from unplanned spills. Licensees are required to develop and implement a spill control plan prior to beginning uranium recovery operations. NRC ensures these procedures are correctly implemented through its inspection and enforcement process, thereby reducing the overall cumulative impact of unplanned spills. GEIS Section 2.11.2 also discusses historical information with respect to spills at NRC-regulated ISR facilities. No changes were made to the SEIS in response to this comment.*

Comment: N018-050
One commenter expressed concern that the proposed Nichols Ranch ISR Project facility and two other proposed ISR facilities could produce a cumulative amount of byproduct material from decommissioning that would result in a large impact to disposal options in Wyoming.

***Response**: An important aspect of the NRC staff evaluation of potential waste management impacts is the availability of disposal capacity. As discussed in the GEIS, NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material that would be associated with facility operations, aquifer restoration, and decommissioning. Such agreements ensure that sufficient disposal capacity for byproduct material would be available throughout the life of the facility.*

As discussed in draft SEIS Section 2.2.1.6.3, the applicant does not presently have an agreement in place with a licensed site to accept their solid byproduct material for disposal. The applicant preferred destination for disposal of byproduct material is at the Pathfinder-Shirley Basin site in Mills, Wyoming. If that facility does not have sufficient capacity at the time the request for an agreement is made, then the applicant could engage other low-level radioactive waste disposal facilities that are licensed to accept byproduct material. Another existing facility that is licensed by NRC to accept byproduct material for disposal is the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico. Additionally, three sites are licensed by NRC Agreement States to accept byproduct material for disposal (i.e., the EnergySolutions site in Clive, Utah; the White Mesa uranium mill site in Blanding, Utah; and the Waste Controls Specialists site in Andrews, Texas).

At the time of this writing, NRC has received no proposals to expand byproduct material disposal capacity in Wyoming. As discussed in the GEIS (Section G5.32.2), proposals for onsite disposal of byproduct materials at locations without available disposal capacity are uncommon, but if such proposals were received by NRC, they would be evaluated on a case-by-case basis against criteria in 10 CFR Part 40, Appendix A. NRC would evaluate the potential environmental impacts of any such proposals if and when they are received. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations, the NRC staff continue to conclude that the potential waste management impacts associated with the generation of byproduct material would be SMALL.

B.5.29.5 Other

Comment: N011-019
One commenter noted that the SEIS cumulative impacts analysis should consider the ISR facility impact on climate change and related effects that climate change might have on groundwater supply for the region.

***Response**: EPA issued regulations for inventorying greenhouse gas emissions on October 20, 2009, and on February 18, 2010, after the draft SEIS was published for comment, the CEQ issued draft guidance to agencies on the consideration of the effects of climate change and greenhouse gas emissions in the context of NEPA environmental reviews. NRC is evaluating the best approach to address these recent developments with respect to climate change and greenhouse gas emissions while performing its NEPA reviews. In response to public comments, the discussion of cumulative impacts was revised. Section 5.7.1 of the final SEIS discusses global climate change and greenhouse gas emissions from the proposed Nichols Ranch ISR Project.*

Comment: N013-021
One commenter noted that the analysis of cumulative impacts is an integral part of any NEPA document, especially in an area like the Powder River Basin.

***Response**: NRC staff agrees that analyzing cumulative impacts is integral to performing a NEPA review. SEIS Chapter 5 analyzes the potential cumulative impacts associated with the potential licensing of the Nichols Ranch ISR Project. Section 5.1.1 of the SEIS identifies other past, present, and reasonably foreseeable future actions that include uranium recovery sites, coal mining, oil and gas production, CBM operations, and other mining in the area. Activities regulated by other Federal and State agencies, such as livestock grazing on public lands, are also considered in the analysis. Chapter 5 of the SEIS was revised in response to public comments to clarify the discussion and to improve the transparency of the analysis.*

Comment: N013-034
One commenter stated closer well spacings used in uranium ISR facilities would have extreme impacts (on land use) compared to traditional oil and gas or CBM operations with a wider well spacing. The commenter also states NRC did not analyze any combined impacts from the different facilities.

***Response**: The well spacing used to extract uranium from the subsurface deposit depends on the geometry of the ore body as well as the hydrologic characteristics of the aquifer. Typically, the footprint of an ore body would be much smaller than an oil and gas exploration or production effort, which is why the well spacing is more dense. The potential impact from drilling wells for the Nichols Ranch ISR Project is discussed in Section 4.5.2 along with actions the applicant would take to mitigate the potential impact, and Chapter 6 explains the justification for the proposed groundwater monitoring, which includes discussion of the proposed well spacing. Approximately 24–32 ha [60–80 ac] would be fenced to grazing at any given time over the life of the project. As shown in SEIS Figure 2-1, the estimate life of the proposed Nichols Ranch ISR Project is approximately 10 years. However, after decommissioning, the land would be returned to its preextraction use. Chapter 5 of the SEIS discusses the cumulative impact from the proposed action when added to other reasonably foreseeable future actions that are discussed in Section 5.1.1. The identified reasonably foreseeable future actions included consideration of other uranium recovery sites, coal mining in the area, oil and gas production, and CBM activities in the vicinity of the proposed Nichols Ranch ISR Project. The analysis of cumulative impacts was revised in response to public comments to clarify and improve the transparency of the analysis.*

Comment: N013-035
A commenter stated the SEIS did not discuss potential cumulative effects on wildlife in the vicinity of the proposed Nichols Ranch ISR Project.

***Response**: SEIS Section 4.6 discusses potential impacts on terrestrial ecology, vegetation, wildlife, aquatic ecology, and protected species populations, including the sage-grouse. Since the publication of the draft SEIS in December 2009, several developments have occurred with regard to Federal, State, and local regulation of activities that may affect habitat and sage-grouse populations. Text throughout the SEIS, including Section 5.6 which discusses the potential cumulative impact on terrestrial ecology, vegetation, wildlife, aquatic ecology, and protected species populations, has been updated to reflect these recent developments.*

Comments: N013-039; N013-040
One commenter was concerned with the apparent variable scale by which cumulative impacts are evaluated in SEIS Section 5.

***Response**: SEIS Chapter 5 evaluates the combined impacts from the proposed Nichols Ranch ISR project, along with the impact from other reasonably foreseeable past, present and future activities in the vicinity. The potential impact is evaluated on a scale commensurate with the resource area that could be affected and considers site-specific and other activities. For example, since noise dissipates quickly from the source a small geographic scale is considered in the analysis of cumulative impacts compared to biota such as sage brush, which considers a much larger geographic scale since that species has a large geographic range. When the relatively small impact from activities at the proposed Nichols Ranch ISR Project are added to the potential impact to a resource area from reasonably foreseeable present and future activities in the area, the proposed Nichols Ranch ISR Project contribution to the cumulative impact on the resource can be evaluated. NRC staff acknowledges the scale of analysis varies by resource area. Chapter 5 was revised in response to public comments to define the geographic area as well as the timeframe considered in the cumulative impact analysis.*

B.5.29.6 References

10 CFR Part 40. Appendix A *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

75 FR 13909, U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered." Federal Register: Volume 75, No. 55, pp. 13,909–13,959. March 23, 2010.

NRC. NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities. Washington, DC: ML093220036. May 2009.

WGFD. Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats. Version 6.0. Cheyenne, Wyoming. April 2010.

B.5.30 Environmental Justice

Comments: N020-043; N020-044
One commenter stated that NRC does not provide a sufficient basis for using whole counties for the environmental justice impact area, which is contrary to the NRC recommendation that the minority and low-income populations in the impact area be compared to county proportions. This commenter also stated no explanation was given as to why the Nichols Ranch ISR SEIS used a three-county impact area, while the SEISs for the similar proposed Lost Creek ISR and Moore Ranch ISR facilities used a one-county area.

***Response**: The commenter refers to SEIS Section 4.12 that describes the deviation from the NRC Policy Statement on Environmental Justice (69 FR 52040). NRC has revised this discussion and analysis of environmental justice impacts in the final SEIS in response to these comments. The analysis of impacts to minority and low-income populations in the Final SEIS no longer deviates from the NRC Policy Statement on Environmental Justice. The analysis of impacts follows the procedural guidelines for environmental justice review described in the Policy Statement by defining the geographic area for assessment (Campbell and Johnson counties) and identifying potentially affected minority and low-income populations down to the Census block group level. An assessment of the environmental effects of ISR facility construction, operation, and decommissioning and aquifer restoration at Nichols Ranch on minority and low-income populations is presented, and it was determined that the effects would not be disproportionately high and adverse. The risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish and wildlife was also analyzed.*

B.5.30.1 Reference

69 FR 52040, U.S. Nuclear Regulatory Commission. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." Federal Register. Vol. 69, No. 163, pp. 52,040–52,048. August 24, 2004.

B.5.31 Best Management Practices

B.5.31.1 Enforcement of Mitigation Measures and Best Management Practices

Comment: N011-028
One commenter stated that classifying groundwater impacts from leaks and spills as SMALL is unjustified because this relies on the assumption that mitigation measures would be effective.

***Response**: As described in Section 6.3.2 of the SEIS, the applicant would be required to have leak detection, spill response, and cleanup programs (Uranerz, 2007). Furthermore, NRC requires well mechanical integrity testing (NRC, 2003b) along with a similar requirement in the WDEQ UIC permit (Uranerz, 2007) to further reduce the potential leaks from well integrity failure during operations. Finally, any contamination from leaks and spills is required to be remediated to appropriate soil and water quality regulatory standards. As noted in SEIS Section 4.5.2, implementation of the required leak-detection program, well MIT, and remediation requirements should mitigate the potential impacts from leaks and spills to shallow (near-surface) aquifers. To evaluate the potential effectiveness of these mitigation measures, NRC staff reviewed information the applicant provided in its license application as amended (including the technical and environmental reports), information and the data NRC staff collected independently, and information and data provided in the GEIS. GEIS Section 2.11 (NRC, 2009) presents a historical discussion of ISR operations, and Section 2.14 refers to specific facilities in Wyoming, Nebraska, and New Mexico. In Section 2.11.4 of the GEIS, the NRC staff documented that, based on historical information at operating ISR facilities, excursions have occurred at these facilities. The NRC staff has analyzed the environmental impacts of excursions from mechanical integrity leaks from licensed ISR facilities (NRC, 2009b). In this analysis, NRC staff found that the environmental impacts from leaks to groundwater from mechanical integrity failures were SMALL and mitigated by remediation actions (NRC, 2009b). In addition, for all excursion events at licensed facilities, the NRC concluded excursions could be effectively mitigated and the environmental impacts were SMALL and temporary (NRC, 2009b). Based on this analysis, NRC*

staff found the mitigation measures for leaks and spills at Nichols Ranch Project will result in SMALL potential impacts.

Comments: N013-015; N016-001; N016-002; N016-003; N016-004
Two commenters expressed concerns about the implementation and enforcement of mitigation measures in the SEIS. One commenter stated that in many cases, the SEIS makes statements concerning mitigation as if the measures were in place or enforceable; however, some measures have not been decided and NRC does not have authority to enforce these requirements. Another commenter also questioned the NRC authority to enforce some of the mitigation measures and wanted to know what agencies oversee the mitigation measures and how they would be accomplished.

***Response**: Mitigation measures, best management practices, and management actions contained in the SEIS fall into four main categories: (i) measures that may be incorporated into the NRC license as license conditions; (ii) mitigation measures that are requirements other agencies established through permits that ISR facilities must obtain (see SEIS Table 1-2); (iii) mitigation measures the applicant committed to follow in its NRC license application; or (iv) mitigation measures that are not enforceable but that the applicant could voluntarily abide by to further reduce environmental impacts to a given resource area. NRC establishes license conditions for each individual ISR facility on a site-specific basis. NRC can only impose license conditions within the limits of its statutory authority granted by Congress. State and other Federal agencies can also impose license or permit conditions for individual ISR facilities based on their statutory and regulatory authorities. NRC relies on mitigation measures contained as a NRC license condition, included in the license application or imposed by other federal or state agencies, when making a reasoned prediction of the environmental impact of the proposed project.*

The following is a summary of some of the mitigation measures that would be implemented at the proposed Nichols Ranch ISR Project. Uranerz committed in its license application to follow: BLM criteria for road-building material for access roads; wetting roads to reduce fugitive dust emissions; adopt mitigation measures in the BLM Programmatic Agreement to address adverse impacts to the Pumpkin Buttes TCPs; use riprap and hay bales to prevent erosion and reseed areas; and adopt mitigative measures to reduce impacts near Greater sage-grouse leks. Examples of mitigative measures imposed through another Federal or State licenses or permits would include the WDEQ UIC disposal well permit. WDEQ would be the agency to establish and enforce these requirements under its UIC permit. Another example is the BLM approval of the Plan of Operations, which could include mitigative measures from the BLM Programmatic Agreement for the Pumpkin Buttes TCP. BLM would be the agency to establish and enforce these requirements. Chapter 4 of the SEIS was revised to include further discussion of mitigation measures included in the license application and other federal and state agency regulatory programs.

Comment: N013-017
One commenter stated the final SEIS must disclose all mitigation measures NRC would incorporate into the license and, in doing this, identify the mitigation measures the agency has authority to enforce. This commenter further stated that mitigation measures not included in the NRC license would be conjecture at this point.

***Response**: Mitigation measures, best management practices, and management actions may be imposed through two main methods: (i) incorporation into license conditions on the NRC license; or (ii) as requirements other agencies established through permits that ISR facilities*

must obtain (see Table 1-2 of the SEIS). NRC establishes license conditions for each individual ISR facility on a site-specific basis.

The intent of an EIS is to disclose impacts to the public and serve as a decisionmaking tool. NRC evaluates the SEIS and the SER in determining whether to grant the license, and to determine appropriate terms of a license, if it decides to grant a license. NRC can only impose license conditions within the limits of the authority granted by Congress. However, NRC can also rely on mitigation measures the applicant includes in its license application or specifically includes as a license condition. The entire ISR license application is subject to a general license condition in an NRC-issued ISR license. Therefore, the mitigation measures contained in the license application are covered under this license condition and subject to NRC enforcement authority. State and other Federal agencies can also establish permit conditions for individual ISR facilities based on their statutory and regulatory authorities. NRC can reasonably rely on these mitigation measures in making a reasoned prediction of the environmental impact of the project as proposed. When an NRC license is granted, the facility would then be routinely inspected by NRC staff and other State and Federal agencies for compliance with their respective requirements and license conditions. As a result, the SEIS does consider best management practices, mitigation measures, and management actions contained in the license application when evaluating environmental impacts to a resource area. No changes were made to the SEIS beyond the information provided in this response.

Comment: N017-018
One commenter stated NRC did not demonstrate a commitment to follow strict measures to protect sage-grouse. The commenter stated the "nonmandatory" language used in both the GEIS (NRC, 2009) and SEIS left the protection of the sage-grouse to the discretion of the applicant.

***Response**: NRC recognizes that sage-grouse are a species of great concern in Wyoming and has consulted with stakeholders as described in Section 1.7 of this SEIS. As discussed in Section 3.6.1.2.2, no sage-grouse leks were observed within the proposed project area during wildlife inventories Uranerz conducted. However, eight sage-grouse leks exist within the 3.2-km [2-mi] radius of the proposed Hank Unit and one lek exists within the 3.2-km [2-mi] radius of the Nichols Ranch Unit. Changes were also made in Section 3.6.3 to include the FWS rule listing the Greater sage-grouse as a candidate species, the revised WGFD Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats, and the BLM revised National Sage-Grouse Habitat Conservation Strategy (75 FR 13909; WGFD, 2010; BLM, 2010).*

Section 4.6.1.1.3 of the SEIS discusses mitigation measures that the applicant discussed in its license application for the proposed Nichols Ranch ISR Project to limit potential impacts to the Greater sage-grouse; this section was updated to reflect the current State and task force guidelines. However, NRC is not bound by WGFD recommendations or BLM guidelines and does not have the statutory authority to impose wildlife mitigation measures upon a licensee. NRC can enforce mitigation measures in license conditions or in the license application. Mitigative measures would also be negotiated between the applicant and the agency. Sections 3.6 and 4.6 were revised to both update the information on sage-grouse and more clearly describe the applicant's commitments regarding sage-grouse as stated in its license application.

B.5.31.2 Completeness of the Mitigation Measures and Best Management Practices

Comment: N007-006, N007-009
One commenter recommended that topsoil from road and well construction be stockpiled and respread around the construction site prior to seeding to expedite revegetation and minimize wind and water erosion impacts. The commenter expressed that much of the proposed project area is sandy and susceptible to wind and water erosion if not expeditiously reclaimed, and recommended the SEIS describe interim mitigation strategy.

***Response**: As noted in SEIS Sections 2.2.1.2.1, 2.2.1.2.4.3, and 2.2.1.5.5, the applicant has committed to stockpiling and redistributing topsoils during the construction and reclamation phases. The applicant has also committed to stockpiling topsoil during construction, stabilizing stockpiles to mitigate erosion, and redistributing topsoils during site decommissioning and reclamation. The applicant has committed to segregating topsoils and subsoils from the excavation of mud pits during well construction and emplacing subsoil followed by topsoil immediately following the use of each mud pit. The applicant has also committed to reclaiming all roads on BLM land and any others designated by landowners on private property by removing scoria or gravel on the road surface, reapplying topsoil, and then mulching and reseeding the road surface. The applicant is required to submit a detailed reclamation plan to NRC for review and approval before reclamation activities at the site begin. As noted in SEIS Sections 4.4.1.1, 4.5.1.1.1, and 4.7.1.1, the applicant has developed an interim mitigation strategy for handling topsoils. The applicant committed to stockpiling topsoils during construction and locating stockpiles in a manner that would minimize losses from wind and water erosion, including the use of berms around the bases and seeding with wheatgrass. The applicant committed to interim reclamation of pipeline trenches in the vicinity of surface waters by returning excavated native soil to pipeline trenches, restoring the preexisting grade in the channel to the original condition, and reseeding and mulching bare soil for stability. In addition to the previous activities, the applicant has committed to the wetting of roads and cleared land areas to reduce dust emissions. No change was made to the Nichols Ranch ISR SEIS beyond the information provided in this response.*

Comments: N007-018; N007-019
One commenter requested that NRC develop and implement interim reclamation to mitigate the fast growth of undesirable species. The commenter stated this plan should include spreading topsoil, reseeding with a native mix, and monitoring periodically with remedial reclamation activity, if necessary.

***Response**: BMPs, mitigation measures, and management actions that have been used historically at ISR facilities to avoid or reduce potential environmental impacts would be implemented at the proposed Nichols Ranch ISR Project to reestablish temporary or permanent native vegetation as soon as possible after disturbance. SEIS Sections 4.4.1.1, 4.5.1.1.1, and 4.7.1.1 describe interim mitigation strategies. In its license application, Uranerz committed to stockpiling topsoils during construction and locating stockpiles in a manner that would minimize losses from wind and water erosion, including the use of berms around the bases and seeding with wheatgrass. The applicant committed to interim reclamation of pipeline trenches in the vicinity of surface waters by returning excavated native soil to pipeline trenches, restoring the preexisting grade in the channel to the original condition, and reseeding and mulching bare soil for stability. In addition to the previous activities, the applicant has committed to wetting of roads and cleared land areas to reduce dust emissions.*

Uranerz would reseed disturbed areas with WDEQ- or BLM-approved seed mixtures as soon as conditions allow (Uranerz, 2007). Section 4.6.1.1.1.1 describes that the majority of disturbance to vegetation would result from wellfield development during the construction phase; this area which would be reclaimed and reseeded as soon as practicable following project completion in accordance with an approved Reclamation Plan. For instance, when the installation of each well is completed, Uranerz would implement measures such as reseeding to stabilize loose soil.

Regarding periodic monitoring, Section 4.6.1.1.1.1 explains that Uranerz has committed to mitigation measures, which include washing vehicles that come into the proposed Nichols Ranch ISR Project area and herbicide application, as necessary, to control the spread of Canada thistle and prevent the introduction of undesirable species. As explained in Section 4.6.1.2, Uranerz would monitor for invasive and noxious weeds that could potentially colonize disturbed areas.

Based on the discussion already presented in the SEIS, no additional changes were made to the SEIS beyond the information provided in this response.

B.5.31.3 General Comments Related to Best Management Practices and Mitigation Measures

Comment: N013-018
A commenter stated NRC must comply with NEPA by fully describing the effectiveness of each mitigation measure (e.g., each mitigation measure should be evaluated separately and given a rating) and that this was not done in the draft Nichols Ranch ISR SEIS.

Response*: The Council on Environmental Quality (CEQ) defines mitigation as measures that avoid, minimize, rectify, reduce, or compensate for environmental impacts. In general, the applicant, not NRC, proposes mitigation measures for a particular project. The mitigation measures the applicant proposed are reviewed not only by NRC but other Federal, State, or local regulatory agencies that have authority over the applicant activities or the various resources that may be affected by applicant actions. NRC reviews all mitigation measures an applicant proposed, as well as those that are safety related (e.g., those that affect public and occupational health). Mitigation measures that protect other resources would be further reviewed by other agencies, such as WGFD (for vegetation and wildlife) and WDEQ-WQD (for groundwater and surface water). When an NRC license is granted, the facility would then be routinely inspected by NRC staff and other State and Federal agencies for compliance with their respective requirements and conditions. While NRC neither proposes nor endorses particular mitigation measures, it does review what has been proposed (in cooperation with other agencies).*

As noted previously, NRC can only impose license conditions within the limits of authority Congress granted. However, NRC can also rely on mitigation measures the applicant includes in its license application or includes as a license condition. No changes were made to the SEIS beyond the information provided in this response.

Comment: N020-042
One commenter noted the SEIS used terms of possibility rather than of assurance when discussing BMP implementation, monitoring and detecting system operation, and spill response. This commenter questioned what BMPs would be implemented and if there was a way to assure BMPs were followed, monitoring and detecting systems were functioning properly, and spill responses were quick.

***Response**: These types of practices may be, but are not always, imposed through conditions on the NRC license or as requirements other agencies established through permits ISR facilities must obtain (see SEIS Section 1.6). NRC establishes license conditions for each individual ISR facility on a site-specific basis. NRC can only impose license conditions within the limits of its statutory authority granted by Congress. State and other Federal agencies can also impose permit conditions for individual ISR facilities based on their statutory and regulatory authorities. However, NRC can also rely on mitigation measures the applicant includes in its license application or includes as a license condition. SEIS Chapter 6 describes the applicant's proposed monitoring programs including wellfield and pipeline flow and pressure monitoring.*

When a license is granted, NRC staff and other State and Federal agencies routinely inspect the facility for compliance with their respective requirements and conditions. If any violations of NRC requirements or license conditions are identified in NRC inspections, NRC may issue a written notice of violation, and in certain circumstances, can require payment of a civil penalty, injunctive relief, corrective actions, or seek criminal penalties. Similarly, monitoring and detection systems and spill response are under the purview of NRC and other agencies. Inspection is a mechanism used to determine that systems operate properly and responses are timely. NRC also has a process for members of the public to report allegations of violations to the agency through email or a telephone hotline. Additional information on the allegation process can be accessed through the NRC Web site. No changes were made to the SEIS beyond the information provided in this response.

B.5.31.4 References

75 FR 13909, U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered." Federal Register: Volume 75, No. 55, pp. 13,909–13,959. March 23, 2010.

BLM. Instruction Memorandum No. 2010-071. "Subject: Gunnison and Greater Sage-grouse Management Considerations for Energy Development (Supplement to National Sage-Grouse Habitat Conservation Strategy)." Washington, D.C: BLM. March 5, 2010.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

WGFD. "Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats." Version 6.0. Cheyenne, Wyoming. April 2010.

B.5.32 Monitoring

Comment: N008-021
The applicant commented the ore zone wells located within the wellfields used to establish baseline water quality would not be sampled during the operation phase, whereas SEIS Section 6.3.1.1 indicates these wells would be sampled during this phase.

***Response**: NRC agrees with the commenter. The ore zone monitoring wells will be sampled prior to wellfield operations. The horizontal perimeter ring monitoring wells will be sampled during wellfield operations. Section 6.3.1.1 of the SEIS was revised in response to this comment.*

Comment: N016-010; N016-11
One commenter wanted to know whether flow rates of artesian wells in the vicinity of the proposed Nichols Ranch ISR Project would be monitored. Another commenter wanted to know what impacts the proposed action would have on artesian wells outside the ore zone and whether landowners would be compensated if wells lose pressure.

***Response**: Uranerz stated that flowing wells within the 3-m [10-ft] drawdown contour may be impacted and has identified a total of 10 wells within an 8-km [5-mi] radius that are flowing wells and screened within the A Sand (Uranerz, 2007). A pump or other supplement may have to be installed in a flowing well if the drawdowns cause it to cease flowing. However, Uranerz would not regularly monitor flow rates of private wells during operations. As described in Section 6.2.5 of the SEIS, Uranerz would sample private wells within 1 km [0.6 mi] of the Nichols Ranch Unit and Hank Unit boundaries four times per year for natural uranium and radium-226. However, these samples would not include measuring flow rates. Uranerz has stated in its NRC license application that it would assist private well owners with any difficulties they experience with their wells due to the anticipated drawdowns, including setting pumps deeper or drilling new wells as part of "confidential surface use agreements in place with the landowners," detailing mitigation measures that would be implemented if a free-flowing well is impacted by the proposed Nichols Ranch ISR Project (Uranerz, 2007). NRC has no involvement in this process and does not review these agreements. No further changes were made to the SEIS beyond the information provided in this response.*

Comment: N018-030
One commenter stated monitoring culverts and ephemeral stream crossings for signs of erosion are important in consideration of mitigation before erosion escalates.

***Response**: Uranerz has committed to minimizing damage from erosion and to wellfield infrastructure by avoiding well installation in ephemeral drainages (Uranerz, 2007). If such wells must be installed, Uranerz would implement appropriate erosion protection controls to minimize damage to the drainage. Such controls include grading and contouring, culvert installation, low-water crossings constructed of stone, water contour bars, and designated traffic routes. Section 4.5.1.1.1 of the SEIS was revised in response to this comment.*

Comment: N020-036
One commenter stated the SEIS does not provide any detailed information concerning the methodology for choosing well spacing or sampling frequency for the groundwater detection monitoring program.

***Response**: Section 6.3.1 of the SEIS discusses the groundwater monitoring program, including well spacing and sampling frequency proposed by the applicant. The proposed well spacing and sampling is consistent with NUREG–1569, Standard Review Plan for* In-Situ *Leach Uranium Extraction License Applications (NRC, 2003), which provides staff guidance on evaluating the appropriate monitor well spacing and sampling frequency. The applicant's monitoring program (inclusive of the well spacing) should ensure early detection of potential excursions. SEIS Section 6.3.1 was revised to better describe the applicant's proposed groundwater monitoring program.*

B.5.32.1 References

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. Washington, DC: NRC. June 2003.

NRC. Regulatory Guide 4.14, "Radiological Effluent and Environmental Monitoring at Uranium Mills." Rev. 1. Washington, DC: NRC. April 1980.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

B.5.33 Editorial

B.5.33.1 Grammatical Editorial

Comments: N012-006; N020-011
Commenters, including the applicant, suggested corrections for typographical errors in the SEIS.

Response*: Proposed changes were checked for accuracy, determined to be appropriate, and incorporated into the SEIS.*

Comment: N014-002
One commenter stated as a general proposition, the SEIS should be clear and consistent.

Response*: NRC acknowledges the importance of providing clear and consistent information. Because the comment was general in nature, no changes were made to the SEIS in direct response to this comment. Specific or detailed comments concerning clarity and consistency are addressed in Sections B.5.33.2, B.5.33.3, and other sections of this appendix.*

B.5.33.2 Technical Editorial

Comments: N001-004; N017-015; N017-016; N018-075
Several commenters discussed the quality of the figures in the SEIS. One commenter stated the clarity of the visual figures and graphics in the draft SEIS was inadequate. This same commenter noted interactions with the NRC to obtain revised figures prior to the end of the comment period and that only four revised figures were posted on the NRC website before public comment period closed. Another commenter stated the scale of the SEIS maps was inadequate for evaluation of surface resource impacts at the site-specific level.

Response*: NRC staff reviewed all 30 figures in the SEIS and determined the following 14 required revision: 2-2, 2-3, 3-2, 3-3, 3-5, 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, 6-8, and 6-9. NRC staff opted to revise and improve the following 10 figures: 1-1, 2-4, 2-5, 2-6, 2-7, 2-8, 2-11, 3-1, 3-6, and 3-7. The final SEIS included a total of 24 revised figures. Prior to the publication of the final SEIS, all revised figures were posted on the NRC website. Four of these revised figures were posted on the NRC website prior to the closure of the public comment period on March 3, 2010. In response to these comments, the figures identified in this response were revised to improve the quality.*

Comment: N007-010
One commenter suggested the readability of SEIS Section 3.6.3 would be improved if the section was reorganized using the protection status for the subcategories rather than the species.

***Response**: NRC acknowledges information can be organized in different manners. NRC opted to organize the information by species and provided Table 3-8, which presented information columns describing protection status by species. Because the organization in the SEIS is considered appropriate, no changes were made to the SEIS.*

Comment: N007-022
One commenter requested all references to CBM be changed to coal bed natural gas.

***Response**: NRC acknowledges that coal bed natural gas can be considered a more accurate term. However, NRC considers CBM to be a commonly used and understood term. Because NRC considers CBM an appropriate term to use, no changes were made to the SEIS.*

Comment: N008-010
One commenter stated the Pumpkin Buttes are located north, east, and southeast of the Hank Unit, whereas SEIS Section 3.10.2 states Pumpkin Buttes are located to the north, west, and southwest.

***Response**: The commenter is correct. SEIS Section 3.10.2 was revised to accurately describe the location of the Hank Unit relative to Pumpkin Buttes.*

Comment: N008-018
One commenter stated the Nichols Ranch Unit is located the west of Pumpkin Buttes, whereas SEIS Section 4.9.3.1 states Nichols Ranch Unit is to the east.

***Response**: The commenter is correct. SEIS Section 4.9.3.1 was revised to accurately describe the location of the Hank Unit relative to Pumpkin Buttes.*

Comment: N008-022
A commenter was concerned the discussion in the SEIS regarding leak detection was not accurate and required clarification.

***Response**: NRC staff reviewed the proposed action as described in the environmental report and technical report (Uranerz, 2007) for leak detection of wells and surface water protection. In response to this comment, SEIS Section 6.3.3 was revised to reflect the information the applicant presented in these documents.*

Comment: N008-023
The commenter proposed clarification remarks in SEIS Table 8-1 concerning the processing of groundwater during the operations phase.

***Response**: NRC agrees with the comment. SEIS Table 8-1 was revised accordingly.*

Comment: N014-003
One commenter requested the license not be referred to as a “source material license” but rather a “uranium recovery license” or a “combined source and byproduct material license.”

***Response**: Per NRC regulations in 10 CFR Part 40, the applicant is issued a "source material license." No changes were made to the SEIS in response to this comment.*

Comment: N014-004
One commenter stated the final SEIS should indicate the terms "ISL" and "ISR" can be used interchangeably.

***Response**: SEIS Section 1.1 states that for purposes of the SEIS, "in-situ recovery" or ISR is synonymous with "in-situ leach" or ISL. Because the SEIS discussion already addresses this issue, no changes were made to the SEIS.*

Comment: N014-005
One commenter recommended references to the proposed action as "mining" should be replaced with the term "milling."

***Response**: NRC agrees that the proposed action at the Nichols Ranch ISR Project site should be described as milling rather than mining. NRC staff reviewed the discussions of the proposed action in the draft SEIS and did not find any instances where the substitution of the term "milling" for "mining" would be warranted. Because the terms used to describe the proposed action were appropriate, no changes were made to the SEIS.*

Comment: N014-007
One commenter stated the final SEIS should use the term "unrestricted use" when referring to completed surface reclamation activities.

***Response**: NRC staff agrees with the commenter that the "unrestricted use" term is correct when referring to surface reclamation activities. NRC staff reviewed the SEIS and did not find any instances where the description of completed surface reclamation activities warranted a change. Because the language in the SEIS was considered appropriate, no changes were made to the SEIS.*

Comment: N020-010
One commenter requested Appendix A to include the tribal consultation letter from December 24, 2008.

***Response**: NRC agrees with this comment. Appendix A of the SEIS was revised to include this letter.*

B.5.33.3 Programmatic Editorial

Comment: N014-001
One commenter stated the existing SEIS language concerning the preliminary recommendation on issuing a license was inadequate and should be rephrased to provide a clear understanding that the environmental review has resulted in a finding that the license should be issued.

***Response**: As described in SEIS Section 1.6.1, the NRC licensing process includes a detailed technical review of the proposed Nichols Ranch ISR Project license application, which comprises both a safety and environmental review. These two reviews are conducted in parallel [see Figure 1.7-1, GEIS (NRC, 2009)]. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51. The safety review focuses on assessing compliance with the applicable regulatory requirements in 10 CFR Part 20 and 10 CFR Part 40, Appendix A.*

NRC staff reviewed the SEIS concerning the preliminary recommendation and determined that it was consistent with the NRC licensing process. Because the SEIS is considered appropriate, no changes were made to the SEIS.

Comment: N014-006
A commenter noted NRC should use the terms "proposed," "potential," and "could" when referring to the proposed action and the impacts analyzed.

***Response**: The draft Nichols Ranch ISR SEIS was published with the term "proposed" in front of each reference to the Nichols Ranch ISR Project. The word "potential" was used in front of "impacts" when appropriate. Because the words "potential" and "proposed" are used throughout the SEIS, the word "would" is used instead of "could" to indicate what impacts are most likely to occur from the proposed action. The word "would" is still conditional and appropriate. NRC staff reviewed the SEIS and made changes where appropriate.*

B.5.33.4 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. Appendix A *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

Uranerz. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. ML080080594, ML083230892, ML091000572, ML090850289, ML090850370, ML090970719, ML090850597, ML090840186, ML090820583, ML091610148, ML102650539, November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, May 2009, and September 2010. Casper, Wyoming: 2007.

APPENDIX C

ALTERNATE CONCENTRATION LIMITS

ALTERNATE CONCENTRATION LIMITS

In-situ recovery (ISR) facilities operate by first extracting uranium from specific areas called wellfields. After uranium recovery has ended, the groundwater in the wellfield contains constituents that were mobilized by the lixiviant. Licensees shall commence aquifer restoration in each wellfield soon after the uranium recovery operations end (NRC, 2008). Aquifer restoration criteria for the site-specific baseline constituents are determined either for each individual well or as a wellfield average.

NRC licensees are required to return water quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in the regulations: "5B(5)─At the point of compliance, the concentration of a hazardous constituent must not exceed─(a) The Commission approved background concentration of that constituent in the groundwater; (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (c) An alternate concentration limit is established by the Commission."

For an alternate concentration limit (ACL) to be considered by the NRC, a licensee must submit a license amendment application to request an ACL. In this ACL license amendment request, the licensee must provide the basis for any proposed limits including consideration of practicable corrective actions that limits are as low as reasonably achievable (ALARA), and information on the factors the Commission must consider. The NRC will establish a site-specific ACL for a hazardous constituent as provided in paragraph 5B(5) if the NRC finds the proposed limit as ALARA, after considering practicable corrective actions, and determining that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.

To determine if the ACL does not pose a potential hazard to human health or the environment, NRC performs three risk assessments (NRC, 2003a). The first is a hazard assessment which evaluates the radiological dose and toxicity of the constituents in question and the risk to human health and environment. The second is an exposure assessment to examine the existing distribution of hazardous constituents, as well as potential sources for future releases and the potential consequences associated with the human and environmental exposure to the hazardous constituents. The last assessment is a corrective action assessment which evaluates (1) all applicant proposed corrective actions; (2) the technical feasibility of each proposed corrective actions; (3) the costs and benefits associated with each proposed corrective action; and (4) the preferred corrective action to achieve the hazardous constituent concentration which is protective of human health and the environment.

To perform these assessments, the NRC staff uses a rigorous review process. Licensees must provide a comprehensive ACL amendment that addresses groundwater and surface water quality and expected impacts on human health and the environment. Such information required in an amendment request pursuant to 10 CFR Part 40, Appendix A, Criterion 5B(6) includes the following factors:

- Potential adverse effects on groundwater quality, considering the following:
  - The physical and chemical characteristics of the waste in the licensed site including its potential for migration
  - The hydrogeologic characteristics of the facility and surrounding land
  - The quantity of groundwater and the direction of groundwater flow
  - The proximity and withdrawal rates of groundwater users

- — The current and future uses of groundwater in the area
- — The existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality
- — The potential for health risks caused by human exposure to waste constituents
- — The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents
- — The persistence and permanence of the potential adverse effects.

- Potential adverse effects on hydraulically connected surface water quality, considering the following:
  - — The volume and physical and chemical characteristics of the waste in the licensed site
  - — The hydrogeologic characteristics of the facility and surrounding land
  - — The quantity and quality of groundwater, and the direction of groundwater flow
  - — The patterns of rainfall in the region
  - — The proximity of the licensed site to surface waters
  - — The current and future uses of surface waters in the area and any water quality standards established for those surface waters
  - — The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality
  - — The potential for health risks caused by human exposure to waste constituents
  - — The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents
  - — The persistence and permanence of the potential adverse effects.

Although state “class of use” standards are not recognized in NRC’s regulations as restoration standards, these standards may be considered as one factor in evaluating ACL requests for ISR facilities located in Wyoming. Furthermore, in considering ACL requests, particular importance is placed on protecting underground sources of drinking water (USDWs). The use of modeling and additional groundwater monitoring may be necessary to show that ACLs in ISR wellfields would not adversely impact USDWs. It must be demonstrated that the licensee has attempted to restore hazardous constituents in groundwater to background or a maximum contaminant level—whichever level is higher.

Before an ISR licensee is allowed to extract uranium, the EPA under 40 CFR Part 146.4 and in accordance with the Safe Drinking Water Act must issue an aquifer exemption covering the portion of the aquifer in which the uranium-bearing rock is located. The EPA cannot exempt the portion of the aquifer unless it is found that “it does not currently serve as a source of drinking water” and “cannot now and will not in the future serve as a source of drinking water”. Due to these criteria, only impacts outside of the exempted aquifer are evaluated. In most cases, the water in aquifers adjacent to the uranium ore zones does not meet drinking water standards. The staff will not approve an ACL if it will impact any adjacent USDWs. Therefore, the impact of granting an ACL request is SMALL.

Further guidance for the review of ACLs for ISR facilities is being developed in a revision of NUREG–1569 (NRC, 2003a). Existing guidance for the review of ACLs for conventional mills is in NUREG–1620, “Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978.” (NRC, 2003b).

References

10 CFR Part 40. Appendix A. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, Appendix A, "Criteria Relating to the Operations of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily from their Source Material Content."

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of Environment.* Part 146, "Underground Injection Control Program: Criteria and Standards."

NRC. Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities." Revision 3. Washington, DC: NRC. November 2008.

NRC. NUREG–1620, "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites under Title II of the Uranium Mill Tailings Radiation Control Act of 1978," Final Report, Washington, DC. NRC 2003a.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications." Final Report. Washington, DC: NRC. June 2003b.

APPENDIX D

NONROAD COMBUSTION ENGINE EMISSIONS ESTIMATES

CONTENTS

Section Page

TABLES.....D–iii
ACRONYMS/ABBREVIATIONS.....D–iv

D NONROAD COMBUSTION ENGINE EMISSIONS ESTIMATES D–1
D.1 Introduction D–1
D.2 Nonroad Diesel Combustion Engine Exhaust Emissions Calculation Methods D–2
D.2.1 Well Drilling Emissions Calculations D–2
D.2.2 Construction Equipment Emissions Calculations D–3
D.2.3 Reclamation Equipment Emissions Calculations D–5
D.3 Results and Discussion D–7
D.4 References D–12

TABLES

Section Page

D.2-1 Well Drilling Input Parameters for Emissions Calculations..... D–4
D.2-2 Emissions Factors (EF_i,) for Uncontrolled Diesel Industrial Engines (lb/MMbTU).... D–4
D.2-3 Emissions Factors (EF_i,) for Large Stationary Diesel Engines (lb/MMbTU)..... D–4
D.2-4 Horsepower (hp) and Operating Times (hr/yr) for Diesel Construction Equipment.. D–6
D.2-5 Emissions Factors (EF_i,) for Uncontrolled Diesel Industrial Engines (lb/hp-hr)..... D–6
D.2-6 Horsepower (hp) and Operating Times (hr) for Diesel Reclamation Equipment..... D–6

D.3-1 Calculated Annual Emissions From Well Drilling Activities (tons/yr)..... D–8
D.3-2 Calculated Annual Emissions From Construction Equipment (tons/yr)..... D–8
D.3-3 Total Calculated Annual Emissions From Drilling and Construction (tons/yr)..... D–8
D.3-4 Adjusted Annual Diesel Emission From Drilling and Construction (tons/yr)..... D–9
D.3-5 Effect of Using Updated Emissions Factors That Account for Pollution Controls .. D–10
D.3-6 Calculated Diesel Equipment Emission (tons/yr) From Reclamation of One Wellfield and the Central Processing Facilities D–10
D.3-7 Adjusted Annual Diesel Equipment Emissions (tons/yr) From Reclamation..... D–11
D.3-8 Estimated Cumulative Emissions From the Proposed Action and Modified Action-No Hand Unit (Alternative #3) (tons)..... D–12

ABBREVIATIONS/ACRONYMS

CO	carbon monoxide
CO_2	carbon dioxide
EF_i	emissions factors
EPA	U.S. Environmental Protection Agency
ISR	*In-Situ* Recovery
SEIS	supplemental environmental impact statement
MMBtu	million British thermal units
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides
NRC	U.S. Nuclear Regulatory Commission
PM10	particulate matter
SO_x	sulfur oxides
VOC	volatile organic compounds
WDEQ	Wyoming Department of Environmental Quality

D NONROAD COMBUSTION ENGINE EMISSIONS ESTIMATES

D.1 Introduction

The primary nonradiological emissions from *in-situ* recovery (ISR) facilities include diesel combustion engine emissions from construction equipment (including drilling rigs) and fugitive dust emissions from vehicle travel on unpaved roads (NRC, 2009, Section 2.7.1). This appendix provides estimates of the expected nonroad combustion engine emissions from the proposed action. Fugitive dust emissions are discussed in the supplemental environmental impact statement (SEIS) and therefore are not discussed further in this appendix.

The U.S. Nuclear Regulatory Commission (NRC) has previously evaluated combustion engine emissions associated with ISR facilities in prior licensing actions (NRC, 1997, 2004) and has characterized the potential impacts to air quality as minor. The drilling rigs that are used during construction of these facilities, in particular, are not presently subject to State of Wyoming new source emissions permitting and, the state does not presently require applicants that propose facilities in attainment areas (i.e., areas in compliance with ambient air quality standards) to document their emissions from these sources. Similarly, NRC has not routinely requested detailed nonradiological emissions information from applicants. As a result, existing information pertaining to ISR construction emission activities is limited. Nonetheless, to address recent concerns expressed in public comments on the draft SEIS about potential air quality impacts (EPA, 2010), representative emissions estimates are calculated in this appendix.

On the basis of the similarities in design and construction of ISR facilities and the nature of associated nonradiological emissions, the nonroad combustion engine exhaust calculations in this appendix are based on a combination of proposal-specific and other representative information that the NRC staff consider adequate to support a conservative emissions screening analysis. The current calculations incorporate the best available information the applicant provided for the proposed action; representative information provided by other NRC applicants as applicable; and emissions factors developed by the U.S. Environmental Protection Agency (EPA). Mobile road (vehicle) combustion emissions were not calculated here, because these engine emissions are controlled at the source by mandated emission control technology and the magnitude of proposed road vehicle activity is small relative to existing road traffic (Section 4.3) of this SEIS.

The calculations in this appendix were conducted to support the NRC evaluation of potential environmental impacts to air quality from the proposed action. These calculations are provided to meet NRC obligations pursuant to the National Environmental Policy Act of 1969, as amended, to more completely disclose the potential environmental impacts from the proposed action. While NRC is responsible for assessing the potential environmental impacts from the proposed action, NRC does not have the authority to develop or enforce regulations to control nonradiological air emissions from equipment licensees used. This authority rests with the State of Wyoming Department of Environmental Quality (WDEQ). To ensure the air quality of Wyoming is adequately protected, in addition to addressing all NRC regulatory requirements regarding radiological emissions, NRC applicants and licensees must also comply with all applicable state and federal air quality regulatory compliance and permitting requirements.

D.2 Nonroad Diesel Combustion Engine Exhaust Emissions Calculation Methods

D.2.1 Well Drilling Emissions Calculations

ISR facilities are constructed using commonly available construction equipment including truck mounted or mobile drilling rigs (NRC, 2009). Based on past estimates (NRC, 2004), NRC staff expect well drilling activities would represent the majority of combustion engine emissions during the construction period. Emissions from diesel combustion engines, including drilling rigs, that the staff evaluated for potential impacts to air quality include nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), particulate matter PM_{10}, formaldehyde, volatile organic compounds (VOCs), and carbon dioxide (CO_2). CO_2 emissions are also calculated to support NRC staff evaluation of greenhouse gas emissions in the SEIS.

Diesel emissions were estimated using emission factors developed by EPA. Emission factors provide the ratio of the mass of a pollutant emitted to the atmosphere by a source engine to the level of activity of the emission source (Eastern Research Group, 1996). The level of activity of the emission source in an emission factor is represented by power output (in horsepower-hours) or fuel use represented by heat energy of combusted fuel in million British Thermal Units (MMBtu). EPA developed emission factors for different engine classes based on its review of a variety of engine test data (EPA, 1996; 2004). Currently available EPA documentation of emission factors for diesel combustion engines include AP-42 (EPA, 1996) and a more recent update of emission factors for the EPA NONROAD model (EPA, 2004). WDEQ recognizes EPA (1996) as a source for emission factors that may be used to estimate emissions from drilling rigs (WDEQ, 2010a), while the NONROAD model factors represent a more current data source. For the following calculations, the emission factors from AP-42 (EPA, 1996) were used. The updated emission factors for the NONROAD model are considered for context in the discussion of the calculated emissions results.

WDEQ (2010a) provided methods for calculating emissions from drilling rigs based on fuel use. The WDEQ calculation methods are from worksheets it has provided to minor oil and gas emitters in a proposed ozone nonattainment area in southwestern Wyoming (WDEQ, 2010b). These methods were adapted to the current analysis and are summarized by the following equations

$$E_{tot,r,i} = F_{tot,r}\, HC_{fuel}\, EF_i\, U_{conv} \qquad \text{(D–1)}$$

where

$E_{tot,r,i}$ — annual total emissions for drilling rig type *r* and pollutant *i* [tons/yr]
$F_{tot,r}$ — annual fuel use for drilling rig type *r* [gal/yr]
HC_{fuel} — heat content of diesel fuel [Btu/gal]
$EF_{i,r}$ — emission factor for pollutant *i* from drilling rig type *r* [lb/MMBtu]
U_{conv} — unit conversion [MMBtu/1E+6 Btu][ton/2000lb]

and

$$F_{tot,r} = \sum_n DT_{n,r}\, FC_r \qquad \text{(D–2)}$$

where

DT_n — duration of drilling for individual well *n* [hr]
FC_r — hourly fuel consumption for drilling rig type *r* [gal/hr]

Input parameters for well drilling equipment diesel emission calculations are provided in Tables D.2-1, D.2-2, and D.2-3. Proposed drilling activities include (i) drilling water wells for wellfield operations and associated monitoring and (ii) drilling deep disposal wells for disposal of operational liquid wastes. Water well drilling is expected to involve truck-mounted drilling equipment that requires, on average, 12 hours of drilling per well and consumes approximately 9 L [2.5 gal] of diesel fuel per hour (LCI, 2010). These operational water wells would be drilled to the depth of the ore body {approximately 91 to 183 m [300 to 600 ft] (Uranerz, 2007)}. Deep disposal well drilling would go to a greater depth (several thousands of feet) relative to the water wells. Such drilling requires a more powerful drilling rig that consumes more fuel than a water well drilling rig. An NRC applicant estimated it takes approximately 528 hours and about 212 L [56 gal] of diesel fuel per hour (LCI, 2010) to complete one deep well. The applicant proposes to drill eight deep wells, although the drilling schedule has not been provided. Because the proposed wellfield development is phased over a period of years, for the base calculation of annual emissions from the Nichols Ranch Unit, the drilling of one deep well in the first year is assumed. To account for the differences in the two types of drilling operations (i.e., water wells, deep disposal wells), emissions calculations were conducted for each type of drilling activity. Input parameters for each activity are provided in Table D.2-1.

D.2.2 Construction Equipment Emissions Calculations

In addition to the use of drilling rigs, proposed wellfield construction involves the use of common diesel powered construction equipment that would also contribute to air emissions. Emissions from this equipment were calculated using emission factors based on power output and operating time using the following equation

$$E_{tot,r,i} = HP_r\, OT_r\, EF_i\, U_{conv} \qquad \text{(D–3)}$$

where

$E_{tot,r,i}$ — annual total emissions for construction equipment type *r* and pollutant *i* [tons/yr]
HP_r — engine horsepower rating for construction equipment type *r* [hp]
OT_r — operating time for construction equipment type *r* [hr/yr]
$EF_{i,}$ — emission factor for pollutant *i* for diesel industrial engines [lb/hp-hr]
U_{conv} — unit conversion [ton/2,000 lb]

Table D.2-1. Well Drilling Input Parameters for Emissions Calculations

Parameter	Symbol	Value	Remarks
Duration of drilling activities for 525 water wells [hr]	$\sum DT_{n,rn}$	6,038	Staff estimate for drilling one wellfield based on average per well drill time provided by an applicant* and the proposed number of wells for wellfield #1
Hourly fuel consumption for truck mounted drilling rig [gal/hr]*	FC_{r_water}	2.5	Provided by an applicant*
Annual fuel use for truck-mounted water well drilling rigs [gal/yr]*	F_{tot,r_water}	15,095	Staff calculated from drilling duration and hourly fuel consumption
Duration of drilling activities for 1 deep waste disposal well [hr]	$\sum_{n} DT_{n.r}$	528	Provided by an applicant* for drilling 1 deep well
Hourly fuel consumption for deep well drilling rig [gal/hr]*	FC_{r_deep}	56.25	Provided by an applicant*
Annual fuel use for deep well drilling rig [gal/yr]*	F_{tot,r_deep}	29,700	Staff calculated from drilling duration and hourly fuel consumption
Heat content of diesel fuel [Btu/gal]	HC_{fuel}	137,000	Value from EPA AP–42†

*LCI (2010)
†EPA (1996)
*To convert from gal to L, multiply by 3.785

Table D.2-2. Emissions Factors ($EF_{i,}$) for Uncontrolled Diesel Industrial Engines (lb/MMBtu)

Pollutant	Value*
Nitrogen Oxides (NO_x)	4.41
Carbon Monoxide (CO)	0.95
Sulfur Oxides (SO_x)	0.29
Particulate Matter (PM_{10})	0.31
Carbon Dioxide (CO_2)	164
Formaldehyde	0.00118
Volatile Organic Compounds (VOC)	0.35

Source: EPA, 1996 (Chapter 3.3, Tables 3.3-1 and 3.3-2)
*To convert from lb/MMBtu to ng/J, multiply by 430

Table D.2-3. Emissions Factors ($EF_{i,}$) for Large Stationary Diesel Engines (lb/MMBtu)

Pollutant	Value*
Nitrogen Oxides (NO_x)	3.2
Carbon Monoxide (CO)	0.85
Sulfur Oxides (SO_x)	1.01
Particulate Matter (PM_{10})	0.10
Carbon Dioxide (CO_2)	0.85
Formaldehyde	7.89E-5
Volatile Organic Compounds (VOC)	0.09

Source: EPA (1996, Chapter 3.4, Tables 3.4-1 and 3.4-3)

Input parameters used in the construction equipment emissions calculations, including the types of equipment the applicant could use during the construction period, operating times for this equipment, and applicable emission factors, are provided in Tables D.2-4 and D.2-5. The information in Table D.2-4 summarizes detailed equipment emissions information an applicant (LCI, 2010) voluntarily submitted to WDEQ to support a survey of small emitters. Table D.2-5 lists the applicable power-output-based emissions factors for diesel industrial engines.

D.2.3 Reclamation Equipment Emissions Calculations

The emissions during the construction period are expected to bound annual emissions from operations and aquifer restoration phases because the use of diesel-powered equipment during those phases is much less than during construction (NRC, 2004). Construction equipment use during decommissioning and reclamation (hereafter reclamation) is expected to be similar to the construction phase (NRC, 2004) because many aspects of reclamation, in effect, are the reverse of the activities conducted during construction. During construction, well drilling and facility construction activities predominate, while during reclamation diesel equipment is used for other activities such as well plugging and abandonment, equipment removal, and land reclamation. The applicant has planned a 1- to 2-year period for the reclamation of each wellfield as shown in Figure 2-1 of the final SEIS.

Emissions for diesel equipment used for reclamation activities were calculated using the same methods as in Section D2.2 for construction equipment [Eq. (D–3)], although input parameters were revised for equipment horsepower and operating times to reflect available information on the proposed reclamation activities. The staff identified the most detailed and complete information on proposed activities in the surety estimate for the proposed facility (Uranerz, 2007). Limited information on equipment was provided in the applicant's surety; however, because equipment needed for ISR reclamation work is expected to be similar among sites, the equipment was assumed to be similar to that another applicant described (EMC, 2007). Based on the available equipment information, specific equipment models were selected by reviewing WDEQ-provided documentation of commonly used reclamation equipment (WDEQ, 2009).

Equipment horsepower information for specific models was obtained from manufacturer documentation. A few equipment items were only generally described in the surety estimate as truck or tow vehicles for well abandonment activities, and these were assumed to be rated at 250 horsepower. Operating times for each item of equipment were derived from detailed information and assumptions on specific reclamation activities discussed in the applicant surety estimate (Uranerz, 2007), including building demolition floor removal, pipeline removal, well abandonment, and reclamation of disturbed surface areas such as wellfields, facilities areas, and access roads. Equipment usage was not explicitly called out in the applicant surety for specific activities (e.g., back hoe, track hoe, dozer, dump truck, scraper, motor grader), so operating times were estimated based, in part, on assumptions about which reclamation activities would utilize the equipment (e.g., back hoe and track hoe for excavation, the motor grader was assumed for road grading and grading cleared foundation areas, the dozer for ripping packed land surface areas, the dump truck for transporting excavated topsoil, and the scraper was assigned the same hours as for the construction work discussed in Section D2.2). Information on equipment productivity, such as grading or ripping rates and payload amounts, was obtained from the aforementioned WDEQ documentation (WDEQ, 2009). The resulting equipment and operation times are provided in Table D.2-6. The emissions factors used in the calculations are provided in Table D.2-5.

Table D.2-4. Horsepower (hp) and Operating Times (hr/yr) for Diesel Construction Equipment

Equipment	Horsepower (HP_r)	Operating Time (OT_r)
Lull 944E Telehandler	110	515
John Deere 710J Backhoe	126	410
John Deere 410 Backhoe	66	275
Truck	250	100
John Deere Loader	200	60
Scraper	600	60
Blade	300	40
Caterpillar D8 Dozer	321	15
Source: LCI, 2010		

Table D.2-5. Emissions Factors (EF_i) for Uncontrolled Diesel Industrial Engines (lb/hp-hr)

Pollutant	Value*
Nitrogen Oxides (NO_x)	0.031
Carbon Monoxide (CO)	0.00668
Sulfur Oxides (SO_x)	0.00205
Particulate Matter (PM_{10})	0.00220
Carbon Dioxide (CO_2)	1.15
Formaldehyde	0.00000826
Volatile Organic Compounds (VOC)	0.00247
Source: EPA (1996, Chapter 3.3, Tables 3.3-1 and 3.3-2) *To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608	

Table D.2-6. Horsepower (hp) and Operating Times (hr) for Diesel Reclamation Equipment

Equipment	Horsepower (HP_r)	Operating Time (OT_r)
Dump Truck	250	1610
Caterpillar 320DL Track Hoe	148	1350
Heavy Truck	250	1050
Caterpillar 430E Backhoe	101	900
Lull 944E Telehandler	110	450
New Holland 545D Tractor	63	120
Caterpillar 657G Scraper	600	50
Caterpillar D9 Dozer	474	38
Caterpillar 16H Motor Grader	265	4
Sources: Derived by staff from information in the following references: (1) EMC, 2007; (2) LCI, 2010; (3) Uranerz, 2007; (4) WDEQ, 2009.		

D.3 Results and Discussion

The estimated annual emissions from well drilling and construction equipment are provided in Tables D.3-1 and D.3-2. These results apply to completing a single wellfield (Nichols Ranch Unit Production Area #1) and one deep disposal well. The total estimated annual emissions from both calculations combined are provided in Table D.3-3. The combined results for drilling and construction equipment show CO_2 and NO_x annual emissions are the highest of the pollutants evaluated. For well drilling equipment, the rig used for the deep disposal well generated higher annual emission estimates when compared to the emissions from drilling all the water wells for a single wellfield (525 wells). This result is explained by the larger, more fuel consuming, engine used by a deep well rig in comparison to the smaller water well rig and the long drilling time per well required for deep drilling.

For example, the deep well drilling is estimated to emit 57 percent of the annual NO_x drilling emissions, compared to water well drilling of 525 wells that represents 43 percent of the annual drilling NO_x emission total. Compared with the calculated drilling emissions, the magnitude of the calculated construction equipment emissions is small. The total construction equipment emissions of NO_x are 24 percent of the total annual NO_x from all activities included in the calculations, while drilling activities constitute the remaining 76 percent of the total emissions.

Additional factors considered in this analysis that could increase the annual emissions estimates include the overlap in planned wellfield construction activities and the number of deep disposal wells that the applicant might drill in a single year. While the applicant has proposed a phased approach to wellfield development that does not overlap within each unit (Uranerz, 2007, Table 7-5), wellfield development at the Nichols Ranch Unit does overlap with development activities at the Hank Unit for one quarter of the year. These two units are approximately 6 miles apart and are therefore considered separate emissions sources. Nonetheless, the estimated annual emissions, considering the development overlap between the two units, are approximated by increasing the annual water well drilling and construction equipment emissions in Tables D.3-1 and D.3-2 by 25 percent. This adjustment considers the annual emissions calculated for Nichols Ranch Unit #1 wellfield, and then accounts for the additional emissions from constructing Hank Unit # 1 wellfield during one quarter of that same year. The applicant plans a similar period of overlap during the year when Nichols Ranch Unit #2 wellfield and Hank Unit #2 wellfield are constructed and the emissions for that year would also be approximated by the aforementioned adjustment. The applicant has not provided a schedule for the deep well drilling; however, given the total number of proposed deep disposal wells is eight, this analysis provides two separate sets of emissions estimates. The first set assumes the applicant develops the first proposed wellfield and a portion of the second (as described above) and four deep disposal wells in one year. The second set of estimates uses the same wellfield development assumptions as the first set but assumes all eight deep disposal wells are drilled in the same year. The deep disposal well drilling emissions in these estimates are approximated by scaling the deep well drilling emissions Table D.3-1 by the number of deep disposal wells assumed. The results of applying these adjustments represent estimates of the maximum annual emissions calculated, which are provided in Table D.3-4. For the Modified Action–No Hank Unit (Alternative 3), none of the Hank Unit wellfields would be constructed and fewer deep disposal wells would be needed. For that alternative, annual emissions estimates would be slightly less than the annual results presented in Table D.3-4 that assume four deep disposal wells because the contribution from overlapping Hank wellfield construction would not occur. Because the results would decrease by a small amount (e.g., for NOx the recalculated value would be 29 t/yr [32 T/yr] or a decrease of about 6 percent from the value in Table D.3-4] annual emissions for the alternative are not reported separately in the table.

Table D.3-1. Calculated Annual Emissions From Well Drilling Activities (tons/yr)*

Drilling Activity	NO_x	CO	SO_2	PM_{10}	CO_2	Formaldehyde	VOCs
Operational wellfield (water well) drilling	4.6	0.98	0.30	0.32	170	0.0012	0.37
Deep well drilling	6	2.0	0.10	0.20	340	0.0002	0.20
Total	11	3.0	0.40	0.52	510	0.0014	0.57

*Includes drilling and construction of the first proposed wellfield, and one deep disposal well

*To convert tons to metric tons, multiply by 0.907

Table D.3-2. Calculated Annual Emissions From Construction Equipment (tons/yr)*

Equipment	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOCs†
Lull 944E Telehandler	0.88	0.19	0.058	0.062	33	0.00023	0.070
JD 710J Backhoe	0.80	0.17	0.053	0.057	30	0.00021	0.064
JD 410 Backhoe	0.28	0.060	0.019	0.020	10	0.000075	0.022
Truck	0.40	0.086	0.026	0.028	15	0.00011	0.032
JD Loader	0.18	0.038	0.012	0.013	6.6	0.000047	0.014
Scraper	0.53	0.11	0.035	0.038	20	0.00014	0.042
Blade	0.29	0.043	0.013	0.014	7.4	0.000053	0.016
CAT D8 Dozer	0.070	0.015	0.0046	0.0049	2.6	0.000019	0.0056
Total	3.3	0.72	0.22	0.24	120	0.00089	0.27

*Includes equipment used to support drilling and wellfield development operations

*To convert tons to metric tons, multiply by 0.907

†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO_2 = carbon dioxide; VOCs = volatile organic compounds

Table D.3-3. Total Calculated Annual Emissions From Drilling and Construction (tons/yr)*

Activities	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOCs†
Well drilling and construction	14	4.0	0.62	0.76	630	0.0023	0.84

*Includes drilling and construction of the first proposed wellfield, and one deep disposal well. Results are the sum of results from Tables D.3-1 and D.3-2

*To convert tons to metric tons, multiply by 0.907

†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO_2 = carbon dioxide; VOCs = volatile organic compounds

Table D.3-4. Adjusted Annual Diesel Emissions From Drilling and Construction (tons/yr)*

Activities	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOCs†
Development of the first proposed wellfield and a single deep well adjusted to add emissions from adding three more deep wells and constructing a portion of the second proposed wellfield	34	10	1.0	1.5	1,700	0.0034	1.6
Development of the first proposed wellfield and a single deep well adjusted to add emissions from seven additional deep wells and constructing a portion of a second proposed wellfield	58	18	1.4	2.3	3,100	0.0042	2.4

*Results from Table D.3-3 adjusted to account for additional emissions from planned wellfield construction activities that overlap in time based on the proposed schedule.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} – particulate matter; CO_2 = carbon dioxide; VOCs = volatile organic compounds
*To convert tons to metric tons, multiply by 0.907

The emissions estimates are expected to be conservative because they are based on emissions factors applicable to engines that have no pollution controls. Table D.3-5 provides a comparison of the EPA AP-42 factors (EPA, 1996) that were used for the calculations in this appendix with updated emission factor values (EPA, 2004) that are based on more recent data that apply to engines with pollution controls (Tier 1 representing the first phase of standards that were mandated by the Federal Government in four phases of increasing limits). Table D.3-5 shows calculated emission estimates for NO_x and CO would be reduced approximately by a factor of 2 and PM_{10} and VOC emissions by a factor of 5 if the updated emission factors were used. Because the actual equipment that would be used is uncertain, the assumption of an applicant using older uncontrolled engines bounds the emissions if older equipment is selected for this work. That assumption also provides margin in the estimates if the actual selected equipment meets emission standards.

The results of emissions calculations for reclamation activities are provided in Table D.3-6. Because wellfield reclamation for the Nichols Ranch Unit #1 wellfield is planned to take 1 year, the results in Table D.3-6 are considered representative of annual emissions from constructing that wellfield. According to the applicant schedule, wellfield reclamation activities for wellfields within each unit are not planned to overlap, however, reclamation activities do overlap across units for two quarters of a year (SEIS, Figure 2-1). For the period where overlap occurs, assuming the emissions for reclamation the Nichols Ranch Unit #1 wellfield are comparable to emissions for reclaiming the other wellfields, the annual reclamation emissions from both units (Nichols Ranch Unit #2 wellfield and Hank Unit #1 wellfield) is approximated by multiplying the total pollutant-specific results in Table D.3-6 by a factor of 1.25. This factor considers that Hank Unit #1 wellfield reclamation is scheduled for a 2 year period and two quarters overlap with Nichols Ranch Unit #2 wellfield reclamation, therefore, the emissions applicable to completing 25 percent of a wellfield and facilities decommissioning effort are added to the totals in Table D.3-6 to account for the overlap period. The results of applying this adjustment represent the maximum annual emissions calculated for the reclamation phase, which are provided in

Table D.3-5. Effect of Using Updated Emissions Factors That Account for Pollution Controls

Pollutant	1996 Uncontrolled Emission Factor for Diesel Industrial Engines (lb/hp-hr)	2004 Updated Value (Tier 1 Controlled 300–600 HP Diesel Engines)(lb/hp-hr)	Reduction Ratio (Updated/ Uncontrolled)
Nitrogen Oxides (NO_x)	0.031	0.0132	0.42
Carbon Monoxide (CO)	0.00668	0.00288	0.43
Particulate Matter (PM_{10})	0.00220	0.00044	0.20
Volatile Organic Compounds (VOCs)	0.00247	0.000446	0.18
Sources: EPA, 2004; EPA, 1996 *To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608			

Table D.3-6. Calculated Diesel Equipment Emissions (tons/yr) From Reclamation of One Wellfield and the Processing Facilities

Equipment	NO_x	CO	SO_2	PM_{10}	CO_2	Formaldehyde	VOCs
Dump Truck	6.2	1.3	0.41	0.44	230	0.0016	0.50
Caterpillar 320DL Track Hoe	3.1	0.67	0.20	0.22	110	0.00082	0.25
Heavy Truck	4.1	0.88	0.27	0.29	150	0.0011	0.32
Caterpillar 430E Backhoe	1.4	0.30	0.09	0.10	52	0.00037	0.11
Lull 944E Telehandler	0.77	0.17	0.051	0.054	28	0.00020	0.061
New Holland 545D Tractor	0.12	0.025	0.0077	0.0083	4.3	0.000031	0.0093
Caterpillar 657G Scraper	0.4.76	0.10	0.031	0.033	17	0.00012	0.037
Caterpillar D9 Dozer	0.28	0.060	0.018	0.020	10	0.000074	0.022
Caterpillar 16H Motor Grader	0.020	0.0035	0.0011	0.0012	0.61	0.0000044	0.0013
Total	16	3.5	1.1	1.2	600	0.0044	1.3
To convert tons to metric tons, multiply by 0.907							

Table D.3-7. For the Modified Action–No Hank Unit Alternative 3), because none of the Hank Unit wellfields (would be constructed, none would be reclaimed, and therefore, there would be no overlapping reclamation activities and the annual emissions estimates would be bounded by the results applicable to reclaiming one wellfield per year in Table D.3-6.

During the proposed 5-year period allocated to decommission all wellfields, the magnitude of annual wellfield reclamation emissions for periods where reclamation activities do not overlap (see Table D.3-6) are generally higher than the annual emissions calculated for wellfield construction (see Table D.3-3), by approximately a factor of two or less for several of the pollutants evaluated; however, higher by only 14 percent for NO_x.

Comparing the maximum annual emissions calculated for the construction phase and the reclamation phase (i.e., considering overlapping activities in each phase), the levels of emissions are higher during construction (see Table D.3-4 results for four deep disposal wells) for some pollutants (NO_x, CO, and CO_2) and higher during reclamation (see Table D.3-7) for the others (SO_2, PM_{10}, formaldehyde, VOCs) by no more than a factor of 2, and about the same for PM_{10} and VOCs. When all deep disposal wells are assumed to be drilled in a single year, all the construction emissions estimates (except formaldehyde) are higher than the reclamation emissions.

Cumulative emissions for the proposed action were also approximated using the calculated results for the development and reclamation of the proposed four wellfields and eight deep disposal wells. For the purpose of this analysis, cumulative emissions are the total lifecycle emissions from all phases of the proposed action. Because the principal diesel emissions from the proposed action are associated with equipment used for constructing and decommissioning the project, the analysis focuses on the emissions from those phases. The initial calculated annual emissions in Table D.3-3, and D.3-6 apply to constructing a single wellfield, drilling a single deep disposal well, and reclaiming a single wellfield and facilities. Assuming these emissions are representative of the construction and reclamation of the other wellfields to be developed, these results scale with the total number of wellfields and deep wells that are proposed. The cumulative emissions were conservatively approximated by multiplying the sum of the calculated pollutant-specific well drilling and construction emissions from Table D.3-3 and the reclamation emissions from Table D.3-6 by a factor of 4 and then adding four times the deep well drilling emission estimates in Table D.3-1. The resulting cumulative emissions totals are provided in Table D.3-8. In short, the cumulative emissions totals include the calculated diesel emissions from constructing 4 proposed wellfields, 8 proposed deep disposal wells, and

Table D.3-7. Adjusted Annual Diesel Equipment Emissions (tons/yr) From Reclamation*

Activities	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOCs†
Reclamation of the first proposed wellfield adjusted to approximate emissions from reclaiming one wellfield and a portion of another in a single year	20	4.4	1.4	1.5	750	0.0054	1.6

*Results from Table D.3-6 are adjusted to account for additional emissions from planned reclamation activities that overlap in time based on the proposed schedule.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO_2 = carbon dioxide; VOCs = volatile organic compounds
To convert tons to metric tons, multiply by 0.907

Table D.3-8. Estimated Cumulative Emissions From the Proposed Action* and Modified Action-No Hank Unit (Alternative 3) (tons)

Activities	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOCs†
Proposed Action: Well drilling and construction of 4 wellfields and 8 deep wells and reclamation of all wells and facilities	146	37	7.2	8.5	6300	0.027	9.4
Modified Action–No Hank Unit (Alternative 3): Well drilling and construction of 2 wellfields and 4 deep wells and reclamation of all wells and facilities	73	18	3.6	4.2	3200	0.014	4.7

*The planned duration of the proposed action represents a phased construction, operations, aquifer restoration, and reclamation schedule for each wellfield and facilities over a 10-year period (Uranerz, 2007, Figure 3-12 and Table 7-5). Based on the NRC staff's review of the applicant's proposed schedule for the Nichols Ranch Unit (Uranerz, 2007, Figure 3-12 and Table 7-5), the activities for the Modified Action–No Hank Unit (Alternative 3) would be similarly phased and last approximately 8 years.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO_2 = carbon dioxide; VOCs = volatile organic compounds
To convert tons to metric tons, multiply by 0.907

reclaiming all wellfields and facilities over a 10-year period. The cumulative results are conservative, in part, because the (factor of 4) multiplier over counts the contribution from the plant facilities decommissioning that is included in each wellfield reclamation emissions calculation.

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11. ABSTRACT *(200 words or less)*

By letter dated November 30, 2007, Uranerz Energy Corporation (Uranerz, the applicant) submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Nichols Ranch in-situ recovery (ISR) Project. Uranerz is proposing to construct, operate, conduct aquifer restoration, and decomission an ISR facility at the Nichols Ranch ISR Project site, located in Campbell and Johnson Counties, Wyoming. The NRC staff evaluated site-specific data and information to assess whether the applicant-proposed activities were consistent with activities considered in NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (GEIS) and determined which GEIS data and analyses could be incorporated by reference and what resource areas required site-specific review. The SEIS describes the environment potentially affected by the proposed site activities, describes the potential environmental impacts, and describes Uranerz's environmental monitoring program and proposed mitigation measures. The NRC staff responds to public comments received on the draft SEIS in the final SEIS.

The final SEIS was prepared in compliance with the National Environmental Policy Act of 1969 and in accordance with NRC's implementing regulations at Title 10, "Energy," of the Code of Federal Regulations (CFR), Part 51 (10 CFR Part 51).

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