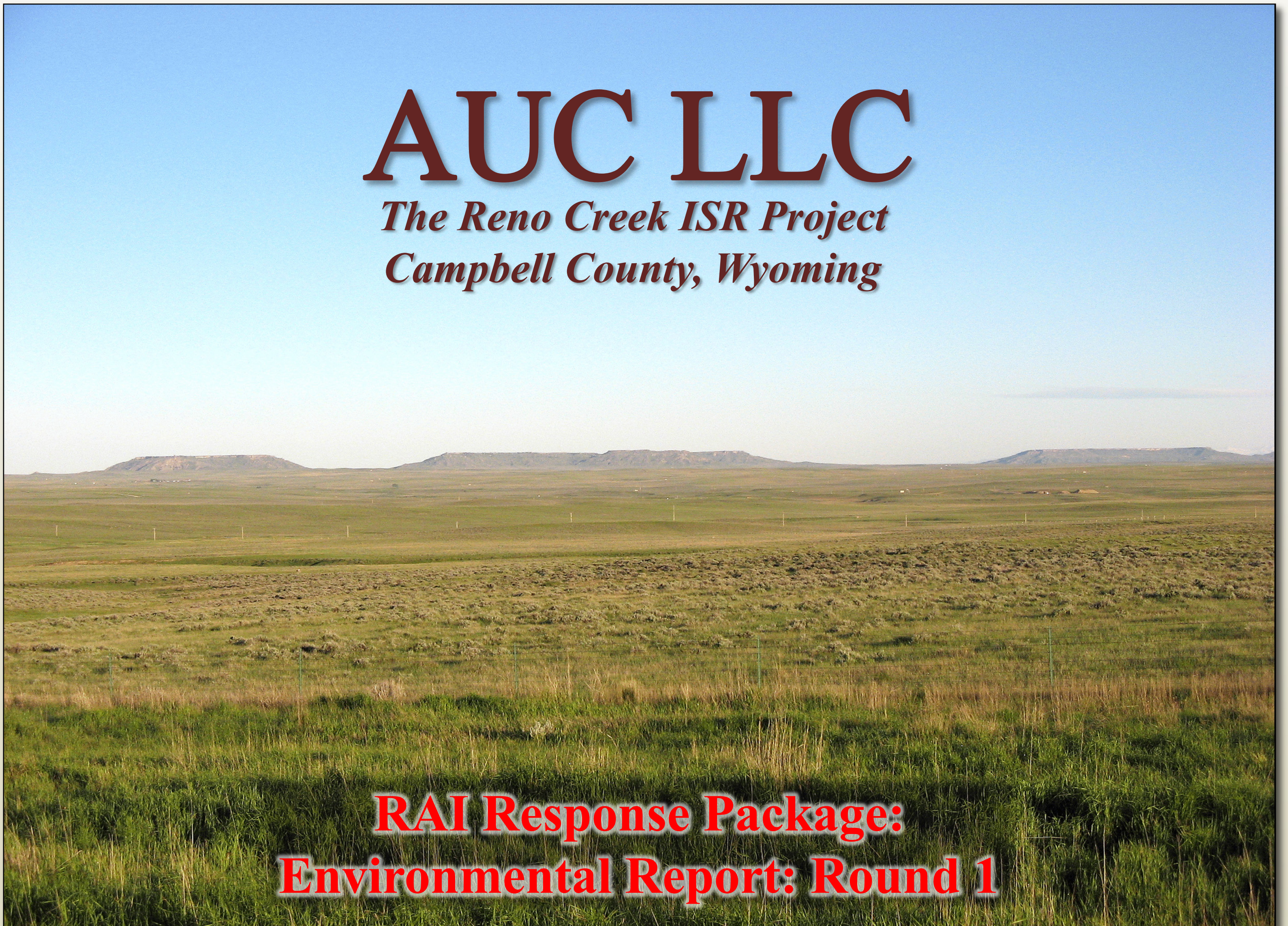
USNRC APPLICATION
Combined Source and 11e.(2) Byproduct Material License



June 2014

AUC LLC
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RAI Response Explanation

AUC is pleased to provide this Environmental Report response package to the NRC staff's Request for Additional Information (RAI) in a letter dated Feb. 10, 2014. Included in this package is each RAI followed by AUC's response. Any response which quotes specific existing application language will highlight that language in quotations. Specific text revisions or new additional language within the application will be highlighted in the color red. All responses which detail revisions or additional language to the application will clearly list the appropriate application location where those changes will be made.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

1. GENERAL

RAI GEN- 1: Preconstruction Activities

Description of Deficiency

On September 15, 2011, the U.S. Nuclear Regulatory Commission (NRC) published a final rule in the Federal Register (76 FR 56951) to clarify the definitions of commencement of construction and construction with respect to materials licensing actions conducted under the NRC's regulations. This final rule was effective on November 14, 2011. The parts of the final rule that are applicable to the NRC's licensing action for the proposed Reno Creek in situ recovery (ISR) project are in Title 10 of the Code of Federal Regulations (10 CFR) 40.4 (Definitions) (repeated in 10 CFR 51.4 (Definitions)) and 10 CFR 51.45 (Environmental Report).

The applicable definitions in 10 CFR 40.4 follow. Commencement of construction means taking any action defined as ''construction'' or any other activity at the site of a facility subject to the regulations in this part (i.e., 10 CFR Part 40) that has a reasonable nexus to:

(1) Radiological health and safety; or

(2) Common defense and security.

Construction means the installation of wells associated with radiological operations (e.g., production, injection, or monitoring well networks associated with in situ recovery or other facilities), the installation of foundations, or in-place assembly, erection, fabrication, or testing for any structure, system, or component of a facility or activity subject to the regulations in this part that are related to radiological safety or security. The term "construction" <u>does not include</u>:

(1) Changes for temporary use of the land for public recreational purposes;

(2) Site exploration, including necessary borings to determine foundation conditions or other preconstruction monitoring to establish background information related to the suitability of the site, the environmental impacts of construction or operation, or the protection of environmental values;

(3) Preparation of the site for construction of the facility, including clearing of the site, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and borrow areas;

(4) Erection of fences and other access control measures that are not related to the safe use of, or security of, radiological materials subject to this part;

(5) Excavation; Enclosure 2

(6) Erection of support buildings (e.g., construction equipment storage sheds, warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and office buildings) for use in connection with the construction of the facility;

(7) Building of service facilities (e.g., paved roads, parking lots, railroad spurs, exterior utility and lighting systems, potable water systems, sanitary sewerage treatment facilities, and transmission lines);

(8) Procurement or fabrication of components or portions of the proposed facility occurring at other than the final, in-place location at the facility; or

(9) Taking any other action that has no reasonable nexus to:

(i) Radiological health and safety, or

(ii) Common defense and security.

The above defined activities comprising what construction does not include are alternately referred to by the NRC staff as "site preparation" or "preconstruction" activities.

Note that activities included under what the definition of what construction means are considered to be part of the proposed action for the purposes of evaluating the environmental impacts of a proposed project. However, the defined activities comprising what construction does not include are not considered by the NRC to be part of the proposed action. The NRC's regulations in 10 CFR 51.45(c) specify what the analyses in applicant's environmental reports must include with regard to the proposed action and site preparation activities.

Regarding the applicant's environmental reports for materials licenses under 10 CFR 51.60, provide the following:

(a) A separate description of those Reno Creek ISR Project site preparation (or preconstruction) activities excluded from the definition of construction (i.e., a description separate from that of the description of the proposed construction activities) which have been or will be undertaken, regardless of when those activities may occur in relation to the potential issuance by the NRC of the license to construct and operate the proposed ISR facility;

(b) A separate description of the environmental impacts of such excluded site preparation activities (also including a description of any proposed measures to avoid or reduce adverse effects of the impacts); and

(c) An analysis of the cumulative impacts of the proposed action (i.e., the incremental impact of the proposed action) on the human environment when added to the impacts of such excluded site preparation activities and to the impacts of other past, present, and reasonably foreseeable future actions (regardless of what agency (Federal or non-Federal) or person undertakes such other actions (see 40 CFR 1508.7)).

Formulation of RAI

Provide a separate description of the proposed Reno Creek ISR Project activities included in the definition of construction, and a separate description of the environmental impacts of those construction activities (also including a description of any proposed measures to avoid or reduce adverse effects of the impacts). Further, the analyses for both the site preparation and construction activities shall, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, those considerations or factors shall be discussed in qualitative terms. The applicant's response for both the site preparation and construction activities should be presented at equivalent levels of detail and should contain sufficient data to aid the NRC staff in its development of an independent analysis.

RAI GEN-1 Response

As noted in NUREG-1910 (GEIS, Sec. 1 Introduction), there can be a scope of potential environmental effects associated with ISR projects such as the proposed Reno Creek Project (Proposed Project). AUC has developed a comprehensive response providing information regarding the preconstruction activities at the Proposed Project. This response is included as Appendix A of this response package.

RAI GEN- 2: Cumulative Effects

Description of Deficiency

In Section 1.8 of the TR, the applicant states that the Central Processing Plant (CPP) will have the capacity to process up to two million pounds of U3O8 per year from the proposed Reno Creek ISR Project operations as well as future ISR facilities operated by AUC and other uranium-loaded resin generators. The acceptance of loaded resin from outside sources along with future amendment areas in the Pumpkin Buttes Uranium District could potentially extend the life of the CPP facilities at the Proposed Project. In order for the NRC to assess the cumulative impacts of past, present, and reasonably foreseeable future actions (RFFA) per Section 5 of the GEIS, the geographic boundaries of the area must be explicitly established for each resource area as noted in Step 2 of the 11-step process established by the Council on Environmental Quality and included as Appendix F in the GEIS. A discussion of RFFA must be included in the cumulative-impact analysis.

Formulation of RAI

Clarify nature and scope of AUC's plans with respect to future ISR facilities operated by AUC and other uranium-loaded resin generators from outside sources. Address any potential cumulative impacts of these future ISR operations. Provide the following information:

(a) Parameters used to develop the scope of the cumulative-impact assessment.

(b) Geographic boundaries of the area that was used in Section 4.14 for each resource area to assess cumulative impacts and explain why this area was selected. Explain how this compares with the criteria from Section 5 and Appendix F of the GEIS.

(c) Identify and describe RFFAs that may potentially contribute to the impacts of the proposed Reno Creek Project in addition to available information regarding the schedule for development of identified actions.

(d) Quantitative information about each feature of the actions that was used to assess cumulative impacts for each resource area.

(e) Address the implications of these future ISR operations outside of the Proposed Reno Creek Project (Per 40 CFR 1502.4, Proposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action are to be evaluated in a single NEPA document).

RAI GEN-2(a) Response

As described in the ER Section 5 (Cumulative Impacts) introduction, the spatial scope of the cumulative impact review is the Wyoming portion of the Powder River Basin. Additionally and more specifically, past, present, and reasonably foreseeable uranium projects within 80 km (50 mi) are described within ER Section 5.1.1.1, provided within ER Table 5-2, and illustrated within ER Figure 5-1. These parameters were chosen to both meet the requirements of NUREG 1748 and remain consistent with NRC recommendation provided during the pre-submittal audit. The NRC advised to remain consistent with the final SEIS for the Nichols Ranch ISR Project, from which AUC replicated similar spatial and temporal extent. The use of these parameters are further supported as the Reno Creek Project is similar to the Nichols Ranch ISR Project in terms of geographic proximity, operations, and life of CPP facilities.

RAI GEN-2(b) Response

The spatial extent and rational is described in response to (a) above. Our geographic scope, as consistent with NUREG 1748 and recent SEIS', have been appropriately established for analysis per Step 2 of Appendix F and Section 5 of the GEIS.

RAI GEN-2(c) Response

AUC has not identified any specific future satellite facilities to be operated by either AUC or other generators, for which the resin acceptance capacity is intended. Regardless of the source of loaded resins, AUC commits to not exceed our licensed processing capacity. As the impacts evaluated for development of our license application were based off this maximum capacity, the acceptance of resins will not contribute to impacts beyond those currently addressed. Additionally, no further impact analysis is necessary as the acceptance of equivalent feed is addressed in NRC Regulatory Issue Summary 2012-06.

Discussion regarding RFFAs is included within the cumulative impacts described in ER Section 5 for uranium, coal, oil and gas, methane, wind energy, and mining.

RAI GEN-2(d) Response

Resulting from pre-audit consultations with NRC staff in November 2011, AUC developed its cumulative impact assessment using the most quantitative and qualitative information available at the time. As the Proposed Project is in close proximity to the

Nichols Ranch ISR project, our impact scoping basis included the assessments developed in the final Nichols Ranch SEIS (ML103440120) as requested by NRC. In addition, AUC used assessments in the Moore Ranch SEIS (ML102290470) and several published reports from the Bureau of Land Management regarding assessed impacts in the Powder River Basin. AUC is now providing an additional updated Preconstruction cumulative impact section with this response package as a result of RAI GEN-1. When combined with the existing information within the application, the potential and cumulative environmental impacts of the Proposed Project are clearly illustrated.

RAI GEN-2(e) Response

There are no identified actions to evaluate beyond the scope of the Proposed Project for the purposes of this license application. AUC understands that multiple proposals which would be closely related to each other would be considered eligible for review as a single NEPA document per 40 CFR 1502.4. However, there are currently no proposed or impending projects within the Proposed Action context to warrant review as a single course of action.

RAI GEN- 3: Permit Updates

Description of Deficiency

Table 1-4 of the ER identifies necessary environmental approvals and status of each with corresponding Federal and State agencies. Text in Section 1.6 states that all listed approvals are in progress. These approvals are necessary before operations can commence.

Formulation of RAI

Provide an update of the status of proposed, ending and approved licenses and permits for the Reno Creek ISR Project. Update ER Table 1-4 on Federal and state licenses and permits required for the proposed Reno Creek ISR Project. Also include any additional county and tribal permits or approvals.

The information provided should identity the issuing agency, describe the type of license, permit or approval needed, and provide the current status of securing the license, permit or approval. This information is needed to complete the description of the proposed action and determine the environmental impacts of the licensing and permitting process on the proposed project.

RAI GEN-3 Response

AUC has updated ER Table 1-4 as shown below:

Table 1-4: Summary of Proposed, Pending and Approved Licenses and Permits for the Reno Creek ISR Uranium Project

Regulatory Agency	Permit or License	Status
Federal: U.S. Nuclear Regulatory Commission (USNRC); U.S. Army Corps of Engineers (USACE); U.S. Environmental Protection Agency (USEPA); Underground Injection Control (UIC)		
USNRC	Source and 11e(2) Byproduct Materials License (10CFR40)	Pending – Submitted October 5, 2012. Docket #040-09092, RAIs received February 2014
USACE	Nationwide Permit Authorization	Proposed - Nationwide Permit preparation prior to disturbance
	Determination of Jurisdictional Wetland	Approved – Wetland delineation approved and forwarded to ACOE in April 2012
USEPA	Aquifer Exemption -Reclassification: (40CFR 144, 146) for Class I and Class III wells	Pending - Aquifer reclassification application prepared by WDEQ-WQD for review by EPA
State: Wyoming Department of Environmental Quality (WDEQ); Land Quality Division (LQD); Water Quality Division (WQD); Air Quality Division (AQD); Wyoming Pollutant Discharge & Elimination System (WYPDES), Wyoming State Engineers Office (SEO, Wyoming Department of Transportation (WYDOT)		
WDEQ/AQD	Air Quality Permit	Proposed - Application approval prior to start of construction - 4th Qtr 2014
WDEQ/LQD	Mineral Exploration Permit	Approved - Drilling Notification (DN) #401, TFN # 5 4/50, February 9, 2011
	Permit to Mine	Pending - Submitted January 2013
	UIC Class III Permit (Permit to Mine)	Pending - Class III UIC Permit, application under review; expected approval by WDEQ in 3rd Qtr 2014
	Aquifer Exemption (Class III UIC Permit)	Pending –Application to be reviewed and classified by WDEQ-WQD - 4th Qtr 2014
WDEQ/WQD	UIC Class I Permit (Deep Disposal Well)	Pending - Permit application under review; expected approval by WDEQ in 3rd quarter 2014
	UIC Class V (WDEQ Title 35-11)	Proposed - Class V UIC permit for an approved site septic system during facility construction
	Industrial/Mining Storm Water WYPDES Permit (WDEQ Title 35-11)	Proposed - Industrial Stormwater WYPDES Permit authorizing discharge associated with mineral and mining activities, 2nd Qtr 2015
	Construction Stormwater WYPDES Permit: (WDEQ Title 35-11)	Proposed - Construction Stormwater WYPDES Permit and Notice of Intent to be filed at least 30 days before construction activities begin in accordance with WDEQ requirements, 4th Qtr 2014
WDEQ/SEO	Permit to Appropriate Ground Water for operational ISR Monitor wells	Proposed - Permit to Appropriate Ground Water (U.W. 5 Form) prior to wellfield construction, 4th Qtr 2014
	Permit to Appropriate Ground Water – CPP Domestic Water Supply Well	Proposed - Permit to Appropriate Ground Water (U.W. 5 Form) prior to plant construction, 4th Qtr 2014
	Surface water reservoir permit for industrial use	Proposed – Surface water retention reservoir permit (SW3) for lined retention pond, 2nd Qtr 2015
WYDOT	District 4 Right-of-Way Access Permit for buried pipeline crossing state Highway 387	Proposed – Application prior to start of construction, 1st Qtr 2015
Campbell County, Wyoming - Campbell County Road & Bridge (CCR&B)		
CCR&B	County road Right-of-Way Access Permit for buried pipeline crossing county roads	Proposed – Application prior to start of construction, , 1st Qtr 2015

RAI GEN- 4: Waste Disposal Options

Description of Deficiency

Table 2-1 of the ER includes a comparison of waste disposal options in terms of advantages and disadvantages but does not fully compare the disposal options or provide information including:

- *Land size/footprint,*
- *Relevant regulations and permits,*
- *Construction requirements,*
- *Wastewater storage prior to disposal,*
- *Wastewater treatment,*
- *Decommissioning,*
- *Environmental benefits,*
- *Climate influences, and*
- *Health and safety issues.*

Formulation of RAI

Provide detailed information for waste disposal options. This information will allow NRC staff to analyze the options in terms of both specific and general environmental impacts.

RAI GEN-4 Response

AUC has provided a discussion of its proposal to include land application as one component in combination with DDWs for wastewater disposal in response to TR RAI-38. Each of the bulleted items presented in this RAI have been addressed in the response to TR RAI-38 and are discussed briefly in this response.

Land Size/Footprint

Figure 3-8 of the TR shows the conceptual CPP layout. This figure has been revised to incorporate the equipment that will be installed for the proposed wastewater treatment system. The revised figure can be seen within the response of RAI-38 of the TR Response Package. The proposed wastewater treatment system will fit into the conceptual CPP layout without increasing the size of the CPP building. The land size footprint of the treated effluent land application system is expected to be less than 1.5 acres. This is in contrast to solar evaporation ponds which require a much larger acreage to be effective in storing and reducing effluent volumes.

Relevant Regulations and Permits

In TR RAI-38 AUC has addressed the relevant regulations regarding liquid effluent discharges to unrestricted areas which includes AUCs plans to comply with 10 CFR 20.1301,10 CFR 20.1302, 10 CFR 20.2002, and 10 CFR 20.2007. Also, AUC has described the process AUC will use to determine if the source of the water is suitable for land application by comparing effluent discharge limits to 10 CFR 20 Appendix B, Table 2 and by discharging under a WYPDES Permit issued by the WDEQ/WQD.

Construction Requirements

Construction details are presented in TR RAI-38 for the proposed treated effluent land application system. The wastewater treatment system will be installed within the CPP.

Wastewater Storage Prior to Disposal

Wastewater will be stored in the Land Application Effluent Tank within the CPP prior to land application of the treated effluent. Brine generated by the wastewater treatment system will be stored in wastewater tanks within the CPP prior to disposal in the DDWs.

Wastewater Treatment

TR RAI-38 provides details of AUCs proposed wastewater treatment system that will be used prior to land application of the treated effluent. This system will be used in conjunction with DDWs to dispose of wastewater generated at the proposed project.

Decommissioning

Decommissioning of the CPP, which will include the proposed wastewater treatment system, is discussed in the Reclamation Plan provided as Addendum 6-A of the TR.

Environmental Benefits

Environmental benefits include reducing the consumptive use of groundwater and providing a much needed source of livestock water to local area ranchers.

Climate Influences

The proposed wastewater treatment system will cause a small increase in the use of electricity in the CPP. There will be no release of carbon dioxide from the operation of the proposed wastewater treatment system.

Health and Safety Issues

The chemicals used in the precipitation process in the proposed wastewater treatment system do not present a significant health or safety hazard when properly stored and used.

RAI GEN- 5: Alternatives

Description of Deficiency

Section 2.1.3 of the ER describes reasonable alternatives considered but rejected. However, as part of the NEPA process, NRC staff must analyze a full range of reasonable alternatives which are both economically and technically feasible in accomplishing the project goals. Currently the application describes the Proposed Action and the No Action alternative and does not give additional information for those alternatives that were considered but rejected.

Formulation of RAI

Provide additional detailed information across all resource areas to allow NRC staff to access reasonable alternatives which may include relocation of the CPP or off-site processing. This information will be used to develop the Alternatives analyses which will allow a comparison of this Alternative with the Proposed Action across all resource areas.

RAI GEN-5 Response

A wide range of alternatives are presented within ER Section 2. To further elaborate on the alternative location of the CPP per RAI-GEN-5, AUC has added additional detail within the alternatives section. The following new section has been added to ER Section 2.1.3. AUC has also added this alternative evaluation to ER Table 2-2 which has been included as Appendix B in this response package.

The text in Section 2.1.3 now includes:

"**Sec. 2.1.3.5 Alternate Location of the Central Processing Plant**

Prior to preparation of this license application, AUC considered two potential locations for the CPP in the Proposed Project area. The first location was the former pilot plant site for Rocky Mountain Energy (see ER Sec. 1.2.1). This site is located primarily in the NW quarter of Section 27, T43N, R73W (see ER Figure 1-2). The second location is in the NE quarter of Section 1, T42N, R74W (see ER Figure 1-2).

After evaluating the potential impacts of both CPP locations, the former pilot plant site was rejected on the basis of the following factors:

- Access to this site would require the development of a main access road measuring nearly one mile from Hwy 387 plus the construction of a new highway intersection.
    - The access road would require greater soil and vegetation disturbance, potentially increasing the environmental and ecological footprints during the project's lifespan.
    - The longer access road may increase fugitive dust potential from vehicular traffic.
    - The former pilot plant site would require utilities (e.g. gas and power lines) to be constructed over a greater distance.
- Landowners within the project area have communicated they prefer not to lease land for use as a CPP. A CPP will operate for numerous years, whereas a wellfield will operate for a shorter time and will be returned to the landowner upon decommissioning.
- Oil and gas firms have occupied ground between the former pilot plant site and the highway, and would create competing land uses; thus, additional logistical concerns. Traversing oil recovery and storage sites may also create challenging radiation management issues.
- The former pilot plant site is closer to a residence, which could result in a higher radiological dose potential.
- The former pilot plant site has more varied topography, so leveling the site for construction of the CPP and ancillary facilities would require more earthwork and surface disturbance.
- There is known mineralization beneath this site which might require layout reconfiguration of the wellfield and related infrastructure.
- This site is positioned on a hill which will have higher visibility from Hwy 387.
- Initial construction costs may be substantially greater than those for the proposed site in Section 1.

AUC's proposed CPP facility location is the SE quarter of the NE quarter of Section 1, T42N, R74W. The following is a list of factors which led AUC to select this site for construction of the proposed CPP:

- This site is located just off Clarkelen road only ¼ mile north of Hwy 387 and will require little development of a main access road to the site.

    - The potential for soil and vegetation disturbances of previously undisturbed areas would be significantly reduced by using existing roadways.
    - This minimal new access road development would result in less potential for fugitive dust from vehicular traffic.
- AUC will be purchasing the proposed CPP site so a land lease will not be required. This will place AUC in a better position to manage and control all site activities.
- The proposed site is situated on relatively flat topography, which would minimize the amount of earthwork and surface disturbance required to prepare the site for construction of the CPP and ancillary facilities.
- There is no known mineralization beneath the proposed site.
- Baseline instrumentation is currently adequate for all baseline environmental studies.
- Visibility from Hwy 387 and Clarkelen Road is limited and less than the rejected location.
- Utilities are established and will only need to be upgraded.
- Access to this site does not conflict with other active mineral development.
- Initial construction costs are substantially less at this proposed site.
- Preliminary geotechnical studies indicate subsoil materials have adequate strength for the proposed structures.

These factors made the proposed CPP location a strong candidate site for construction and operations. Detailed review of potential impacts associated with the alternative CPP location were not analyzed in detail because it is likely that the environmental effects of constructing and operating the CPP at a different location within the Propose Project area would be similar to the Proposed Action."

2. LAND USE

RAI LU- 1: Land Use Classification

Description of Deficiency

Table 3.1-1 and Figure 3.1-1 of the ER indicate that most land within and surrounding the proposed project is classified as non-agricultural land. This is not consistent with Section 3.1.4 (Agriculture) of the ER, which indicates that land within and surrounding the proposed project is predominantly rangeland used for livestock grazing – an agricultural activity.

Formulation of RAI

Provide information for land use classification by providing an explanation of the classification system used to describe land use (e.g., the classification of livestock grazing rangeland as non-agricultural).

RAI LU-1 Response

AUC initially obtained the land use classification information from the WyGISC (Wyoming Geographic Information Science Center) database system. The land use spatial data and land use classifications developed by the State of Wyoming were interpreted from 1:58,200 scale National High Altitude Program (NHAP) color infrared aerial photography as part of the Wyoming Ground-Water Vulnerability Mapping Project. The project was initiated in 1992 by the Wyoming Department of Environmental Quality's Water Quality Division (WDEQ/WQD), in cooperation with the University of Wyoming's Wyoming Water Resources Center (WWRC), the Wyoming State Geological Survey (WSGS), the Wyoming Department of Agriculture (WDA), and the U.S. Environmental Protection Agency, Region VIII (EPA). These photos were interpreted and land use designations were assigned to their corresponding polygons.

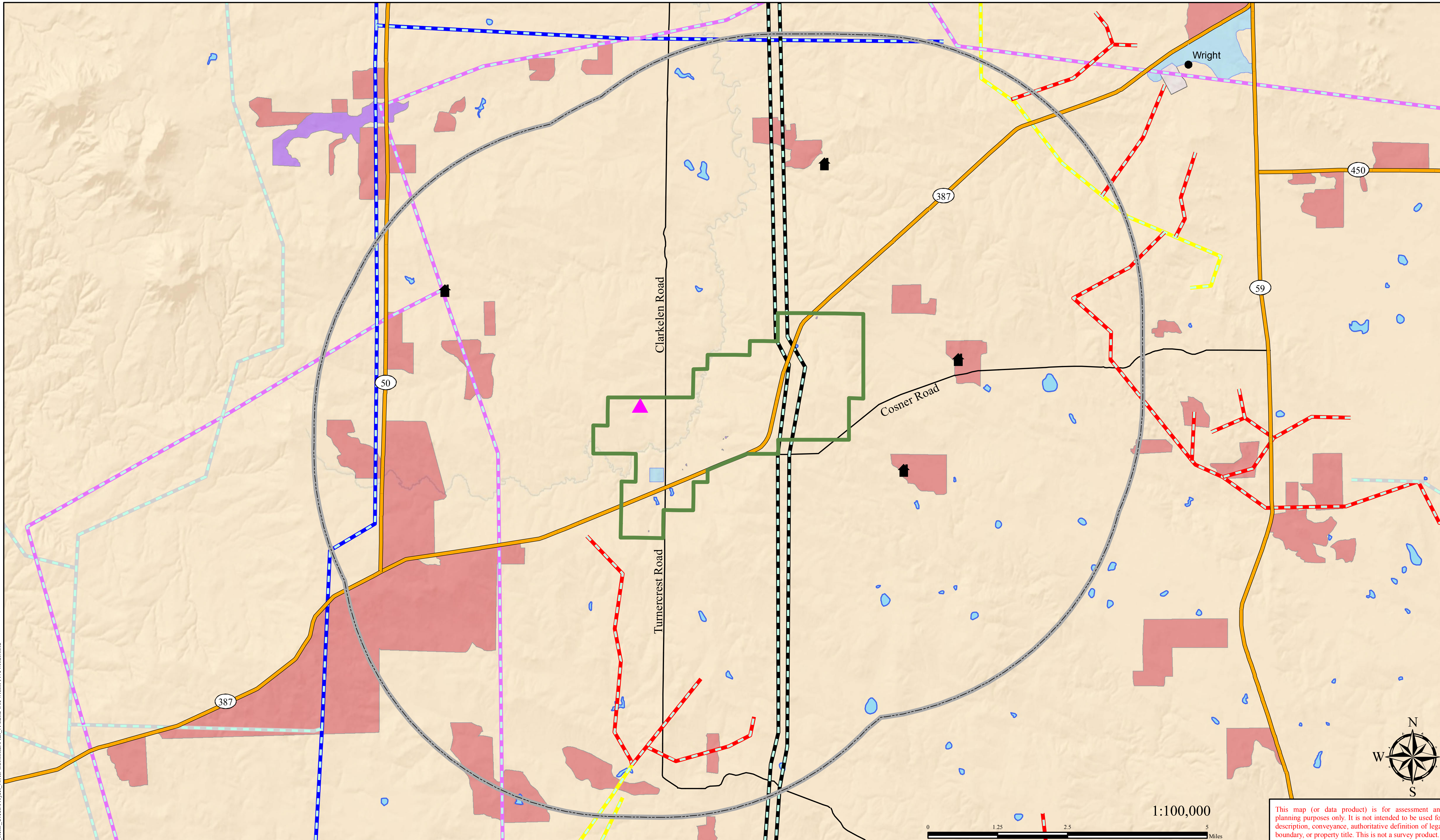
AUC has further evaluated the appropriateness of this classification as compared to the NRC's expectation of the agricultural classification of open range grazing. Using this perspective, and having site information based upon ground reconnaissance and local knowledge of the project area, the land use classification "Non-Agricultural" was revised to be consistent with Section 3.1.4. Those lands previously classified as "Non-Agricultural Land" and used for grazing purposes are now classified as "Agricultural Land". The land category definition of "Agricultural Land" will be applied as the first bulleted item on ER page 3.1-2:

- "Agricultural Land: Non-cultivated land with potential for mixed agricultural use such as livestock grazing, haying of forage crops, and wildlife habitat."

Both Table 3.1-1 and Figure 3.1-1 have been updated to reflect this change and are shown below.

Table 3.1-1: Land Use within Five Miles of the Proposed Project

Land Use Classification	Approximate Area and Percent of Total	
	Project Area	Study Area (5-mile buffer)
Agricultural Land	6019.6 acres (99.4%)	96061.4 acres (92.3%)
Non-Irrigated Cropland	0	7604.4 acres (7.3%)
Reservoirs	8.4 acres (0.1%)	241.4 acres (0.2%)
Transportation	24 acres (0.4%)	131.6 (0.1%)
Industrial	5.0 acres (0.1%)	5.0 acres (0.1%)



PREPARED FOR

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Legend

Residence
Cities and Towns
CBM Compressor Station
Proposed Reno Creek Project Boundary
Five Mile Review
Surface Water Features

Pipeline
Operator
Belle Fourche (Crude Oil)
Fort Union Gas Gathering (Natural Gas)
Kansas-Nebraska Gas Gathering (Natural Gas)
Kinder Morgan Operating, LP. (Natural Gas)
Thunder Creek Gas Services, L.L.C. (Natural Gas)
Western Gas Resources (Natural Gas)

Land Use
Description
Irrigated Cropland
Agricultural Land
Non-Irrigated Cropland
Urban or Built Up

DRAWN BY: RHK
CHECKED BY: RMD
APPROVED BY: JEY

Land Use within Five Miles of the Proposed Project Area

REV #	DESCRIPTION	BY	DATE
0	Draft	RHK	07/05/11
1	Revised Draft for Review	RHK	08/19/11
2	Revised per RAI request	EGS	04/21/14

FIGURE **3.1-1**

Path: O:\WY_Projects\2010-100_AUC_Reno_Creek\Project_MXD\Submittal\Plan_A\Land Use within Five Miles.mxd

RAI LU- 2: Local Residences

Description of Deficiency

Section 3.1.5 of the ER states that there are approximately eight occupants currently living in five residences within 5 mi of the proposed project boundary based on landowner correspondence.

Formulation of RAI

Please provide additional details for nearby residences. Please identify each residence and the number of occupants currently living at each residence within 5 mi of the proposed project boundary.

RAI LU-2 Response

The following table has been added to ER Section 3.1 to provide the requested information. Subsequent tables have been renumbered to maintain sequential order. It is presently assumed the Taffner family will not be occupying a residence in Section 30, Township 43 North, Range 73 West. The Taffner residence has been removed from ER Table 3.1-4. Additionally, mention of the Taffner residence has been removed from any applicable text or figures found in the remainder of the application.

Table 3.1-4: Residences within the Five Mile Review Area of the Proposed Project

Residence	Location	Number of Occupants
Roush	T43-R74-S21 NWNW	2
Levitt	T42-R73-S2 SWNW	1
Levitt Ranch Hand	T43-R73-S25 SWNW	2
Groves	T43-R73-S4-SESE	1

RAI LU- 3: Hunting and Hunting Restrictions

Description of Deficiency

Section 3.1.7 of the ER indicates that the parcel of State of Wyoming land within the proposed project area is accessible via County Road 22 (Clarkelen Road) and provides potential hunting opportunities. However, Section 4.1.1.1.5 of the ER indicates that hunting will be restricted within the proposed project area on private lands.

Formulation of RAI

Provide information regarding:

- *Hunting restrictions on the parcel of state-owned land within the proposed project area.*
- *Whether Wyoming Department of Game and Fish (WGFD) leases any privately-owned land within the proposed project area for hunting.*
- *Communications or agreements with WGFD concerning hunting restrictions on the parcel of state-owned land and potential state-leased private land within the proposed project area.*

RAI LU-3 Response

The Wyoming Game and Fish Department does not have jurisdiction or oversight over hunting access on Wyoming State-owned lands. Hunting or access restrictions on State-owned lands can only be designated by the State of Wyoming, Office of State Lands and Investments, Board of Land Commissioners (BLC). The BLC has extended to the public the privilege of using legally accessible State Trust Land for hunting, fishing and general recreational uses. However, where this privilege has the potential for abuse or damage to lessee interests, for public or lessee safety, the Board may close or restrict specific State Land, roads and/or areas on a temporary or permanent basis. Public users must obey all authorized closures, restrictions, and postings.

AUC presently holds the uranium mineral lease number 0-40866 for the parcel of state-owned land, and an adjacent private landowner currently has a livestock grazing lease with the BLC within the AUC proposed project area. Recreational hunters and shooters cannot enter state land by crossing private property without the permission of the landowner. However, hunters and shooters can legally access the state land via the County road right-of-way along Clarkelen Road. There are no WGFD access leases on private lands within the Proposed Project.

AUC will submit a written request to the Office of State Lands and Investments, Trust Land Management Division, to request hunter and livestock grazing access restrictions within the AUC proposed wellfield areas of the state-owned parcel. This request will specifically request full restrictive access to both recreational hunters, shooters, and restrict all livestock grazing within the AUC proposed wellfield areas. The AUC restriction request to the BLC will be based upon public health and safety and to prevent damage to AUC surface equipment from livestock within the proposed fenced wellfield areas, which will have signage and placarding at the fence lines warning of no entry.

No revisions were made to the application as a result of this RAI.

RAI LU- 4: Potential Impacts Between Proposed Construction & Infrastructure

Description of Deficiency

Figure 3.1-2 of the ER shows existing gas pipelines and coal bed methane (CBM) infrastructure within the proposed project area. This infrastructure includes buried water lines, buried powerlines, and buried gas pipelines. Figure 1-5 (Conceptual Site Plan) of the ER shows planned site facilities and infrastructure including wellfields, trunklines, and pipelines. Based on examination of these two figures, it appears that some of the planned ISR facilities and infrastructure will overlap with existing gas pipelines and CBM infrastructure.

Formulation of RAI

Provide information regarding potential impacts between proposed construction of ISR facilities and infrastructure with existing gas pipelines and coal bed methane facilities and infrastructure at the Reno Creek site including:

- *Whether planned ISR construction activities (e.g., earthmoving activities associated with wellfield and pipeline construction) will overlap or cross existing gas pipelines or CBM infrastructure.*
- *The mitigation measures that will be implemented to ensure that earthmoving activities associated with planned ISR construction will not impact existing gas pipelines and CBM infrastructure.*

RAI LU-4 Response

The CBM infrastructure within the Proposed Project Area is identified in Figure 3.1-2 and mentioned in several locations throughout the text of the license application. In the potential environmental impacts section under land use impacts of the proposed action (ER Section 4.1.1) the last sentence of the fourth paragraph on page 4-3 states:

"Oil and Gas and CBM facilities and infrastructure near the Proposed Project will not be affected."

Mitigation measures are presented in ER Section 6, where mitigations for Mineral Rights (6.1.1.3) are discussed as part of the land use topic. AUC will add the following text to Section 6.1.1.3 to provide additional mitigation detail:

"AUC will also use One Call of Wyoming to identify all utilities in the work area prior to any earth moving activities. As all utilities (e.g. pipelines) are required by state law to be a member of One Call of Wyoming, this will further verify the location of all gas pipelines."

3. AIR QUALITY

RAI AQ- 1: Emission Inventory Calculations for Greenhouse and Non-Greenhouse Gases

Description of Deficiency

Section 4.6 of the ER provides summary information concerning the project level emissions but in some cases, does not provide the details on how this summary information was reached.

Formulation of RAI

Provide a greater level of detail for the project emission inventory calculations for both greenhouse gases and non-greenhouse gases. This would also help address inconsistencies in the environmental report (see AQ-2).

Examples of additional information to provide include, but are not limited to the following:

- *Equations and associated constants for calculating the fugitive dust emissions for travel on unpaved roads and wind erosion,*
- *Quantities of each type of mobile equipment,*
- *Projected emissions from each mobile source,*
- *Methodology for determining operational time of drill rigs, and*
- *Carbon dioxide emissions associated with electricity consumption.*

RAI AQ-1 Response

AUC has developed a comprehensive emissions inventory for criteria pollutants, hazardous air pollutants, and greenhouse gases. The emissions inventory is broken down by project phase, with activity levels, duty cycles, documented emission factors and emission rates listed for all emission sources. Greenhouse gas emissions include indirect emissions from electricity consumption. Estimated emissions account for control or mitigation methods. The emissions inventory is included in a modeling protocol document that AUC will distribute to participating agencies for review. The document has been added to the application as ER Addendum 4-A and as Appendix C with this Response Package.

RAI AQ- 2: Emission Inventory Clarification

Description of Deficiency

Section 4.6 of the ER provides emission inventory information that appear inconsistent. Examples of inconsistencies include, but are not limited to the following:

- *Text on ER page 4-61 states that for all pollutants, the maximum emissions are projected to occur during the first year of construction/operation. However, ER Table 4-8 data shows that maximum particulate emissions occur in year 6.*
- *Text on ER page 4-61 states that no control factors were assumed for the emissions calculations whereas text on ER page 4-63 states that a 50% control factor for water suppression was applied for the fugitive dust calculations.*

Formulation of RAI

Review the emission inventory information provided in the ER for consistency. Provide clarification when appropriate.

RAI AQ-2 Response

AUC has reviewed the emissions inventory and along with the response to RAI AQ-1 provides the following clarifications.

AUC has revised the second paragraph of ER Sec. 4.6.1.1 which originally stated, "It is important to note that no control factors were assumed for the emission calculations." to now read:

"A fugitive dust control efficiency of 50 percent will be used for vehicle travel on project roads, based on periodic water application. A control efficiency of 85 percent will be used for the project access road, based on periodic treatment with a chemical dust suppressant."

AUC has also revised the statement on ER page 4-61 which originally stated, "For all pollutants, the maximum emissions are projected to occur during the first year of construction/operation (Year1)." to now read:

"For all pollutants, the maximum emissions are projected to occur during year six of the project."

RAI AQ- 3: Emission Levels

Description of Deficiency

Section 4.6 of the ER provides quantitative life cycle project emission levels but only qualitative descriptions of project phase emission levels. However, page 4-61 of the ER states that the projects emission were calculated by project phase. Although it is important to provide life cycle emission levels, the phase emission levels are required to independently verify the accuracy of the characterization of the project level emissions.

Formulation of RAI

Provide quantitative project emission levels by the four phases or provide a method to calculate this from the life cycle emission levels (i.e., the combined emission level from all four phases).

RAI AQ-3 Response

The quantitative project emissions information has been provided in response to RAI AQ-1. Emissions have been quantified by project phase and pollutant, as the maximum tons of emissions in a one-year period.

RAI AQ- 4: Emission Generating Activities

Description of Deficiency

In Section 4.6 of the ER, it is unclear whether drilling is only a construction phase activity or if it is also an operation phase activity. Clarification concerning which activities are associated with each phase is needed to accurately characterize the project level emission inventory and potential impacts.

Formulation of RAI

Identify emission generating activities associated with each phase.

RAI AQ-4 Response

The emission generating activities associated with each phase are provided in response to RAI AQ-1 .

RAI AQ- 5: Proposed Mitigation

Description of Deficiency

Text on page 4-63 of the ER states that a 50% control factor was applied to the fugitive road dust emission factors to account for water application for dust suppression. Two paragraphs later on that same page, the text states that the application of water to unpaved roads will reduce the amount of fugitive dust levels equal to or less than existing conditions (i.e., a control factor of 100% or more). The basis for either of these control factor values was not found in the ER. This information is required to provide a clear understanding of the effectiveness of the proposed mitigation that is incorporated into the inventory calculations as well as the basis used to properly characterize the project level emissions used to determine the impact magnitude.

Formulation of RAI

Clarify the effectiveness of all proposed mitigation that is incorporated into the emission inventory calculations and provide the basis.

RAI AQ-5 Response

The effectiveness of dust emission mitigations is provided in response to RAI AQ-2.

RAI AQ- 6: Accuracy of Emission Inventory

Description of Deficiency

Section 4.6 of the ER provides summary information concerning the project level emissions but in some cases, does not provide the details how this summary information was reached. Detailed information is needed to verify the conclusions in the ER.

Formulation of RAI

Provide detailed information and methodology for determining project level emissions, document additional information, and revise the inventory, if appropriate. Examples topics include, but are not limited to the following:

- *Exclusion of commuter traffic combustion emissions since the project NOx emission levels are at about 205 metric tons [226 short tons] per year (ER page 4-69),*
- *Comprehensiveness of the mobile emissions sources since the Dewey-Burdock ISR project inventory (NRC, 2012) identifies 26 mobile sources while the inventory in ER Section 4.6 lists only 11 mobile sources.*
- *Calculation for the amount of time equipment, such as, the drill rigs are used and generate emissions (i.e., based on equipment availability or estimations of actual use).*

RAI AQ-6 Response

Project level emissions information has been provided in response to RAI AQ-1. The emissions inventory includes an itemized list of equipment by type, with associated fuel source, horsepower, operating schedule, and emission factors. All emissions generated within the project area are listed, including passenger vehicle tailpipe and fugitive dust emissions.

RAI AQ- 7: Project Level Visibility

Description of Deficiency

In the ER, the visibility analysis is limited to Section 5.4 (cumulative effects) and is limited to a statement that visibility impacts (page 5-12) will have a small incremental effect on the cumulative impacts. Nitrogen oxides are pollutants that contribute to visibility impacts. According to ER Table 4-8, the pollutant with the highest annual emission from project activities (other than carbon dioxide) is nitrogen oxides with up to 205 metric tons [226 short tons] per year. This level of nitrogen oxide generated from the project activities indicate that a more detailed project level visibility analysis should be completed. This is consistent with EPA expectations for ISR SEIS analyses (Svoboda, 2010).

Formulation of RAI

Provide a detailed project level visibility analysis for the near field and far field impacts.

RAI AQ-7 Response

The response to RAI-AQ-1 also demonstrates lower emissions than originally estimated. In particular, the revised NOx emissions are much lower, and at maximum annual emissions of 42 tons, they resemble the average of three already licensed projects (Nichols Ranch, Lost Creek, and Moore Ranch, with average NOx emissions of 39 tons per year). The letter from EPA (Svoboda, September 2010) cited by NRC in RAI AQ-13, stipulates that far-field modeling should be performed for projects with substantially higher NOx emissions than currently licensed ISR projects, or for projects located near sensitive areas (major population centers, Class I or sensitive Class II airsheds). Based on the revised emissions inventory, Reno Creek does not meet either criterion. Therefore, AUC requests that the requirement for a visibility analysis be waived.

RAI AQ- 8: Cumulative Impacts

Description of Deficiency

The cumulative impact assessment in ER Section 5.4 relies on the Powder River Basin Coal Review analyses for the Bureau of Land Management which models air impacts until 2020. This addresses less than half of the 16 year period for the Reno Creek proposed action. The analyses should consider the air quality cumulative effects over the entire lifespan of the proposed project.

Formulation of RAI

Provide cumulative air analyses that addresses the entire lifespan associated with the proposed action.

RAI AQ-8 Response

The cumulative impact assessment in ER Section 5.4 relies on the Powder River Basin (PRB) Coal Review Phase I analysis, prepared for the Bureau of Land Management, which models regional air quality impacts through 2020. The most recent information incorporated in ER Section 5.4 is the updated Phase I, Task 3A report (BLM 2009). Phase II of the PRB Coal Review was initiated in January 2010 to update the Phase I analyses and project cumulative air quality impacts through 2030. At the time of AUC's original ER submittal, the PRB Coal Review Phase II analysis was ongoing but results had not been published.

In February of 2014 the PRB Coal Review Phase II Task 3A report was issued (BLM 2014). The cumulative air quality analysis in the Phase II Task 3A report is based on "reasonably foreseeable development" (RFD) in the region as updated in the Phase II Task 2 report (BLM 2011). The RFD projections for the PRB extend through year 2030, and concentrate on major industries such as coal mining, coal bed methane, conventional oil and gas, in-situ uranium recovery, and power generation. Since the total lifespan of the Reno Creek ISR Project is expected to be approximately 16 years, this response to RAI-AQ-8 incorporates the projected cumulative impacts from the Phase II Task 3A report for 2030.

In addition to the longer planning horizon and the updated RFD projections, several other changes to the Phase I air quality impact analysis were made in preparing the Phase II analysis:

- The Comprehensive Air Quality Model with Extensions (CAMx) was selected for Phase II, rather than the CALPUFF model used for Phase I;
- Phase II added ozone modeling based on the elevated ozone concentrations observed in southwestern Wyoming and the lowering of the ambient ozone standard by the U.S. EPA in 2008; and
- Projections of greenhouse gas emissions have been added to Phase II.

The future year (2020 and 2030) cumulative air quality impact analysis in Phase II Task 3A focuses on the projected change in impacts (air quality, visibility, atmospheric deposition) resulting from the projected RFD activities in the Wyoming and Montana PRB study areas under the upper development scenario (BLM 2014). A lower RFD scenario was studied but not modeled in Phase II. The Phase II Task 3A report concludes, "*Model predicted cumulative air quality impacts remain unchanged or tend to show improvement between 2020 and 2030*."

The Phase II Task 3A report also shows general improvement in air quality from the base year (2008) to 2030 (BLM 2014). Table 3-2 of the Phase II Task 3A report states that in general, criteria pollutant concentrations are projected to be lower than both the base year (2008) and future year 2020 impacts. The ozone modeling predicted exceedances of the national ambient standard at certain locations in 2008, but predicted those locations to be in compliance in 2020 and 2030. Referring to visibility impacts, Table 3-2 further projects light extinction values to be lower than for both the base year (2008) and the year 2020. Table 3-2 projects acid deposition rates in 2030 to be less than or equal to those predicted for 2020. The percent change in lake acid neutralizing capacity (ANC) in 2030 is predicted to be less than both the base year (2008) and the year 2020. The Phase II Task 3A report addresses Class I and sensitive Class II areas, concluding that modeled concentrations for all pollutants remain unchanged or tend to decrease relative to the base year (2008). Moreover, no model-predicted changes in concentration exceed the Prevention of Significant Deterioration (PSD) increments.

The principal cause of the predicted long-term improvement in air quality in the PRB is the reduced industrial activity reflected in the Phase II Task 3A report (BLM 2014). Predicted regional coal production in 2030 decreased from 752 million tons in the Task 2 RFD report to 651 million tons in the Phase II Task 3A report, reflecting a slower rate of increase in coal demand over the next few decades. Another source of predicted emissions reduction in 2030 is the revised outlook for coal bed methane (CBM) production. The Phase I RFD analysis shows 631 billion cubic feet (BCF) in 2020, compared to 160 BCF predicted for that year in the Phase II Task 3A report.

Even with these adjustments, the Phase II Task 3A report may still overstate long-term cumulative impacts. More recent forecasts by SNL Energy (Gilbert 2014) and the Energy Information Administration (EIA 2014a) show US coal production flattening over the next few decades. Since the PRB share of that production is currently about 450 million tons per year, these projections could lower 2030 coal production in the PRB by another 200 million tons. Among the causes are the newfound abundance and relatively low cost of natural gas, the tightening of emission standards for fossil fuel burning power plants, and the expected retirement of aging coal plants in the Midwest and Southeast (many of which burn PRB coal). Coal markets have also been suppressed by the softening of electric power demand due to conservation, energy efficiency and the growth in renewable energy. These more recent projections are not accounted for in the PRB Coal Review II analysis, and presumably would reduce cumulative air quality impacts even further. The Phase II Task 3A report states that model-predicted improvement to ambient air quality concentrations between the base year (2008) and the future years could be greater if actual coal mine development is less than the upper development scenario (BLM 2014).

The Phase II Task 3A report shows a slight rebound in CBM production in the PRB, to 283 BCF in 2030. At present, however, this appears unlikely since CBM production peaked at 573 BCF in 2008 (EIA 2014b) and has steadily declined since then to about half that value projected in 2014. According to WOGCC data, production has declined to an equivalent annual rate less than 300 BCF as of October 2013 (PLATTS 2013). CBM reserves dropped 36% during a recent 5-year period (EIA 2014b).

For modeling purposes, the Phase II Task 3A analysis assumed an increase of 700 megawatts in coal-fired power generation capacity by 2030. More recent forecasts show zero growth in coal-fired power generation in the PRB. The Dry Fork Station came on line in 2011, and no new coal-fired power plants have been proposed or permitted since then. The Energy Information Administration recently forecast no new coal-fired generation in the U.S. after 2016 (EIA 2014a). If this holds true, modeled 2030 impacts from power plants should be less than predicted in the Phase II Task 3A report.

It should be noted that recent forecasts call for growth in conventional oil and gas activity in the PRB, primarily due to new drilling and completion technologies that make shale gas and shale oil economical to produce. The Phase II Task 3A report predicts that conventional oil and gas production will decrease through 2030 relative to the base year 2008. As a result, the report states that "the contribution to ozone nearby and downwind of the PRB study area is likely to decrease." This statement should be qualified in light of more recent predictions of oil and gas growth in the PRB.

Based on the RFD and modeling results, the Phase II analysis predicts lower cumulative impacts to ambient air quality in 2020 and in 2030 than in the base year of 2008. By contrast, the Phase I analysis predicts higher cumulative impacts in 2020 than in the base year of 2004. For the Wyoming near-field receptors, the Phase I predicted impact of the 24-hour PM_{10} and $PM_{2.5}$ concentrations show localized exceedences of the National Ambient Air Quality Standard (NAAQS) for the base year (2004), as well as for both the upper and lower development scenarios for 2020. The 2020 development scenarios show the concentration increases by a factor of 2.5 relative to the base year for these parameters. Additionally, 2020 development scenarios show a 20 percent increase of annual PM_{10} and $PM_{2.5}$ concentrations at peak Wyoming near-field receptors (BLM 2009).

Because different dispersion models were used in the PRB Coal Review Phase I and Phase II analyses, a direct comparison between numerical model results is not advisable. In relative terms, however, the Phase I analysis predicts long-term degradation in air quality through 2020, particularly in the Wyoming portion of the PRB. On the other hand, the Phase II analysis predicts long-term improvement in air quality through 2030. Therefore, the original cumulative impact analysis in ER Section 5.4 represents an upper bound.

REFERENCES

BLM. "Task 3A Report for the Powder River Basin Coal Review, Cumulative Air Quality Effects." Bureau of Land Management High Plains District Office and Wyoming State Office. 2014.

BLM. "Task 2 Report for the Powder River Basin Coal Review, Past and Present and Reasonably Foreseeable Development Activities." Bureau of Land Management High Plains District Office and Wyoming State Office. 2011.

BLM. "Update of the Task 3D Report for the Powder River Basin Coal Review Cumulative Environmental Effects." Bureau of Land Management High Plains District Office and Wyoming State Office. 2009.

Gilbert. "SNL Energy Notes Strong Pricing, Production Slowdown in March Coal Forecast." Jesse Gilbert and Steve Piper. Coal Age. March 28, 2014.

EIA. "Lower U.S. electricity demand growth would reduce fossil fuels' projected generation share." U.S. Energy Information Administration. 2014a.

EIA. "Coalbed Methane Production." 2014b.

PLATTS. "Wyoming governor calls for increased effort to plug abandoned wells." Gas Daily, Platts McGraw-Hill Financial, December 26, 2013.

RAI AQ- 9: Fugitive PM10 Emissions

Description of Deficiency

Section 4.6 of the ER states that atmospheric dispersion modeling generally shows that fugitive PM10 (particulate matter with a diameter less than 10 micrometers) emissions on the order of 200 tons per year results in an insignificant impact to ambient air beyond a distance of a few hundred yards from the source but no documentation is provided.

Formulation of RAI

Provide the reference or basis for the statement in Section 4.6 of the ER.

RAI AQ-9 Response

AUC has conducted near-field modeling of the five criteria pollutants listed by NRC, including short-term and annual ambient impacts. This protocol is included as Appendix C in this response package.

AUC has revised the first paragraph of the Potential Non-Radiological Emissions discussion on ER page 4-65 which, in part, originally stated, "Atmospheric dispersion modeling generally shows that fugitive PM10 emissions on the order of less than 200 tons per year result are an insignificant impact to ambient air beyond a distance of a few hundred yards from the sources." This statement has been deleted, since AUC has committed to project-specific dispersion modeling.

Subsequently, AUC has revised a portion of that same paragraph on ER page 4-65 which originally stated, "Based on these activities, the projected total particulate matter (PM_{10}) emissions will be less than 200 tons per year." This sentence now reads:

"Based on these activities, the projected total particulate matter (PM_{10}) emissions will be approximately 150 tons in the worst-case year."

RAI AQ-10: Bulk Hazardous Chemicals

Description of Deficiency

Section 1.4.8 of the ER states that the proposed ISR process will store and use bulk hazardous chemicals. However, the air impacts analysis in ER Section 4.6 does not address these bulk hazardous chemicals or other hazardous air pollutants.

Formulation of RAI

Describe the expected emission level of any hazardous air pollutants and other material stored in bulk (e.g., acids) and any associated impacts.

RAI AQ-10 Response

The emissions levels are provided in response to RAI AQ-1. A chemical storage and handling emissions inventory is included in the overall project emissions inventory.

RAI AQ-11: Air Permit Information

Description of Deficiency

Table 1-4 of the ER indicates that an air permit application will be submitted to Wyoming Department of Environmental Quality (WDEQ) during the third quarter of 2013. Section 4.6 of the ER provides air emission inventory data. This type of information will likely be provided to WDEQ as part of the permitting process. An understanding of any distinctions between these two inventories relates to the adequacy and accuracy of the SEIS information used to determine impact significance.

Formulation of RAI

Provide the status of the WDEQ Air Quality Permit application and discuss any differences between the emission inventory supporting the SEIS analyses and the emission inventory supporting the WDEQ analyses. See also RAI – Gen-3.

RAI AQ-11 Response

The air permit application has not yet been submitted to WDEQ/AQD. Emissions shown in the modeling protocol document and referenced in the response to RAI-AQ 1 are consistent with those which will be reported to WDEQ/AQD as part of the air permit application.

RAI AQ-12: Baseline Ambient Criteria

Description of Deficiency

Section 4.6 of the ER states that air quality near the proposed project has been monitored extensively. However, the ER does not provide any baseline ambient criteria air pollutant concentrations for the proposed site.

Formulation of RAI

Provide appropriate baseline ambient criteria air pollutant concentrations for the proposed Reno Creek ISR Project site.

RAI AQ-12 Response

ER Tables 4-14, 4-15 and 4-16 have been added to the application and are shown below. These tables provide an ambient air quality assessment based on regional monitoring by state and industry organizations.

Table 4-14 presents PM_{10} monitoring history for Casper and Antelope Mine, along with the relevant annual average and short-term national ambient air quality standards (NAAQS). In 2012 Antelope Mine measured a 24-hour average of 157 $\mu g/m^3$, slightly over the NAAQS of 150 $\mu g/m^3$. The second high value for 2012, which is more relevant to the form of the NAAQS, was 134 $\mu g/m^3$. Due to impacts from regional wildfires, a request has been sent to EPA to flag the 157 $\mu g/m^3$ value under the Exceptional Event Rule.

Table 4-15 presents $PM_{2.5}$ monitoring history for Casper and Antelope Mine, along with the relevant annual average and short-term standards. Both short-term and annual average concentrations are well below the NAAQS at both sites.

Table 4-16 presents NO_2 monitoring history at four sites in the region. It can be seen that the annual averages are a fraction of the annual NAAQS, and the 1-hour concentrations are approximately one third of the 1-hour NAAQS.

Table 4-14: PM_{10} Monitoring History for Casper and Antelope Mine

Year	PM_{10} Statistic (ug/m^3 STP)	Antelope Mine Monitoring Site					City of Casper Monitoring Site					
		3PM11	4PM11	5PM11	6PM11	6PM10B	2386	649	650	20790/20229	21086	21089
2005	Mean Concentration		12.7	25.7	26.4							
	Max 24-hr Concentration		30	96	58							
	2nd high 24-hr Concentration		26	72	54							
2006	Mean Concentration		16.7	27.6	32.4							
	Max 24-hr Concentration		40	42	74							
	2nd high 24-hr Concentration		34	42	61							
2007	Mean Concentration		25.4	38.4	37.7		18.7	16.7	17.5			
	Max 24-hr Concentration		76	110	109		37	39	45			
	2nd high 24-hr Concentration		76	105	105		31	36	39			
2008	Mean Concentration	10.3	17.7	28.6	30.9	29.3	16.7	17.7	16.6			
	Max 24-hr Concentration	21	40	69	87	88	46	46	39			
	2nd high 24-hr Concentration	17	39	51	72	58	41	42	38			
2009	Mean Concentration	30.4	14.4	24.2	28.6	9.1	16	17.3	15			
	Max 24-hr Concentration	69	37	62	68	28	40	93	58			
	2nd high 24-hr Concentration	44	29	61	50	23	38	51	31			
2010	Mean Concentration	28.5	17.9	26.3	29.6	10.2	14.8	16.1	16.5			
	Max 24-hr Concentration	106	56	107	152	34	45	31	35			
	2nd high 24-hr Concentration	90	55	72	108	26	32	28	34			
2011	Mean Concentration	11	17.2	26.9	29.3	32.2				15.1	14.8	14.4
	Max 24-hr Concentration	45	73	104	108	110				61.7	63.4	45.6
	2nd high 24-hr Concentration	39	53	103	102	100				48.2	42.5	34.2
2012	Mean Concentration	17.2	24.5	34.1	38.2	38.5				17.5	17.5	18.6
	Max 24-hr Concentration	66	87	116	157	132				28.7	41	66.9
	2nd high 24-hr Concentration	65	82	115	134	88				38.1	39.1	54.4
8-yr Average	Mean Concentration	19.5	18.3	29.0	31.6	23.9	16.6	17.0	16.4	16.3	16.2	16.5
	Max 24-hr Concentration	61.4	54.9	88.3	101.6	78.4	42.0	52.3	44.3	45.2	52.2	56.3
	2nd high 24-hr Concentration	46.8	49.3	77.6	85.8	59.0	35.5	39.3	35.5	43.2	40.8	44.3
NAAQS	Annual Mean (old standard)	50	50	50	50	50	50	50	50	50	50	50
	Max 24-hr Concentration	100	150	150	150	150	150	150	150	150	150	150

Source: PM_{10} Database (IML, 2013) and AirData Website (EPA, 2013; http://www.epa.gov/airdata/

Table 4-15: $PM_{2.5}$ Monitoring History for Casper and Antelope Mine

Ambient $PM_{2.5}$ Concentrations at Antelope Mine (ug/m^3 @ LTP)				
Year	**Average $PM_{2.5}$**	**Annual $PM_{2.5}$ NAAQS Standard**	**98th percentile 24-hr $PM_{2.5}$**	**24-hr NAAQS Standard**
2005	5.1	15	14.2	35
2006	5.2	15	26.9	35
2007	5.3	15	20.7	35
2008	6.2	15	30.9	35
2009	6.2	15	15.9	35
2010	2.8	15	16.2	35
2011	3.6	15	17.3	35
2012	7.7	12	23.3	35
8-yr Mean	**5.3**	12	**20.7**	35

Ambient $PM_{2.5}$ Concentrations at Casper (ug/m3 @ LTP)				
Year	**Average $PM_{2.5}$**	**Annual $PM_{2.5}$ NAAQS Standard**	**98th percentile 24-hr $PM_{2.5}$**	**24-hr NAAQS Standard**
2009	4.4	15	11.9	35
2010	4.6	15	13.8	35
2011	4.5	15	14.8	35
2012	5.4	12	17.4	35
4-yr Mean	**4.7**	**12**	**14.5**	**35**

Sources: PRB $PM_{2.5}$ Database (IML,2013) and AirData Website (EPA, 2013; http://www.epa.gov/airdata/

Table 4-16: NO_2 Monitoring History

Ambient NO_2 Concentrations (ppb)									
Monitoring Site	**Parameter**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Antelope Mine	Valid Days	351	248	63	0	140	139	0	0
	Annual Average	2.9	2.7	2.9	n/a	1.4	2.5	n/a	n/a
	Annual Average NAAQS	53	53	53	53	53	53	53	53
	Max Daily High 1-yr Avg	45.0	43.0	98.5	n/a	32.3	33.9	n/a	n/a
	98th %tile of Daily Highs	32.1	40.9	41.8	n/a	30.0	32.6	n/a	n/a
	98th %tile 3-yr Avg			38.3	n/a	n/a	n/a	n/a	n/a
	3-yr Avg 98th %tile NAAQS			100	100	100	100	100	100
Tracy Ranch	Valid Days	292	348	353	340	317	328	334	360
	Annual Average	4.1	6.3	4.3	3.3	4.0	4.1	3.8	5.5
	Annual Average NAAQS	53	53	53	53	53	53	53	53
	Max Daily High 1-yr Avg	44.0	91.7	242.3	34.9	39.7	78.1	50.2	60.4
	98th %tile of Daily Highs	29.1	35.9	32.2	29.9	30.3	32.4	40.5	38.9
	99th %tile 3-yr Avg			32.4	32.7	30.8	30.9	34.4	37.3
	3-yr Avg 98th %tile NAAQS			100	100	100	100	100	100
Thunder Basin National Grassland	Valid Days	365	365	342	278	323	302	225	319
	Annual Average	6.7	4.5	4.3	4.3	4.2	3.8	3.9	4.3
	Annual Average NAAQS	53	53	53	53	53	53	53	53
	Max Daily High 1-yr Avg	21.0	32.0	21.0	14.0	14.0	15	26.0	24.7
	98th %tile of Daily Highs	12.0	12.0	11.0	11.0	11.0	11.0	11.0	11.2
	99th %tile 3-yr Avg			11.7	11.3	11.0	11.0	11.0	11.1
	3-yr Avg 98th %tile NAAQS			100	100	100	100	100	100
Belle Ayr Mine	Valid Days	287	359	72	0	268	353	314	360
	Annual Average	14.5	22.5	21.8	n/a	14.6	6.7	5.7	21.3
	Annual Average NAAQS	53	53	53	53	53	53	53	53
	Max Daily High 1-yr Avg	38.1	150.8	46.4	n/a	73.8	70.2	44.3	61.1
	98th %tile of Daily Highs	33.7	38.9	46.4	n/a	32.3	34.3	35.8	34.3
	99th %tile 3-yr Avg			39.7	n/a	n/a	n/a	34.1	34.8
	3-yr Avg 98th %tile NAAQS			100	100	100	100	100	100

Sources: PRB $PM_{2.5}$ Database (IML,2013) and AirData Website, (EPA, 2013; http://www.epa.gov/airdata/

RAI AQ-13: Emission Estimates

Description of Deficiency

The level of quantitative analysis in Section 4.6 of the ER is limited to annual mass emission estimates. EPA expects ISR projects presenting a substantial increase in emission levels compared to Nichols Ranch, Moore Ranch, or Lost Creek ISR projects to contain a more quantitative approach to modeling direct impacts other than just annual mass emission estimates (Svoboda, 2010). The Reno Creek emission estimates for individual pollutants can be up to nearly 21 times greater than those for the other three ISR projects. Additional information is needed to ensure that an appropriate level of analyses is conducted relative to project emission levels. Therefore, a greater level of quantitative analysis is required (e.g., site specific or analogous pollutant concentrations including consideration of short-term time frames) or a reduction in the pollutant levels similar to the values for three other ISR projects.

Formulation of RAI

Provide a more quantitative approach to modeling direct impacts beside annual emission levels or reduce emission levels to values similar to the three previous ISR projects as documented Table 1 (for example).

Table 1: Emission Estimates (Metric Tons* per year) for Various ISR Projects

Project	Pollutant				
	Carbon Monoxide	Nitrogen Oxides	Particulate Matter PM10	Particulate Matter PM2.5	Sulfur Dioxide
Reno Creek	45.4	205	142.4	31.7	20.9
Lost Creek	10	39	156	na	1
Nichols Ranch	18	58	125	na	1.4
Moore	5	20	15	na	1

Sources: Reno Creek from ER, Lost Creek from NRC 2011a, Nichols Ranch from NRC 2011b, and Moore Ranch from NRC 2010.
*To convert metric tons to short tons, multiply by 1.1023

References:

Svoboda, L. "NUREG-1910, Supplement 1, Environmental Impact Statement, Final Report for Moore Ranch ISR Project, Campbell County, Wyoming." CEQ No. 20100337. Letter (September 27) to D. Skeen, U.S. Nuclear Regulatory Commission, Environmental Protection and Performance Assessment Directorate. Denver, Colorado: U.S. Environmental Protection Agency, Region 8. 2010.

RAI AQ-13 Response

See responses to RAI-AQ-1 and RAI-AQ-9. The comprehensive emissions inventory and near-field modeling analysis (Appendix C of this response package) addresses this concern.

4. ECOLOGY

RAI EC- 1: Crucial Habitat Priority Area

Description of Deficiency

Section 3.5.4.3.4.3 of the ER states that "...(the eastern one-third of the survey area) is also designated by the Wyoming Game and Fish Department (WGFD) as a Crucial Habitat Priority Area for the sagebrush/mixed grassland habitats".

Formulation of RAI

Clarify the number of acres of the proposed project area that has been designated as a Crucial Habitat Priority Area by the WGFD. Additionally, clarify how many acres of the proposed project that are designated as Crucial Habitat Priority Area are planned to be disturbed by project activities.

RAI EC-1 Response

AUC is providing the following clarification for the Wyoming Game and Fish Department (WGFD) designation of Crucial Habitat Priority Area within the Proposed Project Area.

Communications between Mr. Mark Konishi, Deputy Director of the WGFD, and Luke McMahan P.G., Project Geologist with the WDEQ LQD District III in Sheridan, WY, stated the following:

> "….Sage-grouse likely use habitats in and around the project area for winter, breeding, nesting, and brood-rearing habitat. A variety of other sage-dependent non-game birds and small manuals also use these habitats. As proposed, there is one active sage-grouse lek, Porcupine Creek, nearby. We recommend annual spring monitoring of this lek be coordinated with our local biologist in Gillette. The project area does not fall within a sage-grouse core area as defined by the Governor's Executive Order for Sage-Grouse".

Also, in a March 3, 2014 letter from Mr. Mark Konishi (WGFD) to Ms. Jessica Maycock of ICF International, further stated the following:

> "The staff of the Wyoming Game and Fish Department has reviewed the Habitat Priority Areas for ICF International on behalf of Phil Cavendor with AUC, LLC for

the Reno Creek Uranium project in Campbell County. We offer the following comments for your consideration. The monitoring protocols for this project that have been provided are adequate. This project is not within a sage-grouse core area and we are not requiring mitigation measures for sage-grouse. We do expect sage-grouse non-core area stipulations and recommendations to be abided by. In addition, it has come to our attention that the Nuclear Regulatory Commission has inquired about the sagebrush/mixed grassland habitat priority area. Please be advised that our habitat priority areas as found in our Statewide Habitat Plan are a delineation of common habitat types found in Wyoming. This document helps our staff work with others to maintain or improve conditions within each type. The priority areas are not a means nor a basis upon which to develop mitigation measures for species; they are simply recognition of habitat types and provide direction for our staff and cooperating groups to consider when developing habitat projects within each type."

Both WGFD letters are included in this Response Package as Appendix D.

Additionally, the WGFD provides the Habitat Priority Area maps (Revised January 2009 – http://wgfd.wyo.gov/web2011/WILDLIFE-1000426.aspx) identifying the crucial terrestrial habitat areas. However, since the WGFD does not specify GIS numeric perimeter boundaries for these habitat priority areas, AUC would only be guessing the acreage of proposed project area that has been designated as a Crucial Habitat Priority. Additionally and for the same previously-described reason, AUC cannot accurately determine the Crucial Habitat Priority Area acreage planned to be disturbed by project activities. In the ER, Section 1.2.3 Description of the Proposed Action, AUC provides an adequate description of the Disturbed Lands totaling approximately 154 acres (approximately2.5 percent of the Proposed Project area) with two types of disturbance including short term disturbance (< six months), and long term disturbance (> six months). For these reasons and the above-described WGFD letters, AUC has elected to not attempt to produce acreage estimates for the Crucial Habitat Priority Area acreage within the project area.

As stated by the WGFD, these habitat priority areas of the Statewide Habitat Plan only delineate common habitat types, and are not meant as a means or basis upon which to develop mitigation measures for species, but only used as a tool to recognize habitat types and provide direction WGFD staff with habitat development projects. As recommended by the WGFD, AUC will commit to conducting an annual spring monitoring of the noted sage-grouse lek, in coordination with the WGFD biologist in Gillette.

The following paragraph has been added to Section 3.5.4.3.4.3:

"The WGFD Crucial Habitat Priority Areas of the Statewide Habitat Plan only delineate common habitat types, and are not meant as a means or basis upon which to develop mitigation measures for species, but only used as a tool to recognize habitat types and provide direction to WGFD staff with habitat development projects. As recommended by the WGFD, AUC will commit to conducting an annual spring monitoring of the Porcupine Creek sage-grouse lek, in coordination with the WGFD biologist in Gillette."

RAI EC- 2: Planned Disturbance Area for Plant Communities

Description of Deficiency

Tables1-3 and 4-1 of the ER provide a detailed assessment of disturbance calculations for proposed infrastructure, but does not break down the planned disturbances by plant community type during each project phase.

Formulation of RAI

Provide a breakdown of the acreage of long term and short term disturbances for each plant community for each phase of each alternative including the proposed action.

RAI EC-2 Response

AUC has chosen the Central Processing Plant as the proposed action and has performed the requested plant community disturbance calculations. AUC also weighed alternatives to include open pit, underground, heap leach and satellite facilities however the analysis of each alternative was not carried out to such an extent to produce the detailed data needed for disturbance calculations. Rather, AUC was able to compare each alternative to the proposed action and determine, in general terms, whether the disturbance for each alternative would be greater, equal to or less than the proposed action.

The proposed action, the Central Processing Plant, was ultimately chosen because it strikes a balance between causing the least amount of disturbance while remaining technically feasible throughout all phases. Included in the disturbance analysis are the Central Processing Plant facility, well fields, well field access roads, header houses, trunklines, deep disposal well pads and pipelines, and secondary and tertiary access roads. AUC's calculations have indicated that a total of 154.2 acres of topsoil and vegetation will be disturbed, with 106.7 acres of the total being short-term disturbance and 47.5 acres being long term disturbance. The project area is predominantly big brush sagebrush and therefore the vegetation type most likely to be disturbed during the various project phases, followed by meadow grass, upland grass, breaks grassland, in that order.

AUC has added a new table (ER Table 4.5-1; shown below) to the application to provide the requested information. AUC also added the following sentence at the end of the first paragraph of ER Sec. 4.5.1:

"ER Table 4.5-1 depicts a breakdown of disturbances during the Proposed Project's lifespan."

Table 4.5-1: Disturbances During the Four Phases of the Proposed Project

	PRECONSTRUCTION *(Disturbed Vegetation Type (Acres))*						
	BG	BSS	D	MG	UG	W	**Total**
PROPOSED ACTION							
CPP	0	12.1	3.4	0	0	0	**15.5**
ALTERNATIVE ACTION	**Disturbance in Comparison to Proposed Action**						
Open Pit	Greater						
Underground	Greater						
Heap Leach	Greater						
Satellite	Less						
						Total:	**15.5**

	CONSTRUCTION *(Disturbed Vegetation Type (Acres))*						
	BG	BSS	D	MG	UG	W	**Total**
PROPOSED ACTION							
CPP	1.74	117.1	4.45	9.2	6.1	0.15	**138.7**
ALTERNATIVE ACTION	**Disturbance in Comparison to Proposed Action**						
Open Pit	Greater						
Underground	Greater						
Heap Leach	Greater						
Satellite	Equal To						
						Total:	**138.7**

	RESTORATION *(Disturbed Vegetation Type (Acres))*						
	BG	BSS	D	MG	UG	W	**Total**
PROPOSED ACTION							
CPP	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ALTERNATIVE ACTION	**Disturbance in Comparison to Proposed Action**						
Open Pit	N/A						
Underground	N/A						
Heap Leach	N/A						
Satellite	N/A						
						Total:	**N/A**

	DECOMMISSIONING *(Disturbed Vegetation Type (Acres))*						
	BG	BSS	D	MG	UG	W	**Total**
PROPOSED ACTION							
CPP	1.74	129.2	7.84	9.2	6.1	0.15	**154.2**
ALTERNATIVE ACTION	**Disturbance in Comparison to Proposed Action**						
Open Pit	Greater						
Underground	Greater						
Heap Leach	Greater						
Satellite	Equal To						
						Total:	**154.2**

BG = Breaks Grassland **BSS** = Big Sagebrush Shrubland **D** = Previously Disturbed/Developed **MG** = Meadow Grassland **UG** = Upland Grassland **W** = Water

Total Short Term Disturbance	106.7 acres
Total Long Term Disturbance	47.5 acres
Total Disturbance for Removal of Soil and Vegetation	**154.2 Acres**

RAI EC- 3: Mitigation Activities for Sage-Grouse

Description of Deficiency

Section 3.5.4.3.4.3 of the ER states that sagebrush habitats within the area could provide adequate nesting and wintering habitat for Greater sage-grouse (Centrocercus urophasianus), and the moist drainages in the area could also provide adequate brood-rearing and late summer habitat. Part of the project area is also designated as WGFD Crucial Habitat Priority Area and an Enhancement Habitat Priority Area for the sagebrush/mixed grassland habitat within sage-grouse complexes. Project development and operations may occur within T43N R73W Sections 21, 22, 27, and 28, which are in part located within 2 miles of the occupied Porcupine Creek sage-grouse lek. The State of Wyoming Executive Order E.O. 2011-5 recommends limiting activities outside of core population areas as follows: no more than a 0.25 mile no surface occupancy standard and a 2 mile seasonal (Dec 1 – March 14) buffer should be applied to occupied leks. In addition, ER page 4-51 states potential impacts could include sage-grouse mortality from the backup storage pond or temporary mud pits, limited habitat loss or fragmentation, and increased noise and activity that may deter sage-grouse use of the area. The ER page 4-51 also states that ER Section 6 describes mitigation measures that will be put in place to help minimize potential impacts to sage-grouse. ER Section 6.5.2 states AUC will implement mitigation measures included in regulatory guidelines and requirements designed to prevent or reduce impacts to wildlife "which may include one or more of the following practices"; however, ER Sections 4.5.2.3.2 and 6 do not describe sage-grouse mitigation measures that the applicant commits to employ in order to meet regulatory guidelines and requirements. Further, the ER states AUC does not plan to conduct operational monitoring for sage-grouse at this time (ER page 7-14).

Formulation of RAI

Provide additional information regarding planned mitigation activities to protect sage-grouse during all phases of the project that follow published State of Wyoming guidelines.

<u>RAI EC-3 Response</u>

As noted in the RAI EC-1 Response, The WGFD Crucial Habitat Priority Areas of the Statewide Habitat Plan only delineate common habitat types, and are not meant as a means or basis upon which to develop mitigation measures for species, but only used as a tool to recognize habitat types and provide direction WGFD staff with habitat development projects. As recommended by the WGFD, AUC commits to conducting an annual spring monitoring of the noted the Porcupine Creek sage-grouse lek, in coordination with the WGFD biologist in Gillette.

The State of Wyoming Executive Order E.O. 2011-5 applies to those areas identified by the State as “core” areas within this order. As the Proposed Project lies outside of “core” sagegrouse area, the conditions of this order do not apply.

RAI EC- 4: Observed Plant Species

Description of Deficiency

ER page 3.5-7 states that 62 plant species were observed within the big sagebrush shrubland plant community, however only 48 plant species are listed as observed in the plant species summary for the big sagebrush shrubland plant community.

Formulation of RAI

Explain the differences between the number of plant species reported in each plant community (ER Section 3.5.4.1.2) and the number of plant species reported as observed in the plant species summary (ER Addendum 3.5B).

RAI EC-4 Response

The numbers presented in the text represent the total number of plant species observed, during all site evaluations, within a given vegetation community. This number includes plant species sample on cover transects, shrub density belt transects, and species diversity transects, indicted by an "X" in ER Addendum 3.5B, plus incidental species observed during all site evaluations (i.e., vegetation community mapping), indicated by a filled in box in ER Addendum 3.5B. The number of plant species within each of the vegetation communities was re-calculated based on this method. It was determined that 61 plant species were observed or sampled within the Big Sagebrush Shrubland vegetation community. All other vegetation communities had the correct number of plant species observed or sampled.

To clarify this change, the text has been revised in the first sentence of ER Section 3.5.4.1.2.1 within the Species Diversity and Composition section on page 3.5-7 as shown below and now reads:

"Fifteen lifeforms and 61 plant species were sampled or observed within the Big Sagebrush Shrubland plant community."

This change adding "sampled or" was carried throughout the following sections.

Section 3.5.4.1.2.2 (Species Diversity and Composition section) on page 3.5-7:

"Fourteen lifeforms and 59 plant species were sampled or observed within the Meadow Grassland plant community."

Section 3.5.4.1.2.3 (Species Diversity and Composition section) on page 3.5-8:

"Fourteen lifeforms and 49 plant species were sampled or observed within the Upland Grassland plant community."

Section 3.5.4.1.2.4 (Species Diversity and Composition section) on page 3.5-9:

"Fourteen lifeforms and 57 plant species were sampled or observed within the Breaks Grassland plant community."

Addendum 3.5B (Plant Species List) was updated to correct the Breaks Grassland plant community column heading. A column was added to the end of the table to clarify which species were sampled and which species were observed. The changes are indicated in red on the table below.

Vegetation Species Summary (ER Addendum 3.5-B)

Acronym	Current Nomenclature	Common Name	Plant Community			
			BSS	UG	MG	BG
Native Annual Grasses						
ALOCAR	*Alopecurus carolinianus*	Carolina foxtail				
VULOCT	*Vulpia octoflora*	Sixweeks fescue		X		
Introduced Annual Grasses						
BROCOM	*Bromus commutatus*	Bald brome				X
BROJAP	*Bromus japonicus*	Japanese brome	X	X	X	
BROTEC	*Bromus tectorum*	Cheatgrass	X	X	X	X
Native Cool Season Perennial Grasses						
ACHHYM	*Achnatherum hymenoides*	Indian ricegrass				X
ELYLAN	*Elymus lanceolatus*	Thickspike wheatgrass	X			X
ELYSMI	*Elymus smithii*	Western wheatgrass	X	X	X	X
ELYSPI	*Elymus spicatus*	Bluebunch wheatgrass				X
ELYTRA	*Elymus trachycaulus*	Slender wheatgrass				
HESCOM	*Hesperostipa comata*	Needleandthread				X
KOEMAC	*Koeleria macrantha*	Prairie junegrass	X	X		X
NASVIR	*Nassella viridula*	Green needlegrass	X	X	X	X
POAARI	*Poa arida*	Plains bluegrass	X	X		
POAJUN	*Poa juncifolia*	Alkali bluegrass			X	
POASEC	*Poa secunda*	Sandberg bluegrass	X	X	X	X
Native Warm Season Perennial Grasses						
BOUGRA	*Bouteloua gracilis*	Blue grama	X	X	X	X
CALLON	*Calamovilfa longifolia*	Praire sandreed		X	X	
Introduced Perennial Grasses						
AGRCRI	*Agropyron cristatum*	Crested wheatgrass	X	X	X	X
BROINE	*Bromus inermis*	Smooth brome			X	
POABUL	*Poa bulbosa*	Bulbous bluegrass				
POAPRA	*Poa pratensis*	Kentucky bluegrass	X	X	X	X

Vegetation Species Summary (cont.)

Acronym	Current Nomenclature	Common Name	Plant Community			
			BSS	UG	MG	BG
Native Grasslike Species						
CARFIL	*Carex filifolia*	Threadleaf sedge	X	X		X
CARPRA	*Carex praegracilis*	Silver sedge			X	
CARSTE	*Carex stenophylla*	Needleleaf sedge	X	X	X	
ELEPAL	*Eleocharis palustris*	Common spikerush			X	
Native Annual Forbs						
DESPIN	*Descurainia pinnata*	Western tansymustard			X	
LAPRED	*Lappula redowskii*	Bluebur stickseed	X	X	X	
MONNUT	*Monolepis nuttalliana*	Nuttall's povertyweed			X	
PHALIN	*Phacelia linearis*	Threadleaf phacelia				
Introduced Annual Forbs						
ALYALY	*Alyssum alyssoides*	Pale alyssum				
ALYDES	*Alyssum desertorum*	Desert alyssum	X	X	X	X
CAMMIC	*Camelina microcarpa*	Littleseed falseflax	X	X	X	
CHEALB	*Chenopodium album*	Common lambsquarter			X	
CHOTEN	*Chorispora tenella*	Common blue mustard			X	
POLAVI	*Polygonum aviculare*	Prostrate knotweed				
SISALT	*Sisymbrium altissimum*	Tumble mustard				
THLARV	*Thlaspi arvense*	Field pennycress		X	X	X
Introduced Biennial Forbs						
CIRVUL	*Cirsium vulgare*	Bull thistle				
MELOFF	*Melilotus officinalis*	Yellow sweetclover	X			X
TRADUB	*Tragopogon dubius*	Goat's beard		X		X
Native Perennial Forbs						
ACHMIL	*Achillea millefolium*	Western yarrow			X	
AGOGLA	*Agoseris glauca*	Pale agoseris				
ALLTEX	*Allium textile*	Textile onion	X			

Vegetation Species Summary (cont.)

Acronym	Current Nomenclature	Common Name	Plant Community			
			BSS	UG	MG	BG
ARNFUL	*Arnica fulgens*	Foothill arnica	X	X	X	
ASTBIS	*Astragalus bisulcatus*	Twogrooved milkvetch				
ASTMIS	*Astragalus miser*	Weedy milkvetch	X			
ASTMI1	*Astragalus missouriensis*	Missouri milkvetch				
ASTPUR	*Astragalus purshii*	Woolly milkvetch				
ASTSPA	*Astragalus spatulatus*	Spoonleaf milkvetch	X	X		X
CALGUN	*Calochortus gunnisonii*	Gunnison mariposalily				
CIRFLO	*Cirsium flodmanii*	Flodman thistle				
CIRUND	*Cirsium undulatum*	Wavyleaf thistle				
COMUMB	*Comandra umbellata*	Common bastard toadflax	X			
CRYCIN	*Cryptantha cinerea*	James' cryptantha				
DELBIC	*Delphinium bicolor*	Little larkspur				X
EREHOO	*Eremogone hookeri*	Hooker sandwort				X
ERIOCH	*Erigeron ochroleucus*	Buff fleabane			X	
ERIPUM	*Erigeron pumilus*	Low fleabane				X
GAUCOC	*Gaura coccinea*	Scarlet gaura				
Native Perennial Forbs						
LEWRED	*Lewisia rediviva*	Bitter root				
LOMFOE	*Lomatium foeniculaceum*	Biscuitroot	X	X	X	X
LUPARG	*Lupinus argenteus*	Silvery lupine	X		X	
MUSDIV	*Musineon divaricatum*	Leafy wildparsley		X		
OXYLAM	*Oxytropis lambertii*	Lambert crazyweed	X			
PEDARG	*Pediomelum argophyllum*	Silverleaf Indian breadroot				

Vegetation Species Summary (cont.)

Acronym	Current Nomenclature	Common Name	Plant Community			
			BSS	UG	MG	BG
PENALB	*Penstemon albidus*	White beardtongue				
PENERI	*Penstemon eriantherus*	Fuzzytongue penstemon				
PHLHOO	*Phlox hoodii*	Hoods phlox	X	X	X	X
SENINT	*Senecio integerrimus*	Lambstongue groundsel				
SPHCOC	*Sphaeralcea coccinea*	Scarlet globemallow	X		X	X
THERHO	*Thermopsis rhombifolia*	Golden banner				
VICAME	*Vicia americana*	American vetch	X	X	X	X
VIONUT	*Viola nuttallii*	Nuttall's violet		X		
ZIGVEN	*Zigadenus venenosus*	Death camas				X
Introduced Perennial Forbs						
ASTCIC	*Astragalus cicer*	Cicer milkvetch	X			
CERARV	*Cerastium arvense*	Field chickweed	X		X	
CIRARV	*Cirsium arvense*	Canada thistle		X		
MEDSAT	*Medicago sativa*	Alfalfa medic		X		
TAROFF	*Taraxacum officinale*	Common dandelion	X	X	X	X
Unknown Forb Species						
CIRSPP	*Cirsium spp.*	Thistle				
RUMSPP	*Rumex spp.*	Dock			X	
Native Full Shrubs						
ARTCAN	*Artemisia cana*	Silver sagebrush			X	X
ARTTRI	*Artemisia tridentata*	Big sagebrush	X	X	X	X
CHRVIS	*Chrysothamnus viscidiflorus*	Sticky-leaved rabbitbrush	X			
ERINAU	*Ericameria nauseosa*	Rubber rabbitbrush	X			X

Vegetation Species Summary (cont.)

Acronym	Current Nomenclature	Common Name	Plant Community			
			BSS	UG	MG	BG
Native Half &Sub-Shrubs						
ARTFRI	*Artemisia frigida*	Fringed sagewort	X	X		X
ARTLUD	*Artemisia ludoviciana*	Louisiana sagewort		X	X	X
ARTPED	*Artemisia pedatifida*	Birdfoot sagebrush	X	X		X
ATRGAR	*Atriplex gardneri*	Gardner saltbush	X	X		X
KRALAN	*Krascheninnikovia lanata*	Winterfat			X	X
LINPUN	*Linanthus pungens*	Granite pricklygila				
Native Succulents						
OPUPOL	*Opuntia polyacantha*	Plains pricklypear				

***Notes:* X = Species sampled on cover transect, shrub density belt transect, or species diversity belt transect.**

Species observed, but not sampled.

RAI EC- 5: Mitigation for Above-Ground Power Lines

Description of Deficiency

Section 3.1.6 of the ER states that because electrical power will be readily available for the proposed project facilities and operations, large-scale installation of new electrical transmission lines is not required. However, new power lines and poles will be needed to connect buildings, pumps, etc. to the existing lines. These new above-ground power lines can impact waterfowl and other birds, primarily through their collision with the lines and any ground wires. Additionally, associated power line poles can provide supplemental perches for raptors, which will provide them with a competitive advantage over sage-obligate prey species. Section 6.5.2 states the applicant will implement mitigation measures included in regulatory guidelines and requirements but does not identify which mitigation measures will be employed. Identification of planned mitigation measures should be in place before impacts occur.

Formulation of RAI

Please clarify the mitigation measures AUC proposes to implement to protect wildlife from above-ground power lines and associated poles.

RAI EC-5 Response

The mitigation measures presented in Section 6.5.2 include several practices AUC will implement to minimize potential impacts to wildlife. Specifically, on page ER 6-36 as part of our identified measures we include:

- "Required use of raptor-safe construction for overhead power lines according to current guidelines and recommendations by the Avian Power Line Interaction Commission and/or USFWS."

The "Suggested Practices for Avian Protection On Power Lines:" publication by the Avian Power Line Interaction Commission is publicly available and includes 47 pages of detailed mitigation techniques that AUC will consider for selecting the most appropriate mitigations at the time of final infrastructure design. This report is now included by reference within Section 6.5.2 as shown below and sourced within Section 10 (References):

- "Required use of raptor-safe construction for overhead power lines according to current guidelines and recommendations by the Avian Power Line Interaction Commission and/or USFWS using methods detailed in the Suggested Practices for Avian Protection On Power Lines: The State of the Art in 2006 (Avian Power

Line Interaction Committee, 2006)."

The following reference has been added to ER Section 10 (References):

Avian Power Line Interaction Committee, *Suggested Practices for Avian Protection on Power Lines*, 2006, website: http://www.dodpif.org/downloads/APLIC_2006_SuggestedPractices.pdf

RAI EC- 6: Weed Mitigation

Description of Deficiency

Section 4.5.2.1 of the ER states that Section 6.5.1 discusses mitigation measures to lessen impacts on native vegetation and control Wyoming State Listed Noxious Weeds (Canada thistle, field bindweed, and Russian olive); however, Section 6.5.1 does not discuss weed control measures AUC will employ during the project. Similarly, Section 6.1.3.6 does not discuss weed control measures that will be employed during the project. Additional sections in Chapter 6 describe revegetation efforts, but do not describe active weed control measures or techniques approved by Campbell County Weed and Pest Control District.

Formulation of RAI

Provide planned mitigation measures to lessen impacts from weeds throughout the project life.

RAI EC-6 Response

The mitigation requirements for "weeds" or invasive and/or noxious vegetation falls under the auspices of "Re-vegetation of disturbed areas in accordance to WDEQ/LQD standards." as listed in Section 6.5.1 (Vegetation). The WDEQ/LQD standards included practices for preventing exotic invasive plant species. The WDEQ/LQD standards also provide measures for monitoring and deeming successful re-vegetation components of the reclamation process.

AUC has added the following paragraph to Section 6.5.1 to clarify the exotic invasive species prevention measures:

"In taking pro-active measures to meet WDEQ/LQD requirements for exotic invasive and noxious plant control, AUC will implement mitigation strategies which may include:

- Requiring earth moving equipment to be cleaned prior to arrival on-site;
- Obtaining re-vegetation seed mixes from reputable dealers providing weed-free product;
- The use of spot treatment of invasive species with a WDEQ/LQD approved herbicide; and
- Implementing a WDEQ/LQD approved vegetation monitoring program, as early detection and treatment will prevent large scale issues."

RAI EC- 7: Mitigation Measures for Avian Injury and Death

Description of Deficiency

Page 4-45 of the ER states "…the lined backup storage pond will be fenced to exclude *wildlife and if significant avian wildlife injuries or deaths are noted then an avian deterrent system will be installed for the pond, consistent with other licensed ISR operations." In the technical report of the application (TR) page 7-15 states that if significant avian wildlife deaths are noted then an avian deterrent system will be installed for the pond. However, there is no discussion of mitigation measures to deter injury or death.*

Formulation of RAI

a. Describe mitigation measures that will be employed before wildlife deaths occur. In particular, provide additional information regarding the design features of storage ponds and temporary mud pits created during the drilling activities that would prevent birds from entering the storage ponds and temporary mud pits (such as netting, noise makers, and/or additional deterrents), and design features that would allow small trapped animals (i.e. birds, small mammals, reptiles and amphibians) to escape the pond and temporary mud pits.

b. Identify the pollutants listed on EPA's water quality criteria for aquatic life table (EPA, 2013) and radiological constituents and estimated maximum concentrations in waste streams that would be collected/stored in any proposed surface impoundments including the backup storage pond and mud pits.

RAI EC-7(a) Response

AUC will be installing a backup storage pond that will be used for short term and temporary wastewater storage which will ultimately be transferred to a deep disposal well. When water is present within the backup storage pond, AUC supports implementing mitigation to reduce the potential for avian and bat mortality. AUC will adopt management and operations practices that include installing visual deterrents at the pond to startle or make the birds feel uncomfortable, and otherwise prevent the birds from using the pond. These visual deterrents that AUC may choose to install include various decoys which mimic avian and terrestrial predators, or various objects that scare or confuse birds with bright colors, motion, reflective surfaces, and surface patterns that resemble predatory bird features. AUC may also choose to implement additional avian hazing efforts to attempt to keep migratory birds off of the pond, which may include flagging, use of a gas fired air cannon, often referred to as a "bird cannon," as well as sonic predatory devices to deter waterfowl and frighten them away from the ponds. Various visual deterrents or sonic predatory devices may be employed to discourage or startle waterfowl, shorebirds, migratory birds, and bats that may attempt to drink or forage within the backup storage pond (e.g. predatory decoys, air cannons, predatory and distress call recordings, etc.)

Additional design features regarding egress from the backup pond or mud pits are not required as the slope of the pond walls and mud pit flow ditch allow for easy escape of any small animals.

No changes were made to the application as a result of this portion of the RAI.

RAI EC-7(b) Response

TR Table 4-3 lists the anticipated liquid byproduct stream water quality for the Proposed Project. This table has been revised and can be viewed in the response to WM-2 later in this document. None of the anticipated maximum amounts of the listed constituents exceed the maximum allowable levels listed in the EPA table.

RAI EC- 8: Wetlands Delineation

Description of Deficiency

In ER Addendum 3.5-G, the U.S. Army Corps of Engineers stated, by letter, that once the project plans are developed in such detail to specify locations where aquatic resources would be affected, a delineation can be conducted in the areas where the U.S. Department of the Army authorization is actually required. Section 4.4.1.1 of the ER references Figure 1-5 and Table 4-1 that provide the proposed project surface disturbances of 154.3 acres; however, the location and acreage of potential wetlands disturbed during the life of the proposed project is not provided in the ER.

Formulation of RAI

Calculate and provide the type and sum of wetlands and open water acres that occur within the proposed disturbed areas during the life of the project.

References:

EPA. "National Recommended Water Quality Criteria, Aquatic Life Criteria Table." Washington DC: U.S. Environmental Protection Agency. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#R> (June 27, 2013). June 11, 2013.

RAI EC-8 Response

The EPA reference (http://water.epa.gov/scitech/swguidance/standards/criteria/current/ index.cfm#R) is not a valid reference. The internet link provided states "*EPA is in the process of updating this criterion to reflect the latest scientific information. As a result, this criterion might change substantially in the near future*."

AUC has previously provided within the ER the location and acreage of potential wetlands, as seen in ER Addendum 3.5-F Wetlands Map. The referenced U.S. Army Corps of Engineers letter of April 11, 2012 to AUC actually states that "Deferring the delineation requirement until site plans are developed in sufficient detail to Identify specific locations where aquatic resources would be affected is justified". This response actually means the USACE is willing to defer any delineation until AUC can show in detail where there will be potential disturbances within previously identified wetland areas.

Text has been added to the ER Section 3.5.4.2.2 as shown below:

"The majority of the wetlands were found along and within existing drainage bottoms; however, these wetlands were generally not continuous along the entire length of the drainages. Classifications of the wetlands along the drainages were primarily Palustrine Emergent (PEM) OWUS. The sum wetland and OWUS, acres identified within the project area, totals 42.31 acres. Addendum 3.5-F provides a map showing the majority of wetlands based on classification, including an acreage calculation of the type and sum of wetlands. These acres are comprised of PEM stream channel, Palustrine Aquatic Bed (PAB) stream channel and isolated ponds, PEM isolated ponds, and Palustrine Unconsolidated Bottom (PUB) isolated ponds and OWUS. The following list is a summary of wetlands acres that are estimated to occur within the proposed disturbed areas:

Wetland Type	Acres
PEMAh	0.38
PEMC	0.69
PABFh	0.73
PEMA	1.42
OWUS	0.71
PEMA	0.01
Total	**3.94**

The total of wetland types within proposed disturbed areas is 3.94 acres. The only open surface water area associated with a wetland is a man-made stock pond with an estimated surface area of 4.42 acres when full, mostly during a limited time in the spring. Of the total proposed project surface area disturbance estimate of 154.3 acres, the potential disturbed wetlands are estimated to be 0.025% of the total wetland acres."

5. SURFACE WATER

RAI SW- 1: Water Quality Data

Description of Deficiency

Section 3.4.1.9 of the ER states that water quality data were available from one USGS stream gage (# 06364700) located on Antelope Creek near Teckla, WY, collected during the period October 3, 1977 through September 7, 2005. The ER also provides mean values and ranges for the following water quality parameters at this gaging station: temperature, dissolved oxygen, total nitrogen, ammonia as nitrogen, and nitrite plus nitrate as nitrogen, as well as the mean values for phosphate and selenium. A tabulated summary of monthly or seasonal average values of these water quality parameters provides clarity and is required to accurately describe water quality in the affected environment as basis for impact evaluation.

Formulation of RAI

Please provide a tabulated summary of historical water quality data for USGS stream gage # 06364700 located on Antelope Creek near Teckla, WY.

RAI SW-1 Response

Due to the extensive size of the tabular data, AUC has provided a direct URL to the web based USGS query interface used to obtain the tabulated summary of historical water quality data for USGS stream gage # 06364700. The reference citation found on page 10-10 of Section 10, "Environmental Report References" of the Environmental Report has been revised to read as follows:

"USGS. (U.S. Geological Survey). National Water Information System (NWIS) for USGS stream gages in Wyoming: 06652000, 06647000, 06646780, 06650000, 06364700. 2008. Website:

http://waterdata.usgs.gov/wy/nwis/uv?referred_module=sw&search_criteria=search_site_no&search_criteria=site_tp_cd&submitted_form=introduction. Accessed August 12, 2008."

AUC has verified that the USGS stream gage data remains available at the described location.

RAI SW- 2: Surface Water Uses

Description of Deficiency

Section 3.4.1.6. of the ER refers to Table 2.7A-11 in the TR Addendum 2.7-A for a listing of all surface water uses obtained from the Wyoming State Engineers Office (SEO) Water Rights Database. This table does not include the amount of water use allowed under the permit. Please provide the quantity of surface water uses or expand Table 2.7A-11 in TR Addendum 2.7-A to include water rights quantities for the listed permits.

Formulation of RAI

Provide bulk estimates of surface water uses in and around the project area. This information is needed for the NRC to evaluate consumptive use impacts of the proposed project.

RAI SW-2 Response

The Wyoming SEO database provides limited consumption data for water rights found within the 2 mile review area. As such, it is not practicable to determine bulk estimates of surface water uses in and around the project area. In regards to the NRC's evaluation of project related consumptive use impacts, there will be none as the proposed project will not consume any surface water resources.

No revisions were made to the application as a result of this RAI.

RAI SW- 3: Monthly Average Flows

Description of Deficiency

Section 3.4.1.2 narrates the summary statistics of stream flow data obtained from the USGS National Water Information System website as reference but does not provide a tabulated summary of the monthly average values of these flow data. This information is needed to describe surface water resources in the affected environment as basis for impact evaluation.

Formulation of RAI

Please provide summary tables showing monthly average flows observed at USGS stream gage sites within the two-mile buffer of the proposed Project.

RAI SW-3 Response

There are no stream gauges within the Proposed Project area or the two-mile buffer. As noted in ER Sec. 3.4.1.2, the nearest stream gauge is the Porcupine Creek Gaging Station (USGS06364300) located approximately 15.0 miles southeast of the Proposed Project boundary. The location of the Porcupine Creek Gaging Station is depicted on TR Figure 2.7A-2 (TR Addendum 2.7-A).

No revisions were made to the application as a result of this RAI.

RAI SW- 4: Wetlands

Description of Deficiency

Wetlands associated with the proposed project site are described under Ecological Resources in Section 3.5 of the ER, but not in the Surface Water section (Section 3.4). A discussion in the Surface Water section on the relevance, or otherwise, of wetlands to the evaluation of surface water impacts is missing. This information is needed to accurately characterize wetlands in the description of the affected environment for the proposed project.

Formulation of RAI

Please clarify the relevance of wetlands in the surface water impacts evaluation.

RAI SW-4 Response

The site specific conditions present at the Proposed Project provide the basis that the wetlands discussion is more relevant to the Ecological Resources section than the Surface Water section. The ephemeral nature of the surface waters provide less significance to the characterization of the site as compared to the more constant presence of wetland indicator plant species found at these locations. The wetlands, containing ecologically relevant plant species, are therefore discussed in the Ecological Resources section.

AUC has provided a new reference to the wetlands discussion within Section 3.4.1.7 as shown below:

"Information regarding wetlands associated with the surface water features is included in ER Section 3.5.4.2."

AUC has also provided the following text in ER Section 3.5.4.2 to show the relevance of wetlands and surface water. The additional references noted in the new text are included below and have also been added to the application:

"Wetlands and riparian systems provide multiple functions in addition to wildlife habitat, such as floodwater attenuation, aquifer surface recharge and discharge as springs, sediment filtering, contaminant removal, erosion control, biological filtering and biomass export. Wetlands and riparian systems have the ability to take up excess surface water flow during high flow events and then later releasing it. Wetland and riparian systems are also used extensively for outdoor recreation such as hunting, fishing, wildlife viewing, as well as agricultural uses for domestic livestock. Wetland functions and values are comprehensively described by Novitzki et al. (1999), EPA (2001), Nicholoff (2003), McKinstry et al. (2004), and several other authors. Riparian system functions and values are described by GAO (1988), Manci (1989), Brinson et al. (2002), Chambers and Miller (2004), Hubert (2004), and Soman et al. (2007)."

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Chambers, J.C. and J.R. Miller. 2004. *Great Basin Riparian Ecosystems: Ecology, Management, and Restoration*. Island Press, Washington, D.C. 303pp.

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GAO [General Accounting Office]. 1988. Public rangelands: some riparian areas restored but widespread improvement will be slow. GAO/RCED88105. US GAO, Resources, Community, and Economic Development Division, Washington, DC.

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6. GROUNDWATER

RAI GW- 1: Baseline Groundwater Quality Information

Description of Deficiency

Section 3.4.2.10.2 of the ER indicates that 21 baseline groundwater monitoring wells were installed in the Production Zone Aquifer. Figure 2.7B-6 of TR Addendum 2.7-B shows the locations of monitoring wells used to characterize baseline groundwater quality. Table 2.7B-31 in TR Addendum 2.7-B lists groundwater quality data for only 10 of the 21 monitoring wells used to characterize baseline groundwater quality.

Formulation of RAI

Provide baseline groundwater quality data for all monitoring wells installed to characterize baseline groundwater quality in the Production Zone Aquifer or an explanation of why these data are not provided.

RAI GW-1 Response

AUC installed 21 Production Zone Aquifer (PZA) monitoring wells (denoted as PZM Wells) across the proposed Reno Creek Project area to evaluate the groundwater hydrology and collect baseline water quality data. Ten of the 21 PZM Wells were installed within mineralized portions of the PZA and were sampled four times (once per quarter) over a one year duration to establish baseline groundwater quality in the mineralized portion of the PZA. Several of these wells were also used as observation wells for the four regional pump tests conducted by AUC.

WDEQ/LQD Guideline 4 requires that baseline sampling wells be installed at a density of one well per square mile within the proposed project boundary. The area within the proposed boundary encompasses approximately 9.5 square miles thus the 10 baseline wells met this requirement. Guideline 4 does not discuss spatial distribution of the baseline wells; therefore, in collaboration with the WDEQ/LQD and NRC staff, the monitoring well locations were deemed sufficient to characterize the groundwater quality of the PZA.

The remaining 11 wells were installed to act as either pumping or observation wells for the four regional pump tests conducted by AUC. Eight of the 11 wells were sampled once. The grouping of the wells in relation to pumping wells and observation wells is shown on Figure 2.7B-6 and discussed in the Regional Hydrologic Test Report located in Addendum 2.7-D.

Piper Diagrams were developed using from 15 of the 18 PZM Wells in order to characterize the regional baseline groundwater quality based on anion and cation distributions as discussed in TR Section 2.7.2.10.2. Even though all 18 wells were not used in the development of the Piper Diagrams (Figure 2.7B-60), the wells did cover the spatial extent of the baseline monitoring well program. These data were used to succesully show the continuity of the PZA, without the additional three wells being incorporated in the Piper Diagrams.

Table 2.7B-31a was added to Addendum 2.7B providing the groundwater quality data collected from the eight non-baseline wells. Additionally, Table 2.7B-31b has been included in Addendum 2.7B to show the intended use for all 21 wells installed to characterize the PZA, including which wells were used to develop the Piper Diagrams.

The new tables are shown below:

Table 2.7B-31a: Non-Baseline PZA Monitoring Well Results

Parameter	Units	Lab Detection	PZM1	PZM3	PZM4		PZM5	PZM9	PZM13	PZM19	PZM20	PZM4D
Collection Date			12/15/2010	8/11/2011	12/16/2010	1/27/2011	11/2/2010	12/20/2010	12/27/2011	6/8/2011	3/10/2011	7/7/2011
Field1												
Field pH	s.u.		8.05	8.85	0.00	7.86	7.52	11.45	7.45	9.67	0.00	0.00
Field Conductivity	µmhos/cm		1266	1408	0	630	1773	1220	3606	1279	0	0
Dissolved Oxygen	mg/L		0.92	2.18	0.00	6.00	7.92	0.35	2.46	0.68	0.00	0.00
Field Turbidity	NTU		4.81	0.00	0.00	1.13	9.89	2.86	0.50	4.90	0.00	0.00
Temperature	°C		6.67	21.77	0.00	8.27	14.89	5.93	10.97	18.07	0.00	0.00
ORP	mV		63.5	207.2	0	176.7	362.1	0	232.2	28.1	0	0
Depth to Water	Ft.		291.83	300.71	0.00	148.20	65.73	291.68	0.00	157.51	0.00	0.00
Anions/Cations												
Alkalinity, Total (As CaCO3)	mg/L	5	75	127	144	145	238	80	119	94	98	0
Alkalinity, Bicarbonate as HCO3	mg/L	5	92	155	175	174	291	<5	145	115	120	0
Alkalinty, Carbonate as CO3	mg/L	5	<5	<5	<5	<5	<5	40	<5	<5	<5	0
Chloride	mg/L	1	6	5	3	3	15	0.1	5	4	3	0
Flouride	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.1	0
Nitrogen, Nitrate-Nitrite (as N)	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0
Sulfate	mg/L	1	913	546	329	330	32	754	2400	541	512	0
Calcium	mg/L	1	100	77	61	66	17	113	526	92	89	0
Magnesium	mg/L	1	23	16	13	14	3	5	102	18	16	0
Potassium	mg/L	1	8	10	6	6	9	21	15	9	8	0
Sodium	mg/L	1	321	227	125	128	109	266	325	171	172	0
Nitrogen, Ammonia (As N)	mg/L	0.1	<0.1	2	<0.1	<0.1	0.8	0.3	0.5	<0.1	<0.1	0
Silica as SiO2	mg/L	1	10	11	10	10	13	4	12	10	9	0
General Parameters												
Laboratory pH	s.u.	0.1	8	8.2	7.9	8.3	8.2	10.7	7.9	7.9	8.2	8.7
Electrical Conductivity	µmhos/cm	5	1790	1480	906	916	579	1720	3110	1070	1180	0
Total Dissolved Solids (180)	mg/L	10	1500	1020	640	690	420	1340	3580	950	920	640
Data Quality												
Cation Sum	meq/L	0.01	21.06	15.29	9.74	10.22	6.05	18.19	49.15	13.7	13.37	0
Anion Sum	meq/L	0.01	21.28	14.06	9.8	10	5.86	17.48	52.53	13.25	12.72	0
Cation-Anion Balance (±5%)	%	0.01	0.53	4.2	0.29	1.08	1.56	1.97	3.32	1.67	2.5	0
Solids, Total Dissolved (Calc)	mg/L	10	1430	970	620	630	330	1210	3460	890	860	0
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	0.01	0	1.05	0	1.1	0	0	1.03	1.07	1.07	0
Metals-Dissolved												
Aluminum	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0
Arsenic	mg/L	0.001	0.002	0.006	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	0
Barium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0
Boron	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0
Cadmium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0
Chromium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Copper	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0
Iron	mg/L	0.05	0.07	<0.05	<0.05	<0.05	0.07	<0.05	0.37	<0.05	<0.05	0
Lead	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Manganese	mg/L	0.01	0.08	0.06	0.03	0.03	0.06	<0.01	0.42	0.11	0.06	0
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0
Molybdenum	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0
Nickel	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0
Selenium	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0
Uranium	mg/L	0.0003	0.0047	0.016	0.0638	0.0819	0.0018	0.003	<0.0003	0.0418	0.0922	0
Vanadium	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0
Zinc	mg/L	0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Metals-Suspended	mg/L											
Uranium	mg/L	0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.0006	<0.0003	0.0004	<0.0003	<0.0003
Metals-Total	mg/L											
Iron	mg/L	0.05	0.31	2.79	0.54	0.13	0.24	0.06	1.11	0.76	0.07	0
Manganese	mg/L	0.01	0.1	0.11	0.03	0.04	0.07	<0.01	0.48	0.12	0.06	0
Radionuclides-Dissolved												
Gross Alpha	pCi/L	4	42	28.9	52.1	78.6	3.4	186	2	35.5	63.9	0
Gross Beta	pCi/L	7	25.3	10	19.6	25.8	6	70.8	7.6	19.3	45.2	0
Lead 210	pCi/L	1	4.8	<1	4.5	3	1.5	5.6	0	1.3	<1	0
Polonium 210	pCi/L	1	2.7	<1	<1	<1	<1	1.3	0	<1	<1	0
Radium 226	pCi/L	0.2	23.5	3.1	2.5	7.9	0.282	107	0.3	1.4	1.3	0.7
Radium 228	pCi/L	1	1.5	<1	<1	<1	1.35	1.4	5.2	1.4	<1	0
Thorium 230	pCi/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0	<0.2	<0.2	0
Radionuclides-Suspended	pCi/L											
Lead 210	pCi/L	1	5.8	1.5	5	15.4	1.3	8.1	0	<1	<1	0
Polonium 210	pCi/L	1	<1	<1	1.1	<1	<1	<1	0	<1	<1	0
Radium 226	pCi/L	0.2	0.3	<0.2	<0.2	7.9	<0.2	0.7	0	<0.2	<0.2	0
Thorium 230	pCi/L	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	0	<0.2	<0.2	0
Radionuclides-Total	pCi/L											
Radon 222	pCi/L	50	11900	8460	0	67300	2150	38600	22900	396	2690	0

Table 2.7B-31b: PZA Monitoring Well Information

Monitoring Well ID	Monitoring Well Uses					
	PZA Baseline Monitoring Wells (TR Table 2.7B-31)	Hydrologic Pump Test Wells	PZA Pump Test Observation Wells	Non-Baseline PZA Monitoring Wells Sampled	PZA Monitoring Wells plotted on Piper Diagram (TR Figure 2.7B-60)	PZA Monitoring Wells not plotted on Piper Diagram (TR Figure 2.7B-60)
PZM-1		x		x	x	
PZM-2	x				x	
PZM-3		x		x	x	
PZM-4			x	x		x
PZM-4D		x		x		x
PZM-5		x		x	x	
PZM-6	x		x		x	
PZM-7	x				x	
PZM-8	x		x		x	
PZM-9			x	x	x	
PZM-10	x		x		x	
PZM-11			x			x
PZM-12			x			x
PZM-13			x			x
PZM-14	x		x		x	
PZM-15	x		x		x	
PZM-16	x		x		x	
PZM-17	x		x		x	
PZM-18	x		x		x	
PZM-19			x	x	x	
PZM-20			x	x		x
Total	**10**	**4**	**15**	**8**	**15**	**6**

RAI GW- 2: EPA-Designated Sole-Source Aquifers

Description of Deficiency

NUREG 1748 (Section 6.3.4) requires the ER include a qualitative description of groundwater aquifers, including identification of EPA-designated sole-source aquifers. If there are no sole-source aquifers near the site, then the information should be explicitly stated.

Formulation of RAI

Provide information regarding the identification of EPA-designated sole-source aquifers in the vicinity of the proposed ISR site.

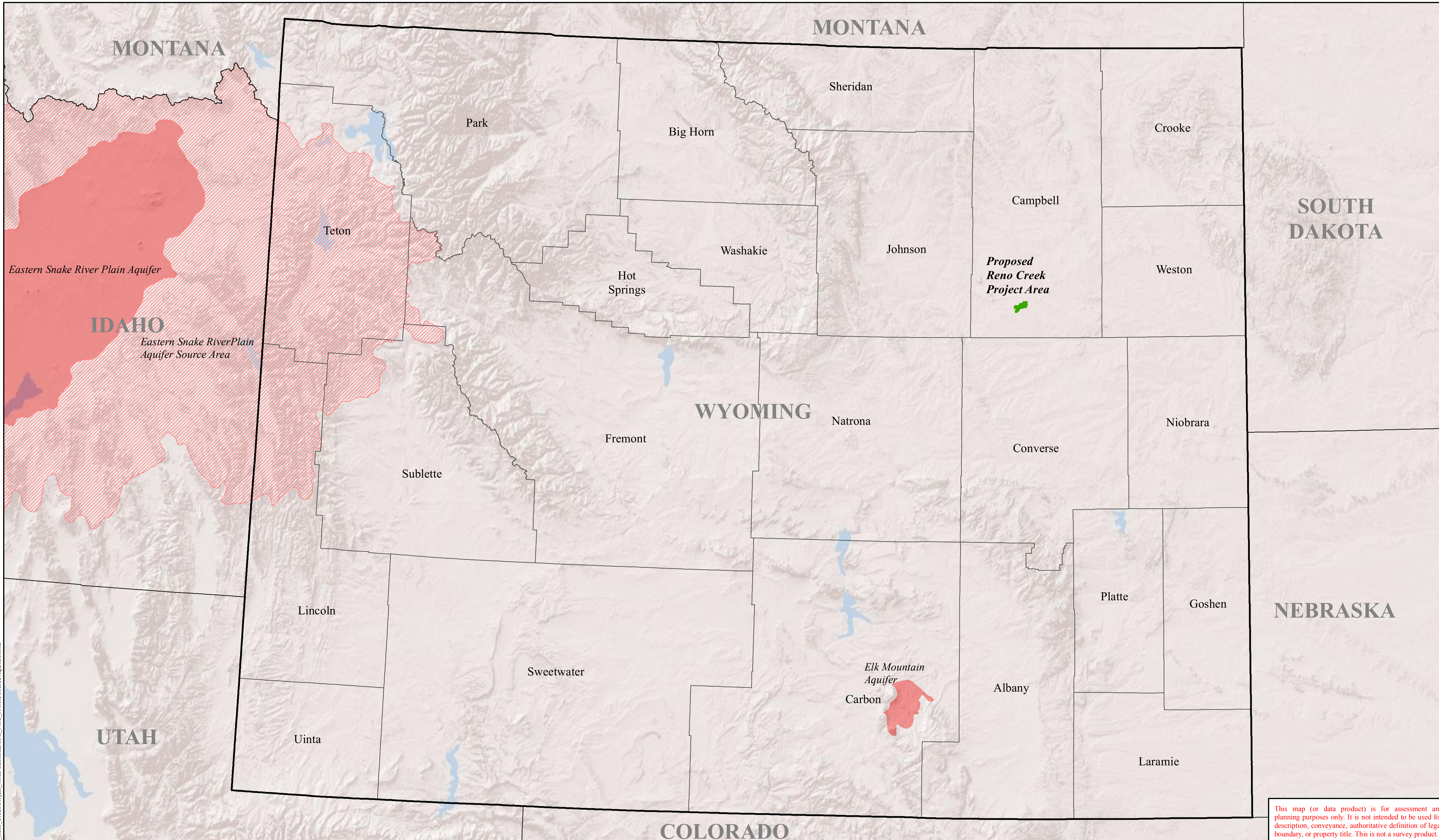
RAI GW-2 Response

There are no sole-source aquifers within the vicinity of the Proposed Project. As requested, the following paragraph has been inserted into ER Sec. 3.4.2.1 (Regional Hydrogeology) and TR Sec. 2.7.2.1 (Regional Hydrogeology) making this explicit statement:

"EPA-Designated Sole-Source Aquifers

As noted in NUREG-1748 (Sec. 6.3.4), a qualitative description of ground water aquifers is necessary including identification of EPA-designated sole-source aquifers. There are no sole source aquifers (SSA) located in the vicinity of the Proposed Project. The nearest EPA designated SSA is Elk Mountain Aquifer, located in eastern Carbon County, approximately 140 miles south by southwest from the center of the project area. The Eastern Snake River Plain Aquifer Streamflow Source Area lies approximately 207 miles west of the center of the project area, and the Eastern Snake River Aquifer lies approximately 295 miles west of the project area center. These aquifers and their proximity to the Proposed Project is illustrated within TR Figure 2.7B-1a."

This new figure TR 2.7B-1a is shown below and has been added to the application.



PREPARED FOR

AUC LLC
LAKEWOOD, CO

PROPOSED RENO CREEK PROJECT
CAMPBELL COUNTY, WY

TREC, Inc.
Engineering & Environmental Management
900 Werner Court
Suite 150
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Phone (307) 265-0696
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Legend
- Proposed Reno Creek Project Area
- Sole Source Aquifer Source Area
- Sole Source Aquifer

1:2,000,000

0 12.5 25 50 75 100 Miles

N W E S

DRAWN BY: EGS
CHECKED BY: CAT
APPROVED BY: RMD

Sole Source Aquifers

REV #	DESCRIPTION	BY	DATE	FIGURE
0	Draft for Review	EGS	04/22/14	2.7B-1a
1	Final	EGS	04/22/14	
2				

Path: O:\WY_Projects\2010-100_AUC_Reno_Creek\Project_MXD\Submittal\RAI_NRC_r1\Sole Source Aquifers.mxd

June 2014

RAI GW- 3: Groundwater Model

Description of Deficiency

Section 4.4.2.3.3, page 4-38 of the ER, cites the groundwater model as the basis for the conclusions that the potential impact from consumptive use of groundwater during operations is expected to be small. It also asserts that the potential impacts on groundwater due to consumptive use outside of the proposed project area are expected to be negligible. The groundwater model is cited as the basis for these conclusions. The groundwater flow model results indicate that an average production bleed rate of one percent will be sufficient to maintain an inward gradient in both the fully and partially saturated portions of the PZA during uranium recovery operations. The groundwater model also demonstrates that the amount of consumptive use during all phases will generate negligible drawdown outside of wellfield areas. The ER notes that there is minimal use of groundwater in the recovery zone sands near or adjacent to the wellfield areas. Hence, the conclusion in the ER is that there is no potential impact to:

(i) Other users of groundwater in the area, and
(ii) Water users outside of the proposed project boundary.

In Section 7.2.1.2 of the ER, the groundwater model was used to determine:

(i) The distance between perimeter ring monitoring wells, and
(ii) The distance between production patterns and perimeter ring monitoring wells for the production units located within the fully saturated and partially saturated portion of the PZA.

In addition, in Section 7.2.2.2 of the ER, the applicant relied on the groundwater model to demonstrate that an excursion can be recovered under hydrologic conditions present at the proposed project. The numerical model was used to simulate the occurrence and recovery of an excursion using pumping rates that could be achieved and maintained at the site.

Formulation of RAI

A re-evaluation of these conclusions should be submitted if there are any changes made to the groundwater model in response to safety RAIs related to the groundwater model. Additionally, provide a discussion of the impacts of the safety-RAIs related to groundwater model (Addendum 2.7C) on the:

(i) Potential impacts during operation,

(ii) Monitoring well locations, and

(iii) Potential excursion verification and corrective actions.

<u>RAI GW-3 Response</u>

No changes or re-evaluations of the previous conclusions presented in the ER are required based on the results of additional groundwater model simulations that were conducted and presented in response to the Safety RAI-14. Sensitivity analyses of aquifer properties (hydraulic conductivity, storativity, and specific yield) were run for an evaluation of impacts on the regional drawdown predicted results. The results indicate that hydraulic conductivity and specific yield are the most sensitive parameters to drawdown. Assumptions for these parameters were conservative for the previous modeling simulation results, and for specific yield, the assigned value was likely overly conservative and drawdown based on a higher assumed value would result in less predicted drawdown, especially in the partially saturated portions of the Project. The results of these sensitivity analyses do not change the previous conclusions presented in the ER.

With respect to the perimeter monitor well spacing distances and demonstration of excursion recovery, additional information is presented in RAI-14 regarding these issues. Additional discussion is provided regarding the single-layer model presented to NRC, and additional supporting information regarding the adequacy of the proposed monitoring well spacings is provided in this response. Based on these, no changes in the previously presented conclusions in the ER are necessary.

RAI GW- 4: Mitigation to Adjacent Wells

Description of Deficiency

Section 4.4.2.3.3 of the ER states that if significant impacts to either the adjacent domestic wells or to stock wells in the vicinity of the proposed project are observed, the following mitigation measures will be considered:

(i) Lowering the pump level in the wells, if possible;

(ii) Deepening the wells, if possible; or

(iii) Replacing the wells with new wells completed in sands that are not impacted by ISR operations.

Formulation of RAI

Clarify commitment to mitigate any significant impacts to adjacent wells in the vicinity during operations.

RAI GW-4 Response

AUC has revised the following text in Section 4.4.2.3.3 to commit to mitigating impacts to adjacent wells. The changes are shown in red below:

"If significant impacts to either the adjacent domestic wells or to stock wells in the vicinity of the Proposed Project are observed (e.g., water levels drop to a point that impairs the usefulness of the wells), AUC commits to mitigating impacts, which may include implementing one or more of the following measures:

- Lowering the pump level in the wells, if possible;
- Deepening the wells, if possible; or
- Replacing the wells with new wells completed in sands that are not impacted by ISR operations."

RAI GW- 5: Best Management Practices

Description of Deficiency

Section 4.4.2.2 of the ER presents several measures to minimize impact of construction operations on the overlying and production zone aquifer. The Generic Environmental Impact Statement for In Situ Leach Uranium Milling Facilities [NUREG-1910 (GEIS)] notes that potential impacts to groundwater during construction of an ISR facility are from the consumptive use of groundwater, injection of drilling fluids and mud during well drilling, and spills of fuels and lubricants from construction equipment. Surface activities that can introduce contaminants into soils are more likely to affect near-surface and shallow aquifers during construction. NRC staff concluded in the GEIS that during construction, groundwater use is limited and groundwater quality is protected by implementing best management practices (BMPs), which include spill prevention and cleanup programs. The application discusses various spill prevention measures to mitigate impacts to surface water resources (ER Section 6.4.1.3). However, the application does not present any information related to implementing best management practices (BMPs) that focus on protecting groundwater resources (i.e., near-surface and shallow aquifers) during construction.

Formulation of RAI

Identify BMPs, if any, will be implemented during construction to limit groundwater use and protect groundwater quality.

RAI GW-5 Response

AUC has added text to Section 6.4.2.2 that identifies BMP's useful in limiting groundwater use and protecting groundwater quality as shown below:

"6.4.2.2.9 Groundwater Best Management Practices

To assist in limiting groundwater use and protecting groundwater quality, AUC may implement one or more of the following BMP's for the Proposed Project:

- Recycle water collected in subsurface areas for use in dust suppression and other activities;
- Implement measures to minimize water use during operations;
- Minimize surface disturbance, which will minimize changes in surface water flow and subsequent infiltration;
- Provide rapid response cleanup and remediation capability, techniques,

procedures and training for potential spills;

- Monitor to detect and define unanticipated surface spills, releases or similar events that may infiltrate into the groundwater system;
- Manage water balance to ensure hydraulic flow into the production zone;
- Monitor manifold pressures to detect leaks;
- Install monitor wells to monitor for potential lixiviant excursion;
- Manage pumping and injection to control and recover excursions; and
- Monitor closest private domestic, livestock, and agricultural wells as appropriate during operations."

RAI GW- 6: Baseline Groundwater Quality

Description of Deficiency

Results of site-specific baseline groundwater quality sampling for chemical parameters and constituents measured to characterize baseline groundwater quality are presented in Tables 2.7B-22 through 2.7B-40 in TR Addendum 2.7-B. Table 2.7B-22 lists the chemical parameters and constituents measured in groundwater quality samples. Chemical parameters include pH, total dissolved solids, and conductivity. Constituents include major and minor cations and anions, metals, and radionuclides. The tables in TR Addendum 2.7-B also report parameters and constituents in groundwater quality samples that exceed WDEQ class of use standards and EPA primary and secondary maximum contaminant level (MCLs). However, Section 3.4.2.10.2 of the ER (Proposed Reno Creek Project Groundwater Quality) only discusses and evaluates the concentration of major cations and anions in groundwater quality samples. No discussion and evaluation is provided for metals, radionuclides, and general parameters such as pH, total dissolved solids, and conductivity. In addition, with respect of all chemical parameters and constituents, no discussion and evaluation is provided for exceedences in WDEQ class of use standards and EPA primary and secondary MCLs.

Formulation of RAI

Provide additional site-specific baseline groundwater quality information.

A. *Provide a discussion and analysis of the concentration of metals (e.g., uranium, selenium, vanadium, molybdenum, arsenic, etc.) and radionuclides (e.g., Ra-226) in baseline groundwater quality samples.*
B. *Provide a discussion and analysis of the range of chemical parameters (e.g., pH, total dissolved solids, conductivity) in baseline groundwater quality samples.*
C. *Provide a discussion and analysis of exceedences in WDEQ class of use standards and EPA primary and secondary MCLs in baseline groundwater quality samples with respect of all chemical parameters and constituents.*

RAI GW-6 Response

AUC has provided comprehensive chemical and radiochemical analyses of groundwater sampling which properly depicts and characterizes the existing pre-operational baseline conditions for the mineralized and surrounding aquifers. For example, TR Sec. 2.7.2.10.1 discusses the regional groundwater quality while Sec. 2.7.2.10.2 gives an in-depth analysis of the water quality sampling for the Proposed Project area. The corresponding tables for each discussion in TR Addendum 2.7-B provide a more detailed, numerical depiction to assist in the reviewer's overall assessment of AUC's findings. Some of the sampling results exceed both EPA and WDEQ standards as observed by the reviewer. The analytical results provided allow a thorough review of the existing pre-operational baseline conditions.

Considering the data available in the application, AUC concludes the groundwater quality discussion is "reasonably comprehensive" as requested in the acceptance criteria detailed in NUREG-1569 ((Sec. 2.7.3(4)).

No changes were made to the application as a result of this RAI.

7. PUBLIC AND OCCUPATIONAL HEALTH

RAI POH- 1: Clarify Applicable Requirements for Decommissioning

Description of Deficiency

Section 1.3 of the ER refers to satisfying 10 CFR Part 20, Subpart E requirements in the context of decommissioning and unrestricted release of the site. Based on the scope described in 10 CFR 20.1401(a), Subpart E requirements do not apply to in-situ uranium recovery facilities. Unrestricted release of the site should be based on compliance with 10 CFR Part 40, Appendix A, Criterion 6 (as noted on ER page 6-20) which establishes the release criterion for radium. An acceptable method for deriving unrestricted release criteria for other radionuclides based on the site-specific dose applicable to Criterion 6 is described as the benchmark dose approach detailed in NUREG-1569.

Formulation of RAI

Describe any revisions to the ER that may be required to ensure correct and consistent citations to the applicable decommissioning regulations.

RAI POH-1 Response

Citations within TR Sec. 1.9 (p. 1-11) and ER Sec. 1.3 (p. 1-17) have been changed to 10 CFR Part 40, Appendix A, Criterion 6(6). Those two sections now read:

"Once groundwater restoration, D&D, and reclamation activities conclude and AUC has met the requirements of 10 CFR 40, Appendix A, Criterion 6(6), the site will be released for unrestricted use."

RAI POH- 2: Well Equipment Removal at Decommissioning

Description of Deficiency

Section 6.1.9 of the TR (Well Plugging and Abandonment) states the following: Wellfield plugging and surface reclamation…..The following procedure will be used to plug the wells: 1) All pumps and piping will be removed from wells, when practicable;

The application should clarify under what circumstances it would be impracticable to remove pumps and piping from wells. The application should also describe whether leaving equipment in place would affect the integrity of well plugging. This information is needed to completely describe the applicant's proposal regarding what equipment is expected to be removed or remain in place after decommissioning. This information would inform the impact analyses for public and occupational health regarding potential sources of contamination or migration of contaminants, groundwater resources regarding integrity of well plugging, and waste management regarding the proposed management practices and the potential volumes of waste requiring offsite disposal.

Formulation of RAI

Provide clarification regarding the removal of well equipment under the classification of "when practicable" during decommissioning.

RAI POH-2 Response

AUC intends on removing well equipment from all wells prior to well plugging. Therefore AUC has removed the term "when practicable" from the first bullet in TR Section 6.1.9. The revision reads as follows:

"1) All pumps and piping will be removed from wells;"

RAI POH- 3: Maximum Radon Emission

Description of Deficiency

Addendum 7A of the TR, contains radon emission estimates for each radon generating activity but does not provide a maximum annual radon emission based on the combination of radon-emitting activities that would be occurring concurrently during any year of the proposed sixteen year facility lifecycle. A combined release estimate is needed for evaluation of potential impacts because the annual public dose impact would be an accumulation of dose from all radon releases that occur in that year. Identifying the year of highest radon emissions is informative and allows for efficient documentation and analysis (only that year's release and dose needs to be described because all other years would be lower than the maximum). This information is needed to describe the bounding annual radon release and dose from the proposed action that will be evaluated in the impact analysis of public health.

Formulation of RAI

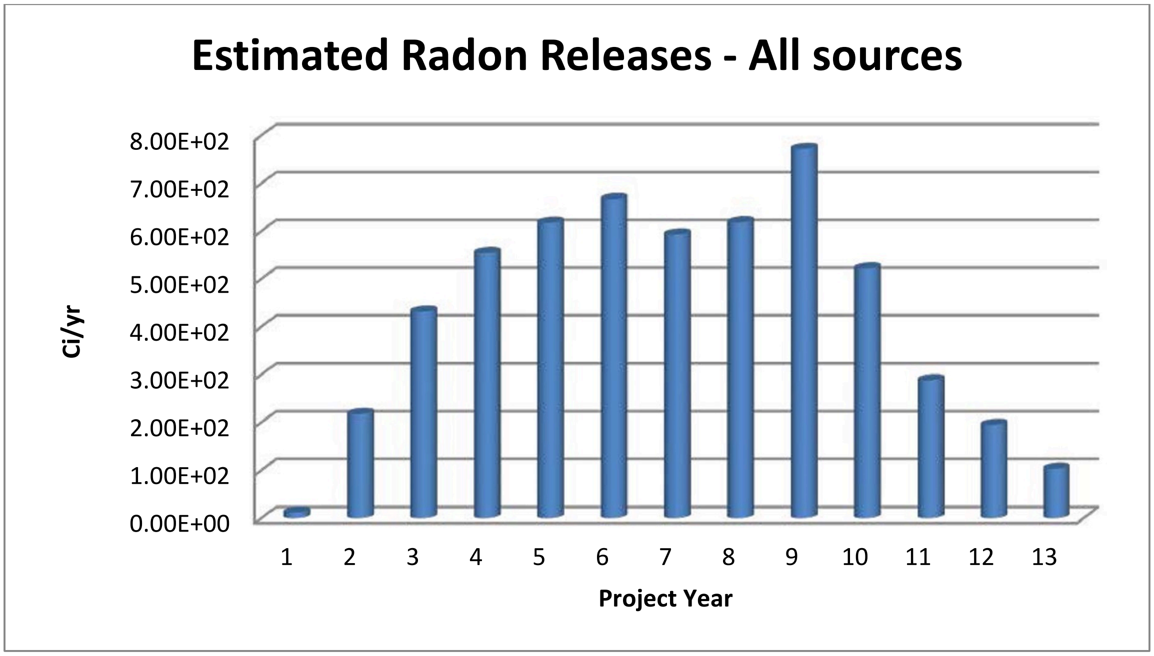
Based on the analysis in TR Addendum 7A, provide the year of highest total radon emission based on the analysis in Addendum 7A of the TR and the basis for the estimate. Also provide or otherwise reference the location of the calculated public dose that corresponds to the year of highest radon release.

RAI POH-3 Response

Table 7 of the MILDOS report listed maximum radon release from a single production unit, for source including new well drilling, purge of water during production and restoration, ion exchange, and venting during both production and restoration. The listed value is the largest release at any production unit in any year. The observation was correctly made that the table did not provide a maximum annual radon emission based on a combination of activities that could occur.

Different production units have different Rn annual release rates for several reasons. First, production units vary in size. Second, a given production unit may not be "on" or active for an entire year. In that case, the annual rate of Rn release is prorated for the active portion of the year.

So, to calculate the total Rn released in a year requires a combination of the size of the source, plus its staging. For example, restoration venting for production unit 4 does not occur until yr 6 and then continues for the first quarter of year 7. Taking into account the staging and size of each production unit, the profile of Rn releases for years 1 – 13 are as shown in the graph below. The maximum Rn release of 772 Ci occurs in year 9. The graph below will be substituted for the original Table 7 to help clarify the radon release profile.



It also bears considering that during a given year these releases occur at different locations including the centroid of production units and the processing plant. Radon releases from new well drilling occur in the wellfield and are modeled as being released at the centroid of the production unit. The same is true of Rn venting during restoration. Release of Rn during purge of water during purge is modeled as occurring at the CPP, not at the centroid of the production unit.

RAI POH- 4: Missing Technical Report Figure

Description of Deficiency

Section 3.2.1.4 (Yellowcake Drying and Packaging System) of the TR references Figure 3-10; however, this figure could not be located in the TR.

Formulation of RAI

Provide missing Figure 3-10. Additionally, provide a complete description of the proposed yellowcake dryer so that the potential impacts from yellowcake drying, including worker safety and radiological air emissions, can be evaluated.

RAI POH-4 Response

A comprehensive description of the yellowcake drying process is provided in TR Section 3.2.1.4. To further clarify the yellowcake drying process, TR Figure 3-10 depicting the yellowcake drying and packaging system has been added to the application and is shown below:

TREC, Inc.
Engineering & Environmental Management
www.treccorp.com

DRYER FLOW DIAGRAM
AUC
RENO CREEK

3-10

Drawn: EM	Checked: BJ	Approved: BP
Rev. #	Description	Date
0	Initial Draft	11/30/11

DRAWING: z:\current_projects\3001_auc\3001-2010-100 reno creek permit app\cad\figures\2010-107_dryer figure_20111107.dwg

Print Date: 4/7/2014 10:05 AM

8. TRANSPORTATION

RAI TR- 1: Clarify Local and Regional Traffic Count Data

Description of Deficiency

Table 3.2-2 of the ER provides traffic count data from the Wyoming Department of Transportation. The first two entries are labeled "Hwys 50 and 387" and "Hwys 59 and 387." By listing two roads, the labels are not clear which road the traffic count was taken. The traffic count information for roads in the vicinity of the site is used to evaluate potential impacts to traffic in the transportation impact analysis.

Formulation of RAI

Provide clarification of data in Table 3.2-2.

RAI TR-1 Response

The entries in question refer to the traffic data at two separate junctions of highways near the Proposed Project area. AUC has revised ER Table 3.2-2 to clarify the information in the table and is shown below:

Table 3.2-2: Local and Regional Road Traffic Counts

2010 AADT (Vehicles/Day)		
Highway	All Vehicles	Trucks
Pine Tree Junction (Junction of Hwys 50 and 387)	827	183
Reno Junction (Junction of Hwys 59 and 387)	3,679	497
Gillette South (Hwy 59 milepost 102)	5,681	838

Source: WYDOT (2010)

RAI TR- 2: Basis for Traffic Estimates

Description of Deficiency

The ER (Page 4-13, first paragraph) projects daily vehicle traffic during construction and operations phases at 75 vehicles but provides no basis or reference for the estimates. The number provided in the application appears inconsistent with the number of construction workers described in ER Sections 4.10.1.1 of 146 direct construction phase jobs and Section 4.10.1.2 of up to 44 operational staff. Similarly, traffic estimates are provided for the decommissioning phase with no bases.

Formulation of RAI

Provide the basis for traffic estimates for each phase of the proposed facility lifecycle so the license application is complete.

RAI TR-2 Response

AUC has added additional discussion to Section 4.2 (Potential Traffic Impacts) to provide basis for traffic counts during the four main project phases. We have also developed a new table to provide a simplified overview of estimated traffic during each of these phases as shown below:

Table 4-5: Estimated Daily Workers and Proposed Project Related Vehicle Traffic

Project Phase	Daily Workers	Vehicle Traffic/day*
Construction	80	29
Operations	92	32
Groundwater Restoration	52	18
Decommissioning	22	6

*Number based on average of 2.5 workers/vehicle;
2 transportation vans (8 people per van); and
2 commercial vehicles per day

AUC has revised the last paragraph in ER Section 4.2.1.1 (Potential Construction Impacts) to provide the updated traffic counts and basis as shown in red below:

"The daily vehicle traffic volume related to the proposed project in 2015 is projected to be approximately 29 vehicles or 3.1 percent of the projected total at Pine Tree Junction, and approximately 0.7 percent of the projected total number of vehicles at Reno

Junction. The average daily estimated increase in auto traffic is based on the workforce level, which varies greatly depending upon the phase of the project. Vehicle traffic includes passenger vehicles, light duty trucks, other personal or work vehicles, and commercial delivery and pickup vehicles to and from the Proposed Project site during construction and operation. Car pooling will be encouraged and is standard industry practice. AUC will provide a van (8 people) for tansportation of employees to and from Gillete and Casper lcoations. The 29 vehicles per day during construction is an estimate assuming that there is an average of 2.5 workers per vehicle traveling to the site from the residential areas. This estimate is derived by the expectation that the majority of workers are anticipated to travel from Gillette and Casper from the site. The 29 vehicles per day also includes an estimated 2 commercial vehicles per day associated with the delivery and pickup of supplies and equipment."

AUC has revised the first paragraph in ER Sec. 4.2.1.2 (Potential Operation Impacts) to provide the updated traffic counts and basis as shown in red below:

"All shipments will be transported by appropriately licensed transporters and subject to both federal (NRC 10 CFR Part 71; DOT 49 CFR Part 173) and state transportation regulations. The following sections identify the materials that will be shipped during operations. Potentially, up to 32 vehicles will be traveling to and from the site on a daily basis, approximately 2 of which will be for the delivery of packages and office supplies, process related fuels and chemicals, and yellowcake. The remaining 30 vehicles per day is based on an anticipated 92 employees on site arriving by carpool with 2.5 workers per vehicle and 8 per transporation van."

AUC has revised ER Sec. 4.2.1.3 (Potential Groundwater Restoration Impacts) to provide the updated traffic counts and basis as shown in red below:

"The potential transportation impacts during groundwater restoration after production ceases are expected to be less than potential impacts during operations. The number of workers on site is expected to peak at approximately 52 during the late phases of groundwater restoration. AUC anticipates the corresponding increase to the area's traffic system to be approximately 18 total vehicles. This includes 16 vehicles for workers at 2.5 workers per vehicle, 8 per transporation van, and 2 vehicles per day for commercial delivery and pickup. Additionally, yellowcake shipments will decrease due to a decrease in flowrate through the IX columns and a decrease in the uranium concentration in the pregnant lixiviant recovered from the Proposed Project production units during post production groundwater restoration. The shipments of process chemicals will similarly decrease due to a decrease in the number of resin elutions and uranium precipitations during the active phase of groundwater restoration."

AUC has revised ER Sec. 4.2.1.4 (Potential Decommissioning Impacts) to provide the updated traffic counts and basis as shown in red below:

"During decommissioning, a small increase in truck traffic along with personal vehicles will occur due to the increased number of contractors and shipments associated with decommissioning activities, focused particularly in the CPP area. During this phase AUC anticipates a total workforce of approximately 22 and the corresponding traffic increase to number 6 vehicles. This estimate is based on 2.5 workers per vehicle, 8 per transporation van, and an additional 2 commercial vehicles per day for commercial delivery and pickup. Fuel shipments will increase as a result of the operation of heavy equipment. Decommissioning will result in an increase in shipments of solid 11e.(2) byproduct material and solid non-11e.(2) byproduct material. It is estimated that the frequency of 11e.(2) byproduct material shipments will increase from approximately 5 per year during operation and aquifer restoration to between 100 and 200 shipments per year during decommissioning. These will still be relatively infrequent compared to passenger vehicles and will have a small impact on traffic. Solid waste shipments are expected to increase from about 1 per week during operation and aquifer restoration to about 2 per week during decommissioning. Hazardous waste shipments are expected to remain unchanged at about 1 per month throughout all four project phases. Potential transportation impacts are expected to be similar during decommissioning as those occurring during the previous three project phases."

RAI TR- 3: Methods Used to Evaluate Traffic Impacts - Clarify the Description of the Methods Used to Evaluate Traffic Impacts

Description of Deficiency

The methods and data used for the traffic analysis on page 4-12 of the ER are not clearly described. For example, the analysis refers to ER Table 3.2-5 as projected traffic during all project phases but does not include traffic from the proposed action (comparable numbers match those provided in ER Table 3.2-2, Local and Regional Traffic Counts). The traffic analysis on ER page 4-12 also provides estimates of other projected traffic volumes in year 2015, however, the analysis does not provide clear description of how these estimates were derived.

Formulation of RAI

Provide details of the traffic analysis so staff can understand basis of the estimates including methodology, data sources, and bases for any assumptions made. This information is needed to evaluate traffic impacts for each phase of the proposed action.

RAI TR-3 Response

It is assumed that nearly all the vehicle trips to and from the Proposed Project will occur on State Highway 387 from either the east or west. Those trips include the estimated amounts of AUC workers, service and supply trips, construction vehicles, etc., as described in the previous responses to TR-1 and TR-2. To calculate the known numbers of vehicles on this route, AUC utilized the public website information available from WYDOT (Wyoming Department of Transportation) traffic counters. These traffic counter locations are situated both east and west of Clarkelen Road which will be the main access road from Hwy 387 to the Proposed Project area.

As noted in the response to TR-2, AUC estimates 2.5 workers per vehicle from the anticipated residential and construction staging areas of Gillette to the east and Casper to the west. Following phone conversations with WYDOT official S. Wiseman in March 2012, AUC calculated the projected volume of annual traffic increases utilizing WYDOT's methodology of a 1.5-percent annual increase as noted in ER Table 4-4. Pertinent changes made to the application are described in the responses to TR-1, TR-2 and TR-4.

No revisions were made to the application as a result of this RAI.

RAI TR- 4: Traffic Mitigations

Description of Deficiency

Section 6.2.2 of the ER lists traffic mitigations as potential mitigations, but does not specify if AUC proposes to commit to these mitigation measures to reduce potential traffic impacts. Additional information is needed because NRC staff can only rely on mitigation measures if they are requirements imposed by regulatory agencies or commitments from the applicant.

Formulation of RAI

Clarify if any of the described mitigations are commitments or options.

RAI TR-4 Response

AUC is committed to using appropriate mitigation measures wherever practicable to reduce potential negative impacts related to the Reno Creek Project. To clarify this commitment regarding traffic impacts, new text has been added to the last sentence of the first paragraph in ER Section 6.2.2 as shown below in red and now reads:

"AUC will mitigate potential traffic impacts, utilizing one or more of the mitigation options discussed below and include working with the local Community, plus Campbell County, the WDOT, State Patrol, and other agencies:

- Working with Campbell County and WYDOT to develop an emergency notification and response plan for the Proposed Project, including ongoing training activities;
- Improve signage on affected portions of Clarkelen/Turnercrest Road and Highway 387;
- Implementing a policy to enforce speed limits on county roads for AUC employees and contractors;
- Performing routine assessments of the road condition; and
- Implementing dust control BMPs such as wetting affected portions of county roads, particularly near residences."

9. WASTE MANAGEMENT

RAI WM- 1: Capacity for Disposition of Non-Hazardous Waste

Description of Deficiency

The ER does not describe the available disposal capacity for non-hazardous solid waste generated by the proposed action, in particular, during the decommissioning phase. This information is needed to describe the affected environment and evaluate potential impacts to waste management resources.

Formulation of RAI

Provide the available capacity for disposition of non-hazardous solid waste.

RAI WM-1 Response

In regards to capacity for disposition of non-hazardous waste disposal, discussion within ER Section 4.13.1.1.3.1 states:

"Non-hazardous solid waste will be disposed off-site in a municipal landfill permitted by WDEQ/SHWD. The nearest municipal solid material landfill is in Gillette, Wyoming (approximately 50 road miles north). The Campbell County landfill has a current capacity of 36 years for municipal solid waste and nine years for construction and debris material remaining."

AUC has added the following text as a subsequent paragraph in ER Section 4.13.1.1.3.1 to address remaining concerns regarding non-hazardous waste disposal:

"As the Proposed Project progresses, AUC will maintain contact with the Campbell County Public Works, Campbell County Landfill. If capacity at the landfill becomes a concern, AUC will commit to utilizing another WDEQ permitted facility for non-hazardous solid waste disposal."

RAI WM- 2: Description of Wastewater Constituents

Description of Deficiency

Table 4-3 of the TR provides a summary of anticipated liquid byproduct material water quality that lists minimum and maximum concentrations of 11 chemical parameters of the waste stream. Some constituents that are commonly present in ISR wastewater that could be harmful to humans or wildlife if exposures were to occur are not included in the table including arsenic, barium, cadmium, chromium, lead, magnesium, molybdenum, nickel, selenium, and Th-230.

Formulation of RAI

Provide concentration estimates for these additional constituents in the liquid byproduct material wastewater stream for the proposed project. (This information is needed to evaluate the level of potential hazard to humans and wildlife from wastewater solutions under both normal and accidental release scenarios.)

RAI WM-2 Response

TR Table 4-3 (Summary of Anticipated Liquid Byproduct Stream Waste Quality) has been updated and is shown below.

TR Table 4-3: Summary of Anticipated Liquid Byproduct Stream Waste Quality

Chemical Parameter	Estimated Range of the Waste Stream Water Quality	
	Minimum	Maximum
	(mg/L)	(mg/L)
pH (standard units)	6	9
Sodium	150	30,000
Calcium	200	1,000
Potassium	10	1,000
Bicarbonate as HCO_3	1,500	8,000
Carbonate as CO_3	0	500
Sulfate	80	20,000
Chloride	200	35,000
Uranium as U-nat	1	15
Radium (in pCi/L)	300	3,000
Total Dissolved Solids	2,500	50,000
Arsenic	<0.001*	0.2
Barium	<0.1*	2
Cadmium	<0.001*	0.002
Chromium	<0.01*	0.05
Lead	<0.01*	0.065
Magnesium	10	150
Molybdenum	<0.01*	1
Nickel	<0.05*	0.2
Selenium	<0.005*	2
Th-230 (in pCi/L)	<0.2*	100

**Reporting limit*

10. ADDITIONAL NON-RAI INFORMATION REQUESTS

AUC has prepared the requested black and white figures in PDF file format for use in the Reno Creek ISR SEIS as Appendix E which is comprised of the following components:

- Additional Non-RAI Requests SEIS Figure Matrix
- SEIS Figures
- SEIS Figure Index of Change
- Digital Elevation Model clipped to a five mile buffer around the proposed project area boundary.

APPENDICES

APPENDIX A

Response to RAI GEN-1: Preconstruction Activities

TABLE OF CONTENTS

1. PRECONSTRUCTION ACTIVITIES

As noted in NUREG-1910 (GEIS, Sec. 1 Introduction), there can be a scope of potential environmental effects associated with ISR projects such as the proposed Reno Creek Project (Proposed Project). This section discusses and describes the degree of potential environmental impacts that may be associated with preconstruction activities at the Proposed Project. Potential impacts can be direct, indirect, and/or cumulative in nature, and can be temporary (short term) or permanent (long term). As noted in NUREG-1748 (Appendix F), direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance but still reasonably foreseeable. Comparable and/or further discussions regarding potential impacts can be found in:

- Section 2 of the TR (Site Characterization);
- Section 7 of the TR (Environmental Effects)
- Section 4 of the ER (Environmental Effects);
- Section 6 of the ER (Mitigation Measures);
- Section 7 of the ER (Environmental Measurements/Monitoring); and
- Section 8 of the ER (Environmental Consequences).

1.1 Potential Preconstruction Impacts

In 10 CFR Part 40.4, NRC defines Construction Activities which are governed by Materials Licensing on the basis of a nexus to radiological health and safety. In the process, NRC defined what activities are not Construction or whose commencement does not have a nexus to radiological health and safety. These activities are not strictly subject to NRC's jurisdiction and may be commenced at the discretion of the applicant at any time prior to receipt of a Materials License. As a result, therefore, such activities are not officially subject to the NEPA process associated with the issuance of a Materials License. Such activities are referred to generally as Preconstruction Activities.

However, in order to achieve both full disclosure and a comprehensive discussion of all potential environmental impacts from the Reno Creek Project, AUC has separated its proposed construction activities into two parts: Preconstruction and Construction.

Preconstruction Activities are actually a part of the overall Construction process for the proposed project, and inherently are simply an earlier part of normal Construction activities, for example, installation of electrical power to the site or site grading. Thus, nothing is done under Preconstruction that would not be done as part of the project anyway. It is simply the case that Preconstruction Activities may be conducted immediately prior to the receipt of a Materials License instead of immediately after its receipt.

Further, the timing of Preconstruction Activities is constrained by State permitting. All necessary State of Wyoming Permits must be received prior to the commencement of Preconstruction Activities. Therefore, only during the time between AUC's receipt of its State of Wyoming Permits and the receipt of its Materials License from NRC may Preconstruction Activities be conducted. As a consequence, Preconstruction Activities will likely be continuous with Construction Activities, separated only by the date of Materials License receipt.

The Preconstruction Activities that AUC anticipates conducting prior to the receipt of its Materials License from NRC, determined in accordance with 10 CFR 40.4, are included as the bulleted items in the following list:

1) Changes for temporary use of the land for public recreational purposes;
    - AUC Preconstruction Activity: Not applicable.
2) Site exploration, including necessary borings to determine foundation conditions or other preconstruction monitoring to establish background information related to the suitability of the site, the environmental impacts of construction or operation, or the protection of environmental values;
    - AUC Preconstruction Activity: Install preconstruction ground water monitoring wells to establish background information related to the environmental impacts of operations;
3) Preparation of the site for construction of the facility, including clearing of the site, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and borrow areas;
    - AUC Preconstruction Activity: Conduct site grading and excavation to prepare for the construction of the CPP and Administration/Maintenance buildings;
4) Erection of fences and other access control measures that are not related to the safe use of, or security of, radiological materials subject to this part;
    - AUC Preconstruction Activity: Erect fences and other access control measures;

5) Excavation;
    - AUC Preconstruction Activity: Excavate the back-up storage pond;
6) Erection of support buildings (*e.g.*, construction equipment storage sheds, warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and office buildings) for use in connection with the construction of the facility;
    - AUC Preconstruction Activity: Not applicable.
7) Building of service facilities (*e.g.*, paved roads, parking lots, railroad spurs, exterior utility and lighting systems, potable water systems, sanitary sewerage treatment facilities, and transmission lines);
    - AUC Preconstruction Activity: Upgrade the existing road into the proposed CPP site and build the parking lot;
    - AUC Preconstruction Activity: Build secondary and tertiary access roads to the Production Unit 1 (PU1) area.
    - AUC Preconstruction Activity: Install a potable water well system;
    - AUC Preconstruction Activity: Build a sanitary sewerage treatment facility which includes excavation of the septic drain field ;
    - AUC Preconstruction Activity: Provide electrical service to the site by installing transmission lines and transformers.
8) Procurement or fabrication of components or portions of the proposed facility occurring at other than the final, in-place location at the facility; or
    - AUC Preconstruction Activity: AUC will procure or fabricate components or portions of the proposed facility at other than the final, in-place location at the facility;
9) Taking any other action that has no reasonable nexus to:
    (i) Radiological health and safety, or
    (ii) Common defense and security.
    - AUC Preconstruction Activity: Not applicable.

Although the Proposed Action covers a total of 6,057 acres, not all lands will be affected. Potentially affected lands during the Proposed Action's 16 year life span include disturbed lands totaling approximately 154 acres or around 2.5 percent of the Proposed Project area. The preconstruction portion of this disturbance is expected to be much smaller, accounting for approximately 18 acres or around 0.3 percent of the project area (see TR Section 7,

Table 7-1 for complete disturbance calculations). Note that the 18 acre area disturbed during Preconstruction is wholly included in the approximately 154 acres of total disturbance in the project.

1.1.1 Potential Preconstruction Impacts to Land Use

The following section summarizes the potential impacts of the Proposed Project relating to preconstruction activities. Additional details regarding construction and operation potential impacts are included in Section 7 of the TR. A more detailed discussion of the environmental impacts of all phases of the Proposed Project is included in Section 4 of the ER. The Proposed Project Schedule (Figure 1-6) is included in Section 1 of the ER and has been revised to include preconstruction.

Much of the Proposed Project area will remain undisturbed due to the relatively minor nature of surface disturbance associated with the ISR process. Nevertheless, the preconstruction activities associated with the Proposed Project infrastructure has the potential to impact the land use by:

- Changing and disturbing existing land uses;
- Restricting access and establishment of right-of-ways;
- Limiting livestock grazing;
- Limiting recreational activities; and
- Altering historic and cultural resources.

These potential impacts to land use are considered temporary and reversible through the process of post-operation surface reclamation, thereby returning the land to unrestricted use consistent with pre-operational conditions. AUC may leave affected areas unrestored at the request of landowners (e.g. roadways and structures). Regardless of the final disposition, all areas and structures will be decontaminated to allow for unrestricted use as described in detail in TR Section 6. Potential preconstruction land use impacts are expected to be much smaller than construction and operations impacts as the largest portion of land use changes will occur with the wellfield development during construction.

1.1.1.1 Changing and Disturbing Existing Land Uses

Minimal surface disturbance will occur as a result of preconstruction activities. A significant portion of the preconstruction area has previously been disturbed by infrastructure and other prior and on-going activities. The land use changes at the CPP site will be similar for the preconstruction and construction phases since both phases will occur at the same location.

1.1.1.1.1 Central Processing Plant Area

The CPP area will include the CPP building, office/maintenance building, storage areas, backup pond, parking area, laydown area, and a solid 11e.(2) storage area. Preconstruction activities at the proposed CPP area will disturb an estimated 15.5 acres and will be fenced to control access. Surface disturbing activities associated with construction of the CPP area will include topsoil stripping; excavation, backfilling, compacting, and grading to prepare a level site. Additional preconstruction activities will include excavation of the back-up storage pond, installation of a potable water well system, sanitary sewerage treatment facility, installation of transmission lines and transformers and upgrading the current access road to the CPP area. The Taffner homestead is currently positioned where the proposed CPP will be located. AUC will acquire the Taffner property prior to construction and it will not thereafter be used as a residence.

Land use at this site will be temporarily changed as the CPP area will be used for industrial purposes throughout the preconstruction, construction, operation, aquifer restoration, and decommissioning phases.

1.1.1.1.2 Access Roads

Access roads constructed during the preconstruction phase will include secondary and tertiary roads to gain access to PU1. The estimated surface disturbance associated with access road construction is approximately 2 acres and is calculated assuming approximately 1100 feet of 12 feet wide secondary access roads and 9000 feet of 8 feet wide tertiary roads. Surface disturbance activities associated with secondary access road construction include topsoil stripping and stockpiling, excavation, backfill, compaction, and grading. The roads will generally follow the existing topography. Tertiary roads will be unconstructed, two-track roads.

Access roads will be constructed on land currently used for livestock grazing. Potential changes in this land use will be small and temporary. Surface disturbance will also be minimized by locating access roads, pipelines, and utilities in common corridors and by utilizing existing roads wherever possible. There are numerous existing access roads that traverse the Proposed Project area which AUC will use whenever possible. Majority of these roads were developed and utilized for oil and gas, CBM, and ranching activities.

1.1.1.1.3 Deep Disposal Wells

AUC will construct up to four deep disposal wells (DDWs) as part of the Proposed Action. However, AUC will not create any surface disturbance related to the DDWs nor will AUC install any of the DDWs as part of preconstruction activities.

1.1.1.1.4 Access Restrictions and Establishment of Right-of-Way

Access during preconstruction activities may be controlled by fencing in areas where costly equipment and materials are temporarily stored. No public right-of-way will be established during preconstruction of the Proposed Project. All access roads will be private access roads for authorized AUC employees and contractors. All access roads constructed will be reclaimed during decommissioning unless transferred to the affected landowner after decommissioning is complete.

1.1.1.2 Mineral Rights

The only known recoverable minerals in the Proposed Project area include conventional oil and gas and CBM. There are numerous existing access roads and well pads on-site associated with each of these operations. Ten producing oil wells and 46 producing CBM wells are located within the Proposed Project boundary. The location of these wells are shown in Figure 2.7B-59 in Addendum 2.7-B of the TR. The existing infrastructure associated with these operations will not be impacted by preconstruction activities.

1.1.1.3 Livestock Access Restrictions

The primary land use within the Proposed Project area is livestock grazing on rangeland. Considering the relatively small size of the area impacted by preconstruction, the exclusion of grazing from this area from this phase through the course of the Proposed Project will have a minimal to no impact on local livestock production. AUC will establish surface use agreements with surface owners/lessees to provide compensation for the temporary loss of area used for agricultural purposes.

1.1.1.4 Restrictions on Recreational Activities

Currently, the primary recreational activity in the vicinity of the Proposed Project is hunting, which will be restricted to protect workers. Hunting will be restricted within the Proposed Project area on private lands for the life of the project, beginning with preconstruction activities. There is no public access to private lands and limited recreation opportunity on State of Wyoming managed lands within the Proposed Project area.

Therefore, the potential impact on such land uses due to the restricted access areas is anticipated to be small and similar for preconstruction as the rest of the project.

1.1.1.5 Altering Historic and Cultural Resources

Potential impacts to historic and cultural resources will be minimized by avoiding preconstruction and construction at sites identified by the Class III inventory as potentially eligible for listing on the NRHP. Consultation with the appropriate SHPO and Tribal Historic Preservation Office (THPO) will ensure all sites existing or located during AUC's operations are properly managed. An Unanticipated Discovery Plan (UDP) will be implemented prior to preconstruction for phased identification of previously unidentified historic and cultural resources encountered during all phases of the Proposed Action. This will include a stop-work provision and a requirement to seek expert advice and approval prior to resuming activities, if any previously undiscovered cultural resources are encountered. A brief outline of the UDP can be found in ER Section 7.5.

1.1.2 Potential Preconstruction Impacts to Transportation

The average daily estimated increase in auto traffic is based on the workforce level, which varies greatly depending upon the phase of the project. Vehicle traffic includes passenger vehicles, light duty trucks, other personal or work vehicles, and commercial delivery and pickup vehicles to and from the Proposed Project site during each project phase. There will be an estimated 12 vehicles per day during preconstruction, which is estimated assuming that there is an average of 2.5 workers per vehicle traveling to the site from the residential areas. This estimate is derived by the expectation that the majority of workers are anticipated to travel from Gillette at a distance of over 40 miles from the site. The 12 vehicles per day also includes an estimated 4 commercial vehicles per day associated with the delivery and pickup of supplies and equipment. Given the relatively minor increase in traffic and the short term nature of the preconstruction phase the potential impacts on transportation resources is expected to be small. These impacts are very similar to the construction impacts found in ER Section 4.2.1.1 (Potential Construction Impacts)

1.1.3 Potential Preconstruction Impacts to Geology and Soils

There is very limited long term and minor short term potential impact to geology and soils due to the shallow depth of disturbance and minimal acreage of surface disturbance associated with preconstruction activities. Primarily because all soils will be appropriately stripped, stockpiled, and stabilized for reuse later in the project schedule.

1.1.3.1 Potential Preconstruction Impacts to Geology

Potential geological impacts could occur during preconstruction when relatively minor, temporary disturbance will occur near the soil surface. NUREG- 1748 notes that geological resources are more likely to exert an impact than be impacted by the Proposed Action. The main probable geologic hazard present in Wyoming is earthquakes. Earthquake probabilities and consequences are discussed in ER Section 3.3, including current earthquake probability maps that are used in the newest building codes (2,500 year maps).

1.1.3.2 Potential Preconstruction Impacts to Soils

Potential soil impacts include soil loss, compaction, salinity, loss of soil productivity, and soil contamination. Preconstruction activities at the Proposed Project site will result in a small and temporary disturbance of the soil. Topsoil will be removed and stockpiled during construction and will be stabilized to minimize erosion for later use in the decommissioning phase of the project as required. Stockpiles and denuded soil surface will be stabilized by seeding with a cover crop to minimize erosion. Detailed soil impact mitigation measures are found in ER Section 6.3.

1.1.4 Potential Preconstruction Water Resource Impacts

The Proposed Action has the potential to impact surface water and groundwater to varying degrees during each phase of the project. As discussed in TR Section 2.7, surface water and groundwater within the Proposed Project area are used for livestock and wildlife watering and industrial use.

1.1.4.1 Potential Preconstruction Impacts to Surface Water

Natural flow in the region is categorized as ephemeral and flows rarely, only occurring during snowmelt and rainstorm events. The headwaters of the Belle Fourche River are located within the Proposed Project area. The Belle Fourche River can be characterized as an ephemeral channel with isolated pockets of water and wetlands. Stock tanks and reservoirs are scattered throughout the Proposed Project area, however, these usually do not contain water, or very little water, by late in the summer season.

The primary potential impact from the removal of vegetation and disturbance of soil is water quality degradation. Surface water quality within the proposed project area has the potential to be adversely impacted by increasing suspended sediment concentrations due to vegetation removal and soil disturbance. During preconstruction and construction temporary sediment control features will be used until vegetation can be re-established to minimize the potential impacts to surface water due to vegetation removal and soil disturbance. Temporary sediment control features include sediment logs, silt fence, straw bales, or other BMPs.

Preconstruction activities have the potential to temporarily increase the sediment yield of the disturbed areas. The site disturbing activities will include vegetation removal and topsoil stockpiling, limited periods of low impact stream channel disturbance and minor wetland encroachment. These activities have the potential to result in minor hydrocarbon spills, primarily related to fuel and lubricants from heavy equipment operation.

There will be minimal impacts on ephemeral stream channels from preconstruction activities. Roads will be constructed in a manner so as to avoid the ephemeral stream channels where possible. BMPs will be implemented in the occurrence of stream channel crossings. Such BMPs will be consistent with those applied at other licensed ISR facilities.

A Large Construction General Permit (CGP) will be developed by AUC and will be issued from the WDEQ Stormwater Program prior to the commencement of any preconstruction activities. Also, a Storm Water Pollution Prevention Plan Permit (SWPPP) will be developed and implemented with oversight by the WDEQ. This will address all storm water drainage impacts from erosion and sedimentation during Proposed Project construction activities. Wyoming Pollutant Discharge Elimination System (WYPDES) permits will be obtained in accordance with WDEQ/WQD regulations. BMPs will be implemented to reduce impacts in accordance with storm water management plans developed for those permits.

1.1.4.2 Potential Preconstruction Impacts to Groundwater

As noted in NUREG-1910 (GEIS 4.2.4.2.1), the potential for groundwater impacts during construction at ISR facilities is primarily from consumptive groundwater use, the introduction of drilling fluids and muds from well drilling, and spills of fuels and lubricants from construction equipment. The GEIS goes on to state each of these impacts is considered small if best management practices are utilized such as the implementation of a spill prevention and cleanup plan. AUC will implement such a plan prior to any preconstruction activity and commits to using best management practices in all phases of construction activities. Preconstruction impacts will also be limited by the construction rule as AUC may not drill the whole wellfield

As discussed in detail in Section 2.7 of this TR, while there is perched water in some of the near surface sands, none of them exhibit the characteristics of an aquifer. Similarly, the

Underlying Unit in the Proposed Project area does not exhibit the characteristics of an aquifer. Therefore, there will be no potential impacts on any surficial aquifer or Underlying Unit. Water quality of the Overlying Aquifer (OA) and Production Zone Aquifer (PZA) at depth should not be impacted during the preconstruction phase.

1.1.5 Potential Ecological Effects of Preconstruction

The preconstruction will consist of significant features associated with ISR recovery operations including CPP ancillary facilities and other supporting infrastructure. The Proposed Project will not control or disturb large expanses of habitat compared to that of conventional uranium recovery methods. All disturbed areas will be reclaimed either at the completion of construction or during decommissioning. Once construction is complete, the disturbance area will be reduced to only that needed to maintain operations. Limited habitat disturbance also results in fewer displaced animals from existing territories into other, potentially occupied, areas, which reduces competition and stress on animals in both locations.

Given the factors outlined above, and the limited use of the Proposed Project area by most vertebrate species of concern, impacts to those species from preconstruction activities are expected to be small as described below. Mitigation measures designed to prevent or reduce impacts to wildlife are discussed in Section 6.5 of the ER. A detailed description of vegetation, terrestrial wildlife, fisheries, and threatened and endangered species associated with the Proposed Project area is contained in Section 3.5 of the ER.

Much more detailed discussions of potential construction impacts regarding vegetation, wetlands, wildlife, fisheries, raptors, upland game birds, sensitive species, big game mammals, small and medium size mammals, waterfowl and shorebirds, reptiles and amphibians, fish and micro-invertebrates, and threatened and endangered species can be found in Section 4.5.2 of the ER.

1.1.6 Potential Preconstruction Impacts to Air Quality

Preconstruction activities at the Proposed Project site will cause minimal short-term effects on local air quality. As part of the Reno Creek Project emissions inventory, preconstruction emissions have been quantified for all criteria pollutants, hazardous air pollutants and greenhouse gases. The complete emissions inventory is included in a modeling protocol document that AUC will distribute to participating agencies for review. This document demonstrates that estimated preconstruction emissions are substantially lower than the maximum annual emission total, which occurs in year 6 of the project. Therefore, modeling results reflect Year 6, to represent maximum project impacts on ambient air quality. The modeling protocol document is included as Appendix C of the ER RAI Response Package.

1.1.7 Potential Noise Effects of Preconstruction

As discussed in Section 4.3.7.1 of the GEIS, potential noise impacts will be greatest during preconstruction activities at the CPP area because of the heavy equipment involved and given the likelihood that these facilities will be built in rural areas where background noises levels are typically lower than urban areas. The use of graders, heavy trucks, bulldozers, and other equipment used to construct access roads and build the CPP support facilities will generate noise that will be audible above the undisturbed background noises. Noise will likely be higher during daylight hours when construction is more likely to occur and more noticeable in proximity to operating equipment. Administrative and engineering controls will maintain noise levels in work areas below OSHA regulatory limits and, if necessary, additional mitigation will be provided by use of personnel hearing protection. For individuals living in the vicinity of the site, ambient noise levels will return to background levels at a distance greater than 300m (1,000ft) from the construction activities. Wildlife will be expected to avoid areas where noise-generating activities are occurring. Noise levels from drilling operations will be less than those during construction as full wellfield development will not occur during preconstruction.

Additionally, as stated in the GEIS, the traffic noise during construction will be localized, limited to highways in the vicinity of the proposed project and access roads within the Proposed Project area. Relative short-term increases in noise levels associated with passing traffic will be small for the larger roads, but could be moderate for lightly traveled rural roads. AUC will enforce site speed limits to further mitigate traffic noise impacts.

1.1.8 Potential Preconstruction Impacts to Historic, Scenic and Cultural Resources

NRC's NUREG 1910 Vol. 2 (pg. 4.3-25) notes that most of the potential for adverse effects to potentially NRHP-eligible historic properties, traditional cultural properties, and paleontological material, both direct and indirect, will likely occur during land-disturbing activities. The Proposed Project has no known sites that are eligible for NRHP listing, as discussed in detail in Section 2.4 of this TR. Buried cultural features and deposits and paleontological material that are not visible on the surface during the initial cultural resources inventories could be discovered during earth-moving activities. AUC commits to implementing an Unanticipated Discovery Plan, which will include stop-work provision if any previously undiscovered cultural resources are encountered during preconstruction, construction and operations including site decommissioning.

1.1.8.1 Historic and Cultural Resources Impacts

Class I and III cultural resource surveys were conducted on the Proposed Project area and the results are included in Addendum 3.8-A of the ER. Although specific potential impacts to cultural resources within the Proposed Project are presently not defined, none of the 78 known cultural resources is considered eligible for the National Register. Therefore, the current Proposed Project will not affect any known significant cultural resources and no additional archaeological work or special consideration is recommended.

NRC's NUREG 1910 Vol. 2 (pg. 4.3-25) notes that most of the potential for adverse effects to potentially NRHP-eligible historic properties, TCPs, and paleontological material, both direct and indirect, will likely occur during land-disturbing activities. Buried cultural features and deposits and paleontological material that are not visible on the surface during the initial cultural resources inventories could be discovered during earth-moving activities. As described in Section 6.8 of this ER, AUC will implement an Unanticipated Discovery Plan to prevent the loss of undiscovered cultural artifacts. The discovery of cultural artifacts in an operational area shall result in a work stoppage in the vicinity of the find until the resources can be evaluated by a professional archaeologist.

Potential indirect impacts also can occur outside the Proposed Project area and related facilities and components. Visual intrusions, increased access to formerly remote or inaccessible resources, potential impacts to traditional cultural properties and culturally significant landscapes, as well as other ethnographically significant cultural landscapes may adversely affect these resources. As described in ER Section 3.8, no Native American heritage, special interest, or sacred sites have been formally identified and recorded to date by studies directly associated with the Proposed Project. Implementing a stop-work provision and other mitigation measures as described in Section 6.8 of this ER, will assure that potential impacts to historical and cultural resources will be minimized.

1.1.8.2 Visual and Scenic Resources Impacts

The preconstruction activities will result in temporary, small impacts to the visual and scenic resources of the area that would be consistent with the visual resource classification of the area by the BLM. The BLM has classified the project area as a Class III and the management objective of VRM Class III is to partially retain the existing character of the landscape. The level of change to the characteristic landscape can be moderate. Under the Proposed Action, the character of the existing landscape would be retained, but would be modified with noticeable but minor additional industrial facilities, utilities, and roads.

Temporary and short-term visual effects during the preconstruction period will result from ground clearing, grading, vehicular and pedestrian traffic, construction of ancillary facilities, construction of access roads and electric distribution lines. Preconstruction debris will be removed from new construction areas as soon as possible and temporarily disturbed areas will be reclaimed as soon as possible following preconstruction and construction.

Potential long-term effects will result from the addition of structures to the landscape such as access roads, and electric distribution lines. Potential effects from long-term activities will occur over the life of the project, but will be mitigated at the end of the project lifecycle.

Heavy equipment brought in during preconstruction activities may be visible from certain vantage points from Highway 387, Clarkelen/Turnercrest Road, and Cosner Road and views from the one residence nearest to the Proposed Project. Dust generated may also impact visual resources. Visible dust particles will be released during activities such as the mechanical disturbance of rock and soil materials, bulldozing, and vehicles traveling on gravel roads. Particles are also transported by wind blowing over the surface of bare land and stockpiles. As described in ER Section 6.9, dust will be minimized by wetting disturbed areas during construction, promptly restoring and re-seeding disturbed soil, and enforcing speed limits for AUC employees and contractors.

In general, resource protection measures proposed for erosion control, road construction, rehabilitation and re-vegetation will mitigate effects to visual quality. Thus the potential visual impacts will likely be small and temporary in nature.

1.1.9 Potential Preconstruction Impacts to Socioeconomics

As noted in NUREG-1910 (GEIS, Section 4.2.10.1), the construction phase will cause a potentially moderate impact to the local economy, resulting from the purchases of goods and services directly related to construction activities. Impacts to community services in Wright, Gillette, and rural Campbell County or the towns of Midwest and Edgerton in northern Natrona County, such as roads, housing, schools, and energy costs will be minor or non-existent and temporary.

In developing a socioeconomic impact evaluation, it would not be practicable to separate preconstruction from construction phases. This is primarily due to the fact that while the NRC defines the two separately based on the nexus of radiological safety, the employment of workers to construct all portions of the facilities would not be separated as such. For example, skilled laborers used to build the shop or office facilities would also be used to build the CPP. As the preconstruction and construction activities are synonymous terms in the scope of socioeconomics, they should be reviewed together in developing the potential impacts. This evaluation is provided in detail in TR Section 7.1.2. (Potential Construction Impacts to Socioeconomics).

1.1.10 Potential Preconstruction Impacts to Public Health

Potential impacts to public health associated from preconstruction activities include fugitive dust, combustion emissions, noise, and occupational hazards. By definition in 10 CFR 40.4, preconstruction activities have no nexus to radiological health and safety. As a consequence, no radiological impacts will occur during preconstruction.

The employees of AUC will practice a hearing conservation program to prevent occupational noise impacts during preconstruction activities. Members of the general public will not be exposed to potentially damaging noise levels because they will not have access to areas where construction is occurring. Other potential hazards include those of standard operations during construction such as strains and sprains resulting from slips, trips, and falls. Potential injuries related to the occupation will be minimized by implementing worker safety procedure in conformance with the Wyoming Occupational Health and Safety Act, Title 27, Labor and Employment, Chapter 11, Occupational Health and Safety and applicable OSHA standards. None of these potential risks affect the general public.

1.1.11 Potential Preconstruction Byproduct Management Impacts

As the basis for separating preconstruction from construction activities is distinguished by the nexus of radiological safety, 11e.(2) byproduct will not be produced during the preconstruction phase.

1.1.11.1 Non-Hazardous Solid waste

Solid waste material will be generated during preconstruction, including minor construction debris. Approximately 30 yd^3 will be created each week during the 26 weeks of activities.

1.1.11.1.1 Solid Waste Management

During preconstruction, solid waste will be stored in roll-off containers in designated areas prior to shipment off-site to a nearby landfill. Non-hazardous solid waste will be disposed off-site in a municipal landfill permitted by WDEQ/SHWD. The nearest municipal solid material landfill is in Gillette, Wyoming (approximately 50 road miles north). The

Campbell County landfill has a current capacity of 36 years for municipal solid waste and nine years for construction and debris material remaining. The potential impact to area municipal landfills from disposing solid waste generated by the preconstruction phase will be small and similar to those in the construction phase.

1.1.11.2 Hazardous Waste

Hazardous waste generated by during preconstruction activities may include small quantities of used oil from equipment and vehicles, oil-contaminated soil, oily rags, solvents, cleaners, and degreasers. Less than 220 pounds (100 kg) per month of hazardous waste will be generated during the preconstruction period.

Hazardous Waste Management

Hazardous waste will be stored in secure containers. The containers will be compatible with the materials stored, visually inspected for leaks, rust, etc. and will be labeled with contents. During preconstruction the containers will be stored within an earth bermed storage area.

1.1.11.2.1 Hazardous Waste Disposal

Hazardous waste will be transported to an off-site treatment, storage and disposal facility that is licensed by WDEQ/SHWD (or a nearby state) to manage hazardous byproducts. The Campbell County Landfill, located just north of Gillette, accepts used oil for recycling and certain other hazardous byproducts by contract. If needed, small quantities of used reagents or other types of hazardous waste may occasionally be transported to more distant licensed disposal facilities by a licensed hazardous waste contractor. Since minimal hazardous waste is expected to be generated during preconstruction and there are readily available disposal options, the potential for hazardous waste impacts is expected to be small.

1.1.11.3 Domestic Sewage

The quantity of domestic sewage generated by the proposed action will vary according to the number of workers during each project phase. The peak number of workers is estimated to be up to 30 during preconstruction activities. During preconstruction portable toilets will be used. The portable toilet services will likely be contracted out of Gillette and consist of a minimum of 1 toilet seat and 1 urinal per 40 workers based on OSHA standard 1926.51(c). Although leaks or spills from portable units can occur, site impacts from domestic sewage is expected to be small.

APPENDIX B

Response to RAI GEN-5:
Revised ER Table 2-2: Comparison of Predicted Environmental Impacts

Table 2-2: Comparison of Predicted Environmental Impacts

Potential Impact	Alternative	Potential Impacts
Potential Land Surface Impacts	Proposed Action	Surface disturbance will range from short term for construction of well pads and utility/pipeline corridors that will be reclaimed after construction to long term for roads, buildings, parking areas, and backup pond that will remain until final D&D. All disturbance will be reclaimed to be suitable for pre-construction uses. Disturbance areas and values are listed in ER Table 1-3.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Open-pit mining will result in significant surface disturbance due to the pit overburden stockpiling and will create permanent topographic changes, increase fugitive dust, and the potential for subsidence. Both heap leaching and open-pit mining methods require crushing the ore and disposing of the tailings, creating long term or permanent solid 11e.(2) byproduct material.
	Alternate CPP Location	Greater soil disturbance as a result of longer access road construction and new utility improvements; increased fugitive dust potential; increased vegetative disturbances
	CPP versus Satellite Plant	Satellite plant will result in a smaller surface disturbance due the smaller facility size than the proposed central processing plant.
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Byproduct Management	Disposal in evaporation ponds will result in slightly more surface disturbance than the proposed backup pond due to the increased surface area to aid in the evaporation process.
	Uranium Processing Alternatives	Use of single-stage rather than the proposed two-stage RO system would create approximately twice as much brine as the Proposed Action, requiring greater disposal capacity for liquid 11e.(2) byproduct material disposal.

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Land Use Impacts	Proposed Action	Small impacts on agricultural production (livestock grazing) and hunting on up to 481 acres for duration of the Proposed Project.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Area used for pit, ramps, haul roads, overburden stockpiles, and topsoil stockpiles will be restricted from any other uses for the duration of the Proposed Project.
	Alternate CPP Location	Oil and gas firms have occupied ground at this site which increase competition for land uses; local landowners prefer not to lease CPP at this location
	CPP versus Satellite Plant	Same as Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Byproduct Management	Same as Proposed Action plus additional land use impact from installation of evaporation ponds and/or land application areas.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Transportation Impacts	Proposed Action	An estimated 23.3 acres will be disturbed to construct infrastructure access roads (secondary and tertiary). A small risk of spills of process chemicals and small quantities of 11e.(2) byproduct material during the project life.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Conventional mining methods will require more employees which will increase traffic on local roads.
	Alternate CPP Location	To avoid construction of a new intersection with Hwy 387 and adversely impact current traffic patterns, access to the alternate site would likely utilize Cosner Road which currently intersects Hwy 387 approximately two miles southwest of the alternate site. Cosner Road is a seldom-used rural road with very little traffic when compared to the well-traveled Clarkelen Road which is a main rural connector to the city of Gillette to the north. Thus, transportation impacts would be greater at the alternate site.
	CPP versus Satellite Plant	A satellite plant will increase the traffic volume due to the shipment of loaded resin to a central processing facility
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Byproduct Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Geology and Soil Impacts	Proposed Action	Approximately 154 acres (short and long term) will potentially be disturbed over the life of the Proposed Project. Topsoil will be stripped for construction of recovery facilities and access to these facilities. Topsoil will be stockpiled and seeded with a temporary seed mix to protect from erosion until it is replaced during reclamation. Once replaced, topsoil will be revegetated and support pre-construction land use resulting in no significant impacts on geology. Disturbance areas and values are listed in ER Table 1-3.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Open pit mining will have significant impacts on geology and soil since all overburden from the surface to the ore zones will be removed. The overburden will be stockpiled and seeded with a temporary seed mix to protect form erosion until replaced during reclamation.
	Alternate CPP Location	Soil impacts greater due to longer access road
	CPP versus Satellite Plant	Same as the Proposed Action
	Use of Alternate Lixiviants	Same as the Proposed Action
	Alternate Byproduct Management	Evaporation ponds would require a larger surface area disturbance than the Proposed Action resulting in more topsoil removal and stockpiling.
	Uranium Processing Alternatives	Use of single-stage RO treatment would require more DDWs for additional liquid 11e.(2) byproduct disposal which would require more topsoil to be removed

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Surface Water Impacts	Proposed Action	Surface disturbance may pose a small risk of increased sediment load to ephemeral drainages. Minimal risk of fuel or chemical spills.
	No Action	None
	Alternate Milling Method	Open pit mining will alter the surface drainage network requiring the restoration of all drainages during reclamation. The surface disturbance is significantly increased from the Proposed Action and will pose a larger risk of sediment load to surface waters. In addition, the potential for large amounts of groundwater to be discharged from the open pit will impact ephemeral drainages that only see flow during runoff or storm events.
	Alternate CPP Location	Same as the Proposed Action
	CPP versus Satellite Plant	Same as the Proposed Action
	Use of Alternate Lixiviants	The potential spill of an acid or ammonia based lixiviant will have more of an adverse effect on surface water than a sodium-bicarbonate based lixiviant.
	Alternate Byproduct Management	Evaporation ponds will disturb more surface area resulting in the increased risk of sediment load to drainages.
	Uranium Processing Alternatives	Same as the Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Groundwater Impacts	Proposed Action	Excursion of lixiviant may have a small potential to contaminate adjacent groundwater. Minimal risk of fuel or chemical spills leaching to shallow groundwater. Small net withdrawal of water from the ore zone aquifer to contain fluids. Water consumed will naturally recharge with time.
	No Action	None
	Alternate Milling Method	Open-pit and underground mining will drastically alter the hydrogeology of the area. All aquifers from the bottom of the ore zone to the surface will be exposed. Groundwater exposed in pit will need to be discharged altering surface water flow.
	Alternate CPP Location	Same as the Proposed Action
	CPP versus Satellite Plant	Same as the Proposed Action
	Use of Alternate Lixiviants	The potential migration of an acid or ammonia based lixiviant will have more of an adverse effect on groundwater than a sodium-bicarbonate based lixiviant.
	Alternate Byproduct Management	Same as the Proposed Action
	Uranium Processing Alternatives	Use of single-stage RO or not treating groundwater sweep recovery solutions with RO will increase net amount of groundwater withdrawn from ore zone aquifer.

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Ecological Impacts	Proposed Action	BMPs will minimize wildlife access to lined backup pond and storage facilities. No threatened or endangered species will be impacted as none where identified in baseline studies. Loss of habitat will be minimal and temporary.
	No Action	None
	Alternate Milling Method	Open pit mining will disturb much more habitat by increased surface disturbance.
	Alternate CPP Location	Same as the Proposed Action
	CPP versus Satellite Plant	Same as the Proposed Action
	Use of Alternate Lixiviants	Same as the Proposed Action
	Alternate Byproduct Management	More habitat loss could result due to increased impoundment size.
	Uranium Processing Alternatives	Same as the Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Air Quality Impacts	Proposed Action	Slight increases in fugitive dust will occur, primarily during construction. An increase in fugitive dusts over baseline levels will occur during the life of the project.
	No Action	None
	Alternate Milling Method	Open-pit mining will increase fugitive dust emissions by exposing much more disturbed soil surface. Large equipment will increase gaseous greenhouse emissions. Tailings will increase risk of airborne contaminants, including radioactive materials.
	Alternate CPP Location	Longer access road from Cosner Road would increase fugitive dust potential.
	CPP versus Satellite Plant	The potential for impact to air quality increases due to the potential exposure to dried yellowcake particulates from an accident.
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Byproduct Management	Increased emissions may occur if larger lined evaporation ponds are constructed.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Noise Impacts	Proposed Action	Noise will increase over background levels. Nearest residence could experience noise levels above the annoyance (55 dBA) threshold during construction.
	No Action	None
	Alternate Milling Method	Increased noise levels will result from open-pit mining due to heavy equipment operation.
	Alternate CPP Location	Same as Proposed Action
	CPP versus Satellite Plant	A CPP will potentially produce less noise with the absence of resin shipping trucks.
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Byproduct Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Historical and Cultural Impacts	Proposed Action	Potential impacts will be minimal, since NRHP eligible sites do not exist on the Proposed Project site. A stop-work provision will be used if any previously undiscovered cultural resources are found.
	No Action	None
	Alternate Milling Method	Open-pit mining disturbs more area than that of ISR facilities increasing the chance of disturbing unknown cultural resources.
	Alternate CPP Location	Similar to Proposed Action though potential impacts could vary depending upon location of undiscovered historical and cultural resources.
	CPP versus Satellite Plant	Same as Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Byproduct Management	Similar to Proposed Action, although potential impacts could increase with increased evaporation pond size.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Visual/Scenic Impacts	Proposed Action	Minimal visual impacts will result from new structures and equipment but will remain consistent with the BLM visual resource classification of the area.
	No Action	None
	Alternate Milling Method	Open-pit mining will create a significant visual impact with large stockpiles and a large tailings impoundment.
	Alternate CPP Location	Similar to Proposed Action though potential impacts could vary depending upon location to nearby roads
	CPP versus Satellite Plant	Similar to the Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Byproduct Management	More and larger impoundments than required under the Proposed Action will have localized visual impacts.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Socioeconomic Impacts	Proposed Action	Most of the workforce is expected to come from the local area minimizing impacts on housing and local services. Project will have slight, positive benefit to the State on severance tax, royalty, and sales and use tax collections and moderate benefits to Campbell County on property and production taxes. Remoteness of the site might slightly increase the need for increased emergency services (fire and ambulance service).
	No Action	None
	Alternate Milling Method	Conventional mining and milling methods require more employees than ISR facilities. Revenues to the State, which are based on production, will be similar to Proposed Action, but Campbell County revenues from property taxes will be more due to additional equipment required for conventional mining.
	Alternate CPP Location	Same as Proposed Action
	CPP versus Satellite Plant	A CPP will require more employees than a satellite facility which will have a direct positive impact on the local economy
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Byproduct Management	Same as Proposed Action possibly extending the construction period due to the need to construct more impoundments.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Non-Radiological Impacts	Proposed Action	Minimal risk of public exposure through chemical leaks and spills will be mitigated by employing BMPs.
	No Action	None
	Alternate Milling Method	Conventional mining and milling methods have an increased risk and more severe accidents compared to that of the Proposed Action. Safety hazards are compounded due to the depths of the mineral ore to be recovered.
	Alternate CPP Location	Same as Proposed Action
	CPP versus Satellite Plant	A CPP has additional equipment and chemicals that could present safety hazards not found in a satellite facility
	Use of Alternate Lixiviants	Similar to Proposed Action; acid or ammonia-based lixiviant will introduce additional non-radiological health risks.
	Alternate Byproduct Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Radiological Impacts	Proposed Action	The estimated radiological impacts resulting from routine site activities will be compared to applicable public dose limits as well as naturally occurring background levels.
	No Action	None
	Alternate Milling Method	Radiological exposure to the personnel in these processes is increased, not only from the mining process but also from milling and the resultant mill tailings. The milling process generates a significant amount of byproduct relative to the amount of ore processed. Extensive mill tailings impoundments are needed for the disposal of these byproducts.
	Alternate CPP Location	This site is closer to nearest residence which could result in a higher radiological dose potential.
	CPP versus Satellite Plant	Same as Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate byproduct Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (cont.)

Potential Impact	Alternative	Potential Impacts
Potential Byproduct Management Impacts	Proposed Action	The Proposed Project deep injection well(s) will isolate liquid byproducts generated by the project from any underground source of drinking water. A slight risk of exposure to the public during transportation exists though will be minimized by employing BMPs.
	No Action	None
	Alternate Milling Method	Conventional mining and milling creates considerably more waste than ISR, including solid 11e.(2) byproduct material (tailings), and residue left from the treatment of water.
	Alternate CPP Location	Same as Proposed Action
	CPP versus Satellite Plant	A CPP will potentially create more 11e.(2) and non-11e.(2) byproducts than a satellite plant requiring more byproduct to be transported and disposed at a licensed facility.
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Byproduct Management	Evaporation ponds accumulate salts and windblown material such as dust that will need eventual removal increasing the risk for potential impacts during transport to an off-site facility.
	Uranium Processing Alternatives	Same as Proposed Action

APPENDIX C

Response to RAI AQ-1:
Ambient Air Quality Modeling Protocol and Results

Ambient Air Quality Modeling Protocol and Results

Reno Creek ISR Project

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Campbell County, Wyoming

May, 2014

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

AUC LLC has proposed to construct an in-situ recovery (ISR) uranium facility at the Reno Creek site in the southern Powder River Basin (PRB) of east-central Wyoming. An assessment of the potential air quality impacts of the proposed facility is requested as part of the NRC license application and Supplemental Environmental Impact Study (SEIS). AUC enlisted IML Air Science to develop a project emissions inventory and to model the potential impacts of these emissions on ambient air quality.

The Reno Creek site and surrounding area lie within a Class II airshed under the Clean Air Act. There are no Class I areas within 50 kilometers of the Reno Creek ISR Project, and the project does not qualify as a major source of any criteria pollutant or hazardous air pollutant (HAP). Therefore, an ambient air quality impact analysis will be conducted, but analysis of Air Quality Related Values (AQRV) will not be part of this study.

This air quality modeling protocol addresses the approach for assessing the ambient air quality impacts from the proposed source emissions for comparison with the National Ambient Air Quality Standards (NAAQS) for particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), carbon monoxide (CO), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2). It also addresses the approach for comparing modeled project impacts to the Prevention of Significant Deterioration (PSD) Class II increments for PM_{10}, $PM_{2.5}$, SO_2 and NO_2. Project-related emissions of hazardous air pollutants (HAP) and greenhouse gases (carbon dioxide or CO_2) will be estimated and summarized, but not modeled.

A project emissions inventory is presented in Appendix A to this document. The timing and spatial allocation of those emissions are detailed in Appendix B.

1.1. Project Overview

The proposed Reno Creek Project is a uranium in-situ recovery (ISR) facility in Campbell County, Wyoming. The facility is composed of multiple well fields and a central processing plant. The project will entail four phases: construction, operation, aquifer restoration and decommissioning. The construction phase will be further partitioned into a pre-license construction phase, a facilities construction phase and a well field construction phase. Fugitive emission sources of particulate matter (PM_{10}, $PM_{2.5}$) include construction and drilling activities, wind erosion, product transport, pickup traffic, delivery trucks, and passenger vehicles. Particulates (PM_{10}, $PM_{2.5}$), carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen and sulfur (NO_x and SO_2), and a small amount of hazardous air pollutants (HAP) will be emitted by mobile equipment engine exhaust and by stationary sources such as space heaters, an emergency generator and a thermal dryer.

1.2. Modeling Overview

The initial emissions inventory calculations for the Reno Creek ISR Project were submitted to NRC in 2012. Based on the subsequent completion of more detailed project plans, refinements to the emissions inventory were made as part of this modeling protocol development. The revised emissions will be modeled for ambient air quality impacts during the highest-emissions year, at the project boundary and at locations within 30 km of the project. Ambient air quality impact analyses will be performed using the AERMOD dispersion model. Section 2 discusses project related emissions and modeled emission sources that will be input to AERMOD.

1.3. Pollutants of Concern

Both combustion emissions and fugitive dust emissions will be modeled in the air quality analysis. The stationary and fugitive emission sources at the Reno Creek ISR Project will produce particulate matter smaller than ten microns in size (PM_{10}) and particulate matter smaller than 2.5 microns in size ($PM_{2.5}$). Stationary and mobile sources will emit PM_{10}, $PM_{2.5}$, carbon monoxide (CO), sulfur dioxide (SO_2) and oxides of nitrogen (NO_x). For the AERMOD analysis, it is assumed that 75% of NO_x emissions will be converted to NO_2 for annual average impact modeling, and 80% of NO_x emissions will be converted to NO_2 for 1-hour average impact modeling (Ambient Ratio Method, ARM). Thus, five criteria pollutants (PM_{10}, $PM_{2.5}$, CO, SO_2 and NO_2) will be analyzed for compliance with the NAAQS. Four of these pollutants, PM_{10}, $PM_{2.5}$, SO_2 and NO_2 will be further analyzed for comparison with the PSD increments in Class II areas. The comparisons to the PSD Class II increments will be made for disclosure purposes only, intended to evaluate a threshold of concern for potential impacts, and do not represent a regulatory PSD increment comparison. The Reno Creek ISR Project does not qualify as a PSD source.

Both the NAAQS and the PSD analyses will be conducted using the AERMOD software. The modeling domain for AERMOD will extend 30 km in all directions from the center of the Reno Creek ISR Project. Modeled impacts within this domain will be compared to the NAAQS and Class II PSD increments. The nearest Class I area to Reno Creek is Wind Cave National Park, approximately 100 miles east of the project. The next closest is the Northern Cheyenne Indian Reservation, approximately 125 miles to the north. Since there are no Class I areas within 50 kilometers of the Reno Creek ISR Project, and the project does not qualify as a major source of any criteria pollutant or hazardous air pollutant (HAP), a Class I PSD increment analysis will not be conducted. Also because the nearest Class I area is 100 miles from the project, an AQRV analysis will not be conducted.

The principle form of HAP will be formaldehyde in diesel engine exhaust. For the Reno Creek ISR Project formaldehyde emissions will be inventoried but not modeled. Diesel engines emit from 2% to 5% as much formaldehyde per unit of energy input as natural gas fired engines (EPA 1995c). The latter are used extensively in the region for compressor stations, heaters, and other applications in the oil and gas industry. Appendix A shows maximum annual formaldehyde emissions of 1.84 tons at The Reno Creek ISR Project. This total is roughly equivalent to the annual emissions from a single, 1500-hp, natural gas fired compressor.

1.4. Regulatory Status

The Reno Creek ISR Project will be a non-categorical stationary source. Criteria pollutant emissions from the facility will be below the New Source Review major source threshold of 250 tons/year. Therefore, the facility will not be subject to PSD permitting regulations. The potential to emit HAPs will be less than 10 tons/year for any individual HAP, and less than 25 tons/year for all HAPs combined. Therefore, the facility will not be a major HAP source. Point source emissions of criteria pollutants from the facility will be less than the Title V source threshold of 100 tons per year. As a minor source of criteria pollutant emissions and HAPs, the Reno Creek ISR Project will be required to obtain an air quality construction permit from the Wyoming Department of Environmental Quality, Air Quality Division (AQD). The emissions inventory and modeling results generated in this study will be submitted to AQD as part of the air quality construction permit application.

2 EMISSION AND SOURCE DATA

2.1. Facility Processes and Emission Controls Affected

The nature of the proposed facility is to extract uranium oxide in solution from uranium bearing formations using in-situ recovery. The solution is processed at on-site facilities to recover yellow cake for transport to an off-site refining facility. Facility processes and emission controls planned for the Reno Creek ISR Project include the use of water and a chemical dust suppressant to control fugitive dust emissions from unpaved roads, a vacuum dryer to eliminate yellow cake dust generation, and standard diesel engine controls to minimize tailpipe emissions.

2.2. Emission Factors Used to Calculate Potential Emissions

The Reno Creek ISR Project will generate stationary source, fugitive dust and tailpipe emissions. In general, fugitive dust emissions from the Reno Creek ISR Project will include traffic on unpaved roads, drilling and earth moving activities, road maintenance, topsoil stripping and reclamation, and wind erosion on disturbed areas. Emission factors for these sources are provided in EPA's AP-42, Compilation of Air Pollutant Emission Factors as listed below (EPA 1995c):

- Unpaved roads — Chapter 13, Section 13.2.2
- Drilling and earth moving — Chapter 11, Section 11.9, Table 11.9-4
- Topsoil stripping and reclamation — Chapter 11, Section 11.9, Table 11.9-4
- Wind erosion — Chapter 11, Section 11.9, Table 11.9-4

In some cases fugitive $PM_{2.5}$ emission factors were not available in AP-42. For wind erosion, a $PM_{2.5}$/ PM_{10} ratio of 15% was applied to the respective PM_{10} emission factor. For unpaved road dust, a $PM_{2.5}$/ PM_{10} ratio of 10% was applied to the respective PM_{10} emission factor. These ratios follow recommendations in a study performed for the Western Regional Air Partnership (WRAP) by Midwest Research Institute (MRI 2006).

Published fugitive dust emission factors are modified by specific control measures. EPA guidance provided in AP-42 allows for natural mitigation of fugitive dust emissions based on days of precipitation per year (page 13.2.2-7, Equation 2). For the Reno Creek ISR Project area this value was determined to average 87 days per year, based on three years of meteorological monitoring. A precipitation day is defined in Section

13.2 of AP-42 as any day measuring precipitation of 0.01” or more. The emission factor correction for precipitation days applies to all unpaved roads. Guidance also typically allows for 50% control efficiency with the use of water trucks, and 85% for the application of chemical dust suppressant on unpaved roads (TRC 2005).

Gasoline and diesel equipment tailpipe emissions were calculated using emission factors from several sources. THC (total hydrocarbon), SO_2, CO_2 and aldehyde emission factors were taken from AP-42 Chapter 3, Table 3.3-1. NO_x, CO, and PM_{10} emission factors for diesel engines are based on EPA standards for various engine tier ratings (EPA 1998). Drill rigs were assumed to have Tier 1 engines, while all other mobile diesel equipment was assumed to conform to Tier 3 standards. The THC emission factor for Tier 1 diesel engines was used for drill rigs, in place of AP-42. $PM_{2.5}$ emissions from equipment tailpipes were assumed to be 97% of PM_{10} emissions (EPA 2004a). Emission factors for propane fired heaters and emergency generators were obtained from AP-42, Table 1.5-1 (EPA 1995c). Conversion factors for greenhouse gas emissions associated with electricity consumption, stated in terms of carbon dioxide equivalent (CO_2e), were obtained from EPA’s Clean Energy website (EPA 2013a).

In most cases, equipment activity levels used to calculate emissions were based on available hours and typical load factors. Load factors for pickup trucks, passenger vehicles, and certain support equipment were assumed to be 25%, due to low throttle settings and/or intermittent operation. The load factor for the heavy drill rigs (for deep disposal wells) was assumed to be 60%, due to higher loading and near-continuous operation. Most other load factors, including those for truck-mounted drill rigs, were assumed to be 40%. In its Nonroad Model, EPA uses 43% for diesel powered drill rigs (EPA, 2010). For the Jonah Infill Drilling Project EIS, a load factor of 42% was used for drill rigs (TRC 2005). Because the Reno Creek ISR Project drill holes will be shallow relative to conventional oil and gas operations, a 40% load factor is considered to be representative.

2.3. Schedule of Fugitive Particulate Emissions

The potential fugitive emission rates from the Reno Creek ISR Project are summarized in Table 2-1. Detailed emission calculations for the proposed project have been provided in Appendix A. The basis for timing and the source apportionment of equipment-generated fugitive emissions are presented in Appendix B. Year 6 will be modeled since it shows the highest total for fugitive dust emissions, at 156 tons of PM_{10} (Table 2-1). During year 6 three phases are expected to be active, including well field construction, operation and aquifer restoration. Note that year "-1" in Table 2-1 corresponds to pre-license construction activities.

Table 2-1: Potential Fugitive Emissions by Year (tons/year)

Year	Active Phases	PM_{10}	$PM_{2.5}$
-1	Construction	24.47	2.63
1	Construction, Operation	109.07	11.09
2	Construction, Operation	130.82	13.31
3	Construction, Operation	154.77	15.71
4	Construction, Operation, Restoration	155.15	15.77
5	Construction, Operation, Restoration	155.54	15.82
6	Construction, Operation, Restoration	155.92	15.88
7	Construction, Operation, Restoration, Decomm	141.73	14.47
8	Construction, Operation, Restoration, Decomm	136.96	13.99
9	Construction, Operation, Restoration, Decomm	131.54	13.42
10	Operation, Restoration, Decomm	58.86	6.08
11-15	Operation, Restoration, Decomm	< 60	< 10

2.4. Schedule of Tailpipe Emissions

Table 2-2 summarizes potential combustion emissions from equipment tailpipes. As with fugitive emissions, the highest annual tailpipe emissions of PM_{10}, $PM_{2.5}$, CO, SO_2 and NO_x are projected for years 3 through 6. NO_x emissions are projected to be 43 tons in year 6. Since point source emissions will be generally constant from year to year, total gaseous emissions are also projected to be highest in years 3 through 6. Detailed emission calculations for the proposed project have been provided in Appendix A. The basis for timing of tailpipe emissions is presented in Appendix B. Year 6 will be modeled since it shares the highest total emissions and is consistent with the year of highest fugitive dust emissions. Again, year "-1" in Table 2-2 corresponds to pre-license construction activities.

Table 2-2: Potential Tailpipe Emissions by Year (tons)

Year	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
THC	1.06	18.00	22.22	26.48	26.48	26.48	26.48	23.91	23.06	22.20	9.37	9.37	6.40	6.40	6.40	3.61
NO_x	2.46	37.02	41.92	43.28	43.28	43.28	43.28	38.38	36.75	35.11	10.61	10.61	7.43	7.43	7.43	5.63
CO	2.29	35.86	42.37	41.58	41.58	41.58	41.58	36.18	34.38	32.58	5.59	5.59	3.84	3.84	3.84	2.58
SO_2	0.50	5.73	6.48	6.73	6.73	6.73	6.73	5.91	5.63	5.36	1.25	1.25	0.86	0.86	0.86	0.64
CO_2	296	3,618	4,161	4,436	4,436	4,436	4,436	3,917	3,745	3,572	979	979	672	672	672	456
PM_{10}	0.14	2.18	2.46	2.54	2.54	2.54	2.54	2.26	2.17	2.08	0.68	0.68	0.48	0.48	0.48	0.37
$PM_{2.5}$	0.13	2.12	2.38	2.47	2.47	2.47	2.47	2.20	2.11	2.02	0.66	0.66	0.46	0.46	0.46	0.36
HAP	0.12	1.48	1.71	1.83	1.83	1.83	1.83	1.62	1.55	1.48	0.41	0.41	0.28	0.28	0.28	0.19

For NO_2 modeling, AERMOD will be configured to use the Tier 2 ARM method. Under this regulatory default option, NO_x emissions are multiplied by 0.75 to estimate annual NO_2 impacts (WDEQ 2014), and by 0.80 to estimate 1-hour NO_2 impacts (EPA 2011). NO_2 is the regulated pollutant, with associated NAAQS and PSD increments, per Section 6.2.3 of EPA's Guideline on Air Quality Models (40 CFR 51 Appendix W).

2.5. Stationary Equipment Emissions

Table 2-3 summarizes stationary equipment emissions, all from LPG combustion. With the exception of facilities construction, these emissions are assumed to be constant from year to year.

Table 2-3: Potential Stationary Equipment Emissions per Year (Tons)

Pollutant	Vacuum Dryers	Main Heater	Furnace	Radiant Heaters	TOTAL
NO_x	0.67	0.37	0.03	0.30	1.39
CO	0.39	0.22	0.02	0.18	0.80
$PM_{10}/PM_{2.5}$	0.04	0.02	0.00	0.02	0.07
SO_2	0.00	0.00	0.00	0.00	0.00
TOC	0.05	0.03	0.00	0.02	0.11
VOC	0.00	0.00	0.00	0.00	0.00
CO_2	648.22	359.02	31.41	293.20	1332
HAP	0.00	0.00	0.00	0.00	0.00

2.6. Source Parameters

The modeled emission sources in AERMOD will include area sources and point sources. Area sources include disturbed acreage, well fields, reclamation areas, primary project roads, the access road to the project, and plant facilities. AERMOD release heights for area sources of fugitive dust will follow recent EPA guidance (EPA 2012) assuming average vehicle heights are 3.0 meters for project roads and well fields, and 2.0 meters for the access road. Based on this guidance, release heights for 3-meter and 2-meter vehicle heights are 2.55 and 1.70 meters, respectively. Corresponding sigma-Z values are 2.37 and 1.58 meters, respectively. For those sources dominated by wind erosion (e.g. facilities areas), release heights are assumed to be 1 foot (0.3 meters) and sigma-Z is assumed to be zero. Release heights for equipment tailpipe emissions are assumed to be 1 meter, with a sigma-Z of zero.

Appendix B details the apportionment of equipment and fugitive emissions among these sources. Based on this apportionment process, Table 2-4 summarizes area source emissions (tons/year) for the modeled year. For particulate sources, these emissions include both fugitive and tailpipe emissions.

Table 2-4: Year 6 Area Source Emission Totals (tons)

Area Source Category	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO
Reclaimed Well Fields	0.00	0.00	0.00	0.00	0.00
Constructed Well Fields	36.52	114.89	13.32	6.21	37.63
Facility	1.09	0.08	0.07	0.07	0.23
Deep Injection Wells	0.00	0.00	0.00	0.00	0.00
Project Roads	5.36	35.08	3.81	0.40	3.49
Access Road	0.32	2.62	0.28	0.04	0.23
Disturbed Areas	0.00	5.79	0.87	0.00	0.00
TOTAL TONS EMISSIONS	**43.28**	**158.46**	**18.35**	**6.73**	**41.58**

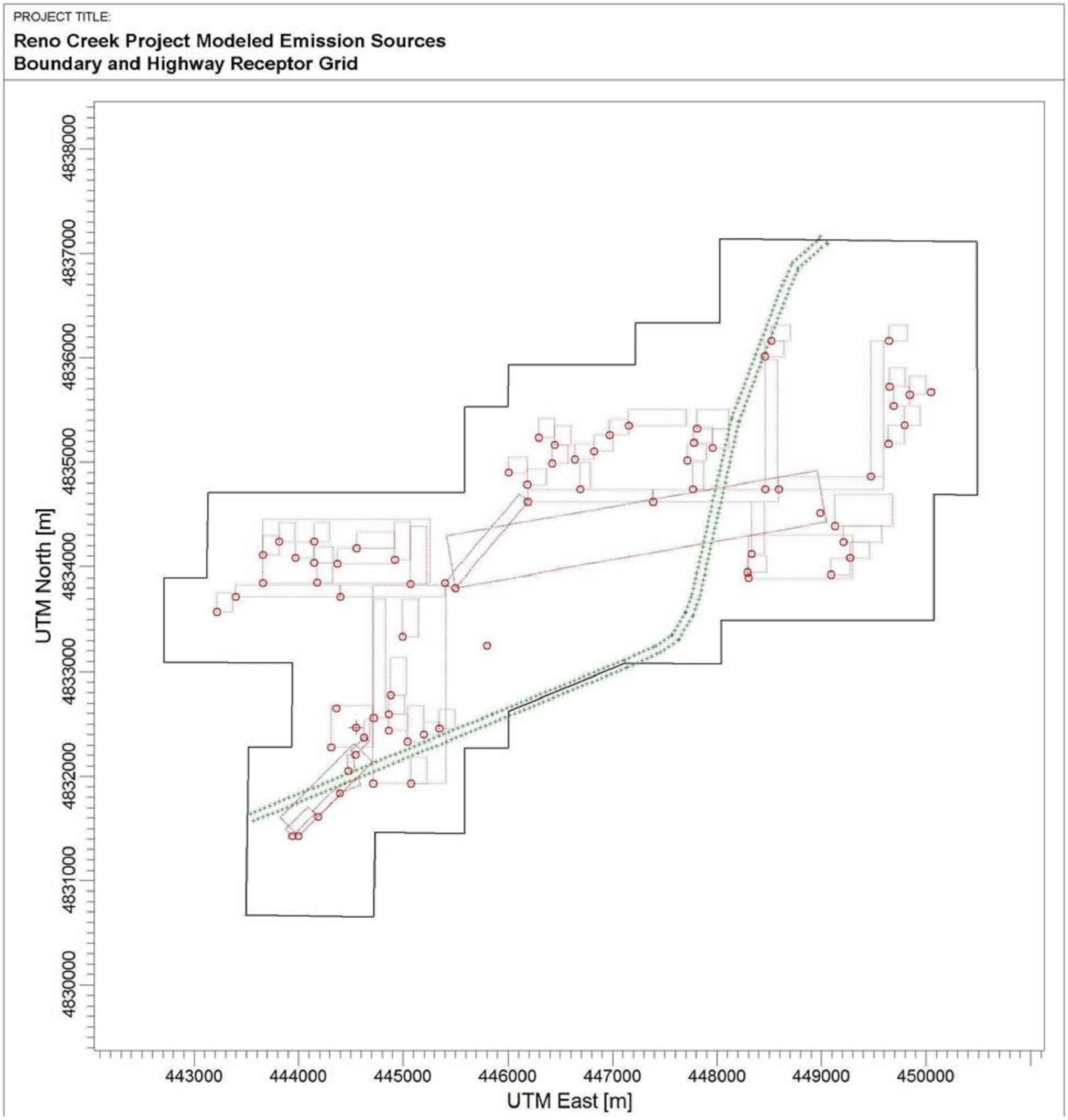
Table 2-5 summarizes point source emission rates (tons/year) and associated stack parameters for the modeled year. All modeled point sources have a vertical discharge.

Table 2-5: Point Source Emission Rates and Stack Parameters

Point Sources	Dryer	Main Heater	Furnace	Radiant Heaters
No. of Units	2	1	1	7
MMBtu/hr per Unit	1.3	1.2	0.105	0.14
Stack Diameter (meters)	0.229	0.203	0.076	0.127
Stack Height (meters)	18	12	12	3
Temp °K	366	344	344	344
Flow Rate (m3/sec)	0.207	0.179	0.016	0.021
Velocity (m/sec)	5.04	5.53	3.44	1.65
Emission Rate PM_{10} (g/sec)	2.51E-03	1.16E-03	1.01E-04	9.45E-04
Emission Rate $PM_{2.5}$ (g/sec)	2.51E-03	1.16E-03	1.01E-04	9.45E-04
Emission Rate NO_x (g/sec)	4.66E-02	2.15E-02	1.88E-03	1.76E-02
Emission Rate SO_2 (g/sec)	5.73E-05	2.65E-05	2.32E-06	2.16E-05
Emission Rate CO (g/sec)	2.69E-02	1.24E-02	1.09E-03	1.01E-02

Figure 2-1 shows the locations and orientations of all modeled point and area sources for the Reno Creek ISR Project. Modeled point sources reside at the central processing plant in the southwestern portion of the project area. Area sources were digitized as rectangles to reduce model complexity and execution time. Figure 2-2 identifies the modeled area sources by the prefix identifying a particular area source group. Area source group WF7, for example, is comprised of three rectangles modeled in AERMOD as WF7_1, WF7_2, and WF7_3. Also shown in Figure 2-1 is Highway 387, which bisects the project area.

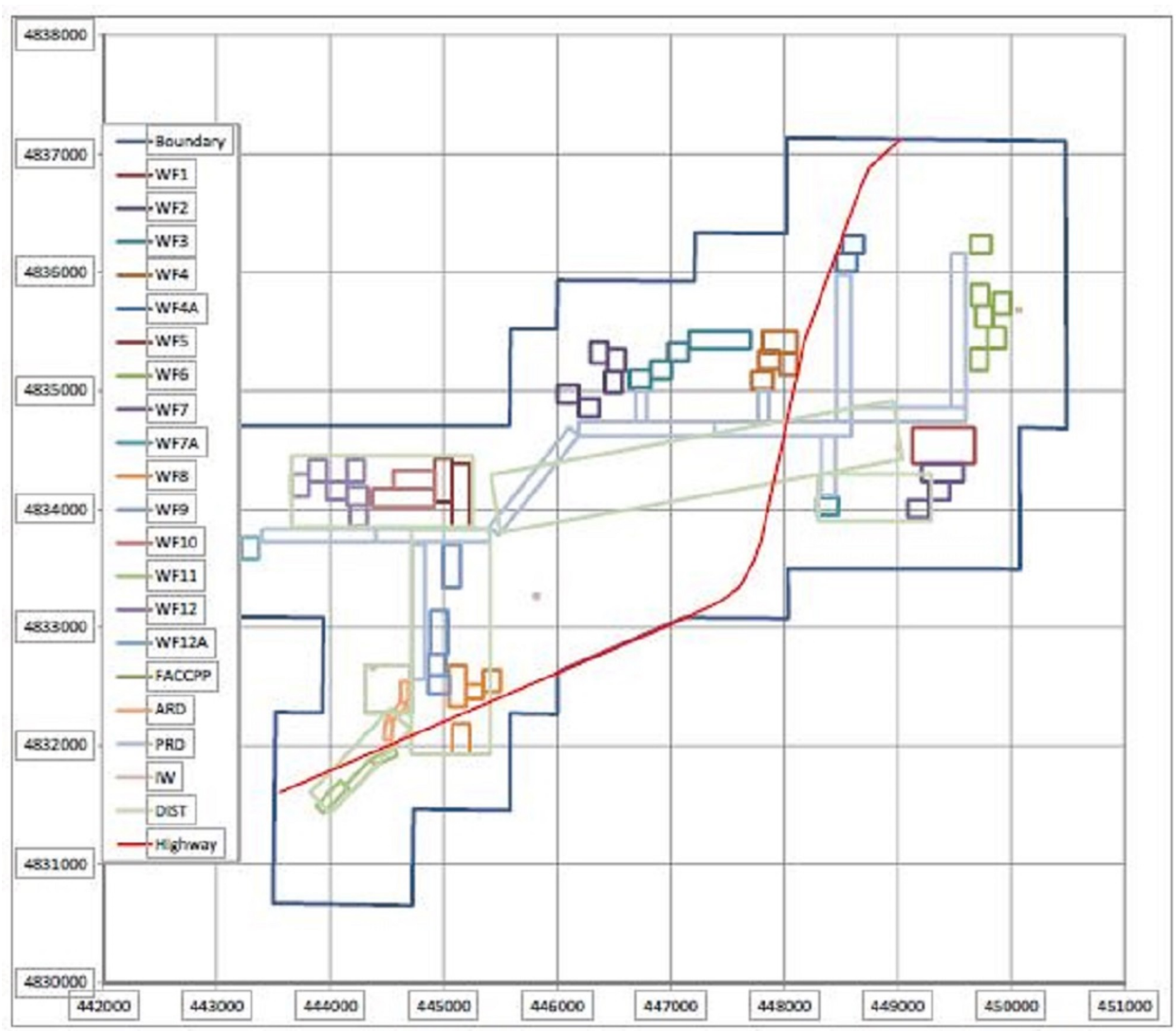
Figure 2-1: Reno Creek ISR Project Emission Source Locations



Source emission rates will be assumed to be uniform during the time each source is active, but variable throughout the modeled year based on equipment operation schedules. For point sources, average emission rates in tons/year will be converted to lbs./hour for the hours each source is operated. For area sources, average emission rates of tons/year will be converted to lbs./hour/ft^2 for the hours each source is active and the area over which the source emissions are distributed.

Table B-2 in Appendix B shows the assumed timing of emissions for AERMOD, which allows the flexibility of assigning hours per day, days per week, and months per year to each type of emission source.

Figure 2-2: Reno Creek ISR Project Area Emission Source Groups



2.7. Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions will be inventoried but not modeled. There are no NAAQS associated with GHG concentrations in the atmosphere. The significant sources of GHG associated with the Reno Creek ISR Project are combustion emissions, process emissions, and equivalent emissions from electricity consumption in the form of CO_2. Combustion emissions from equipment engine exhaust and gas-powered, stationary equipment are estimated using emission factors from AP-42. Appendix A presents the estimated CO_2 totals from combustion, with a maximum of 5,768 tons per year (tpy). Process emissions are estimated based on process assumptions and production rates. Appendix A also presents the estimated CO_2 from the uranium recovery process, with a maximum of 755 tpy. Total direct, project-related GHG emissions are projected to be 6,523 tpy. The principal uses of electricity for the Reno Creek ISR Project are the central processing plant and the well field pumps. Appendix A also presents estimated indirect GHG emissions, or CO_2e, from electricity consumption, with a maximum of 39,422 tpy.

Minor amounts of methane and nitrous oxides, both of which are considered greenhouse gases, will be emitted from propane combustion. The GHG potential or CO_2 equivalent of these emissions is a fraction of one percent of the estimated total CO_2 emissions from the Reno Creek ISR Project. Therefore, the above figures for CO_2 emissions are representative of GHG emissions, yielding a maximum combined GHG emissions of 45,945 tpy.

3 AMBIENT AIR QUALITY IMPACT MODELING METHODOLOGY

3.1. Model Selection and Justification

The proposed facility includes multiple sources, including point sources and area sources that have a wide range of parameters that are too complex to merge into a single emission point. Therefore, criteria pollutant emissions will be modeled with the American Meteorological Society (AMS) and EPA Regulatory model (AERMOD) Version 13350 to evaluate air dispersion from multiple sources. AERMOD was chosen over the Industrial Source Complex (ISC3) model since it has been promulgated by the EPA as the preferred air dispersion model in the Agency's "Guideline on Air Quality Models" (40 CFR 51 Appendix W). AERMOD officially replaced the ISC3 air dispersion model effective December 9, 2006 (one year after rule promulgation) as published in the Federal Register on November 9, 2005. The Lakes Environmental software will be used to implement the AERMOD model (Lakes AERMOD View Version 8.5).

3.2. Model Options

The AERMOD regulatory settings will be left in the default settings with one exception. For modeling short-term PM_{10} impacts, the dry depletion option will be evaluated and compared to the default setting (no dry depletion). Section 3.9 below discusses the basis for modeling fugitive dust emissions using dry depletion. Table 3-1 summarizes the non-default setting used for AERMOD.

Table 3-1: Non-Default Settings in AERMOD

NON-DEFAULT OPTION	PURPOSE	MODELING SCENARIO
Dry Depletion	Account for particle deposition	Refined PM_{10} 24-hr analysis only

The US EPA 1-hour NO_2 NAAQS option in AERMOD View will be exercised to output both the maximum and the 98th percentile 1-hour NO_2 concentrations for each receptor and modeled year. The output will also include the 3-year average of the 98th percentile concentrations, matching the format of the NAAQS standard.

3.3. Averaging Periods

For the purpose of this modeling analysis, the annual and 24-hour averaging periods will be utilized for PM_{10} and $PM_{2.5}$ modeling. The 8-hour and 1-hour averaging periods will be used for CO modeling. The annual and 1-hour averaging periods will be used for

NO_2 while the annual, 24-hour, 3-hour and 1-hour averaging periods will be used for SO_2 modeling. These averaging periods are consistent with the NAAQS primary and secondary standards and the PSD increments. All short-term model results will be presented in the format of the appropriate NAAQS standard. These include: (a) 4th high 24-hour PM_{10} value over three years, (b) 3-year average of yearly 98th percentile, or 8th high 24-hour $PM_{2.5}$ values, (c) 3-year average of yearly 98th percentile, or 8th high 1-hour NO_2 values, (d) 3-year average of yearly 99th percentile, or 4th high 1-hour SO_2 values.

3.4. Building Downwash

Based on the proposed facility design, buildings and/or structures will cause negligible influences on normal atmospheric flow in the immediate vicinity of the emission sources. Therefore building downwash will not be modeled.

3.5. Elevation Data

The terrain surrounding the Reno Creek ISR Project is relatively flat. However, the terrain encompassing model receptors includes hills and valleys. Therefore, the Elevated Terrain mode will be used. Receptor elevations will be entered based on elevations obtained from USGS digital elevation model (DEM) files.

3.6. Receptor Network

Figures 3-1, 3-2 and 3-3 display the AERMOD receptor placement. The model domain includes a total of 5,964 receptors, including fenceline, fine grid, intermediate grid and coarse grid receptors. The receptor grid extends in all directions from the project site to at least 30 km from the project center. Figure 3-3 shows the entire modeling domain for the Reno Creek ISR Project. The receptor network is described below.

3.6.1. Fenceline Receptors

Discrete receptors will be placed along the project boundary at least every 50 meters in linear fenceline distance, with a receptor placed at each boundary corner. Areas inside the project boundary will not be analyzed, except for the segment of Highway 387 that bisects the project area.

A refined analysis of PM_{10} and NO_2 impacts from the project will be conducted at fenceline receptors spaced 50 meters apart and offset 50 meters from the highway centerline along each side of the highway (Figure 2-1). These fenceline receptors define a corridor that slightly exceeds the nominal, 250-foot width of the highway right-of-way. Therefore, they represent a conservative boundary for ambient air along the highway.

3.6.2. Fine Grid

A fine grid of receptors will be placed at 100-meter spacing within a 1,000-meter-wide corridor along the project boundary (Figure 3-1). The placement of these fine-grid receptors is intended to identify the highest 24-hour PM_{10} and 1-hour NO_2 impacts, which would be expected to occur either along the fenceline or within this 1,000-meter-wide corridor.

3.6.3. Intermediate Grid

In addition to the fine grid, an intermediate grid of receptors will be placed at 500-meter spacing, from the outer edge of the fine grid outward to a distance 10 kilometers (km) in all directions from the project center. A second intermediate grid will be placed at 1-km spacing, from the outer edge of the first intermediate grid outward in all directions to a distance 15 km from the project center (Figure 3-2).

3.6.4. Coarse Grid

A coarse grid will be placed at 5-km spacing, from the outer edge of the second intermediate grid outward in all directions to a distance of 30 km from the project center (Figure 3-3).

Figure 3-1: Reno Creek ISR Project AERMOD Boundary and Fine Grid Receptors

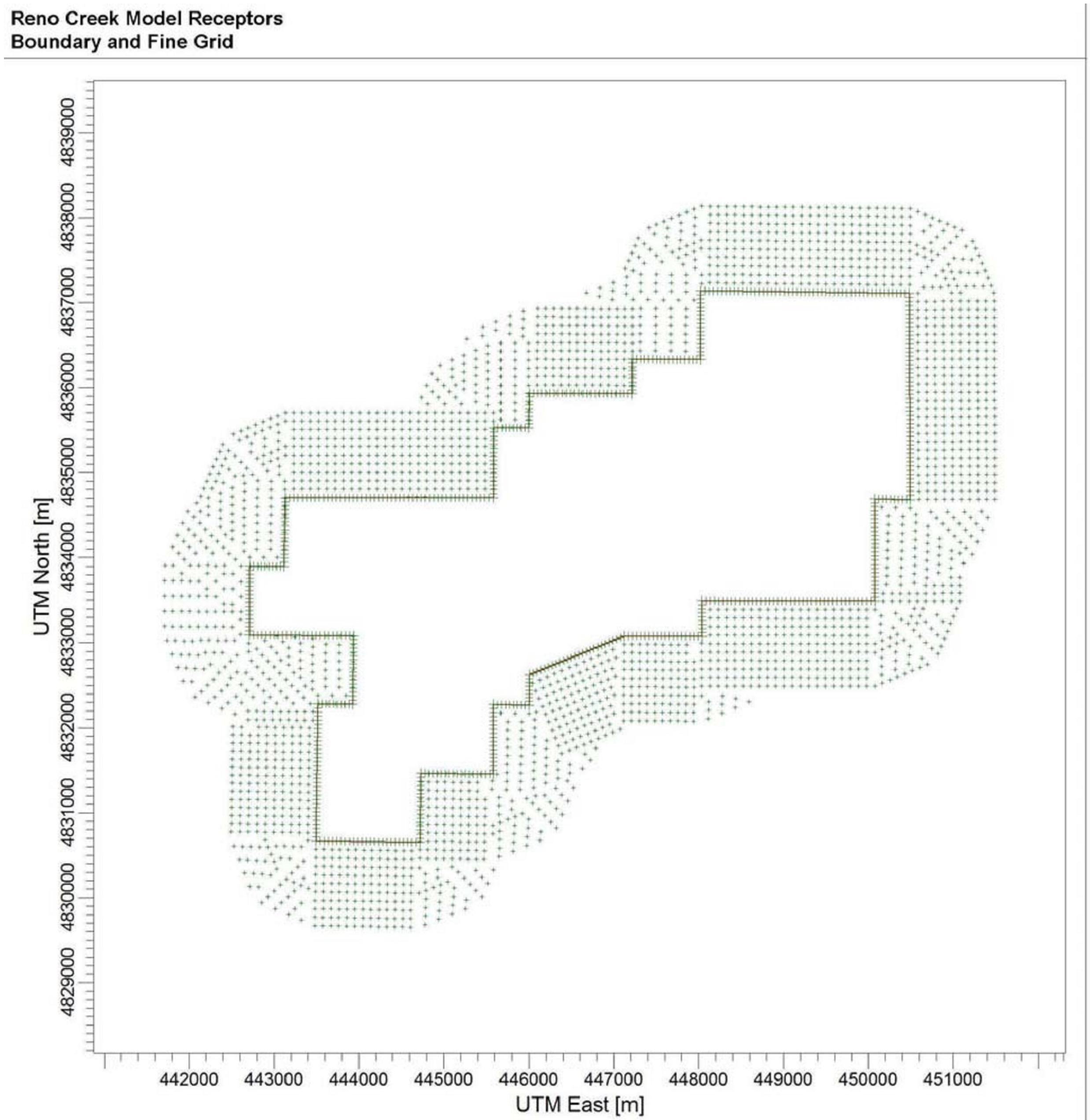


Figure 3-2: Reno Creek ISR Project AERMOD Sources and Close-in Receptors

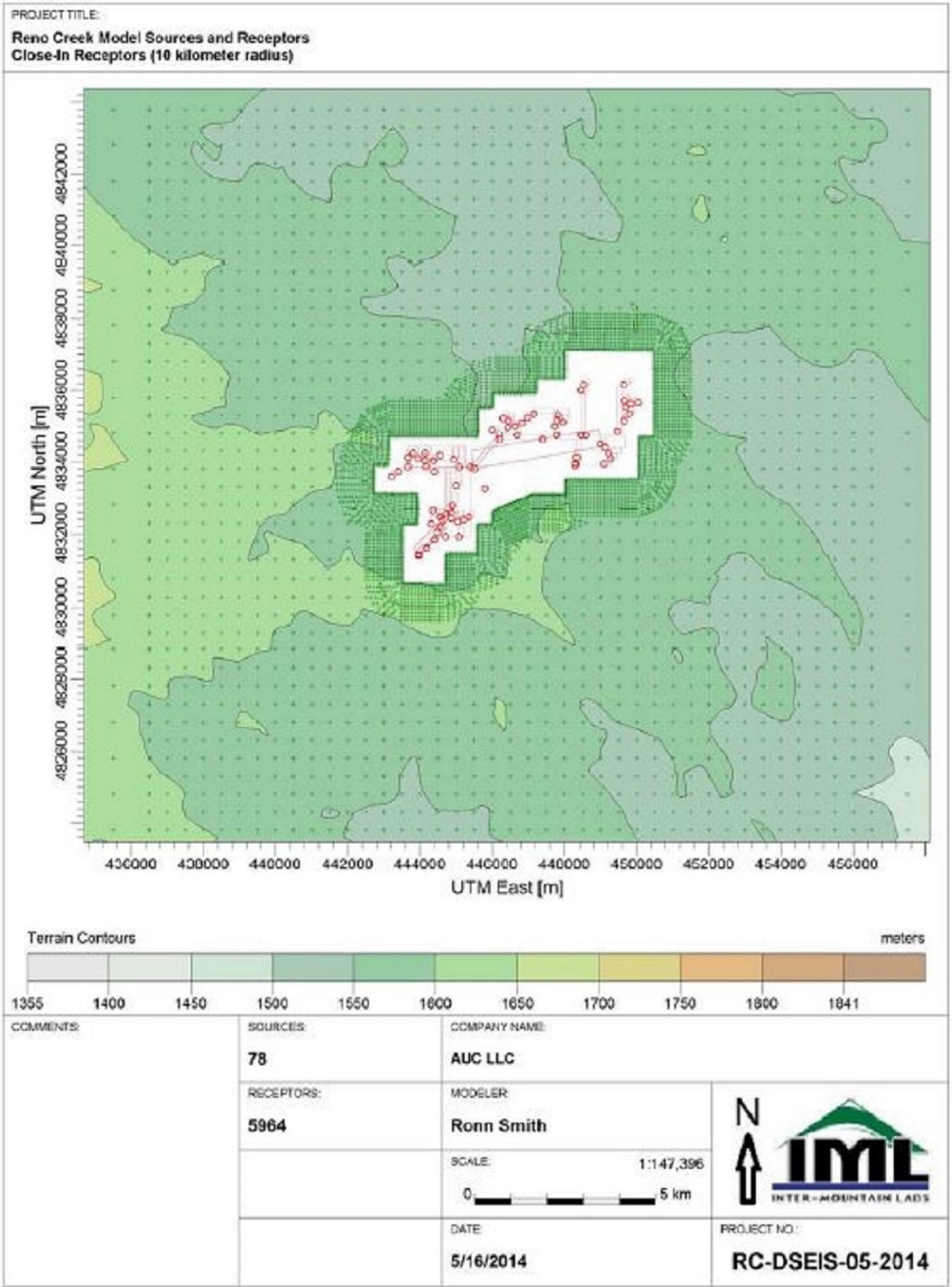
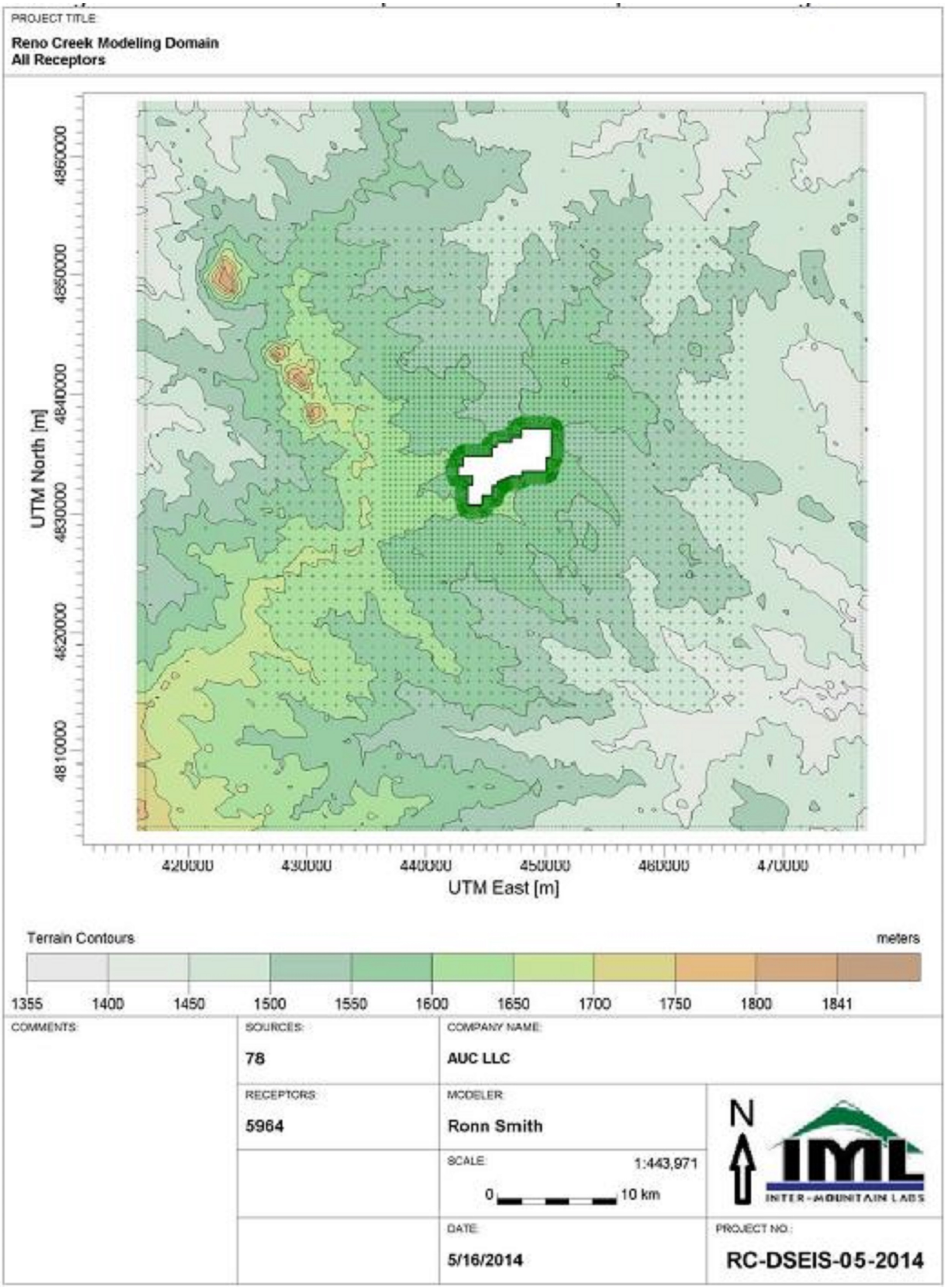


Figure 3-3: Reno Creek ISR Project AERMOD All Receptors and Modeling Domain



3.7. Meteorological Data

The baseline meteorological data collected from the Reno Creek ISR Project site represents three years (November 1, 2010 through October 31, 2013). EPA recommends that AERMOD be run with a minimum of three years of meteorological data. Therefore the model will use all three years of hourly data collected on-site for surface meteorology. The Reno Creek meteorological station meets EPA's Meteorological Monitoring Guidance for Regulatory Modeling Applications (EPA 2000).

No upper air data are available at the Reno Creek site. The upper air data will be obtained from the nearest available (and most representative) source, the Rapid City, South Dakota National Weather Service upper air site. This data set will be processed using the AERMET program. The surface characteristics (albedo, Bowen ratio and roughness) representative of the land type surrounding the meteorological station location are required by the AERMET data processing procedures. AERSURFACE will be used to estimate the surface characteristics at the site based on land use/type files generated by the USGS. The AERMET program will combine the on-site meteorological data with the upper air data to create the AERMOD meteorological data files.

3.8. Background Concentrations

For this ambient air quality impact analysis, only the project impacts will be modeled. Background concentrations for each pollutant and averaging interval will be added to the modeled impacts to estimate maximum, total ambient concentrations. The data sources for assumed background concentrations are as follows:

PM_{10} – Antelope Coal Mine background monitor (AQD)
$PM_{2.5}$ – Newcastle Refining air quality permit modeling (AQD)
NO_2 – Newcastle Refining air quality permit modeling (AQD)
SO_2 – Newcastle Refining air quality permit modeling (AQD)
CO – Newcastle Refining air quality permit modeling (AQD)

Table 3-2 lists the background concentrations to be used for this modeling analysis. The Antelope Mine PM_{10} monitor, with multiple years of hourly data collected, is located approximately 20 miles southeast of the Reno Creek ISR Project. The background concentrations for PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO were provided by AQD per agency agreement (NRC 2014). These concentrations were used in modeling for a recent project near Newcastle and are deemed representative of the southern PRB.

Table 3-2: Assumed Background Concentrations for Modeling Analysis

Pollutant	Averaging Interval and Statistic	Back-ground ($\mu g/m^3$)	NAAQS Limit ($\mu g/m^3$)
PM_{10}	Annual Average	15	--
	4th High 24-Hr Maximum	40	150
$PM_{2.5}$	Annual Average	3.4	12
	24-Hr High	8	35
NO_2	Annual Average	6	100
	98th Percentile of Daily 1-Hr Highs	21	187
SO_2	Annual Average	1.3	--
	24-Hr	16.3	--
	3-Hr	124.7	1300
	99th Percentile of Daily 1-Hr Highs	43.2	200
CO	8-Hr High	378	10000
	1-Hr High	680	40000

3.9. Dry Depletion Option

Fugitive dust emissions from mobile equipment and wind erosion are the principal contributors to near-field PM_{10} impacts at the Reno Creek ISR Project. EPA studies have established the tendency for ground-level, fugitive dust emissions to partially settle out within a short distance of the emission source (EPA 1994a) (EPA 1995a). This deposition includes a portion of the PM_{10} fraction (Countess 2001). Conservation of mass requires that deposition be accompanied by plume depletion. This is the purpose of the dry depletion option in AERMOD and its predecessor model, ISC3 (EPA 1995b). Dry depletion accounts for the partial settling and deposition of PM_{10} particles as the dust plume disperses away from the source. The mechanisms for particle deposition and settling include gravity, diffusion, impaction and others. Failure to account for deposition and depletion can lead dispersion models such as AERMOD to significantly over-predict maximum 24-hour PM_{10} concentrations.

Several studies have cited the tendency of ISC3, the predecessor to AERMOD, to over-predict maximum 24-hour PM_{10} concentrations by a factor of four (Cliff 2011, Sullivan 2006, Pace 2005). Moreover, a study by McVehil-Monnett demonstrated AERMOD to be equivalent to, or more conservative than ISC3 in predicting short-term impacts from fugitive dust emissions (MMA 2011). EPA scientist Thompson Pace recently proposed a conceptual model “to approximate the dust removal near the source that is not accounted for in either the current emissions inventories or commonly used regional scale air quality models” (Pace 2005).

EPA guidance emphasizes the need to coordinate the use of deposition modeling options with the appropriate reviewing authority (EPA 2005). For the Reno Creek ISR Project, the AERMOD dry depletion option will not be used in the initial modeling analysis. The model execution times with dry depletion enabled are an order of magnitude longer, making it impractical to use for the entire modeling domain. The dry deposition option will, however, be considered in a refined analysis of 24-hour PM_{10} impacts. Modeling only those receptors from the initial modeling analysis which show the top 50 concentrations (whether or not they exceed the NAAQS) will reduce total execution time with the dry depletion option to a reasonable level. This strategy is influenced by guidance from the New Mexico Air Quality Bureau (New Mexico 2006): “Because of the length of time to run a model with plume depletion, the Bureau recommends only applying plume depletion to receptors that are modeled to be above standards when the model is run without plume depletion.”

3.9.1. Rationale for Using Dry Depletion in Refined PM_{10} Analysis

The Reno Creek ISR Project meets EPA’s dry deposition criteria of multiple, quantifiable sources of fugitive emissions where a refined modeling analysis is being conducted and deposition is likely to occur (Trinity 2007). While these criteria were originally associated with ISC3, EPA guidance for AERMOD is similar (EPA 2005). As with most (if not all) ISR projects, fugitive dust will be the dominant pollutant at Reno Creek. Historically, short-term modeling of PM_{10} impacts at receptors close to fugitive dust sources has been shown to over-predict ambient concentrations (Cliffs 2011) (MMA 2011). The results of a study posted by EPA “suggest that rapid deposition of PM_{10} particles, and the relatively long residence time of the optical plume associated with small particles (<2μm), may have led to overestimates of airborne particle mass in plumes” (Fitz 2002).

The likelihood of deposition of particles in the PM_{10} size range is large for this application. In addition to gravity settling, high modeled concentrations at receptors within a few hundred meters of the fugitive emission sources suggest the likelihood of high concentration gradients. These gradients are expected to produce significant diffusion-based settling. The Fugitive Dust Model (FDM) was developed two decades ago to compute concentration and deposition impacts from fugitive dust sources. A key feature of FDM was the improved gradient-transfer deposition algorithm, which is significant for particles in the PM_{10} size class (EPA 1992).

3.9.2. Precedent for Using Dry Depletion in Refined PM_{10} Analysis

Precedent has been established by state and federal agencies for using the dry depletion option in AERMOD to model short-term impacts from fugitive dust emissions. For example, a coal lease application in Utah triggered PM_{10} modeling that included a refined analysis using deposition and plume depletion (BLM 2010). Page 9 of Appendix K in the Alton Coal Lease DEIS states, "deposition was only considered for assessing the final PM_{10} modeled ambient air impacts." Page 10 states, "the primary pollutants of concern are fugitive dust."

The Colorado Department of Public Health and Environment (CDPHE) uses dry depletion to model PM_{10} impacts from fugitive dust sources at mining facilities seeking air quality construction permits (Majano 2013). Recent projects for which this option was used include the Lafarge Gypsum Ranch Pit, Oxbow Mining's Elk Creek Mine, and Bowie Resources' Bowie N.2 Mine. The Wyoming Department of Environmental Quality indicated that it would accept the use of plume depletion algorithms in AERMOD as long as an applicant justifies the inputs, including particle size, particle density and mass fraction (Nall 2013).

A large landfill project in eastern Oregon also modeled fugitive dust impacts using dry depletion (Sullivan 2006). The primary emission source at this facility is haul road traffic transporting waste material. The Oregon Department of Environmental Quality worked with the landfill owners to refine both the emissions inventory and the modeling protocol. The document lists plume depletion as one of the options implemented, and discusses the importance of considering PM_{10} deposition and plume depletion when modeling fugitive dust.

EPA cited dry deposition in a study conducted using ISC3 at a Wyoming surface coal mine (EPA 1995b). "In order to appropriately model the particulate emission scenarios, the depletion of dispersed particles from the plume due to gravitational settling and other dry deposition factors were considered."

A recent modeling analysis was triggered by high fugitive dust impacts in the Salt River area of Arizona. Maricopa County was reclassified as a serious PM_{10} nonattainment area on June 10, 1996. The primary sources of particulate pollution in this area are “fugitive dust from construction sites, agricultural fields, unpaved parking lots and roads, disturbed vacant lots and paved roads” (Maricopa 2006). Cited among the “general characteristics that make AERMOD suitable for application in the Salt River Study area” is the claim that “gravitational settling and dry deposition are handled well.”

3.9.3. Input Parameters for Dry Depletion Option

AERMOD provides two methods for specifying particle characteristics under the dry depletion option. Method 1, used for this analysis, requires the user to input particle size distribution and particle density. The latter, not to be confused with bulk density, is commonly cited in the literature as 2.65 g/cm^3 for soil particles. The Environmental Science Division of Argonne National Lab states, “A typical value of 2.65 g/cm^3 has been suggested to characterize the soil particle density of a general mineral soil (Freeze and Cherry 1979). Aluminosilicate clay minerals have particle density variations in the same range” (ANL 2013). A study of fugitive dust from unpaved road surfaces also cites 2.65 g/cm^3 for soil particle density (Watson 1996).

The PM_{10} particle size distribution was obtained from the modeling protocol for a mine in Arizona (Rosemont 2009). The modelers for the Rosemont project acquired this distribution from AP-42 Section 13.2.4 and applied it to fugitive dust emissions from haul roads. Because Section 13.2.4 applies to aggregate handling and storage piles, another source was consulted to validate the use of this particle size distribution for haul road dust. A study by Watson, Chow and Pace referenced in a New Jersey Department of Environmental Protection report (NJDEP 2005) found that 52.3% of the particulate from road and soil dust is less than 10 µm in diameter. Of this particulate 10.7% was found to be smaller than 2.5 µm in diameter and the remaining 41.6% fell between 10 and 2.5 µm. Assuming that fugitive dust particle sizes follow a lognormal distribution (EPA 2013b), these two data points were transformed into a multi-point particle size distribution for comparison to the original particle size distribution. The geometric mass mean diameter for the original distribution is 6.47 µm, while the mean diameter for the lognormal distribution is 5.76 µm. Since these values are very similar, the Rosemont PM_{10} size distribution will be used for AERMOD dry deposition modeling (Table 3-3).

Table 3-3: Assumed PM_{10} Particle Size Distribution for Dry Depletion Option

Particle Size (µm)	Fraction
2.2	0.069
3.17	0.128
6.1	0.385
7.82	0.224
9.32	0.194

4 APPLICABLE REGULATORY LIMITS FOR CITERIA POLLUTANTS

4.1. Methodology for Evaluation of Compliance with Standards

The modeled concentration of the five criteria pollutants will be compared to the National Ambient Air Quality Standards. Predicted PM_{10}, $PM_{2.5}$, SO_2, and NO_2 concentrations will also be compared to the allowable Prevention of Significant Deterioration (PSD) increments for Class II airsheds. The Reno Creek ISR Project is not subject to a regulatory PSD increment analysis since it is not a major emission source. The PSD increments and modeled concentrations are provided for disclosure purposes only.

4.2. NAAQS and PSD Increments

The applicable standards and associated averaging intervals to be used in the modeling analysis are summarized in Table 4-1. Primary standards provide public health protection. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. PSD increments protect air quality in Class I and Class II areas from significant deterioration.

The purpose of PSD increments is to protect public health and welfare, and to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value. The goal of this program is to prevent significant deterioration of air quality in areas that meet the NAAQS. Areas in the U.S. have been classified in two categories for the purpose of this program. Class I areas include national wilderness areas, parks and memorial parks of a certain size, and international parks. Class II areas include most of the remaining parts of the country.

Table 4-1: National Ambient Air Quality Standards (μg/m^3)

Criteria Pollutant	Averaging Time	Primary NAAQS	Secondary NAAQS	PSD Class I Increments	PSD Class II Increments
Nitrogen Dioxide	Annual	100	100	2.5	25
	1-hour	187	---	---	---
PM_{10}	24-hour	150	150	8	30
	Annual	---	---	4	17
$PM_{2.5}$	24-hour	35	35	2	9
	Annual	12	15	1	4
SO_2	1-hour	200	---	---	---
	3-hour	---	1,300	25	512
	24-hour	---	---	5	91
	Annual	---	---	2	20
CO	1-hour	40,000	---	---	---
	8-hour	10,000	---	---	---

4.3. Presentation of Modeling Results

The purpose of the dispersion modeling outlined in this protocol is to predict ambient air quality impacts from emissions at the Reno Creek ISR Project. These predictions will be compared to relevant NAAQS and PSD increments in the Class II area surrounding the project site. Section 5 of this report includes all the information necessary for this comparison. Along with the appendices, Section 5 includes: (a) maximum impacts for each pollutant in the format of the applicable standard for each averaging period; (b) locations of the model receptors where these impacts are predicted to occur; (c) an emission source location map; (d) a complete list of source parameters; (e) complete modeling input and output files; and (f) graphic presentations of the modeling results for each pollutant, showing top receptor concentrations and isopleth maps based on predicted project impacts.

4.4. Summary

The AERMOD model with on-site meteorological data and maximum project emissions will be used to assess the ambient air quality impact of the criteria pollutants associated with the Reno Creek ISR Project. The model will be initially run with regulatory default options. A refined model run will be conducted for 24-hour PM_{10} impacts using the dry depletion option in AERMOD. Emissions of PM_{10}, $PM_{2.5}$, CO, SO_2 and NO_x associated with the proposed emission sources will be modeled. NO_x impacts will be converted to NO_2 impacts and maximum modeled concentrations of all five pollutants will be compared to NAAQS and (where applicable) PSD Class II increments.

5 MODELING RESULTS

5.1. Introduction

The stationary and fugitive emission sources at the Reno Creek Project will produce particulate matter smaller than ten microns in size (PM_{10}) and particulate matter smaller than 2.5 microns in size ($PM_{2.5}$). Stationary and mobile sources will emit PM_{10}, $PM_{2.5}$, carbon monoxide (CO), sulfur dioxide (SO_2) and oxides of nitrogen (NO_x). For predicting annual average impacts it was assumed that 75% of NO_x emissions will be converted to NO_2. For predicting 1-hour impacts it was assumed that 80% of NO_x emissions will be converted to NO_2. Thus, five criteria pollutants (PM_{10}, $PM_{2.5}$, CO, SO_2 and NO_2) were analyzed for compliance with the NAAQS using the AERMOD dispersion modeling software. For disclosure purposes four of these pollutants, PM_{10}, $PM_{2.5}$, SO_2 and NO_2 were further analyzed for comparison to the allowable PSD increments in Class II areas. For each scenario, emissions from all 78 emission sources identified and quantified in the Reno Creek Project emissions inventory (Figures 2-1 and 2-2), were modeled. Each model run, with the exception of a “dry depletion” run discussed in Section 5.2 below, produced maximum pollutant concentrations and related statistics at all 5,964 receptors in the 100-km by 100-km modeling domain (Figure 3-3).

Table 5-1 summarizes the results of the AERMOD model runs for all pollutants and relevant averaging intervals. All results are presented in the format of the applicable NAAQS, referred to as design values. Predicted total ambient concentrations are computed as the sum of the design-value project impacts and the background concentrations. For each pollutant, this sum is given as a percentage of the NAAQS. Separate modeling results are shown in Table 5-1 for PM_{10} based on three scenarios:

1. Initial modeling (regulatory default settings)
2. Refined analysis for 20 highest receptors (dry depletion option)
3. Analysis of impacts along public highway bisecting project permit area

Table 5-1 also shows the results from scenarios 1 and 3 above applied separately to NO_2 impacts.

Sections 5.2 through 5.6 discuss results in detail for each of the five criteria pollutants listed in Table 5-1. All receptors were predicted to be in compliance with all NAAQS as reflected in Table 5-1. Initial modeling showed 24-hour PM_{10} impacts plus background, at greater than 90% of the NAAQS at two receptors along Highway 387 in the southwest section of the project. NO_2 modeling also showed 1-hour NO_2 impacts plus background, at greater than 90% of the NAAQS at these two receptors and a third, nearby receptor. All three receptors fall on the northern fence line of Highway 387, less than 100 meters from well field construction activities projected in year 6.

The last three column headings in Table 5-1 are meant to be exclusive. For 24-hour PM_{10}, the three columns correspond to the top 3 daily averages over the 3-year period. They do not necessarily fall in separate years. For all other pollutants, the columns correspond to design values in year one (11/1/10-10/31/11), year two (11/1/11-10/31/12) and year three (11/1/12-10/31/13). The separate contexts implied by the column headings reflect the way the overall statistic is calculated. For 24-hour PM_{10}, the relevant statistic is the 4^{th} high over 3 years, so the top 3 values are of interest regardless of when they occurred. In all other cases, the relevant statistic is an average of the value from each year, so the 3 yearly values are of interest.

Table 5-2 compares model predictions to PSD Class II increments. Class I increments were not evaluated since there are no Class I areas within 50 kilometers of the Reno Creek ISR Project. Although the Reno Creek Project is not a major source and therefore does not meet the criteria for PSD regulation, the results in Table 5-2 are presented for disclosure purposes.

Comparisons between modeled concentrations and PSD increments rely on EPA's definition: for any period other than annual, the allowable increment for a given pollutant may be exceeded during one such period per year at any one location (EPA 1986). Therefore, the relevant 24-hour PM_{10} and $PM_{2.5}$ concentrations are the highest yearly 2^{nd} high values at any one receptor. There are no PSD increments associated with the 1-hour NO_2 and 1-hour SO_2 concentrations. For the 3-hour and 24-hour SO_2 increments, the highest concentration at any receptor serves as a surrogate (since it will always be higher than the highest yearly 2^{nd} high).

Table 5-1: Summary of Predicted Pollutant Concentrations (AERMOD)

Pollutant	Averaging Interval and Statistic	Ambient Impact (µg/m^3)	Back-ground (µg/m^3)	Total Ambient Concentration (µg/m^3)	NAAQS Limit (µg/m^3)	% of NAAQS Limit	Receptor (UTM Easting, Northing)	1st Year Statistic (1st High for 24-Hr PM_{10})	2nd Year Statistic (2nd High for 24-Hr PM_{10})	3rd Year Statistic (3rd High for 24-Hr PM_{10})
PM_{10} Initial Run (No Dry Depletion)	Annual Average	2.7	15	17.74	--		445587, 4832275	--	--	--
	4th High 24-Hr Maximum	63.1	40.0	103.1	150	68.7%	445587, 4832275	96.2	74.6	64.3
PM_{10} Final Run (Top 20 Receptors With Dry Depletion)	Annual Average	2.0	15	17.02	--			--	--	--
	4th High 24-Hr Maximum	34.0	40.0	74.0	150	49.3%	445587, 4832275	--	--	--
PM_{10} Highway Run (No Dry Depletion)	Annual Average	8.6	15	23.6	--			--	--	--
	4th High 24-Hr Maximum	103.4	40.0	143.4	150	95.6%	445341, 4832384	134.4	130.0	114.4
$PM_{2.5}$	Annual Average	0.3	3.4	3.7	12	31.1%	445587, 4832275	--	--	--
	24-Hr High	2.1	8.0	10.1	35	28.9%	445587, 4832275	2.8	1.9	1.6
NO_2	Annual Average	0.8	6.0	6.8	100	6.8%	445587, 4832275	--	--	--
	98th Percentile of Daily 1-Hr Highs	64.0	21.0	85.0	188	45.2%	445587, 4832275	100.4	45.9	45.9
NO_2 Highway Run	Annual Average	2.8	6.0	8.8	100	8.8%	445202, 4832327	--	--	--
	98th Percentile of Daily 1-Hr Highs	165.1	21.0	186.1	188	99.0%	445341, 4832384	195.6	178.6	121.0
SO_2	Annual Average	0.1	1.3	1.4	--		445587, 4832275	--	--	--
	24-Hr	5.6	16.3	21.9	--		445587, 4832275	--	--	--
	3-Hr	45.0	124.7	169.7	1300	13.1%	445587, 4832275	--	--	--
	99th Percentile of Daily 1-Hr Highs	25.9	43.2	69.1	200	34.5%	445679, 4832273	24.3	31.4	21.9
CO	8-Hr High	103.3	378.0	481.3	10000	4.8%	445587, 4832275	--	--	--
	1-Hr High	798.4	680.0	1478.4	40000	3.7%	445587, 4832275	--	--	--

Table 5-2: Summary of PSD Increment Comparisons (AERMOD)

Pollutant	Averaging Interval and Statistic	Class II Impact	Allowable Class II PSD Increment	% of Class II PSD Increment
PM_{10} Initial Run (No Dry Depletion)	Annual Average	2.7	17	16%
	Highest Yearly 2nd High	64.3	30	214%
PM_{10} Final Run (Top 20 Receptors With Dry Depletion)	Annual Average	2.0	17	--
	Highest Yearly 2nd High	34.6	30	115%
$PM_{2.5}$	Annual Average	0.3	4	8%
	Highest Yearly 2nd High	7.6	9	84%
NO_2	Annual Average	0.8	25	3%
	98th Percentile of Daily 1-Hr Highs	64.0	--	--
NO_2 Highway Run	Annual Average	2.8	25	11%
	98th Percentile of Daily 1-Hr Highs	165.1	--	--
SO_2	Annual Average	0.1	20	1%
	24-Hr	5.6	91	6%
	3-Hr	45.0	512	9%
	99th Percentile of Daily 1-Hr Highs	25.9	--	--
CO	8-Hr High	103.3	--	--
	1-Hr High	798.4	--	--

It can be seen from Table 5-2 that all potential Class II impacts fell below the associated PSD increment except for limited exceedances of the 24-hour PM_{10} increment. Receptors with predicted values above the increment were confined to 21 receptors within 300 meters of the southern portion of the project boundary (see Section 5.2), and 58 receptors along the highway that bisects the permit area. All of these receptors are in close proximity to project emission sources. Non-highway receptors exceeding the PSD 24-hour PM_{10} increment in the initial run were further modeled in a refined analysis, with the dry depletion option enabled in AERMOD. The refined analysis predicted that concentrations at all but four of these 21 receptors would be within the PSD Class II increment.Figures 2-1 and 2-2 show the source configuration for modeling Reno Creek Project emissions in AERMOD. Section 5.2 discusses the initial and refined PM_{10}

modeling results. Sections 5.3 through 5.6 discuss modeling results for $PM_{2.5}$, NO_2, SO_2 and CO.

5.2. PM_{10} Modeling Analysis

Particulate matter in the form of PM_{10} emissions will constitute the single largest air pollutant from the proposed Reno Creek Project. The primary source of PM_{10} emissions will be fugitive dust generated by traffic on unpaved roads, road maintenance, drilling and construction activities, and wind erosion on disturbed areas. A small fraction of the total PM_{10} emissions will be generated by fuel combustion. Nearly all of these combustion emissions will also qualify as $PM_{2.5}$ (particles with aerodynamic diameter less than 2.5 microns). Accordingly, the outcome of this PM_{10} modeling study is driven by ground-level sources of fugitive dust.

The maximum yearly PM_{10} emissions from the Reno Creek Project were modeled for potential impacts on ambient air quality at all receptors in the modeling domain. Variable emission rates were entered into the model, based on month, day of the week and hour of the day. The model produced maximum receptor concentrations for any calendar day (24-hour average) and for the entire modeling period (annual average). In order to characterize worst-case, short-term impacts, the modeling period spanned three years of hourly meteorological conditions. Section 5.2.1 discusses initial modeling results for the 5,964 receptors located along the project boundary and between the boundary and the edge of the modeling domain. Section 5.2.2 discusses modeling results for 354 additional receptors placed along the portion of Highway 387 that bisects the Reno Creek Project area. Section 5.2.3 deals with the issue of model over-prediction.

5.2.1. Initial PM_{10} Modeling Results

PM_{10} results from the initial AERMOD run are presented below. Table 5-3 lists the top 20 receptors ranked by annual average concentrations. Table 5-4 lists the top 50 receptors ranked by 4th high, 24-hour concentrations (consistent with the NAAQS format). Figure 5-1 is an isopleth, or contour plot of the predicted annual concentrations attributable solely to the Reno Creek Project. Because the significant impacts (greater than 1 μg/m^3) are confined to receptors within approximately 10 km of the project center, Figure 5-2 zooms in on this area. Figure 5-3 is a close-up isopleth map of the predicted maximum 24-hour concentrations attributable to the Reno Creek Project.

Table 5-3 shows that none of the 5,964 receptors had modeled concentrations above the annual, Class II PSD increment of of 17 μg/m^3. Table 5-4 shows the top 50 receptors which, with a background of 40 μg/m^3 added to modeled impacts, were below the 24-hour NAAQS of 150 μg/m^3. Among these receptors, the top 21 modeled concentrations exceeded the PSD Class II increment of 30 μg/m^3. Figure 5-4 illustrates the proximity of these 21 receptors to the project boundary. All of the modeled impacts above 30 μg/m^3 occurred at receptors less than 300 meters from the Reno Creek Project boundary. Figure 5-4 also shows that a refined analysis of these 21 receptors using AERMOD's dry depletion option (see Section 5.2.3), reduced the number of receptors exceeding the PSD Class II increment to four.

Table 5-3: Top 20 Receptors, Annual Average PM_{10} Impacts

UTM Easting	UTM Northing	Maximum Modeled Concentration (μg/m^3)	PSD Class II Increment (μg/m^3)
445587	4832275	2.74	17
445587	4832227	2.52	17
445633	4832274	2.47	17
445587	4832179	2.34	17
445679	4832273	2.23	17
445587	4832130	2.19	17
445587	4832082	2.04	17
445725	4832273	2.04	17
445668	4832174	2.00	17
445587	4832034	1.92	17
445771	4832272	1.88	17
445587	4831985	1.80	17
445817	4832271	1.73	17
445587	4831937	1.68	17
445863	4832270	1.61	17
445749	4832072	1.57	17
445587	4831889	1.53	17
445833	4832171	1.53	17
445908	4832269	1.48	17
445747	4831972	1.38	17

Table 5-4: Top 50 Receptors, 24-Hr Maximum PM_{10} Concentrations (Initial Run)

UTM Easting	UTM Northing	Maximum Modeled Concentration (µg/m^3)	Maximum Concentration with Background (µg/m^3)	NAAQS Concentration (µg/m^3)
445587	4832275	63.05	103.05	150
445633	4832274	62.40	102.40	150
445679	4832273	61.74	101.74	150
445725	4832273	60.33	100.33	150
445771	4832272	58.92	98.92	150
445817	4832271	57.41	97.41	150
445587	4832227	53.56	93.56	150
445863	4832270	50.47	90.47	150
445587	4832130	49.90	89.90	150
445749	4832072	48.51	88.51	150
445908	4832269	47.87	87.87	150
445833	4832171	47.23	87.23	150
445668	4832174	46.16	86.16	150
445587	4832179	42.08	82.08	150
445914	4832069	41.65	81.65	150
445587	4832082	41.24	81.24	150
445912	4831969	41.19	81.19	150
445954	4832268	36.47	76.47	150
445587	4831889	33.56	73.56	150
445587	4831937	32.12	72.12	150
446000	4832267	30.42	70.42	150
445747	4831972	29.36	69.36	150
445998	4832167	29.34	69.34	150
446001	4832312	28.84	68.84	150
450075	4833971	28.34	68.34	150
445587	4832034	27.64	67.64	150
450076	4833779	27.49	67.49	150
450075	4834019	27.28	67.28	150
445910	4831869	27.21	67.21	150
450075	4833923	27.15	67.15	150
446066	4831996	27.11	67.11	150
446300	4832637	27.00	67.00	150
446002	4832445	26.97	66.97	150
450076	4833827	26.93	66.93	150
446338	4832544	26.84	66.84	150
446002	4832489	26.65	66.65	150
446001	4832356	26.63	66.63	150
450076	4833731	26.37	66.37	150
445587	4831840	26.37	66.37	150
446214	4832601	26.34	66.34	150
445587	4831985	26.11	66.11	150
445745	4831872	26.03	66.03	150
444084	4834705	25.96	65.96	150
446228	4832715	25.92	65.92	150
450075	4833875	25.50	65.50	150
446002	4832400	25.21	65.21	150
446064	4831896	25.09	65.09	150
450219	4833889	25.08	65.08	150
446068	4832096	24.57	64.57	150
446272	4832733	24.05	64.05	150

Figure 5-1. Annual Average PM_{10} Concentrations (Without Background)

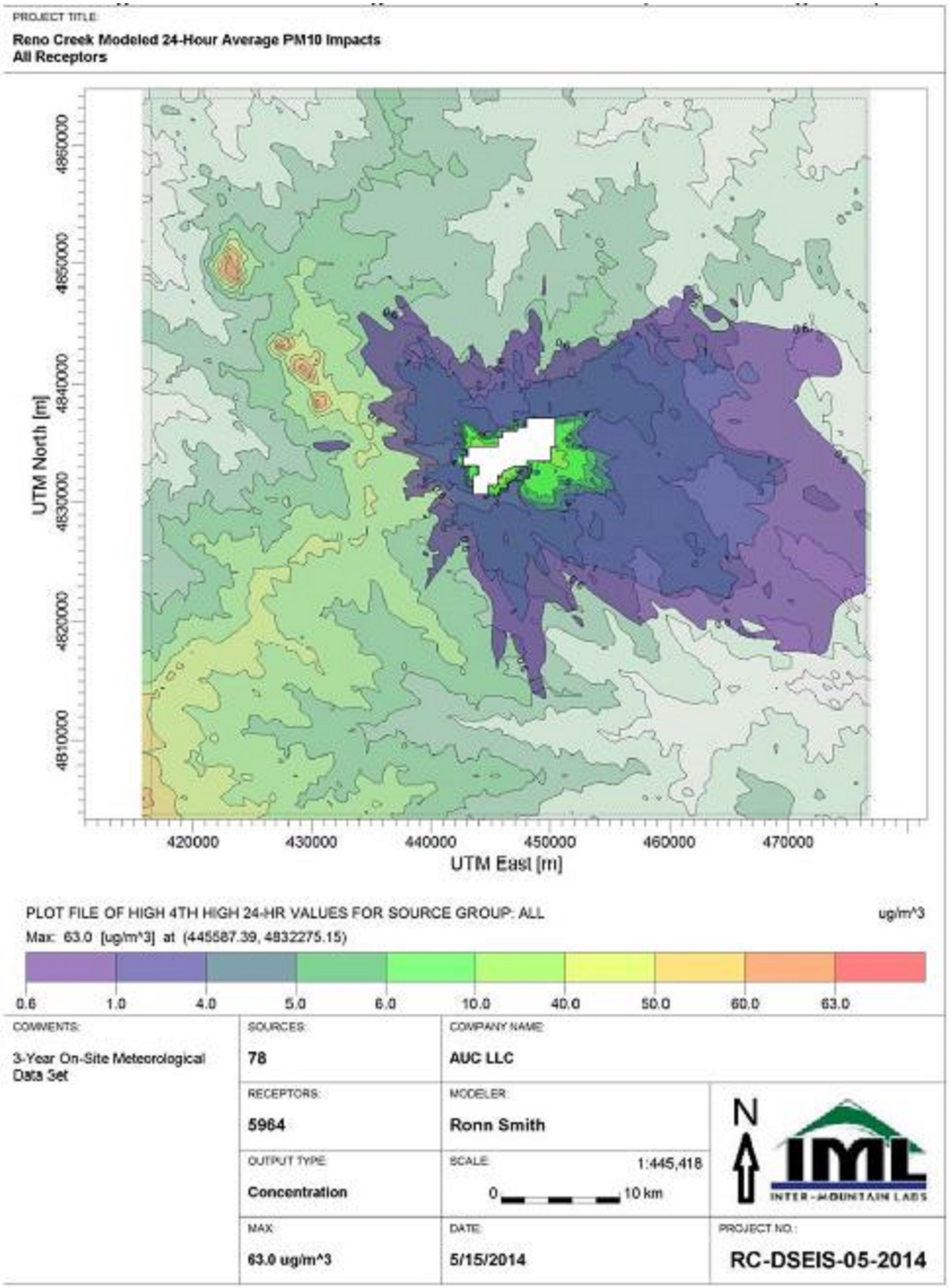


Figure 5-2. Close-up of Annual Average PM_{10} Concentrations (Without Background)

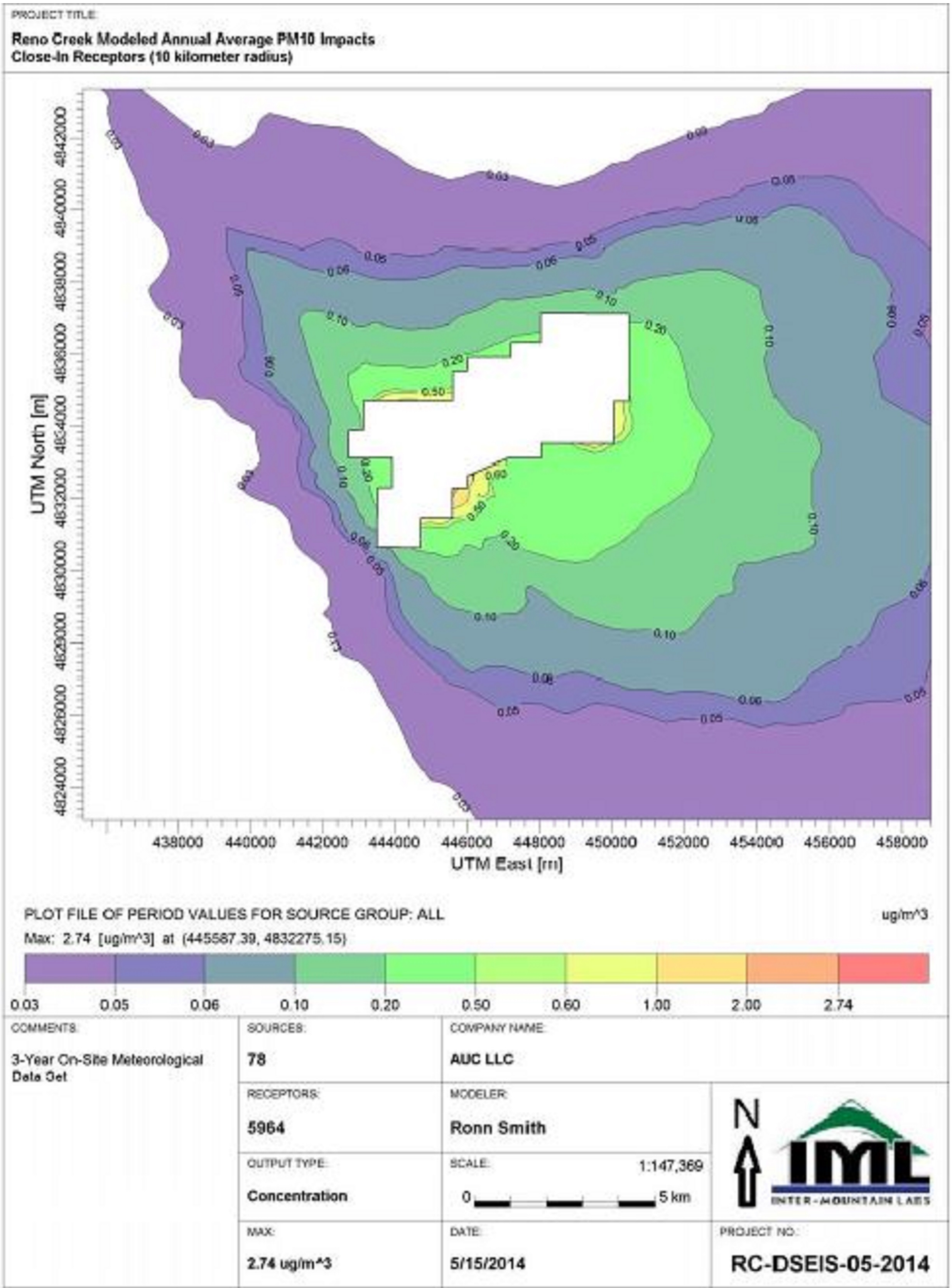


Figure 5-3. Maximum 24-Hour Average PM_{10} Concentrations (Without Background)

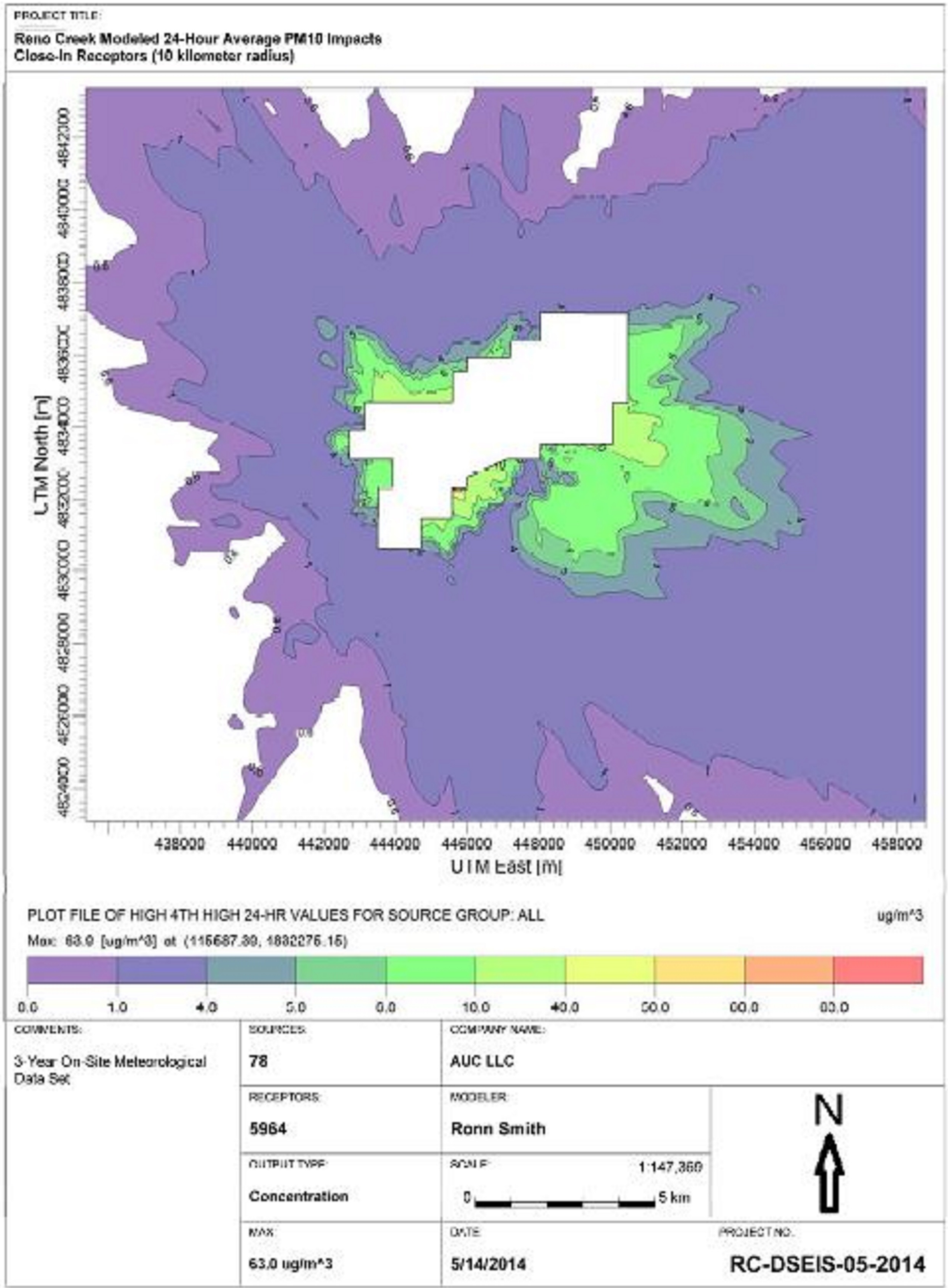
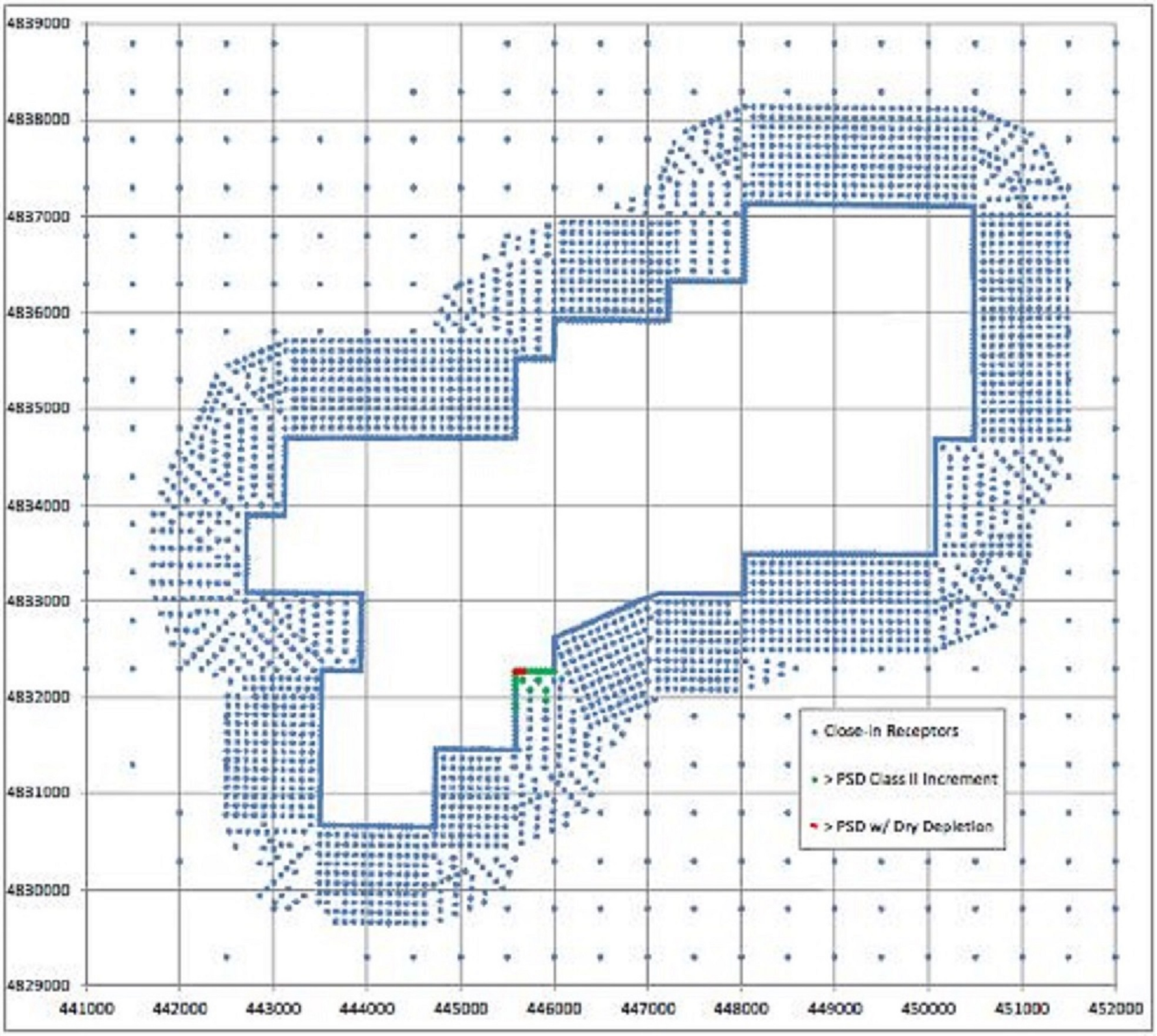


Figure 5-4. Modeled 24-Hour PM_{10} (Top 10 Receptors Without Dry Depletion, no Background)



It is not unusual for dispersion modeling of ground-level fugitive dust sources to predict high short-term values near the emission sources. The Buffalo RMP cited modeled exceedances of 24-hour PM_{10} and $PM_{2.5}$ standards in Wyoming's PRB (BLM 2013). Phase I of the PRB Coal Review states that for near-field receptors, the predicted 24-hour PM_{10} and $PM_{2.5}$ concentrations show localized exceedences of the NAAQS for the base year of 2004, as well as for future years (BLM 2005). An updated study relates these high values to coal bed methane and coal mining activities, stating these exceedances are limited to small individual receptor areas in the near-field (BLM 2009).

5.2.2. PM_{10} Modeling Results for Highway Receptors

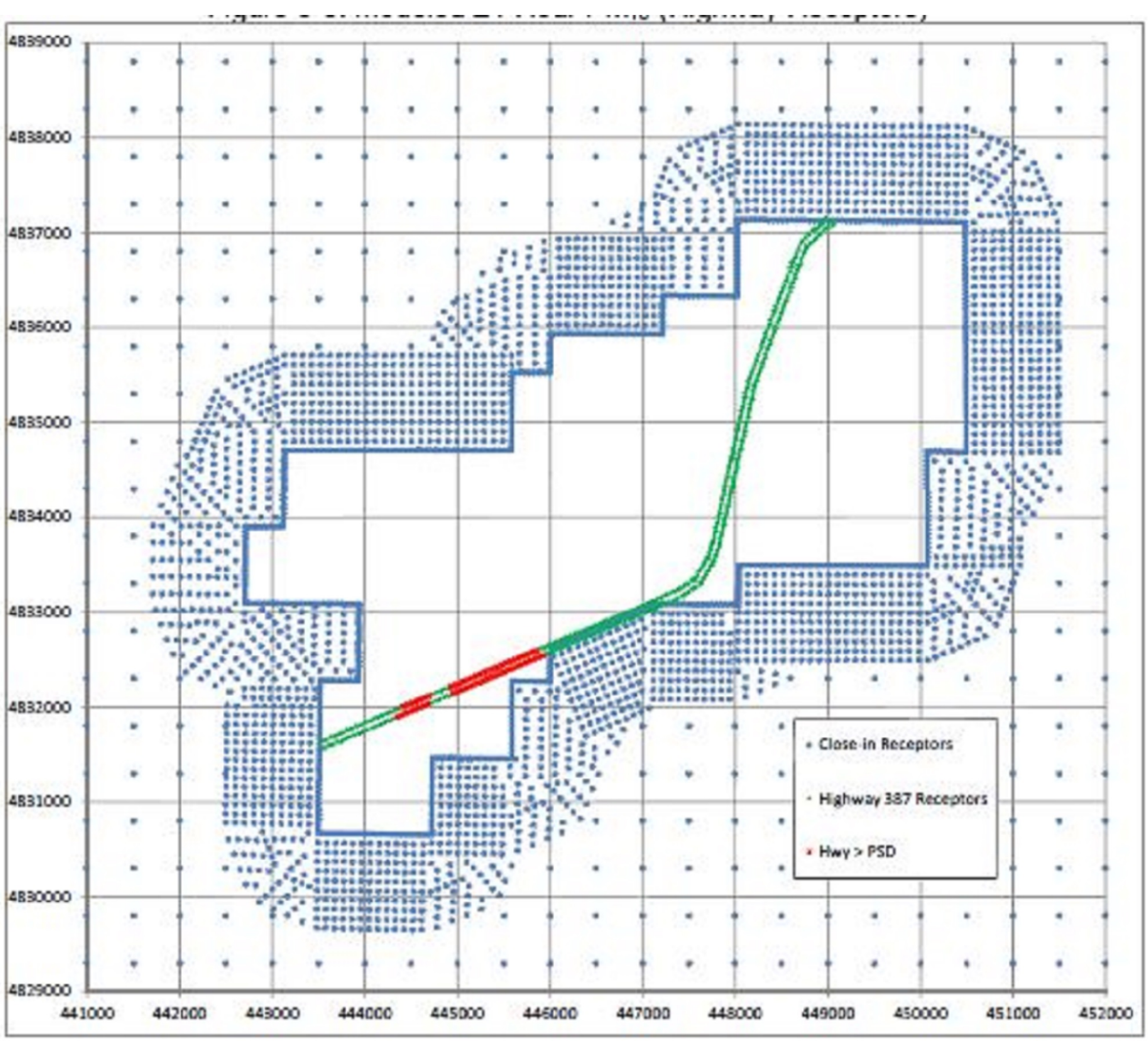
Since U.S. Highway 387 bisects the Reno Creek Project permit area, the highway corridor may be considered ambient air. The highway is fenced on both sides, with a right-of-way width of 250 feet. In order to assess potential impacts along the fence lines, additional receptors were placed at 50-meter intervals, 50 meters on either side of the centerline of the highway. Figure 5-5 depicts the Reno Creek Project boundary receptors, the rectangular grid receptors within approximately 5 km of the project center, and the highway fence line receptors.

Table 5-5 lists the top 20 modeled concentrations among the 354 highway receptors. With background added to modeled impacts, the predicted concentrations are all below the NAAQS. Figure 5-5 shows the highway receptors with modeled impacts above the PSD Class II increment (in red). All of these receptors are located less than 100 meters from project-related sources of fugitive dust.

Table 5-5: Top 20 Highway Receptors, 24-Hr Maximum PM_{10} Concentrations

UTM Easting	UTM Northing	Maximum Modeled Concentration ($\mu g/m^3$)	Maximum Concentration with Background ($\mu g/m^3$)	NAAQS Concentration ($\mu g/m^3$)
445341	4832384	103.36	143.36	150
445387	4832403	97.98	137.98	150
445526	4832461	90.65	130.65	150
445294	4832365	87.72	127.72	150
445433	4832422	87.47	127.47	150
445479	4832441	87.19	127.19	150
445462	4832352	86.20	126.20	150
445416	4832333	83.21	123.21	150
445572	4832480	80.67	120.67	150
445555	4832390	79.89	119.89	150
445601	4832409	79.84	119.84	150
445508	4832371	79.24	119.24	150
445370	4832314	77.42	117.42	150
445248	4832346	71.33	111.33	150
445618	4832499	69.94	109.94	150
445202	4832327	69.77	109.77	150
445647	4832428	67.53	107.53	150
445156	4832308	63.78	103.78	150
444555	4832060	63.53	103.53	150
445664	4832518	61.13	101.13	150

Figure 5-5. Modeled 24-Hour PM_{10} (Highway Receptors)



5.2.3. PM_{10} Modeling Over-Prediction Problems

Despite predicted compliance, these modeling results may still reflect AERMOD's tendency to over-predict the transportability and the resultant air quality impacts of fugitive dust emissions (Cliffs 2011). Among several possible causes, predicted concentrations do not account for particle electrostatic agglomeration, enhanced gravitational settling and deposition near the point of release (AECOM 2012).

This tendency was exposed in ISCST3, the regulatory model that preceded AERMOD. Although AERMOD improved on many of ISCST3's features, these improvements were confined primarily to stationary sources and buoyant plumes. Even with the improvements to AERMOD, the problem of over-predicting 24-hour PM_{10} impacts from fugitive dust persists (Sullivan 2006). For low-level emission plumes, AERMOD has not been evaluated extensively by EPA for performance against measured data. In 2011 MMA conducted a modeling analysis to determine whether AERMOD would yield significant improvements over the ISC3 Short Term model in the prediction of short-term particulate concentrations for surface mining operations. The study found that AERMOD still over-predicts short-term PM_{10} concentrations, and even exceeds the predictions of ISCST3 at model receptors positioned from 100 to 500 meters from the sources of fugitive emissions (MMA 2011). The study concludes that AERMOD "consistently predicts concentrations higher than ISCST in the range of concentrations that would be critical decision points in the permitting process."

5.2.4. Refined PM_{10} Modeling Results

In an attempt to address the problem of over-predicting impacts from fugitive dust at the Reno Creek project, AERMOD was re-run for impacts at select receptors using the dry depletion option. This option, also available with ISCST3, seeks to account for particulate deposition near the source. It requires the user to input particle densities and size distributions. The receptors modeled with dry depletion included all 21 non-highway receptors that exceeded the PSD Class II, 24-hour PM_{10} increment in the initial model run. It was not realistic to use this option for the initial run, as modeling impacts on all receptors in the modeling domain would have required several hundred hours to execute.

With the dry depletion option enabled, AERMOD predicted significantly lower 24-hour PM_{10} impacts as summarized in Table 5-6. The highest design-value concentration was reduced from 63.1 to 34.0 μg/m^3. Taking into account the 24-hour PSD increment definition, the model predicted a highest yearly 2nd high value of 34.6 μg/m^3, only marginally above the PSD increment.

Table 5-6: Top 21 Receptors, 24-Hr Maximum PM_{10} Values With Dry Depletion

UTM Easting	UTM Northing	Maximum Modeled Concentration (μg/m^3)	Maximum Concentration with Background (μg/m^3)	NAAQS Concentration (μg/m^3)
445587	4832275	34.01	74.01	150
445633	4832274	33.52	73.52	150
445679	4832273	32.61	72.61	150
445725	4832273	30.66	70.66	150
445771	4832272	27.92	67.92	150
445817	4832271	25.83	65.83	150
445587	4832227	27.52	67.52	150
445863	4832270	24.95	64.95	150
445587	4832130	25.52	65.52	150
445749	4832072	21.18	61.18	150
445908	4832269	23.02	63.02	150
445833	4832171	22.63	62.63	150
445668	4832174	22.95	62.95	150
445587	4832179	25.49	65.49	150
445914	4832069	17.37	57.37	150
445587	4832082	19.47	59.47	150
445912	4831969	14.69	54.69	150
445954	4832268	20.38	60.38	150
445587	4831889	18.39	58.39	150
445587	4831937	17.35	57.35	150
446000	4832267	17.64	57.64	150

5.3. $PM_{2.5}$ Modeling Analysis

Particulate matter in the form of $PM_{2.5}$ emissions were modeled in a similar fashion to PM_{10} emissions. The primary source of $PM_{2.5}$ emissions will be the smaller fugitive dust particles generated by traffic on unpaved roads, road maintenance, drilling and construction activities, and wind erosion on disturbed areas. A small fraction of the total $PM_{2.5}$ emissions will be generated by fuel combustion.

The maximum yearly $PM_{2.5}$ emissions from the Reno Creek Project were modeled for potential impacts on ambient air quality at all receptors in the modeling domain. Variable emission rates were entered into the model based on month, day and hour. The model produced maximum receptor concentrations for any calendar day (24-hour average) and for the entire modeling period (annual average). The 24-hour design value was computed for each receptor as the three-year average of the 8th high (98th percentile) concentration.

5.3.1. $PM_{2.5}$ Modeling Results

Results from the AERMOD model run are presented below. The model predicted NAAQS compliance for all receptors and averaging intervals. All annual average and maximum yearly 2nd high 24-hour concentrations were predicted to be less than the applicable Class II PSD increments. Table 5-7 lists the top 20 receptors ranked by predicted annual average concentrations. Table 5-8 lists the top 20 receptors ranked by predicted 24-hour maximum concentrations. Figure 5-6 is an isopleth, or contour plot of the predicted annual concentrations attributable solely to the Reno Creek Project. Figure 5-7 is an isopleth map of the predicted, maximum 24-hour impacts attributable to the Reno Creek Project.

Table 5-7: Top 20 Receptors, Annual Average $PM_{2.5}$ Values

UTM Easting	UTM Northing	Maximum Modeled Concentration (µg/m^3)	Maximum Concentration with Background (µg/m^3)	NAAQS Concentration (µg/m^3)
445587	4832275	0.33	3.73	12
445587	4832227	0.30	3.70	12
445633	4832274	0.30	3.70	12
445587	4832179	0.28	3.68	12
445679	4832273	0.27	3.67	12
445587	4832130	0.26	3.66	12
445587	4832082	0.25	3.65	12
445725	4832273	0.24	3.64	12
445668	4832174	0.24	3.64	12
445587	4832034	0.23	3.63	12
445771	4832272	0.23	3.63	12
445587	4831985	0.22	3.62	12
445817	4832271	0.21	3.61	12
445587	4831937	0.20	3.60	12
445863	4832270	0.19	3.59	12
445749	4832072	0.19	3.59	12
445587	4831889	0.19	3.59	12
445833	4832171	0.18	3.58	12
445908	4832269	0.18	3.58	12
445747	4831972	0.17	3.57	12

Table 5-7 shows that all receptor concentrations are predicted to comply with the annual NAAQS (12 µg/m3) and all modeled concentrations are below the PSD Class II increment (4 µg/m3). The highest predicted receptor concentration, with background added, is about 30% of the NAAQS. Modeled concentrations are shown in Figure 5-6.

Table 5-8: Top 20 Receptors, 98th percentile of 24-Hr Maximum $PM_{2.5}$ Values

UTM Easting	UTM Northing	Maximum Modeled Concentration (µg/m³)	Maximum Concentration with Background (µg/m³)	NAAQS Concentration (µg/m³)
445587	4832275	2.11	10.11	35
445587	4832227	2.00	10.00	35
445633	4832274	1.96	9.96	35
445587	4832179	1.93	9.93	35
445679	4832273	1.82	9.82	35
445587	4832130	1.76	9.76	35
445587	4832082	1.72	9.72	35
445725	4832273	1.70	9.70	35
445668	4832174	1.69	9.69	35
445587	4832034	1.66	9.66	35
445587	4831985	1.63	9.63	35
445771	4832272	1.56	9.56	35
445587	4831937	1.51	9.51	35
445749	4832072	1.50	9.50	35
445817	4832271	1.47	9.47	35
445587	4831889	1.42	9.42	35
445863	4832270	1.39	9.39	35
445747	4831972	1.36	9.36	35
445833	4832171	1.29	9.29	35
445908	4832269	1.27	9.27	35

Table 5-8 shows that all receptor concentrations are predicted to comply with the 24-hour NAAQS (35 µg/m³) and all modeled concentrations are below the PSD Class II increment (9 µg/m³). The highest predicted receptor concentration, with background added, is less than 10% of the NAAQS. This is confirmed graphically in Figure 5-7.

Figure 5-6. Annual $PM_{2.5}$ Concentrations (Without Background)

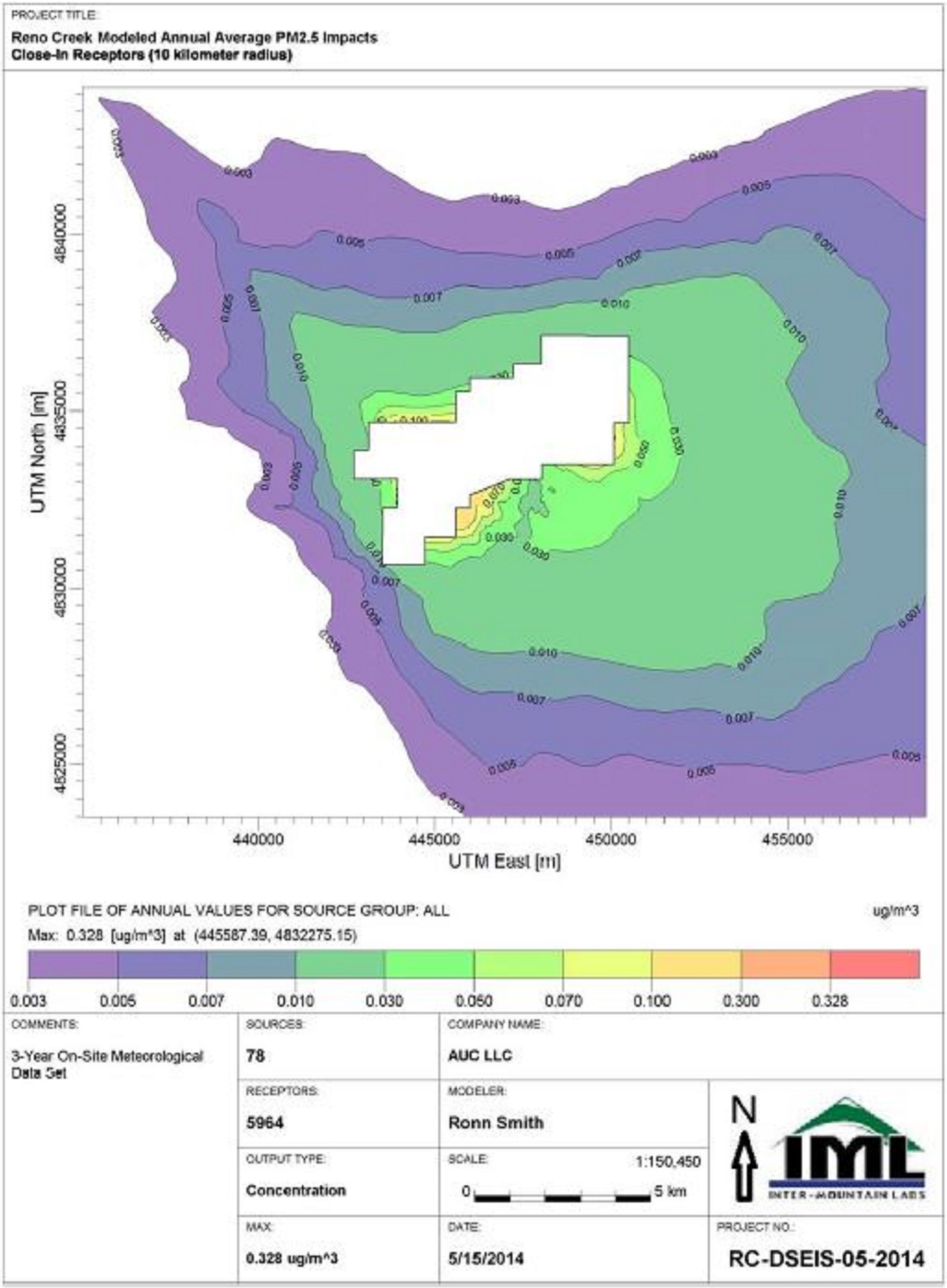
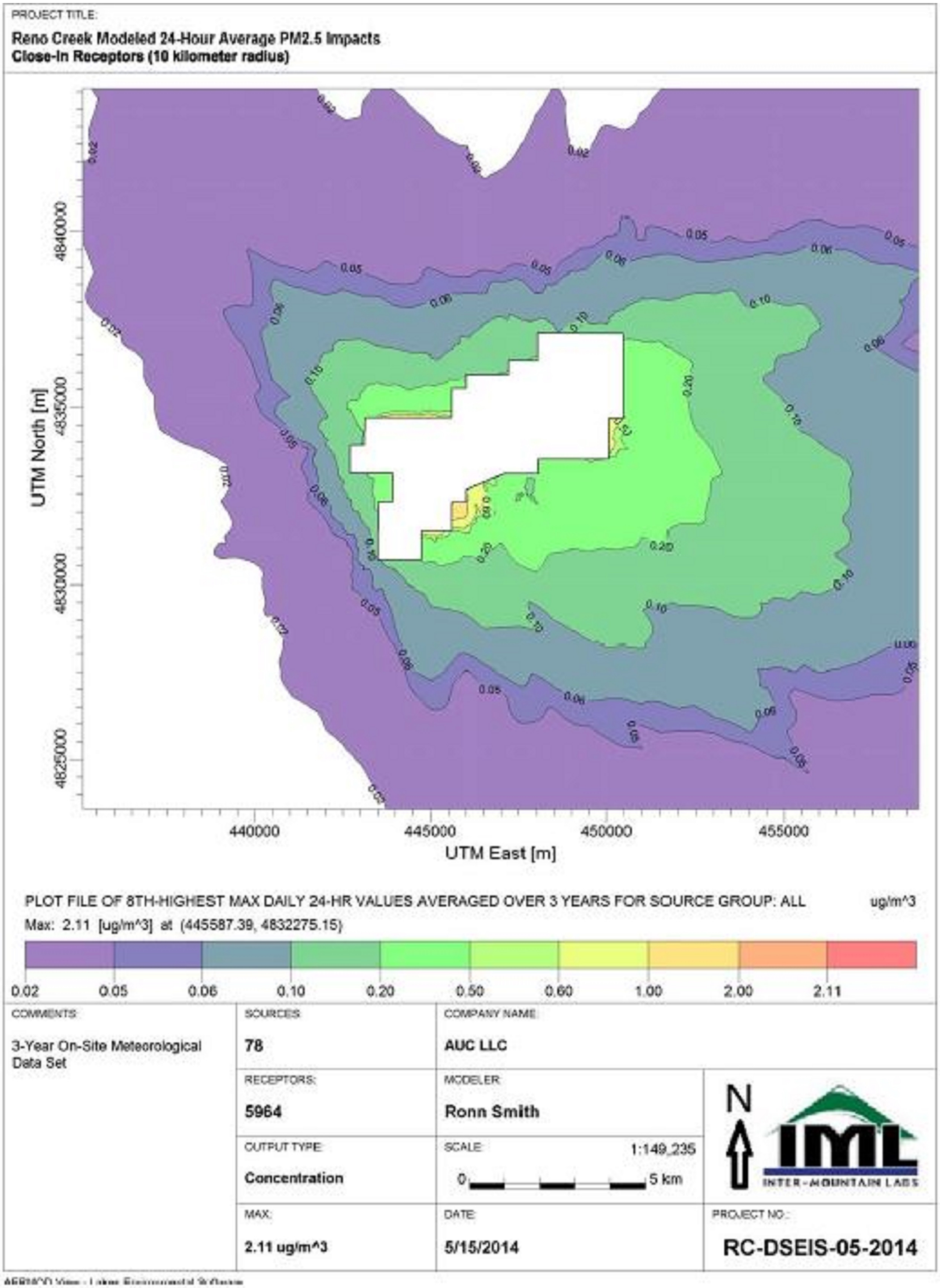


Figure 5-7. Maximum 24-Hour $PM_{2.5}$ Concentrations (Without Background)



5.4. NO_2 Modeling Analysis

NO_2 emissions are derived from oxides of nitrogen (NO_x), at an assumed conversion ratio of 75% for annual impacts and 80% for 1-hour impacts. The primary source of NO_x emissions will be fuel combustion from mobile and stationary sources.

The maximum yearly NO_x emissions from the Reno Creek Project were modeled for potential impacts on ambient air quality at all receptors in the modeling domain. Variable emission rates were entered into the model based on month, day and hour. The model predicted maximum hourly receptor concentrations by calendar day, the 98th percentile of these daily maxima for each year, and the three-year average of the 98th percentiles. It also predicted the average receptor concentrations for the entire modeling period (annual average).

Results from the NO_2 AERMOD model run are presented below. The model predicted NAAQS compliance for all receptors and averaging intervals. It also predicted that all receptor concentrations will be below the annual PSD increment of 25 μg/m^3. Table 5-9 lists the top 20 receptors ranked by annual average concentrations. The highest receptor concentration, with background added, was predicted to be 6.8% of the annual NAAQS. Table 5-10 lists the top 20 receptors ranked according to the 1-hour design value. The highest receptor concentration, with background added, was predicted to be 45.2% of the 1-hour NAAQS. Figure 5-8 is an isopleth, or contour plot of the predicted annual concentrations attributable solely to the Reno Creek Project. Figure 5-9 is an isopleth map of the predicted, 98th percentile 1-hour concentrations attributable to the Reno Creek Project.

The 1-hour NO_2 impacts were modeled separately for the fenceline receptors along Highway 387 where it bisects the project area. Table 5-11 lists the 10 highest modeled concentrations along the highway. The highest value of 186 μg/m^3 is just below the NAAQS. Figure 5-10 shows the locations of the top three 1-hour receptor concentrations, all of which are within 100 meters of project sources of NO_x.

These values should be interpreted in light of AERMOD's tendency to over-predict 1-hour NO_2 impacts. For this reason, Wyoming DEQ does not require 1-hour modeling of minor sources (WDEQ 2014), deferring instead to actual monitoring results. An EPA sponsored study found that for all methods of converting NO_x to NO_2, AERMOD over-predicts at the highest NO_2 concentrations when compared to monitoring data (API 2013).

Table 5-9: Top 20 Receptors, Annual Average NO_2

UTM Easting	UTM Northing	Maximum Modeled Concentration (μg/m^3)	Maximum Concentration with Background (μg/m^3)	NAAQS Concentration (μg/m^3)
445587	4832275	0.84	6.84	100
445587	4832227	0.77	6.77	100
445633	4832274	0.76	6.76	100
445587	4832179	0.71	6.71	100
445679	4832273	0.68	6.68	100
445587	4832130	0.66	6.66	100
445725	4832273	0.62	6.62	100
445587	4832082	0.62	6.62	100
445668	4832174	0.61	6.61	100
445771	4832272	0.57	6.57	100
445587	4832034	0.57	6.57	100
445587	4831985	0.54	6.54	100
445817	4832271	0.53	6.53	100
445587	4831937	0.51	6.51	100
445863	4832270	0.49	6.49	100
445749	4832072	0.48	6.48	100
445587	4831889	0.47	6.47	100
445833	4832171	0.47	6.47	100
445908	4832269	0.45	6.45	100
445587	4831840	0.43	6.43	100

Table 5-10: Top 20 Receptors, 98th percentile of Daily Maximum 1-Hr NO_2 Values

UTM Easting	UTM Northing	Maximum Modeled Concentration (µg/m^3)	Maximum Concentration with Background (µg/m^3)	NAAQS Concentration (µg/m^3)
445587	4832275	64.04	85.04	188
445633	4832274	63.27	84.27	188
445587	4832227	61.97	82.97	188
445679	4832273	60.20	81.20	188
445725	4832273	59.10	80.10	188
445771	4832272	58.83	79.83	188
445668	4832174	54.78	75.78	188
445587	4832034	54.19	75.19	188
445817	4832271	53.36	74.36	188
445587	4832179	52.44	73.44	188
445587	4831985	51.17	72.17	188
445863	4832270	46.70	67.70	188
445833	4832171	45.95	66.95	188
445587	4832082	45.69	66.69	188
445587	4832130	45.40	66.40	188
445747	4831972	45.08	66.08	188
446002	4832400	43.99	64.99	188
445587	4831937	43.33	64.33	188
445749	4832072	42.50	63.50	188
446001	4832356	42.36	63.36	188

Table 5-11: Top 10 Highway Receptors, 98th percentile of Daily Maximum 1-Hr NO_2

UTM Easting	UTM Northing	Maximum Modeled Concentration (µg/m^3)	Maximum Concentration with Background (µg/m^3)	NAAQS Concentration (µg/m^3)
445341	4832384	165.08	186.08	188
445526	4832461	149.41	170.41	188
445387	4832403	148.18	169.18	188
445294	4832365	143.11	164.11	188
445479	4832441	137.52	158.52	188
445433	4832422	132.12	153.12	188
445248	4832346	128.97	149.97	188
445572	4832480	126.08	147.08	188
445202	4832327	122.50	143.50	188
445618	4832499	104.46	125.46	188

Figure 5-8. Annual NO_2 Concentrations (Without Background)

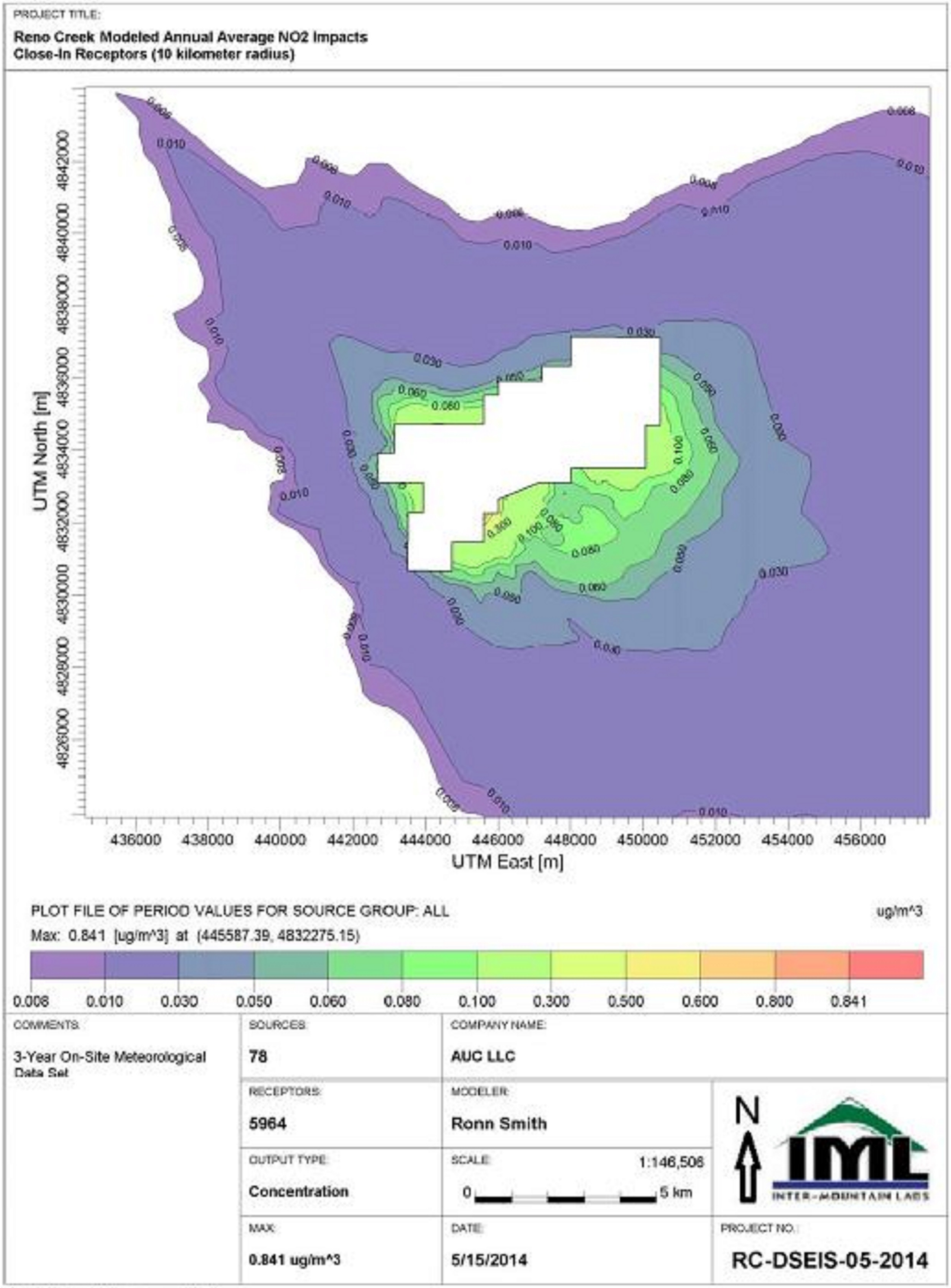


Figure 5-9. Modeled 98th Percentile 1-Hr NO_2 Concentrations (Without Background)

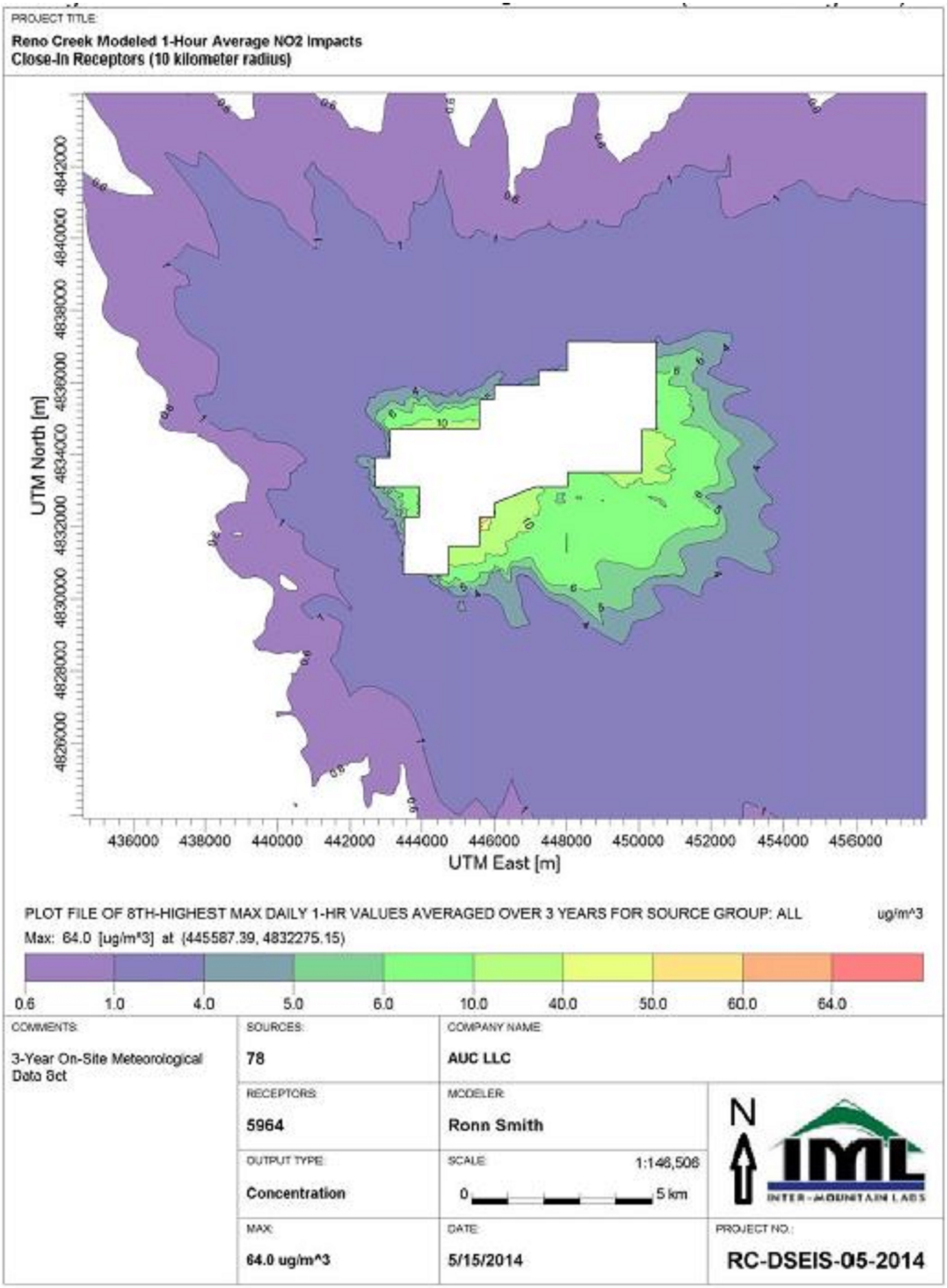
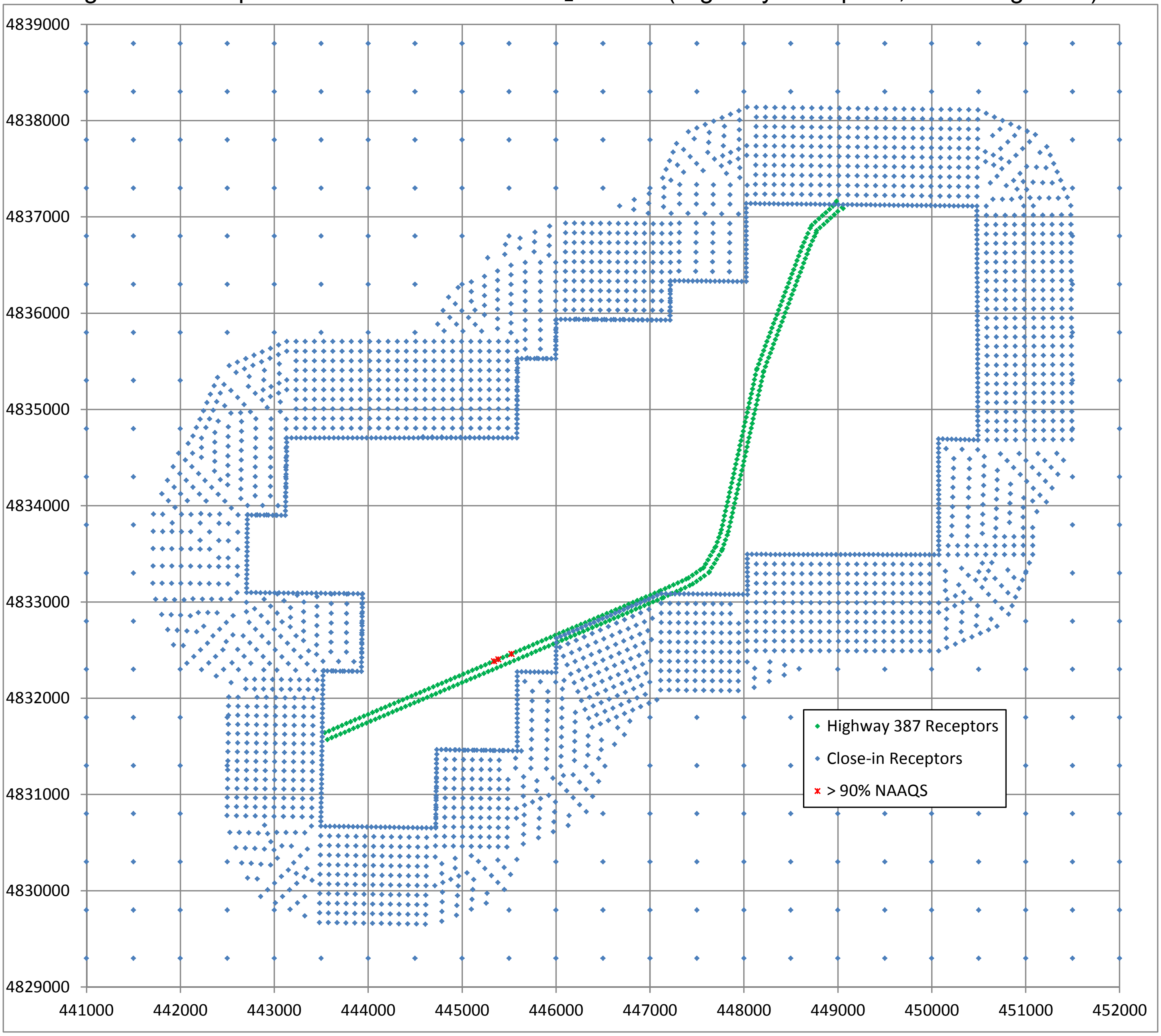


Figure 5-10. Top Three Modeled 1-Hour NO_2 Values (Highway Receptors, No Background)



5.5. SO_2 Modeling Analysis

The primary source of SO_2 emissions from the Reno Creek project will be fuel combustion from mobile and stationary sources.

The maximum yearly SO_2 emissions from the Reno Creek Project were modeled for potential impacts on ambient air quality at all receptors in the modeling domain. Variable emission rates were entered into the model based on month, day and hour. The model produced maximum hourly receptor concentrations by calendar day, the 99th percentile of these daily maxima by year, and the three-year average of the 99th percentiles. It also produced 3-hour maxima, 24-hour maxima, and the average receptor concentrations for the entire modeling period (annual average).

Results from the SO_2 AERMOD model run are presented below. All receptor concentrations were predicted to comply with the appropriate NAAQS. The 24-hour and annual average values were all very near zero. Table 5-12 lists the top 20 receptors ranked by 3-hour average concentrations. The highest receptor concentration, with background added, was predicted to be 13% of the 3-hour NAAQS. Table 5-13 lists the top 20 receptors ranked by 3-year average of the 1-hour maximum (99th percentile) concentrations. The highest receptor concentration, with background added, was predicted to be 35% of the 1-hour NAAQS. Figure 5-11 is an isopleth, or contour plot of the predicted annual concentrations attributable solely to the Reno Creek Project. Figure 5-12 is an isopleth map of the predicted maximum 24-hour concentrations attributable to the Reno Creek Project. Figure 5-13 is an isopleth map of the predicted maximum 3-hour concentrations attributable to the Reno Creek Project. Figure 5-14 is an isopleth map of the predicted, 99th percentile 1-hour concentrations attributable to the Reno Creek Project. AERMOD predicts that all receptor concentrations will be less than the PSD increments for all relevant averaging intervals.

Table 5-12: Top 20 Receptors, 3-Hr Maximum SO_2

UTM Easting	UTM Northing	Maximum Modeled Concentration ($\mu g/m^3$)	Maximum Concentration with Background ($\mu g/m^3$)	NAAQS Concentration ($\mu g/m^3$)
445587	4832275	44.99	169.69	1300
445633	4832274	41.35	166.05	1300
445587	4832227	40.12	164.82	1300
445679	4832273	38.20	162.90	1300
445725	4832273	36.21	160.91	1300
445771	4832272	35.00	159.70	1300
445668	4832174	34.88	159.58	1300
445817	4832271	33.64	158.34	1300
445587	4832179	33.04	157.74	1300
445833	4832171	30.89	155.59	1300
445863	4832270	30.45	155.15	1300
446002	4832400	28.11	152.81	1300
446002	4832445	27.55	152.25	1300
445587	4832130	27.50	152.20	1300
450074	4834405	27.15	151.85	1300
450074	4834453	26.80	151.50	1300
445914	4832069	26.78	151.48	1300
445749	4832072	25.97	150.67	1300
450074	4834356	25.85	150.55	1300
443934	4834705	25.72	150.42	1300

Table 5-13: Top 20 Receptors, 99th percentile of Daily Maximum 1-Hr SO_2 Values

UTM Easting	UTM Northing	Maximum Modeled Concentration (µg/m^3)	Maximum Concentration with Background (µg/m^3)	NAAQS Concentration (µg/m^3)
445679	4832273	25.89	69.09	200
445633	4832274	25.47	68.67	200
445725	4832273	25.36	68.56	200
445771	4832272	24.97	68.17	200
445587	4832275	24.87	68.07	200
445817	4832271	23.87	67.07	200
445863	4832270	22.32	65.52	200
445587	4832227	22.00	65.20	200
445587	4832179	20.69	63.89	200
445908	4832269	20.11	63.31	200
445668	4832174	18.99	62.19	200
445833	4832171	18.39	61.59	200
445587	4832130	18.31	61.51	200
445954	4832268	17.42	60.62	200
445587	4832082	17.14	60.34	200
445587	4831985	16.67	59.87	200
445587	4831937	16.33	59.53	200
445749	4832072	16.31	59.51	200
445587	4832034	15.84	59.04	200

Figure 5-11. Modeled Annual SO_2 Concentrations (Without Background)

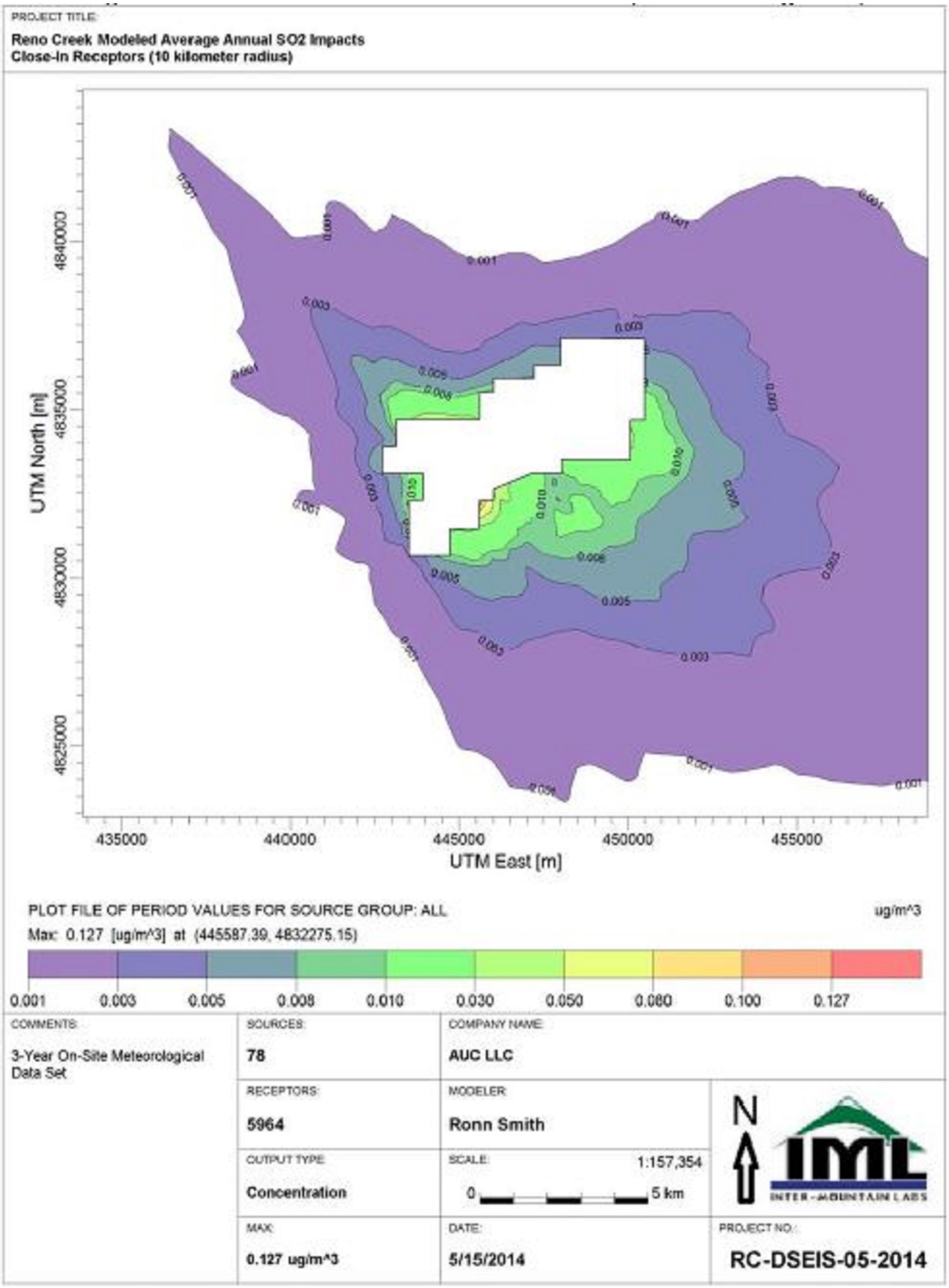


Figure 5-12. Modeled Maximum 24-Hour SO_2 Concentrations (Without Background)

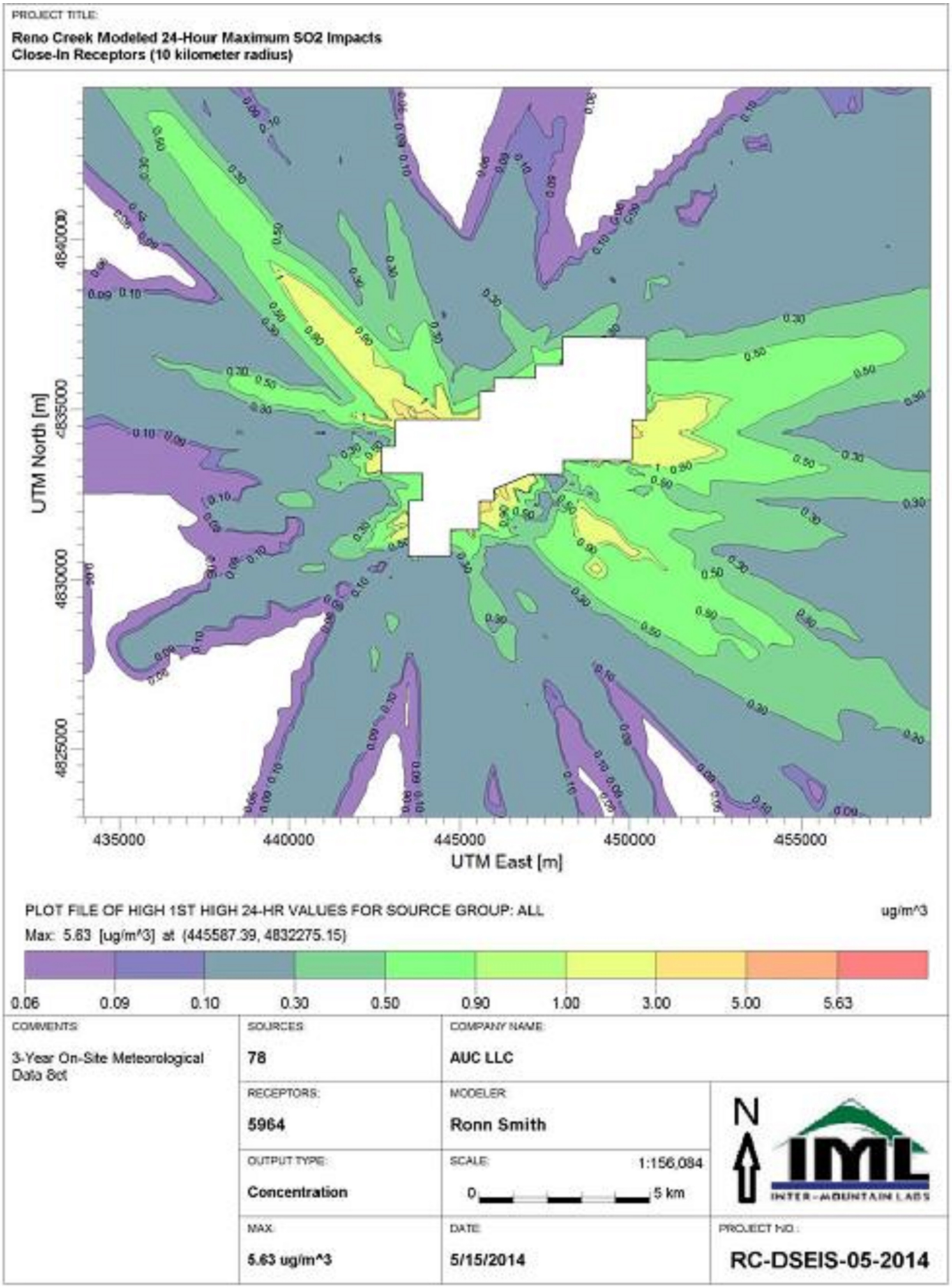


Figure 5-13. Modeled Maximum 3-Hour SO_2 Concentrations (Without Background)

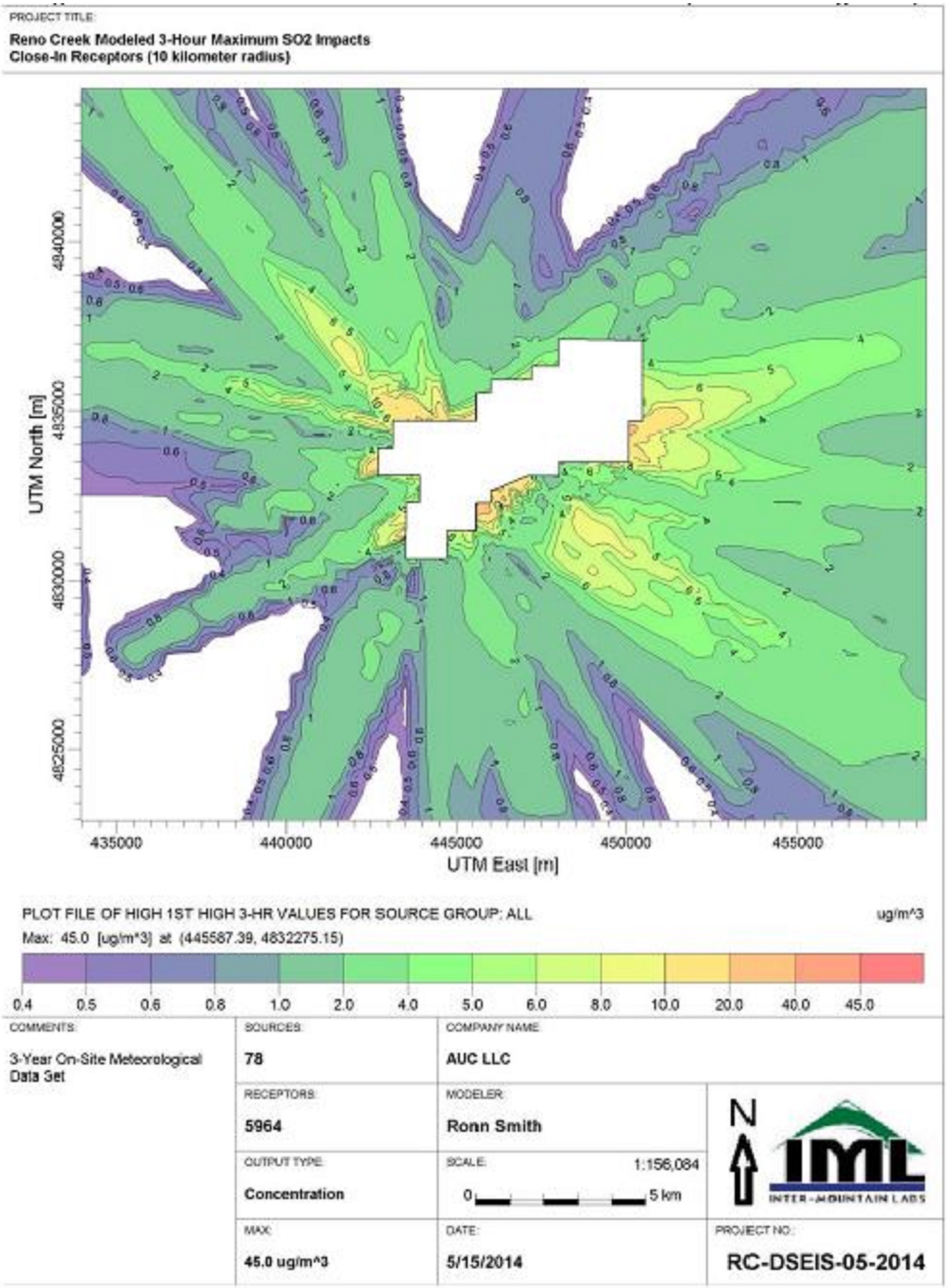
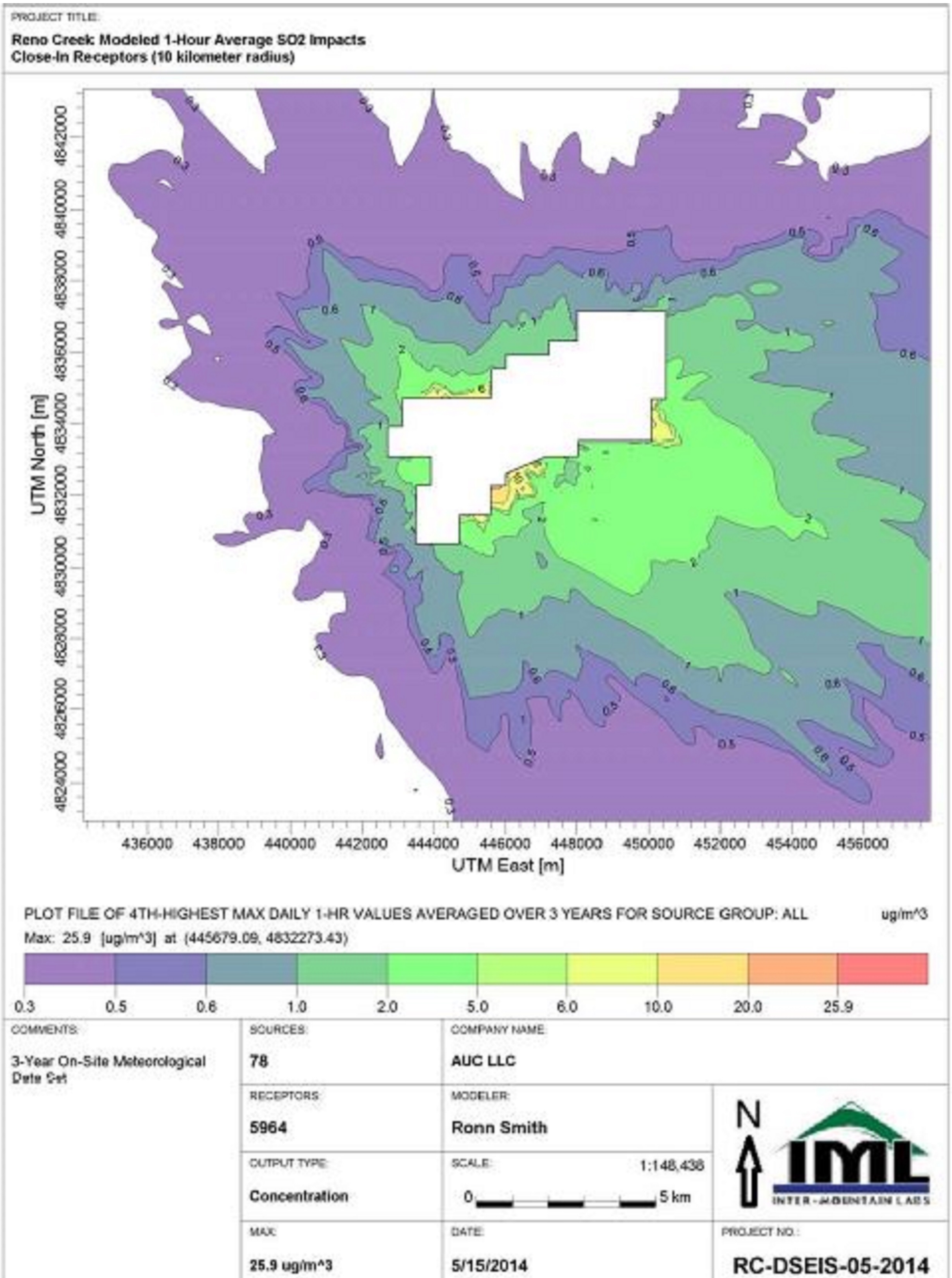


Figure 5-14. Modeled 99th Percentile 1-Hour SO2 Concentrations (Without Background)



5.6. CO Modeling Analysis

The primary source of CO emissions from the Reno Creek project will be fuel combustion from mobile and stationary sources.

The maximum yearly CO emissions from the Reno Creek Project were modeled for potential impacts on ambient air quality at all receptors in the modeling domain. Variable emission rates were entered into the model based on month, day and hour. The model produced maximum 1-hour and 8-hour receptor concentrations over the 3-year modeling period.

Results from the CO AERMOD model run are illustrated below. Modeled concentrations at all receptors were predicted to be below the applicable standards. As shown in Table 5-1, all modeled concentrations of CO (with background added) constituted less than 5% of the NAAQS, and are therefore not tabulated separately. Figure 5-15 is an isopleth, or contour plot of the predicted maximum 8-hour concentrations attributable to the Reno Creek Project. Figure 5-16 is an isopleth map of the predicted maximum 1-hour concentrations attributable to the Reno Creek Project.

Figure 5-15. Modeled Maximum 8-Hr CO Concentrations (Without Background)

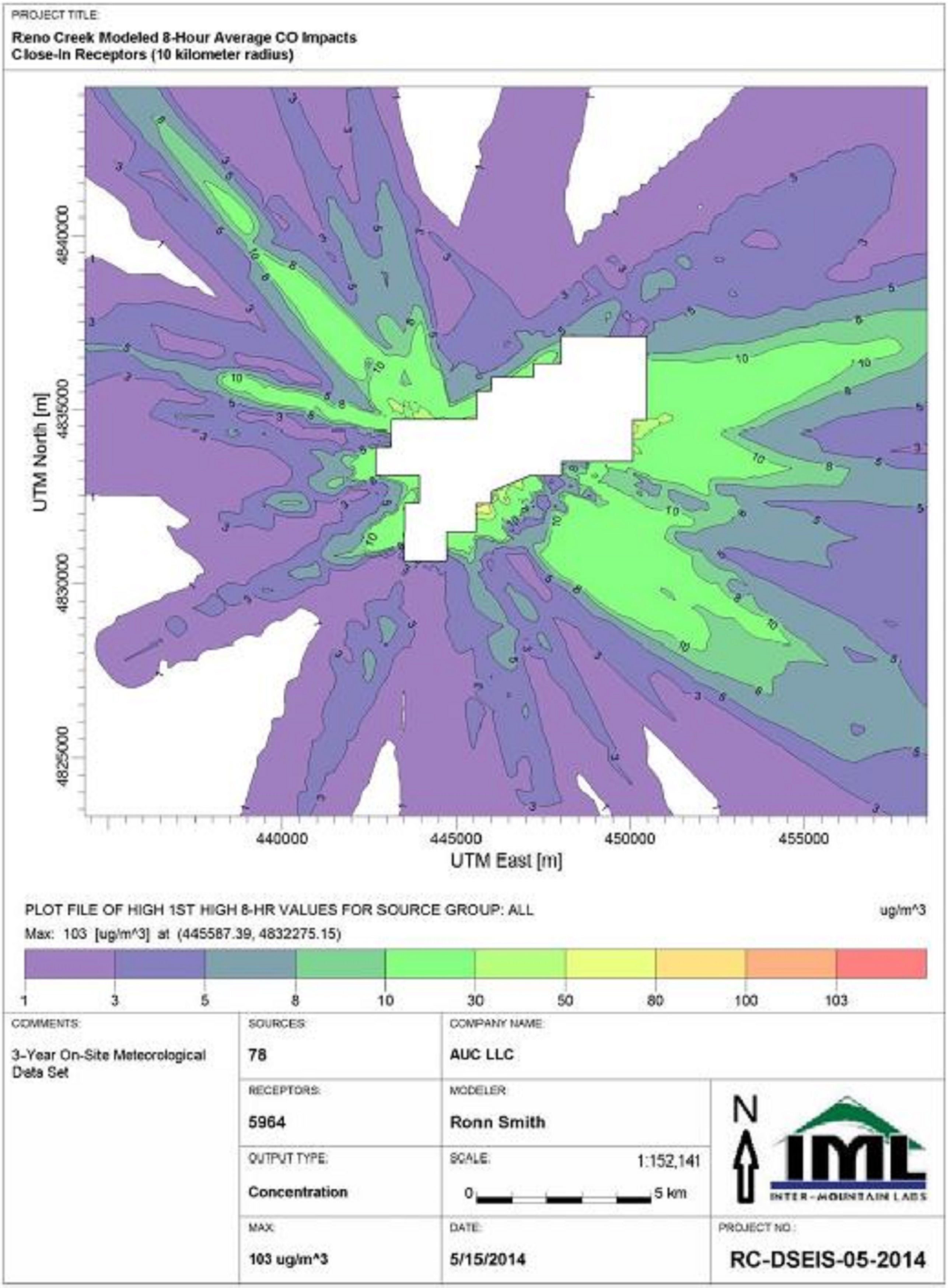
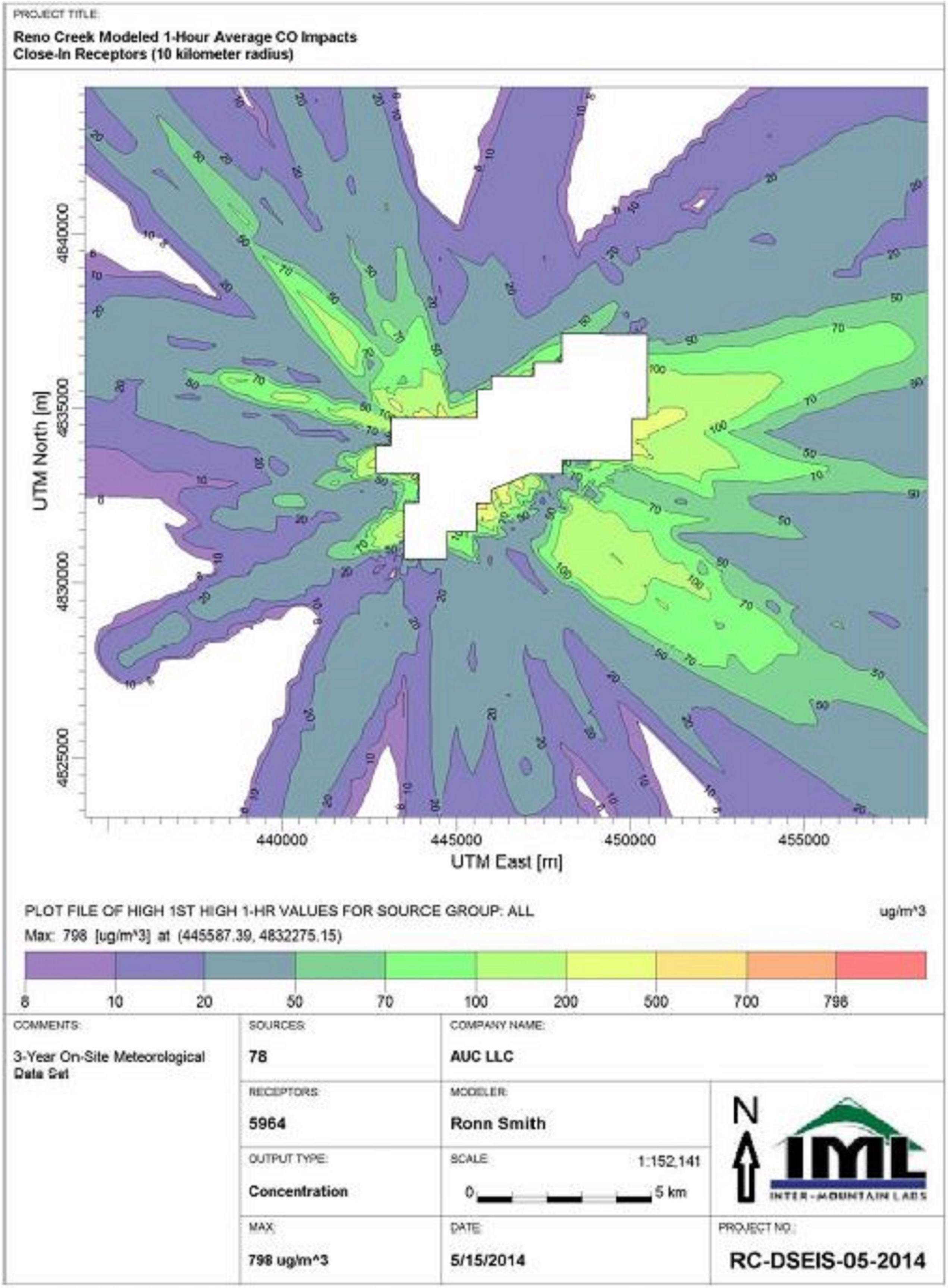


Figure 5-16. Modeled Maximum 1-Hr CO Concentrations (Without Background)



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APPENDIX A

EMISSION INVENTORY CALCULATIONS

Reno Creek Emissions Inventory Calculations

Table A-1 shows the anticipated schedule by project phase, over the expected 15-year duration of the Reno Creek ISR Project. The numbers shown in the chart correspond to resource utilization. For example, in year 1 the annual equipment hours available for the operation phase are utilized at 25%. This increases to 50% in year 2 and 100% in years 3 through 11. In years 12 through 14 those resources shift entirely to aquifer restoration. Table A-1 shows a similar complementarity of equipment hours between the construction and decommissioning phases. In both cases, this approach is intended to avoid double counting equipment hours that are shared between two or more phases. Table A-4 presents the resulting hours for each equipment item, attributable to each phase in year 6 when the maximum total emissions are expected to occur.

Table A-2 shows the available equipment hours and months in year 6, by equipment type. Table A-3 lists the horsepower rating, load factor, fuel type, and emission factors for each equipment type. Load factors are a composite of engine throttle settings and the percent of the time the equipment is actually in operation. Sources for emission factors include:

1. AP-42 Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (THC, SO_2, CO_2, Aldehydes)
2. EPA, Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling - Compression Ignition, April 2004 ($PM_{2.5}$)
3. EPA, Control of Emissions of Air Pollution from Non-Road Diesel Engines; Final Rule, Subpart 89.112, October 1998 (all Tiers: NO_x, CO, PM_{10} ; THC for Tier 1)

Note that hazardous air pollutants (HAP) from tailpipe exhaust refer to aldehyde emissions from fuel combustion.

The horsepower levels, load factors, and emission factors in Table A-3 were applied to the equipment hours for each phase in Table A-4. The results were added across all phases, yielding the annual emissions for each pollutant appearing in Tables A-5 through A-12. Yearly emission totals for each pollutant are reproduced in Table 2-2 of the Modeling Protocol document.

Table A-13 lists the estimated fugitive dust emissions for each year of the project, including both the PM_{10} and the $PM_{2.5}$ forms. The purpose of Table A-13 is to demonstrate that maximum fugitive dust emissions are expected to occur in year 6. Year "-1" refers to pre-licensing construction activity. Since dust generating activities are expected to decline sharply after year 10, the last line in Table A-13 gives only a not-to-exceed value for years 11 through 15.

Tables A-14 through A-17 show the estimated fugitive dust emissions for each phase of the project in year 6 (tons of PM_{10}). Table A-14 presents emissions from well field construction; the next three tables present only the marginal emissions attributable to operation, aquifer restoration and decommissioning, respectively. This approach avoids double counting equipment shared between phases. Emission factors are documented in each table, with mobile equipment generally yielding emissions in terms of lbs. per vehicle mile traveled. For special construction equipment, emission factors are provided in lbs. per hour. A control efficiency of 50% is assumed for all project roads, based on periodic dust suppression using water trucks. For the main access road from the public highway to the facilities, a control efficiency of 85% is assumed based on the application of a chemical dust suppressant ($MgCl_2$). PM_{10} emission calculations in Tables A-14 through A-17 are based on the following constants:

Constant	Symbol	Value
AP-42 Section 13.2.2 Equation 1A empirical constant, Table 13.2.2-2	k	1.5
AP-42 Section 13.2.2 Equation 1A empirical constant, Table 13.2.2-2	a	0.9
AP-42 Section 13.2.2 Equation 1A empirical constant, Table 13.2.2-2	b	0.45
Average silt content (%)	s	8.5
Average moisture content (%)	M	10.4
Average number wet days/year	WD	87

In addition, the following clarifications apply:

1. For drill/workover rigs, "Speed" column = average hours per hole (transit accounted for by HDD Truck)
2. Transit duty refers to percent of scheduled hours that vehicle is actually traveling
3. For trackhoe and backhoe, used 3.00 and a 1.25-cy buckets; a specific gravity of 1.6 was assumed
4. Where separate factors were not given, PM10 was assumed to be 30% of TSP (AP-42 Section 13.2.2, at 12% silt, KPM10/KTSP = 1.5/4.9 = 0.306)
5. For industrial unpaved roads, emission factor E = k(s/12)a(W/3)b
6. Wet days per year obtained from Reno Creek meteorological data, 2010-2013

Table A-18 shows fugitive dust emissions from wind erosion on disturbed areas, by year. Table A-19 details the expected annual emissions from stationary equipment, all of which will be fueled by LPG. Table A-20 summarizes the various sources of greenhouse gas (GHG) emissions, and Table A-21 provides support for the process-related GHG emission calculations.

Table A-1. Reno Creek ISR Project Schedule and Resource Allocation

Phase/Year	Yr -1	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	Yr 15
Facilities Construction	1	1														
Well Field Construction		0.7	0.9	1	1	1	1	0.85	0.8	0.75						
Operation		0.25	0.5	1	1	1	1	1	1	1	1	1				
Aquifer Restoration													1	1	1	
Reclamation/Decommissioning								0.15	0.2	0.25	1	1	1	1	1	1

Table A-2. Mobile Equipment Fleet Sizes and Duty

Equipment Item	Number of Units	Operating Months per Year When Active
Scraper	2	0
Grader	2	12
Bulldozer	1	1
Compactor	1	2
WaterTruck Construction	1	2
Front End Loader	2	12
Trackhoe	1	4
Backhoe	4	12
Drill Rig Water Truck	10	9
Drill Rig	10	9
Pickup Truck 3/4 Ton Well Installation Crew	10	9
Heavy Drill Rig	1	4
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	4	12
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	4	12
Fork Lift	1	12
Passenger Vehicle	20	12
Heavy Duty Diesel Truck	1	12
Delivery and Product Transport Truck	1	12
Workover Rig	1	1
Tractor	1	6
Cementing Unit	4	9
3/4 Ton Well LoggingTruck	2	12
1-Ton Swabbing Unit	2	12
1-Ton MIT Unit	2	12
Diesel 5 ton Telehandler	1	2
Diesel 4 ton Telehandler	1	12
Gasoline Manlift	4	2
175 KW Diesel Generator	1	4
Service/Fuel Truck	1	2
Concrete Pump Truck	1	1
Caisson Rig (for drilling piers)	1	1
Mixer Trucks (concrete delivery)	8	2
Power Trowel	2	1
Jumping Jack/Plate Tamper	3	1
Pickup Truck 1/2 Ton Construction	2	10
Pickup Truck 3/4 Ton Construction Crew Truck	6	10
Skid Steer/Mini Excavator	2	4
Excavator (Bldg. Exc. And Septic Install)	1	2

Table A-3. Mobile Equipment Sizes, Load Factors and Combustion Emission Factors

Basis For Equipment Tailpipe Emissions (Assumes Tier 1 Drill Rig Engines and Tier 3 Mobile Equipment Engines)	Size			Emission Factors (lb/hp-hr)							
	Horse-power	Load Factor	Fuel	THC	NO_x	CO	SO_2	CO_2	PM_{10}	$PM_{2.5}$	HAP
Scraper	330	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Grader	183	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Bulldozer	410	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Compactor	100	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
WaterTruck Construction	325	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Front End Loader	101	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Trackhoe	235	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Backhoe	85	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Drill Rig Water Truck	400	25%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Drill Rig	350	40%	Diesel	0.00214	0.01512	0.01873	0.00205	1.15000	0.00089	0.00086	0.00046
Pickup Truck 3/4 Ton Well Installation Crew	350	20%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
Heavy Drill Rig	750	60%	Diesel	0.00214	0.01512	0.01873	0.00205	1.15000	0.00089	0.00086	0.00046
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	265	20%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	265	20%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
Fork Lift	83	40%	Diesel	0.00251	0.03100	0.00668	0.00205	1.15000	0.00220	0.00213	0.00046
Passenger Vehicle	200	20%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
Heavy Duty Diesel Truck	450	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Delivery and Product Transport Truck	450	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Workover Rig	250	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Tractor	175	40%	Diesel	0.00251	0.03100	0.00668	0.00205	1.15000	0.00220	0.00213	0.00046
Cementing Unit	90	25%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
3/4 Ton Well LoggingTruck	350	25%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
1-Ton Swabbing Unit	350	25%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
1-Ton MIT Unit	350	25%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Diesel 5 ton Telehandler	110	25%	Diesel	0.00251	0.03100	0.00668	0.00205	1.15000	0.00220	0.00213	0.00046
Diesel 4 ton Telehandler	99	25%	Diesel	0.00251	0.03100	0.00668	0.00205	1.15000	0.00220	0.00213	0.00046
Gasoline Manlift	82	25%	Gasoline	0.00251	0.03100	0.00668	0.00205	1.15000	0.00220	0.00213	0.00046
175 KW Diesel Generator	60	80%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Service/Fuel Truck	250	25%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Concrete Pump Truck	400	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Caisson Rig (for drilling piers)	443	60%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Mixer Trucks (concrete delivery)	380	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Power Trowel	6	25%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
Jumping Jack/Plate Tamper	3	25%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
Pickup Truck 1/2 Ton Construction	285	20%	Gasoline	0.02200	0.01100	0.00696	0.00059	1.08000	0.00072	0.00070	0.00049
Pickup Truck 3/4 Ton Construction Crew Truck	397	20%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Skid Steer/Mini Excavator	74	25%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046
Excavator (Bldg. Exc. And Septic Install)	190	40%	Diesel	0.00247	0.00661	0.00573	0.00205	1.15000	0.00033	0.00032	0.00046

Table A-4. Year 6 Equipment Hours by Phase

Equipment Item	Facilities Construction	Well Field Construction	Operation	Aquifer Restoration	Reclamation /Decom-missioning
Scraper	0	0	0	0	0
Grader	0	550	0	0	0
Bulldozer	0	0	0	0	0
Compactor	0	0	0	0	0
WaterTruck Construction	0	0	0	0	0
Front End Loader	0	2,112	0	0	0
Trackhoe	0	704	0	0	0
Backhoe	0	8,448	0	0	0
Drill Rig Water Truck	0	13,860	0	0	0
Drill Rig	0	19,800	0	0	0
Pickup Truck 3/4 Ton Well Installation Crew	0	9,900	0	0	0
Heavy Drill Rig	0	0	0	0	0
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0	8,448	0	0	0
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0	0	8,448	0	0
Fork Lift	0	0	2,112	0	0
Passenger Vehicle	0	360	592	0	0
Heavy Duty Diesel Truck	0	198	528	0	0
Delivery and Product Transport Truck	0	50	132	0	0
Workover Rig	0	0	0	0	0
Tractor	0	1,056	0	0	0
Cementing Unit	0	6,336	0	0	0
3/4 Ton Well LoggingTruck	0	3,168	1,056	0	0
1-Ton Swabbing Unit	0	3,168	1,056	0	0
1-Ton MIT Unit	0	3,168	1,056	0	0
Diesel 5 ton Telehandler	0	0	0	0	0
Diesel 4 ton Telehandler	0	0	0	0	0
Gasoline Manlift	0	0	0	0	0
175 KW Diesel Generator	0	0	0	0	0
Service/Fuel Truck	0	0	0	0	0
Concrete Pump Truck	0	0	0	0	0
Caisson Rig (for drilling piers)	0	0	0	0	0
Mixer Trucks (concrete delivery)	0	0	0	0	0
Power Trowel	0	0	0	0	0
Jumping Jack/Plate Tamper	0	0	0	0	0
Pickup Truck 1/2 Ton Construction	0	0	0	0	0
Pickup Truck 3/4 Ton Construction Crew Truck	0	0	0	0	0
Skid Steer/Mini Excavator	0	0	0	0	0
Excavator (Bldg. Exc. And Septic Install)	0	0	0	0	0

Table A-5. Mobile Equipment THC Emissions

MOBILE EQUIPMENT THC EMISSIONS PER YEAR (TONS)																
	Year -1	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Scraper	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.14	0.14	0.14	0.14	0.14	0.14
Grader	0.02	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02
Bulldozer	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02
Compactor	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterTruck Construction	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.07	0.07	0.07	0.07	0.07	0.07
Front End Loader	0.00	0.07	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Trackhoe	0.00	0.06	0.07	0.08	0.08	0.08	0.08	0.07	0.07	0.06	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	0.01	0.29	0.32	0.35	0.35	0.35	0.35	0.31	0.29	0.27	0.03	0.03	0.03	0.03	0.03	0.03
Drill Rig Water Truck	0.07	1.20	1.54	1.71	1.71	1.71	1.71	1.45	1.37	1.28	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig	0.13	2.07	2.66	2.96	2.96	2.96	2.96	2.52	2.37	2.22	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Well Installation Crew	0.33	5.34	6.86	7.62	7.62	7.62	7.62	6.48	6.10	5.72	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Drill Rig	0.00	0.70	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0.00	3.45	4.43	4.93	4.93	4.93	4.93	4.56	4.43	4.31	2.46	2.46	2.46	2.46	2.46	2.46
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0.00	1.23	2.46	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	2.46	2.46	2.46	0.00
Fork Lift	0.01	0.10	0.04	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.13	0.13	0.04	0.04	0.04	0.04
Passenger Vehicle	0.06	0.35	0.27	0.42	0.42	0.42	0.42	0.41	0.40	0.40	0.34	0.34	0.22	0.22	0.22	0.08
Heavy Duty Diesel Truck	0.00	0.15	0.10	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.12	0.12	0.06	0.06	0.06	0.00
Delivery and Product Transport Truck	0.00	0.04	0.02	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.01	0.01	0.01	0.00
Workover Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02
Tractor	0.00	0.06	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Cementing Unit	0.00	1.10	1.41	1.57	1.57	1.57	1.57	1.39	1.33	1.27	0.39	0.39	0.39	0.39	0.39	0.39
3/4 Ton Well LoggingTruck	0.00	0.27	0.37	0.46	0.46	0.46	0.46	0.41	0.39	0.37	0.11	0.11	0.00	0.00	0.00	0.00
1-Ton Swabbing Unit	0.00	0.27	0.37	0.46	0.46	0.46	0.46	0.41	0.39	0.38	0.14	0.14	0.09	0.09	0.09	0.03
1-Ton MIT Unit	0.00	0.27	0.37	0.46	0.46	0.46	0.46	0.41	0.39	0.37	0.11	0.11	0.06	0.06	0.06	0.00
Diesel 5 ton Telehandler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel 4 ton Telehandler	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.07	0.07	0.07	0.07	0.07	0.07
Gasoline Manlift	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.04	0.04	0.04	0.04	0.04	0.04
175 KW Diesel Generator	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service/Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caisson Rig (for drilling piers)	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixer Trucks (concrete delivery)	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Trowel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jumping Jack/Plate Tamper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Construction	0.11	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Construction Crew Truck	0.03	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Skid Steer/Mini Excavator	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator (Bldg. Exc. And Septic Install)	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL THC	**1.06**	**18.00**	**22.22**	**26.48**	**26.48**	**26.48**	**26.48**	**23.91**	**23.06**	**22.20**	**9.37**	**9.37**	**6.40**	**6.40**	**6.40**	**3.61**

Table A-6. Mobile Equipment NO_x Emissions

MOBILE EQUIPMENT NO_x EMISSIONS PER YEAR (TONS)																
	Year -1	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Scraper	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.08	0.10	0.38	0.38	0.38	0.38	0.38	0.38
Grader	0.05	0.09	0.12	0.13	0.13	0.13	0.13	0.12	0.12	0.11	0.05	0.05	0.05	0.05	0.05	0.05
Bulldozer	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.04	0.04	0.04	0.04	0.04	0.04
Compactor	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterTruck Construction	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.05	0.19	0.19	0.19	0.19	0.19	0.19
Front End Loader	0.00	0.20	0.25	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Trackhoe	0.00	0.15	0.20	0.22	0.22	0.22	0.22	0.19	0.17	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	0.02	0.76	0.85	0.95	0.95	0.95	0.95	0.82	0.78	0.73	0.08	0.08	0.08	0.08	0.08	0.08
Drill Rig Water Truck	0.20	3.21	4.12	4.58	4.58	4.58	4.58	3.89	3.66	3.43	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig	0.90	14.67	18.86	20.95	20.95	20.95	20.95	17.81	16.76	15.71	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Well Installation Crew	0.16	2.67	3.43	3.81	3.81	3.81	3.81	3.24	3.05	2.86	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Drill Rig	0.00	4.96	4.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0.00	1.72	2.22	2.46	2.46	2.46	2.46	2.28	2.22	2.15	1.23	1.23	1.23	1.23	1.23	1.23
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0.00	0.62	1.23	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	1.23	1.23	1.23	0.00
Fork Lift	0.18	1.17	0.54	1.09	1.09	1.09	1.09	1.17	1.20	1.22	1.63	1.63	0.54	0.54	0.54	0.54
Passenger Vehicle	0.03	0.18	0.14	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.17	0.17	0.11	0.11	0.11	0.04
Heavy Duty Diesel Truck	0.00	0.40	0.26	0.43	0.43	0.43	0.43	0.41	0.41	0.40	0.31	0.31	0.16	0.16	0.16	0.00
Delivery and Product Transport Truck	0.00	0.10	0.07	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.08	0.08	0.04	0.04	0.04	0.00
Workover Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.05	0.05	0.05	0.05	0.05	0.05
Tractor	0.00	0.80	1.03	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Cementing Unit	0.00	0.55	0.71	0.78	0.78	0.78	0.78	0.70	0.67	0.64	0.20	0.20	0.20	0.20	0.20	0.20
3/4 Ton Well LoggingTruck	0.00	0.72	0.98	1.22	1.22	1.22	1.22	1.08	1.04	0.99	0.31	0.31	0.00	0.00	0.00	0.00
1-Ton Swabbing Unit	0.00	0.72	0.98	1.22	1.22	1.22	1.22	1.10	1.05	1.01	0.38	0.38	0.23	0.23	0.23	0.08
1-Ton MIT Unit	0.00	0.72	0.98	1.22	1.22	1.22	1.22	1.08	1.04	0.99	0.31	0.31	0.15	0.15	0.15	0.00
Diesel 5 ton Telehandler	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.06	0.06	0.06	0.06	0.06	0.06
Diesel 4 ton Telehandler	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.12	0.16	0.20	0.81	0.81	0.81	0.81	0.81	0.81
Gasoline Manlift	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.07	0.09	0.11	0.45	0.45	0.45	0.45	0.45	0.45
175 KW Diesel Generator	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service/Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caisson Rig (for drilling piers)	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixer Trucks (concrete delivery)	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Trowel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jumping Jack/Plate Tamper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Construction	0.06	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Construction Crew Truck	0.07	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Skid Steer/Mini Excavator	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator (Bldg. Exc. And Septic Install)	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL NO_x	**2.46**	**37.02**	**41.92**	**43.28**	**43.28**	**43.28**	**43.28**	**38.38**	**36.75**	**35.11**	**10.61**	**10.61**	**7.43**	**7.43**	**7.43**	**5.63**

Table A-7. Mobile Equipment CO Emissions

MOBILE EQUIPMENT CO EMISSIONS PER YEAR (TONS)																
	Year -1	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Scraper	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.07	0.08	0.33	0.33	0.33	0.33	0.33	0.33
Grader	0.05	0.08	0.10	0.12	0.12	0.12	0.12	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05
Bulldozer	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.04	0.04	0.04	0.04	0.04	0.04
Compactor	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterTruck Construction	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.16	0.16	0.16	0.16	0.16	0.16
Front End Loader	0.00	0.17	0.22	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Trackhoe	0.00	0.13	0.17	0.19	0.19	0.19	0.19	0.16	0.15	0.14	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	0.02	0.66	0.74	0.82	0.82	0.82	0.82	0.71	0.67	0.63	0.07	0.07	0.07	0.07	0.07	0.07
Drill Rig Water Truck	0.17	2.78	3.57	3.97	3.97	3.97	3.97	3.37	3.17	2.98	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig	1.11	18.17	23.37	25.96	25.96	25.96	25.96	22.07	20.77	19.47	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Well Installation Crew	0.10	1.69	2.17	2.41	2.41	2.41	2.41	2.05	1.93	1.81	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Drill Rig	0.00	6.15	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0.00	1.09	1.40	1.56	1.56	1.56	1.56	1.44	1.40	1.36	0.78	0.78	0.78	0.78	0.78	0.78
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0.00	0.39	0.78	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	0.78	0.78	0.78	0.00
Fork Lift	0.04	0.25	0.12	0.23	0.23	0.23	0.23	0.25	0.26	0.26	0.35	0.35	0.12	0.12	0.12	0.12
Passenger Vehicle	0.02	0.11	0.09	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.11	0.11	0.07	0.07	0.07	0.03
Heavy Duty Diesel Truck	0.00	0.34	0.23	0.37	0.37	0.37	0.37	0.36	0.35	0.35	0.27	0.27	0.14	0.14	0.14	0.00
Delivery and Product Transport Truck	0.00	0.09	0.06	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.07	0.07	0.03	0.03	0.03	0.00
Workover Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.04	0.04	0.04	0.04	0.04	0.04
Tractor	0.00	0.17	0.22	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Cementing Unit	0.00	0.35	0.45	0.50	0.50	0.50	0.50	0.44	0.42	0.40	0.12	0.12	0.12	0.12	0.12	0.12
3/4 Ton Well LoggingTruck	0.00	0.62	0.85	1.06	1.06	1.06	1.06	0.94	0.90	0.86	0.26	0.26	0.00	0.00	0.00	0.00
1-Ton Swabbing Unit	0.00	0.62	0.85	1.06	1.06	1.06	1.06	0.95	0.91	0.88	0.33	0.33	0.20	0.20	0.20	0.07
1-Ton MIT Unit	0.00	0.62	0.85	1.06	1.06	1.06	1.06	0.94	0.90	0.86	0.26	0.26	0.13	0.13	0.13	0.00
Diesel 5 ton Telehandler	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Diesel 4 ton Telehandler	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.04	0.17	0.17	0.17	0.17	0.17	0.17
Gasoline Manlift	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.10	0.10	0.10	0.10	0.10	0.10
175 KW Diesel Generator	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service/Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caisson Rig (for drilling piers)	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixer Trucks (concrete delivery)	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Trowel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jumping Jack/Plate Tamper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Construction	0.03	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Construction Crew Truck	0.06	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Skid Steer/Mini Excavator	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator (Bldg. Exc. And Septic Install)	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL CO	**2.29**	**35.86**	**42.37**	**41.58**	**41.58**	**41.58**	**41.58**	**36.18**	**34.38**	**32.58**	**5.59**	**5.59**	**3.84**	**3.84**	**3.84**	**2.58**

Table A-8. Mobile Equipment SO_2 Emissions

MOBILE EQUIPMENT SO_2 EMISSIONS PER YEAR (TONS)																
	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Scraper	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.03	0.12	0.12	0.12	0.12	0.12	0.12
Grader	0.02	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02
Bulldozer	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Compactor	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterTruck Construction	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.06	0.06	0.06	0.06	0.06	0.06
Front End Loader	0.00	0.06	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Trackhoe	0.00	0.05	0.06	0.07	0.07	0.07	0.07	0.06	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	0.01	0.24	0.26	0.29	0.29	0.29	0.29	0.25	0.24	0.23	0.02	0.02	0.02	0.02	0.02	0.02
Drill Rig Water Truck	0.06	0.99	1.28	1.42	1.42	1.42	1.42	1.21	1.14	1.07	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig	0.12	1.99	2.56	2.84	2.84	2.84	2.84	2.42	2.27	2.13	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Well Installation Crew	0.01	0.14	0.18	0.20	0.20	0.20	0.20	0.17	0.16	0.15	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Drill Rig	0.00	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0.00	0.09	0.12	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.07	0.07	0.07	0.07	0.07	0.07
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0.00	0.03	0.07	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.07	0.07	0.07	0.00
Fork Lift	0.01	0.08	0.04	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.11	0.11	0.04	0.04	0.04	0.04
Passenger Vehicle	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Heavy Duty Diesel Truck	0.00	0.12	0.08	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.10	0.10	0.05	0.05	0.05	0.00
Delivery and Product Transport Truck	0.00	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.00
Workover Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Tractor	0.00	0.05	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Cementing Unit	0.00	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01
3/4 Ton Well LoggingTruck	0.00	0.22	0.30	0.38	0.38	0.38	0.38	0.34	0.32	0.31	0.09	0.09	0.00	0.00	0.00	0.00
1-Ton Swabbing Unit	0.00	0.22	0.30	0.38	0.38	0.38	0.38	0.34	0.33	0.31	0.12	0.12	0.07	0.07	0.07	0.02
1-Ton MIT Unit	0.00	0.22	0.30	0.38	0.38	0.38	0.38	0.34	0.32	0.31	0.09	0.09	0.05	0.05	0.05	0.00
Diesel 5 ton Telehandler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel 4 ton Telehandler	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.05	0.05	0.05	0.05	0.05	0.05
Gasoline Manlift	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.03
175 KW Diesel Generator	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service/Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caisson Rig (for drilling piers)	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixer Trucks (concrete delivery)	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Trowel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jumping Jack/Plate Tamper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Construction	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Construction Crew Truck	0.02	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Skid Steer/Mini Excavator	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator (Bldg. Exc. And Septic Install)	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL SO_2	**0.50**	**5.73**	**6.48**	**6.73**	**6.73**	**6.73**	**6.73**	**5.91**	**5.63**	**5.36**	**1.25**	**1.25**	**0.86**	**0.86**	**0.86**	**0.64**

Table A-9. Mobile Equipment PM_{10} Emissions

MOBILE EQUIPMENT PM_{10} EMISSIONS PER YEAR (TONS)																
	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Scraper	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02
Grader	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Compactor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterTruck Construction	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Front End Loader	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Trackhoe	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	0.00	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig Water Truck	0.01	0.16	0.21	0.23	0.23	0.23	0.23	0.19	0.18	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig	0.05	0.86	1.11	1.23	1.23	1.23	1.23	1.05	0.98	0.92	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Well Installation Crew	0.01	0.17	0.22	0.25	0.25	0.25	0.25	0.21	0.20	0.19	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Drill Rig	0.00	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0.00	0.11	0.15	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.08	0.08	0.08	0.08	0.08	0.08
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0.00	0.04	0.08	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.08	0.08	0.08	0.00
Fork Lift	0.01	0.08	0.04	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.12	0.12	0.04	0.04	0.04	0.04
Passenger Vehicle	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Heavy Duty Diesel Truck	0.00	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00
Delivery and Product Transport Truck	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Workover Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractor	0.00	0.06	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Cementing Unit	0.00	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01
3/4 Ton Well LoggingTruck	0.00	0.04	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.02	0.02	0.00	0.00	0.00	0.00
1-Ton Swabbing Unit	0.00	0.04	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.02	0.02	0.01	0.01	0.01	0.00
1-Ton MIT Unit	0.00	0.04	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.02	0.02	0.01	0.01	0.01	0.00
Diesel 5 ton Telehandler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel 4 ton Telehandler	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.06	0.06	0.06	0.06	0.06	0.06
Gasoline Manlift	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.03
175 KW Diesel Generator	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service/Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caisson Rig (for drilling piers)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixer Trucks (concrete delivery)	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Trowel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jumping Jack/Plate Tamper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Construction	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Construction Crew Truck	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Skid Steer/Mini Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator (Bldg. Exc. And Septic Install)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL PM_{10}	**0.14**	**2.18**	**2.46**	**2.54**	**2.54**	**2.54**	**2.54**	**2.26**	**2.17**	**2.08**	**0.68**	**0.68**	**0.48**	**0.48**	**0.48**	**0.37**

Table A-10. Mobile Equipment $PM_{2.5}$ Emissions

MOBILE EQUIPMENT $PM_{2.5}$ EMISSIONS PER YEAR (TONS)																
	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Scraper	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02
Grader	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Compactor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterTruck Construction	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Front End Loader	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Trackhoe	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	0.00	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig Water Truck	0.01	0.16	0.20	0.22	0.22	0.22	0.22	0.19	0.18	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig	0.05	0.84	1.07	1.19	1.19	1.19	1.19	1.01	0.95	0.89	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Well Installation Crew	0.01	0.17	0.22	0.24	0.24	0.24	0.24	0.21	0.19	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Drill Rig	0.00	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0.00	0.11	0.14	0.16	0.16	0.16	0.16	0.14	0.14	0.14	0.08	0.08	0.08	0.08	0.08	0.08
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0.00	0.04	0.08	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.08	0.08	0.08	0.00
Fork Lift	0.01	0.08	0.04	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.11	0.11	0.04	0.04	0.04	0.04
Passenger Vehicle	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Heavy Duty Diesel Truck	0.00	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00
Delivery and Product Transport Truck	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Workover Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractor	0.00	0.06	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Cementing Unit	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01
3/4 Ton Well LoggingTruck	0.00	0.03	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.01	0.01	0.00	0.00	0.00	0.00
1-Ton Swabbing Unit	0.00	0.03	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.02	0.02	0.01	0.01	0.01	0.00
1-Ton MIT Unit	0.00	0.03	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.00
Diesel 5 ton Telehandler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel 4 ton Telehandler	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.06	0.06	0.06	0.06	0.06	0.06
Gasoline Manlift	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.03
175 KW Diesel Generator	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service/Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caisson Rig (for drilling piers)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixer Trucks (concrete delivery)	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Trowel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jumping Jack/Plate Tamper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Construction	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Construction Crew Truck	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Skid Steer/Mini Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator (Bldg. Exc. And Septic Install)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL $PM_{2.5}$	**0.13**	**2.12**	**2.38**	**2.47**	**2.47**	**2.47**	**2.47**	**2.20**	**2.11**	**2.02**	**0.66**	**0.66**	**0.46**	**0.46**	**0.46**	**0.36**

Table A-11. Mobile Equipment CO_2 Emissions

MOBILE EQUIPMENT CO_2 EMISSIONS PER YEAR (TONS)																
	Year -1	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Scraper	67	0	0	0	0	0	0	10	13	17	67	67	67	67	67	67
Grader	9	16	21	23	23	23	23	21	20	20	9	9	9	9	9	9
Bulldozer	8	0	0	0	0	0	0	1	2	2	8	8	8	8	8	8
Compactor	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WaterTruck Construction	33	0	0	0	0	0	0	5	7	8	33	33	33	33	33	33
Front End Loader	0	34	44	49	49	49	49	49	49	49	49	49	49	49	49	49
Trackhoe	0	27	34	38	38	38	38	32	30	29	0	0	0	0	0	0
Backhoe	4	133	149	165	165	165	165	142	135	127	14	14	14	14	14	14
Drill Rig Water Truck	34	558	717	797	797	797	797	677	638	598	0	0	0	0	0	0
Drill Rig	68	1116	1435	1594	1594	1594	1594	1355	1275	1195	0	0	0	0	0	0
Pickup Truck 3/4 Ton Well Installation Crew	16	262	337	374	374	374	374	318	299	281	0	0	0	0	0	0
Heavy Drill Rig	0	378	378	0	0	0	0	0	0	0	0	0	0	0	0	0
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0	169	218	242	242	242	242	224	218	212	121	121	121	121	121	121
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0	60	121	242	242	242	242	242	242	242	242	242	121	121	121	0
Fork Lift	7	44	20	40	40	40	40	43	44	45	60	60	20	20	20	20
Passenger Vehicle	3	17	13	21	21	21	21	20	20	20	17	17	11	11	11	4
Heavy Duty Diesel Truck	0	69	46	75	75	75	75	72	71	70	55	55	27	27	27	0
Delivery and Product Transport Truck	0	17	11	19	19	19	19	18	18	18	14	14	7	7	7	0
Workover Rig	0	0	0	0	0	0	0	1	2	2	8	8	8	8	8	8
Tractor	0	30	38	43	43	43	43	43	43	43	43	43	43	43	43	43
Cementing Unit	0	54	69	77	77	77	77	68	65	63	19	19	19	19	19	19
3/4 Ton Well LoggingTruck	0	125	170	213	213	213	213	189	181	173	53	53	0	0	0	0
1-Ton Swabbing Unit	0	125	170	213	213	213	213	191	183	176	66	66	40	40	40	13
1-Ton MIT Unit	0	125	170	213	213	213	213	189	181	173	53	53	27	27	27	0
Diesel 5 ton Telehandler	0	2	0	0	0	0	0	0	0	1	2	2	2	2	2	2
Diesel 4 ton Telehandler	0	30	0	0	0	0	0	5	6	8	30	30	30	30	30	30
Gasoline Manlift	0	17	0	0	0	0	0	2	3	4	17	17	17	17	17	17
175 KW Diesel Generator	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service/Fuel Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Pump Truck	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caisson Rig (for drilling piers)	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixer Trucks (concrete delivery)	0	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Trowel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jumping Jack/Plate Tamper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pickup Truck 1/2 Ton Construction	5	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pickup Truck 3/4 Ton Construction Crew Truck	12	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skid Steer/Mini Excavator	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator (Bldg. Exc. And Septic Install)	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CO_2	**296**	**3618**	**4161**	**4436**	**4436**	**4436**	**4436**	**3917**	**3745**	**3572**	**979**	**979**	**672**	**672**	**672**	**456**

Table A-12. Mobile Equipment Formaldehyde Emissions

MOBILE EQUIPMENT HAP EMISSIONS PER YEAR (TONS - FORMALDEHYDE)																
	Year -1	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Scraper	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.03
Grader	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Compactor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterTruck Construction	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Front End Loader	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Trackhoe	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	0.00	0.05	0.06	0.07	0.07	0.07	0.07	0.06	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01
Drill Rig Water Truck	0.01	0.22	0.29	0.32	0.32	0.32	0.32	0.27	0.26	0.24	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig	0.03	0.45	0.58	0.64	0.64	0.64	0.64	0.55	0.51	0.48	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Well Installation Crew	0.01	0.12	0.15	0.17	0.17	0.17	0.17	0.14	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Drill Rig	0.00	0.15	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	0.00	0.08	0.10	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	0.00	0.03	0.05	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.05	0.05	0.05	0.00
Fork Lift	0.00	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
Passenger Vehicle	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Heavy Duty Diesel Truck	0.00	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.00
Delivery and Product Transport Truck	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Workover Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractor	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Cementing Unit	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01
3/4 Ton Well LoggingTruck	0.00	0.05	0.07	0.09	0.09	0.09	0.09	0.08	0.07	0.07	0.02	0.02	0.00	0.00	0.00	0.00
1-Ton Swabbing Unit	0.00	0.05	0.07	0.09	0.09	0.09	0.09	0.08	0.07	0.07	0.03	0.03	0.02	0.02	0.02	0.01
1-Ton MIT Unit	0.00	0.05	0.07	0.09	0.09	0.09	0.09	0.08	0.07	0.07	0.02	0.02	0.01	0.01	0.01	0.00
Diesel 5 ton Telehandler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel 4 ton Telehandler	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Gasoline Manlift	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
175 KW Diesel Generator	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Service/Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caisson Rig (for drilling piers)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixer Trucks (concrete delivery)	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Trowel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jumping Jack/Plate Tamper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 1/2 Ton Construction	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pickup Truck 3/4 Ton Construction Crew Truck	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Skid Steer/Mini Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator (Bldg. Exc. And Septic Install)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL HAP	**0.12**	**1.48**	**1.71**	**1.83**	**1.83**	**1.83**	**1.83**	**1.62**	**1.55**	**1.48**	**0.41**	**0.41**	**0.28**	**0.28**	**0.28**	**0.19**

Table A-13. Fugitive Emissions Summary (Tons/Year)

Year	Active Phases	PM_{10}	$PM_{2.5}$
-1	Construction	24.47	2.63
1	Construction, Operation	109.07	11.09
2	Construction, Operation	130.82	13.31
3	Construction, Operation	154.77	15.71
4	Construction, Operation, Restoration	155.15	15.77
5	Construction, Operation, Restoration	155.54	15.82
6	Construction, Operation, Restoration	155.92	15.88
7	Construction, Operation, Restoration, Decomm	141.73	14.47
8	Construction, Operation, Restoration, Decomm	136.96	13.99
9	Construction, Operation, Restoration, Decomm	131.54	13.42
10	Operation, Restoration, Decomm	58.86	6.08
11-15	Operation, Restoration, Decomm	< 60	< 10

Table A-14. Facilities and Well Field Construction Fugitive Emissions, Year 6

Equipment Item	Quantity	Fleet Hours[2]	Transit Duty[8]	Speed (mph)[1]	Weight (tons)	lb/VMT	VMT	lb/hr	Control Efficiency	PM$_{10}$ tons/yr	Emission Factor Reference
Scraper	2	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Grader	2	550	100%	10		3.06	5,500		50%	4.21	AP-42 Table 11.9-1
Bulldozer	1	0						0.70	0%	0.00	AP-42 Table 11.9-1
Compactor	1	0	100%	10	5	3.06	0		50%	0.00	AP-42 Table 11.9-1
WaterTruck Construction	1	0	100%	15	16	1.78	0		50%	0.00	AP-42 Section 13.2.2
Front End Loader	2	2,112	100%	10	12	1.56	21,120		50%	8.25	AP-42 Section 13.2.2
Trackhoe[3]	1	704						3.20	0%	1.13	AP-42 Table 11.9-4
Backhoe[3]	4	8,448						1.33	0%	5.63	AP-42 Table 11.9-4
Drill Rig Water Truck	10	13,860	100%	10	16	1.78	138,600		50%	61.65	AP-42 Section 13.2.2
Drill Rig[1]	10	19,800		20				0.07	0%	0.64	AP-42 Table 11.9-4
Pickup Truck 3/4 Ton Well Installation Crew	10	9,900	40%	20	3	0.84	79,200		50%	16.59	AP-42 Section 13.2.2
Heavy Drill Rig	1	0		240				0.01	0%	0.00	AP-42 Table 11.9-4
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	4	8,448	40%	20	3	0.84	67,584		50%	14.15	AP-42 Section 13.2.2
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	4	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Fork Lift	1	0	40%	5	1	0.00	0		50%	0.00	AP-42 Section 13.2.2
Passenger Vehicle	20	360	100%	20	2	0.70	7,199		85%	0.38	AP-42 Section 13.2.2
Heavy Duty Diesel Truck	1	198	100%	15	30	2.36	2,977		50%	1.76	AP-42 Section 13.2.2
Delivery and Product Transport Truck	1	50	100%	15	30	2.36	744		50%	0.44	AP-42 Section 13.2.2
Workover Rig	1	0		72				0.02	0%	0.00	AP-42 Table 11.9-4
Tractor	1	1,056	100%	5	5	1.05	5,280		50%	1.39	AP-42 Section 13.2.2
Cementing Unit	4	6,336	20%	15	10	1.44	19,008		50%	6.84	AP-42 Section 13.2.2
3/4 Ton Well LoggingTruck	2	3,168	20%	10	4	0.95	6,336		50%	1.51	AP-42 Section 13.2.2
1-Ton Swabbing Unit	2	3,168	20%	10	5	1.05	6,336		50%	1.67	AP-42 Section 13.2.2
1-Ton MIT Unit	2	3,168	20%	10	5	1.05	6,336		50%	1.67	AP-42 Section 13.2.2
Diesel 5 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Diesel 4 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Gasoline Manlift	4	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
175 KW Diesel Generator	1	0									
Service/Fuel Truck	1	0	40%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Concrete Pump Truck	1	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Caisson Rig (for drilling piers)	1	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Mixer Trucks (concrete delivery)	8	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Power Trowel	2	0									
Jumping Jack/Plate Tamper	3	0									
Pickup Truck 1/2 Ton Construction	2	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Pickup Truck 3/4 Ton Construction Crew Truck	6	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Skid Steer/Mini Excavator	2	0						1.07	0%	0.00	AP-42 Table 11.9-4
Excavator (Bldg. Exc. And Septic Install)	1	0						1.33	0%	0.00	AP-42 Table 11.9-4
TOTAL PM10 EMISSIONS (TONS/YEAR)										**127.90**	

Table A-15. Operation Fugitive Emissions, Year 6

Equipment Item	Quantity	Fleet Hours[2]	Transit Duty[8]	Speed (mph)[1]	Weight (tons)	lb/VMT	VMT	lb/hr	Control Efficiency	PM_{10} tons/yr	Emission Factor Reference
Scraper	2	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Grader	2	0	100%	10		3.06	0		50%	0.00	AP-42 Table 11.9-1
Bulldozer	1	0						0.70	0%	0.00	AP-42 Table 11.9-1
Compactor	1	0	100%	10	5	3.06	0		50%	0.00	AP-42 Table 11.9-1
WaterTruck Construction	1	0	100%	15	16	1.78	0		50%	0.00	AP-42 Section 13.2.2
Front End Loader	2	0	100%	10	12	1.56	0		50%	0.00	AP-42 Section 13.2.2
Trackhoe[3]	1	0						3.20	0%	0.00	AP-42 Table 11.9-4
Backhoe[3]	4	0						1.33	0%	0.00	AP-42 Table 11.9-4
Drill Rig Water Truck	10	0	100%	10	16	1.78	0		50%	0.00	AP-42 Section 13.2.2
Drill Rig[1]	10	0		20				0.07	0%	0.00	AP-42 Table 11.9-4
Pickup Truck 3/4 Ton Well Installation Crew	10	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Heavy Drill Rig	1	0		240				0.01	0%	0.00	AP-42 Table 11.9-4
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	4	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	4	8,448	40%	20	3	0.84	67,584		50%	14.15	AP-42 Section 13.2.2
Fork Lift	1	2,112	40%	5	1	0.00	4,224		50%	0.00	AP-42 Section 13.2.2
Passenger Vehicle	20	592	100%	20	2	0.70	11,840		85%	0.62	AP-42 Section 13.2.2
Heavy Duty Diesel Truck	1	528	100%	15	30	2.36	7,920		50%	4.67	AP-42 Section 13.2.2
Delivery and Product Transport Truck	1	132	100%	15	30	2.36	1,980		50%	1.17	AP-42 Section 13.2.2
Workover Rig	1	0		72				0.02	0%	0.00	AP-42 Table 11.9-4
Tractor	1	0	100%	5	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Cementing Unit	4	0	20%	15	10	1.44	0		50%	0.00	AP-42 Section 13.2.2
3/4 Ton Well LoggingTruck	2	1,056	20%	10	4	0.95	2,112		50%	0.50	AP-42 Section 13.2.2
1-Ton Swabbing Unit	2	1,056	20%	10	5	1.05	2,112		50%	0.56	AP-42 Section 13.2.2
1-Ton MIT Unit	2	1,056	20%	10	5	1.05	2,112		50%	0.56	AP-42 Section 13.2.2
Diesel 5 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Diesel 4 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Gasoline Manlift	4	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
175 KW Diesel Generator	1	0									
Service/Fuel Truck	1	0	40%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Concrete Pump Truck	1	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Caisson Rig (for drilling piers)	1	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Mixer Trucks (concrete delivery)	8	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Power Trowel	2	0									
Jumping Jack/Plate Tamper	3	0									
Pickup Truck 1/2 Ton Construction	2	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Pickup Truck 3/4 Ton Construction Crew Truck	6	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Skid Steer/Mini Excavator	2	0						1.07	0%	0.00	AP-42 Table 11.9-4
Excavator (Bldg. Exc. And Septic Install)	1	0						1.33	0%	0.00	AP-42 Table 11.9-4
TOTAL PM10 EMISSIONS (TONS/YEAR)										**22.23**	

Table A-16. Restoration Fugitive Emissions, Year 6

Equipment Item	Quantity	Fleet Hours[2]	Transit Duty[8]	Speed (mph)[1]	Weight (tons)	lb/VMT	VMT	lb/hr	Control Efficiency	PM_{10} tons/yr	Emission Factor Reference
Scraper	2	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Grader	2	0	100%	10		3.06	0		50%	0.00	AP-42 Table 11.9-1
Bulldozer	1	0						0.70	0%	0.00	AP-42 Table 11.9-1
Compactor	1	0	100%	10	5	3.06	0		50%	0.00	AP-42 Table 11.9-1
WaterTruck Construction	1	0	100%	15	16	1.78	0		50%	0.00	AP-42 Section 13.2.2
Front End Loader	2	0	100%	10	12	1.56	0		50%	0.00	AP-42 Section 13.2.2
Trackhoe[3]	1	0						3.20	0%	0.00	AP-42 Table 11.9-4
Backhoe[3]	4	0						1.33	0%	0.00	AP-42 Table 11.9-4
Drill Rig Water Truck	10	0	100%	10	16	1.78	0		50%	0.00	AP-42 Section 13.2.2
Drill Rig[1]	10	0		20				0.07	0%	0.00	AP-42 Table 11.9-4
Pickup Truck 3/4 Ton Well Installation Crew	10	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Heavy Drill Rig	1	0		240				0.01	0%	0.00	AP-42 Table 11.9-4
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	4	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	4	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Fork Lift	1	0	40%	5	1	0.00	0		50%	0.00	AP-42 Section 13.2.2
Passenger Vehicle	20	0	100%	20	2	0.70	0		85%	0.00	AP-42 Section 13.2.2
Heavy Duty Diesel Truck	1	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Delivery and Product Transport Truck	1	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Workover Rig	1	0		72				0.02	0%	0.00	AP-42 Table 11.9-4
Tractor	1	0	100%	5	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Cementing Unit	4	0	20%	15	10	1.44	0		50%	0.00	AP-42 Section 13.2.2
3/4 Ton Well LoggingTruck	2	0	20%	10	4	0.95	0		50%	0.00	AP-42 Section 13.2.2
1-Ton Swabbing Unit	2	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
1-Ton MIT Unit	2	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Diesel 5 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Diesel 4 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Gasoline Manlift	4	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
175 KW Diesel Generator	1	0									
Service/Fuel Truck	1	0	40%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Concrete Pump Truck	1	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Caisson Rig (for drilling piers)	1	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Mixer Trucks (concrete delivery)	8	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Power Trowel	2	0									
Jumping Jack/Plate Tamper	3	0									
Pickup Truck 1/2 Ton Construction	2	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Pickup Truck 3/4 Ton Construction Crew Truck	6	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Skid Steer/Mini Excavator	2	0						1.07	0%	0.00	AP-42 Table 11.9-4
Excavator (Bldg. Exc. And Septic Install)	1	0						1.33	0%	0.00	AP-42 Table 11.9-4
TOTAL PM10 EMISSIONS (TONS/YEAR)										**0.00**	

Table A-17. Decommissioning Fugitive Emissions, Year 6

Equipment Item	Quantity	Fleet Hours[2]	Transit Duty[8]	Speed (mph)[1]	Weight (tons)	lb/VMT	VMT	lb/hr	Control Efficiency	PM_{10} tons/yr	Emission Factor Reference
Scraper	2	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Grader	2	0	100%	10		3.06	0		50%	0.00	AP-42 Table 11.9-1
Bulldozer	1	0						0.70	0%	0.00	AP-42 Table 11.9-1
Compactor	1	0	100%	10	5	3.06	0		50%	0.00	AP-42 Table 11.9-1
WaterTruck Construction	1	0	100%	15	16	1.78	0		50%	0.00	AP-42 Section 13.2.2
Front End Loader	2	0	100%	10	12	1.56	0		50%	0.00	AP-42 Section 13.2.2
Trackhoe[3]	1	0						3.20	0%	0.00	AP-42 Table 11.9-4
Backhoe[3]	4	0						1.33	0%	0.00	AP-42 Table 11.9-4
Drill Rig Water Truck	10	0	100%	10	16	1.78	0		50%	0.00	AP-42 Section 13.2.2
Drill Rig[1]	10	0		20				0.07	0%	0.00	AP-42 Table 11.9-4
Pickup Truck 3/4 Ton Well Installation Crew	10	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Heavy Drill Rig	1	0		240				0.01	0%	0.00	AP-42 Table 11.9-4
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	4	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	4	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Fork Lift	1	0	40%	5	1	0.00	0		50%	0.00	AP-42 Section 13.2.2
Passenger Vehicle	20	0	100%	20	2	0.70	0		85%	0.00	AP-42 Section 13.2.2
Heavy Duty Diesel Truck	1	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Delivery and Product Transport Truck	1	0	100%	15	30	2.36	0		50%	0.00	AP-42 Section 13.2.2
Workover Rig	1	0		72				0.02	0%	0.00	AP-42 Table 11.9-4
Tractor	1	0	100%	5	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Cementing Unit	4	0	20%	15	10	1.44	0		50%	0.00	AP-42 Section 13.2.2
3/4 Ton Well LoggingTruck	2	0	20%	10	4	0.95	0		50%	0.00	AP-42 Section 13.2.2
1-Ton Swabbing Unit	2	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
1-Ton MIT Unit	2	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Diesel 5 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Diesel 4 ton Telehandler	1	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Gasoline Manlift	4	0	10%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
175 KW Diesel Generator	1	0									
Service/Fuel Truck	1	0	40%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Concrete Pump Truck	1	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Caisson Rig (for drilling piers)	1	0	20%	10	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Mixer Trucks (concrete delivery)	8	0	20%	15	5	1.05	0		50%	0.00	AP-42 Section 13.2.2
Power Trowel	2	0									
Jumping Jack/Plate Tamper	3	0									
Pickup Truck 1/2 Ton Construction	2	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Pickup Truck 3/4 Ton Construction Crew Truck	6	0	40%	20	3	0.84	0		50%	0.00	AP-42 Section 13.2.2
Skid Steer/Mini Excavator	2	0						1.07	0%	0.00	AP-42 Table 11.9-4
Excavator (Bldg. Exc. And Septic Install)	1	0						1.33	0%	0.00	AP-42 Table 11.9-4
TOTAL PM10 EMISSIONS (TONS/YEAR)										**0.00**	

Table A-18. Wind Erosion Emissions

Disturbance Schedule							Emissions		
Year	Short Term Disturbed Acres	Long Term Disturbed Acres	Total Acres Disturbed per Year	Total Acres Disturbed	Total Acres Reclaimed	Net Acres Exposed	TSP Emission Factor (tons/acre/yr)	PM_{10} Emissions (tons/yr)	$PM_{2.5}$ Emissions (tons/yr)
1	12.0	20.0	32.0	32.0	0	32.0	0.38	3.64	0.55
2	15.0	5.4	20.3	52.3	12	40.3	0.38	4.60	0.69
3	12.0	3.4	15.4	67.7	15	40.7	0.38	4.64	0.70
4	12.0	3.4	15.4	83.1	12	44.1	0.38	5.02	0.75
5	12.0	3.4	15.4	98.5	12	47.4	0.38	5.41	0.81
6	12.0	3.4	15.4	113.9	12	50.8	0.38	5.79	0.87
7	12.0	3.4	15.4	129.3	14.6	51.6	0.38	5.88	0.88
8	12.0	3.4	15.4	144.7	15.4	51.6	0.38	5.88	0.88
9	7.5	2.1	9.6	154.3	15.4	45.9	0.38	5.23	0.78
10	0.0	0.0	0.0	154.3	10.9	35.0	0.38	3.99	0.60
11	0.0	0.0	0.0	154.3	3.4	31.6	0.38	3.60	0.54
12	0.0	0.0	0.0	154.3	3.4	28.3	0.38	3.22	0.48
13	0.0	0.0	0.0	154.3	3.4	24.9	0.38	2.84	0.43
14	0.0	0.0	0.0	154.3	3.4	21.6	0.38	2.46	0.37
15	0.0	0.0	0.0	154.3	21.6	0.0	0.38	0.00	0.00

Source: AP-42 Table 11.9-4

Table A-19. Stationary Equipment Emissions

Gas-Fired Small Equipment				
Item	Vacuum Dryers	Main Heater	Furnace	Radiant Heaters
Number of Units	2	1	1	7
Operating hours/yr	3,650	4,380	4,380	4,380
Maximum duty (MMBtu/hr)	1.30	1.20	0.11	0.14
Heating value (MMbtu/gal)	91.5	91.5	91.5	91.5
Years in operation	13	16	16	16

LPG Emission Factors (lb/10^3 gal) - Sources: AP-42 Table 1.5-1, Table 1.4-3				
Pollutant	**Vacuum Dryer**	**Main Heater**	**Furnace**	**Radiant Heaters**
NO_x	13.0	13.0	13.0	13.0
CO	7.5	7.5	7.5	7.5
$PM_{10}/PM_{2.5}$	0.7	0.7	0.7	0.7
SO_2	0.0	0.0	0.0	0.0
TOC	1.0	1.0	1.0	1.0
VOC	0.0	0.0	0.0	0.0
CO_2	12,500	12,500	12,500	12,500
HAP	0.007	0.007	0.007	0.007

Emissions (tons/yr)					
Pollutant	**Vacuum Dryers**	**Main Heater**	**Furnace**	**Radiant Heaters**	**Total**
NO_x	0.67	0.37	0.03	0.30	1.39
CO	0.39	0.22	0.02	0.18	0.80
$PM_{10}/PM_{2.5}$	0.04	0.02	0.00	0.02	0.07
SO_2	0.00	0.00	0.00	0.00	0.00
TOC	0.05	0.03	0.00	0.02	0.11
VOC	0.00	0.00	0.00	0.00	0.00
CO_2	648.22	359.02	31.41	293.20	1331.85
HAP	0.00	0.00	0.00	0.00	0.00

Table A-20. GHG Emissions

Source	Tons/Yr (Max)
Engine tailpipe	4,436
Propane combustion	1,332
U_3O_8 recovery process	755
Electricity consumption	39,422
TOTAL GHG EMISSIONS	**45,945**

Table A-21. Process GHG Emissions

ASSUMPTIONS							
Only greenhouse gas produced in ISR operation is Carbon Dioxide							
Carbon Dioxide is released when acidifying pregnant eluate prior to precipitation of uranyl peroxide.							
1.157	cu ft CO_2/cu ft Natural Gas (The Making Shaping and Treating of Steel, 9th Edition 1971 p. 72)						
1049	btu/cu ft Natural Gas	Pocket Ref 3rd Edition pg 330					
117	Molecular Weight AMV						
6	lb U_3O_8 Per Cubic Foot of Loaded Resin						
2,408,605	lb/yr as UO_4 $2H_2O$			Conversion Factor U to UO_4 $2H_20$			
2,000,000	lb/yr U as U_3O_8			338	Molecular Weight UO_4 $2H_20$		
1,696,000	lb/yr U as U			1.420168	Conversion Factor		
CARBON DIOXIDE FROM UranylTriCarbonate BREAKDOWN							
3,232,376	gm -Mole/yr $UO_2(CO_3)_3$						
9,697,129	gm-Mole/yr CO_2 Released						
426,674	kg/yr CO_2 Released						
470.3	short ton CO_2/yr Released						
CARBON DIOXIDE FROM BREAKDOWN OF CARBONATE IN ELUATE							
333,333	Cubic Feet Resin Processed Per year						
1,000,000	Cubic Feet of Eluate Produced Per Year						
2%	Sodium Carbonate in Eluate						
1.1	Estimated specific gravity of eluate						
1,372,800	lb/yr Sodium Carbonate in Eluate						
42%	CO_2 in Sodium Carbonate						
569,842	lb/yr CO_2 released from Eluate						
285	Short Tons CO_2 released per year from Eluate						
Summary of CO_2 Release							
CO_2 from UTC Breakdown		470.3					
CO_2 from Sodium Carbonate in Eluate		285					
Total Annual CO_2 Production		755	short tons per year				

APPENDIX B

SOURCE APPORTIONMENT AND TIMING

Reno Creek Emissions Inventory – Area Source Apportionment and Timing

Stationary sources within the Reno Creek ISR Project boundary are represented in AERMOD as point sources, with source coordinates, stack parameters and emission rates summarized in Table 2-5 of the main protocol document. The timing of these point source emissions is as follows:

1. Yellow cake dryers – 24 hours per day, 7 days per week, 12 months per year
2. Space heaters and furnace – 24 hours per day, 7 days per week, 6 months per year (Nov-Apr)

Thus, the heaters operate on average, only half the year. A variable rate factor of 2.00 is assigned to the heaters such that their respective emission rates during the times of actual operation are twice what they would be if the heaters operated continuously and year-round.

Emissions from mobile and fugitive sources, or sources that do not have a stationary stack, are represented in AERMOD through area sources. The procedure for allocating mobile source emissions to modeled area sources is described as follows:

1. Each equipment type is designated as an emitter of certain modeled pollutants. The annual amount (tons/year) of each pollutant generated by an emitter is calculated from equipment activity levels, engine sizes, fuel types, and emission factors as detailed in Appendix A of this document.
2. The calculated annual emissions for each emitter are assigned to one of seven area source categories, based on the areas within the project boundary where that emitter is predominantly active during the modeled year.
3. Each area source category is further divided into modeled area sources, each represented spatially as a rectangle described by the UTM coordinates of the southwest (SW) corner of the rectangle, the width and length of the rectangle, and the azimuth angle formed by the side of the rectangle immediately clockwise from the SW corner. Each rectangle approximates the spatial orientation and extent of the corresponding modeled area source.
4. The emissions from a given area source category are apportioned to the component modeled area sources according to their rectangular areas relative to the combined area of the source category, such that the emission rate (lbs./hr./ft^2) for a given pollutant is constant throughout the modeled areas comprising that source category.
5. The emission rates derived through the above procedure are further modified in AERMOD to account for non-continuous operation of the various emitters. For example, emissions generated from passenger vehicles accessing the project site, are modeled to occur within two, two-hour periods each week day (6am to 8am in the morning and 5pm to 7pm in the evening). A variable rate factor greater than one is assigned to each modeled area source, as 8,760 (total hours in a year) divided by the hours actually operated during the year.

Table B-1 lists the equipment types, or emitters that are projected to be active in year 6, along with the area source category wherein each emitter is most active during the modeled year.

Table B-2 shows the modeled area sources, the parent source categories to which they are assigned, their spatial parameters, and the timing of their operation. Actual operating hours are assigned to each modeled source based on the duty cycle of the emitters contributing to that source. These actual operating hours are calculated from the duty cycle as the hours per day multiplied by the days per week, multiplied by the factor 52/12 (average weeks per month), multiplied by the months per year. The variable emission rate factor for each modeled area source then becomes 8,760 divided by actual operating hours. AERMOD provides for the assignment of hours, days, and months to each modeled area source. AERMOD then multiplies the appropriate rate factor by the corresponding base emission rate for each pollutant to simulate the hour-by-hour emissions intensity. This correction, along with the availability of hourly meteorological conditions, provides a more accurate (and conservative) depiction of short-term impacts from project emissions on model receptors.

Table B-1: Allocation of Equipment Emissions to Area Sources in Year 6

Equipment Item	Source Category
Scraper	Reclaimed wellfields
Grader	Constructed wellfields
Bulldozer	Constructed wellfields
Compactor	Constructed wellfields
WaterTruck Construction	Facility
Front End Loader	Constructed wellfields
Track Dozer	Constructed wellfields
Backhoe	Constructed wellfields
Drill Rig Water Truck	Constructed wellfields
Drill Rig	Constructed wellfields
Pickup Truck 3/4 Ton Well Installation Crew	Constructed wellfields
Heavy Drill Rig	Deep Injection Wells
Pickup Truck 1/2 Ton Wellfield Construction/Reclamation	Project Roads
Pickup Truck 1/2 Ton Wellfield Operations/Restoration	Project Roads
Fork Lift	Facility
Passenger Vehicle	Access Road
Heavy Duty Diesel Truck	Project Roads
Delivery and Product Transport Truck	Access Road
Workover Rig	Deep Injection Wells
Tractor	Reclaimed wellfields
Cementing Unit	Constructed wellfields
3/4 Ton Well LoggingTruck	Constructed wellfields
1-Ton Swabbing Unit	Constructed wellfields
1-Ton MIT Unit	Constructed wellfields
Wind Erosion	Disturbed Areas

Table B-2: Modeled Area Source Parameters, Apportionment, Emission Rates and Timing in Year 6

Area Source	XCoord	YCoord	Width	Length	Angle	Source Category in Year 6	Category Emissions Allocation	Modeled Hrs/Day	Modeled Days/Wk	Modeled Months/Yr	Base Emission Rates (lb/hr/ft^2)				
											NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO
FACCPP	444312	4832279	400	400	0	Facility	100.00%	10	5	12	1.44E-07	1.02E-08	9.92E-09	9.53E-09	3.10E-08
WF1_1	444921	4834063	152.4	365.8	0	Reclaimed wellfields	40.00%	12	5	6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WF1_2	445074	4833840	152.4	548.6	0	Reclaimed wellfields	60.00%	12	5	6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WF2_1	446295	4835234	152.4	182.9	0	(Not Active Yr 6)									
WF2_2	446447	4835167	152.4	182.9	0	(Not Active Yr 6)									
WF2_3	446422	4834984	152.4	182.9	0	(Not Active Yr 6)									
WF2_4	446003	4834897	182.9	152.4	0	(Not Active Yr 6)									
WF2_5	446186	4834785	182.9	152.4	0	(Not Active Yr 6)									
WF3_1	446638	4835023	182.9	152.4	0	(Not Active Yr 6)									
WF3_2	446821	4835103	182.9	152.4	0	(Not Active Yr 6)									
WF3_3	446973	4835256	182.9	152.4	0	(Not Active Yr 6)									
WF3_4	447157	4835351	548.6	152.4	0	(Not Active Yr 6)									
WF4_1	447808	4835321	304.8	182.9	0	(Not Active Yr 6)									
WF4_2	447778	4835183	182.9	152.4	0	(Not Active Yr 6)									
WF4_3	447960	4835137	152.4	182.9	0	(Not Active Yr 6)									
WF4_4	447718	4835016	182.9	152.4	0	(Not Active Yr 6)									
WF4A_1	448458	4836009	182.9	152.4	0	(Not Active Yr 6)									
WF4A_2	448520	4836161	182.9	152.4	0	(Not Active Yr 6)									
WF5_1	449131	4834385	548.6	304.8	0	(Not Active Yr 6)									
WF6_1	449644	4836161	182.9	152.4	0	(Not Active Yr 6)									
WF6_2	449650	4835722	152.4	182.9	0	(Not Active Yr 6)									
WF6_3	449846	4835646	152.4	182.9	0	(Not Active Yr 6)									
WF6_4	449692	4835539	152.4	182.9	0	(Not Active Yr 6)									
WF6_5	449795	4835356	152.4	182.9	0	(Not Active Yr 6)									
WF6_6	449643	4835173	152.4	182.9	0	(Not Active Yr 6)									
WF7_1	449213	4834233	365.8	152.4	0	Constructed wellfields	6.45%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF7_2	449275	4834080	182.9	152.4	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF7_3	449092	4833928	182.9	152.4	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF7A_1	448291	4833949	182.9	152.4	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF8_1	445043	4832332	152.4	344.4	0	Constructed wellfields	9.68%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF8_2	445196	4832399	152.4	121.9	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF8_3	445348	4832459	152.4	182.9	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF8_4	445077	4831928	152.4	256.0	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF9_1	444882	4832774	152.4	365.8	0	Constructed wellfields	6.45%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF9_2	444863	4832591	152.4	182.9	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF9_3	444863	4832439	182.9	152.4	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF9_4	444995	4833335	152.4	365.8	0	Constructed wellfields	6.45%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF10_1	444372	4834023	548.6	152.4	0	Constructed wellfields	9.68%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF10_2	444555	4834176	365.8	152.4	0	Constructed wellfields	6.45%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF11_1	443940	4831429	304.8	91.4	45	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF11_2	444188	4831613	304.8	76.2	45	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF11_3	444396	4831836	213.4	67.1	23	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF12_1	443662	4834113	152.4	182.9	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF12_2	443814	4834236	152.4	182.9	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF12_3	443967	4834083	182.9	152.4	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF12_4	444150	4834236	152.4	182.9	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF12_5	444150	4834036	182.9	152.4	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF12_6	444176	4833853	152.4	182.9	0	Constructed wellfields	3.23%	12	5	9	9.49E-07	2.98E-06	3.46E-07	1.61E-07	9.78E-07
WF12A_1	443218	4833576	152.4	182.9	0	(Not Active Yr 6)									
ARD_1	444476	4832051	61.0	152.4	-5	Access Road	39.24%	4	5	12	2.18E-07	1.80E-06	1.92E-07	3.08E-08	1.55E-07
ARD_2	444546	4832206	182.9	61.0	45	Access Road	31.39%	4	5	12	2.18E-07	1.80E-06	1.92E-07	3.08E-08	1.55E-07
ARD_3	444625	4832371	61.0	171.0	0	Access Road	29.37%	4	5	12	2.18E-07	1.80E-06	1.92E-07	3.08E-08	1.55E-07
PRD_1	444720	4832560	114.0	1140.0	0	Project Roads	9.88%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_2	443400	4833720	1000.0	110.0	0	Project Roads	8.37%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_3	444400	4833720	1000.0	110.0	0	Project Roads	8.37%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_4	445400	4833850	110.0	1100.0	-40	Project Roads	9.20%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_5	446190	4834620	1200.0	120.0	0	Project Roads	10.95%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_6	446690	4834740	100.0	260.0	0	Project Roads	1.98%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_7	447390	4834620	1200.0	120.0	0	Project Roads	10.95%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_8	447770	4834740	100.0	260.0	0	Project Roads	1.98%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_9	448330	4834120	120.0	500.0	0	Project Roads	4.56%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_10	448460	4834740	124.0	1240.0	0	Project Roads	11.69%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_11	448590	4834740	1010.0	120.0	0	Project Roads	9.22%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
PRD_12	449470	4834860	130.0	1300.0	0	Project Roads	12.85%	10	5	12	8.64E-08	5.66E-07	6.14E-08	6.43E-09	5.63E-08
IW1	445800	4833250	30.0	30.0	0	Deep Injection Wells	100.00%	24	7	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IW2	448990	4834510	30.0	30.0	0	Deep Injection Wells	100.00%	24	7	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IW3	444360	4832650	30.0	30.0	0	Deep Injection Wells	100.00%	24	7	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IW4	450050	4835670	30.0	30.0	0	Deep Injection Wells	100.00%	24	7	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
DIST_1	444000	4831429	1000.0	250.0	45	Disturbed Areas	5.10%	24	7	12		2.51E-08	3.76E-09		
DIST_2	444312	4832279	400.0	400.0	0	Disturbed Areas	3.27%	24	7	12		2.51E-08	3.76E-09		
DIST_3	444712	4831928	700.0	1900.0	0	Disturbed Areas	27.14%	24	7	12		2.51E-08	3.76E-09		
DIST_4	443660	4833850	1600.0	600.0	0	Disturbed Areas	19.59%	24	7	12		2.51E-08	3.76E-09		
DIST_5	445500	4833800	3600.0	500.0	10	Disturbed Areas	36.73%	24	7	12		2.51E-08	3.76E-09		
DIST_6	448300	4833900	1000.0	400.0	0	Disturbed Areas	8.16%	24	7	12		2.51E-08	3.76E-09		

APPENDIX D

Response to RAI EC-1:
Wyoming Game & Fish Department
Correspondence re: Crucial Habitat Priority Area

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006

Phone: (307) 777-4600 Fax: (307) 777-4699

wgfd.wyo.gov

March 3, 2014

WER 11769
ICF International
Habitat Priority Areas
Reno Creek Uranium Project
Campbell County

Jessica Maycock
Project Manager/Wildlife Biologist
ICF International
405 West Boxelder Road, Suite A-5
Gillette, WY 82718

Dear Ms. Maycock:

The staff of the Wyoming Game and Fish Department has reviewed the Habitat Priority Areas for ICF International on behalf of Phil Cavendor with AUC, LLC for the Reno Creek Uranium project in Campbell County. We offer the following comments for your consideration.

The monitoring protocols for this project that have been provided are adequate. This project is not within a sage-grouse core area and we are not requiring mitigation measures for sage-grouse. We do expect sage-grouse non-core area stipulations and recommendations to be abided by. In addition, it has come to our attention that the Nuclear Regulatory Commission has inquired about the sagebrush/mixed grassland habitat priority area. Please be advised that our habitat priority areas as found in our Statewide Habitat Plan are a delineation of common habitat types found in Wyoming. This document helps our staff work with others to maintain or improve conditions within each type. The priority areas are not a means nor a basis upon which to develop mitigation measures for species; they are simply recognition of habitat types and provide direction for our staff and cooperating groups to consider when developing habitat projects within each type.

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Scott Gamo, Staff Terrestrial Biologist, at 307-777-4509.

Sincerely,

Mark Konishi
Deputy Director

MK/mf/gb

cc: USFWS

"Conserving Wildlife - Serving People"

5 4/150

WYOMING GAME AND FISH DEPARTMENT

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June 7, 2013

MR LB DE SP
KK MT LM JM
PS BK DC DS
JJ MB

WER 7457.01
Department of Environmental Quality
Land Quality Division
Technical Review
Reno Creek Project ISL Permit Application
AUC LLC
TFN 5 4/150
Campell County

Luke McMahan P.G.
Project Geologist
LQD District III
2100 West 5th Street
Sheridan, WY 82801

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JUN 12 2013
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Dear Mr. McMahan:

The staff of the Wyoming Game and Fish Department has completed the technical review for the Reno Creek Project ISL Permit Application, TFN 5 4/150 submitted by AUC LLC in Campbell County. We offer the following comments for your consideration.

Terrestrial Considerations:

The proposed project lies within portions of the North Converse Pronghorn and North Converse Mule Deer Herd Units and portions of the Pumpkin Buttes Pronghorn and Pumpkin Buttes Mule Deer Herd Units. Pronghorn and mule deer utilize the area as yearlong range. Temporary disturbance of big game species during this project may have isolated short-term effects on portions of these herds, as animals could potentially be disturbed away from active project areas. Hunting and hunting access will not likely be affected as any public land that falls within this proposed project area is not currently accessible.

Sage-grouse likely use habitats in and around the project area for winter, breeding, nesting, and brood-rearing habitat. A variety of other sage-dependent non-game birds and small mammals also use these habitats. As proposed, there is one active sage-grouse lek, Porcupine Creek, nearby. We recommend annual spring monitoring of this lek be coordinated with our local biologist in Gillette. The project area does not fall within a sage-grouse core area as defined by the Governor's Executive Order for Sage-Grouse.

"Conserving Wildlife - Serving People"

The reclamation plan and associated plant species list provided to meet DEQ-LQD requirements is appropriate for this area and should provide habitat for wildlife once the project area is reclaimed. We recommend including control of cheatgrass in the weed management plan and consider seeding sage-brush where appropriate.

Aquatic Considerations:

To minimize impacts to the aquatic resources of the Belle Fourch River, we recommend the following:

- Accepted best management practices be implemented to ensure that all sediments and other pollutants are contained within the boundaries of the work area. Disturbed areas that are contributing sediment to surface waters as a result of project activities should be promptly re-vegetated to maintain water quality.

- Equipment should be serviced and fueled away from streams and riparian areas. Equipment staging areas should be at least 300 feet from riparian areas.

- Preventing the spread of aquatic invasive species (AIS) is a priority for the State of Wyoming, and in many cases, the intentional or unintentional spread of organisms from one body of water to another would be considered a violation of State statute and Wyoming Game and Fish Commission Regulation. To prevent the spread of AIS, the following is required:

    If equipment has been used in a high risk infested water [a water known to contain Dreissenid mussels* (zebra/quagga mussels)], the equipment must be inspected by an authorized aquatic invasive species inspector recognized by the state of Wyoming prior to its use in any Wyoming water.

    Any equipment entering the State by land from March through November (regardless of where it was last used), must be inspected by an authorized aquatic invasive species inspector prior to its use in any Wyoming waters.

    If aquatic invasive species are found, the equipment will need to be decontaminated by an authorized aquatic invasive species inspector.

    Any time equipment is moved from one 4th level (8-digit) Hydrological Unit Code watershed to another within Wyoming, the following guidelines are recommended:

    DRAIN: Drain all water from watercraft, gear, equipment, and tanks. ~~Leave~~ wet compartments open to dry.

CLEAN: Clean all plants, mud, and debris from vehicle, tanks, watercraft, and equipment.
DRY: Dry everything thoroughly. In Wyoming, we recommend drying for 5 days in Summer (June - August); 18 days in Spring (March - May) and Fall (September - November); or 3 days in Winter (December - February) when temperatures are at or below freezing.

*A list of high risk infested waters and locations in Wyoming to obtain an AIS inspection can be found at: wgfd.wyo.gov

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Erika Peckham, Senior Wildlife Biologist, at 307- 670-8164, or Paul Mavrakis, Sheridan Region Fisheries Supervisor, at 307-672-7418 Ext. 236.

Sincerely,

for Mark Konishi
Deputy Director

JE/mf/gb

cc: USFWS
Paul Mavrakis, Sheridan Region
Erika Peckham, Sheridan Region
Lynn Jahnke, Sheridan Region

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