POWERTECH (USA) INC.

Application for NRC Uranium Recovery License Proposed Action Fall River and Custer Counties South Dakota Environmental Report

February 2009

Prepared for

US Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852

Prepared by

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Project DV 102.00279.01

Rev	Date	Description	Knight Piésold	Client
0	February 2009	Issued as Final	Paul Bergstrom	Richard Blubaugh

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List of Acronyms and Abbreviations

AADT	Annual Average Daily Traffic
ACS	American Community Survey
AEA	Atomic Energy Act
AEC	Atomic Energy Commission
AG	Agricultural Land
ALARA	As Low As Reasonably Achievable
AMS	air monitoring station
APLIC	Avian Power Line Interaction Committee
AEA	Atomic Energy Act
ANSI	American National Standards Institute
ARR	Airborne Release Rate
ASCE	American Society of Civil Engineers
Augustana	Archaeology Laboratory, Augustana College
AWDN	Automatic Weather Data Network
BNRR	Burlington Northern Rail Road
BEA	Bureau of Economic Analysis
bgs	below ground surface
BKS	BKS Environmental Associates, Inc.
BLM	Bureau of Land Management
BMP	Best Management Practices
BNSF	Burlington Northern Santa Fe Railroad
B.P.	before present
BPT	Best Practices Technology
BS	Big Sagebrush Shrubland
C	Celsius
CBA	cost-benefit analysis
CESQG	Conditionally Exempt Small Quantity Generator
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CG	Cottonwood Gallery
CIR	color infra-red
cm/sec	centimeters per second
cpm	counts per minute
CPP	central processing plant
dBA	A-weighted decibels
D&D	Decommissioning and Decontaminating
DES	Draft Environmental Statement
DGEIS	Draft Generic Environmental Impact Statement
DENR	Department of Environment and Natural Resources
DOE	Department of Energy
DOT	Department of Transportation
DQO	Data Quality Objectives

DR	Damage Ratio
EC	electrical conductivity
EDE	effective dose equivalent
EFN	Energy Fuels Nuclear
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERG	Environmental Restoration Group
ET	evapotranspiration
EXREFA	Extended Reference Area
F	Fahrenheit
FAC	facultative
FACU	facultative upland
FACW	facultative wet
FEMA	Federal Emergency Management Agency
g	gram
gpm	gallons per minute
GDP	gross domestic product
GPS	Global Positioning System
GW	Greasewood Shrubland
HAS	Historical Site Assessment
HDPE	high density polyethylene
HEPA	high efficiency particulate air
HPRCC	High Plains Regional Climate Center
HTF	heat transfer fluid
HVAC	heating, ventilation and air conditioning
ICF Jones & Stokes	Jones & Stokes, formerly Thunderbird-Jones & Stokes
IDLH	immediately dangerous to life and health
IMPLAN	IMpact analysis for PLANning
IQR	interquartile range
ISL	in situ leach (In this document ISL is synonymous with ISR)
ISR	in situ recovery
IX	Ion Exchange
kg	kilograms
km	kilometer
KP	Knight Piésold
L	liter
LAN	land application area north (Dewey)
LAS	land application south (Burdock)
LLD	lower limits of detection
LPF	Leak Path Factor
LSA	Low Specific Activity
m	meter
m^2	square meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

MCL	Maximum Contaminant Level
MDC	minimum detectable concentrations
mg	milligram
mg/m^3	milligram per cubic meter
mi^2	square miles
mm	millimeters
mg/L	milligrams per liter
MIG	Minnesota IMPLAN Group, Inc.
MIT	Mechanical Integrity Test
MPA	main permit area
mph	miles per hour
mrem	millirem
NaI	sodium iodide
NAE	National Academy of Sciences
NAU	National American University
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Engineers
NEA	northeast area
NEPA	National Environmental Policy Act
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NPDES	National Pollution Discharge Elimination System
NPV	net-present value
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NWP	Nationwide Permit
NWS	National Weather Service
OBL	obligate
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
OW	open water
OWUS	Other Waters of the United States
PAA	Proposed Action Area
PABJh	Palustrine Aquatic Bed Intermittently Flooded Diked
pCi/f	picocuries per filter composite
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m^2-s	picocuries per meter squared second
PCN	Pre-construction Notification
PEM	Palustrine Emergent
PGA	peak ground acceleration
PIC	pressurized ion chamber
PP	Ponderosa Pine Woodland
PPE	Personal Protective Equipment
ppm	parts per million

PQL	Practical Quantitation Limit
Powertech (USA)	Powertech (USA) Inc.
psi	pounds per square inch
PUB	Palustrine Unconsolidated Bottom
PUSA	Palustrine Unconsolidated Shore Temporarily Flooded
PVC	polyvinyl chloride
QAPP	Quality Assurance Protection Plan
QC	quality control
R2EM	Riverine Lower Perennial Emergent
RCRA	Resource Conservation and Recovery Act
RER	Replicate Error Ratio
RESRAD	RESRAD Version 6.4 computer code
RFA	roll front area
RG	Regulatory Guide
RMP	Risk Management Program
RO	reverse osmosis
RPD	relative percent difference
RTV	Restoration Target Values
SAR	sodium adsorption ratio
SD	South Dakota
SDAR	South Dakota Administrative Rules
SD DENR	South Dakota Environment and Natural Resources
SDGFP	South Dakota Game, Fish and Parks
SD GOED	South Dakota Governor's Office of Economic Development
SDNHP	South Dakota Natural Heritage Program
SDSMT	South Dakota School of Mines and Technology
SD DOL	South Dakota Department of Labor
SDSU	South Dakota State University
SERP	Safety and Environmental Review Panel
SF	satellite facility
SIC	Standard Industrial Classification
SHPO	State Historical Preservation Office
SKM	Silver King Mines
SMA	surface mine area
SMCL	Secondary drinking water standards
SOP	Standard Operating Procedure
SPAW	Soil-Plant-Atmosphere-Water
SQRU	Scenic Quality Rating Units
SS	Silver Sagebrush Shrubland
SRP	Standard Review Plan
SWMP	Storm Water Management Plan
SWI	Susquehanna Western Inc.
T&E	threatened and endangered
TDS	total dissolved solids
TEDE	total effective dose equivalent

TENORM	Technologically Enhanced Naturally Occuring Radioactive Materials
TF	Thermal Fluid
THPO	Tribal Historic Preservation Office
TLD	thermoluminescent detectors
TPQ	Threshold Planning Quantities
TQ	threshold quantities
TR	Technical Report
TRG	total restoration goals
TRV	target restoration values
TSX	Toronto Stock Exchange
TVA	Tennessee Valley Authority
UCL	Upper Control Limits
UG	Upland Grassland
UIC	Underground Injection Control
U-nat	natural uranium
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UPL	upland
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USDW	Underground Source of Drinking Water
USFS	U.S. Forest Service USFS
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VRM	Visual Resource Management
VSP	Visual Sampling Plan
WDEQ	Wyoming Department of Environmental Quality
WDTI	Western Dakota Technical Institute
WDW	Waste Disposal Well
WL	Working Level
WMC	Wyoming Mineral Corporation
WoUS	Waters of the United States
Wr	weight index
Ws	standard weight
μCi/ml	microcuries per milliliter
μCi/g	microcuries per gram
μg	microgram
μR/hr	microRoentgens per hour
μS/cm	microsiemens per centimeter

1.0 Introduction of the Environmental Report

1.1 Purpose and Need for the Proposed Action

Powertech (USA) Inc. "(Powertech (USA)" submits this Environmental Report (ER) to the United States Nuclear Regulatory Commission ("NRC" or the "Commission") as part of a uranium recovery license application to develop and operate the Dewey-Burdock Uranium Project ("The Proposed Action") using in situ leach (ISL) methods. The Proposed Action will be located near Edgemont, South Dakota in Custer and Fall River Counties and will consist of wellfields, comprised of injection, production, and monitor wells, satellite ion exchange (IX) production facilities, and a central processing plant (CPP), consisting of an elution (resin stripping) system and precipitation, drying and packaging processes to produce a final uranium product (yellowcake). In addition, the Proposed Action will include, waste management facilities, office buildings and other structures or facilities to house work areas and equipment.

During active ISL operations, Powertech (USA) will construct a series of sequentially developed well fields utilizing ISL technologies and processes to produce uranium from identified ore bodies at the Dewey and Burdock sites. The CPP at the Burdock site will perform all processing of uranium loaded IX resin to produce dried yellowcake product, with disposition of the resulting 11e.(2) byproduct material wastes in a manner consistent with NRC and other applicable regulations and guidance. After depletion of portions of the identified ore bodies in operating well fields, Powertech (USA) plans to restore the groundwater in each depleted well field consistent with pre-operational or baseline water quality conditions and in accordance with NRC's application of 10 CFR Part 40 Appendix A, Criterion 5_(b)(5). After active uranium recovery operations cease, Powertech (USA) intends to complete site decommissioning and decontamination (D&D), including groundwater restoration with the ultimate goal of releasing the Proposed Action site for unrestricted release.

Thus, in order to obtain authorization for the Proposed Action, Powertech (USA) is seeking a "Uranium Recovery" License (combined source material and 11e.(2) byproduct material license) from NRC pursuant to the Atomic Energy Act of 1954, as amended, 10 CFR Part 40, Appendix A Criteria, and applicable NRC guidance, as well as the provisions of the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) regulations, as reflected in the Commission's 10 CFR Part 51 regulations.

The uranium is produced as an oxide, with a trade name of “Yellowcake” in the form of U_3O_8. Uranium is used as fuel to produce electricity in nuclear power plants. In the United States, 20 % of the electric power supply is produced by nuclear power. There are currently 104 nuclear power plants in the US and there are more than 30 nuclear power plants planned for construction in the United States. Nuclear power plants produce minimal amounts of greenhouse gases, thereby decreasing the overall carbon footprint of energy production in the United States. In the United States, the operating nuclear power plants, currently have annual requirements for about 54 million pounds of uranium in the forms U_3O_8. The Proposed Action is planned to produce one million (1,000,000) pounds of U_3O_8 annually for seven years with the potential for extending the production life to 20 years with additional resource development in the area. Currently domestic uranium production is 4.5 million pounds of U_3O_8, with the remainder of the necessary uranium being imported from other countries. So the Proposed Action's uranium production will contribute significantly to the energy independence of the United States and will contribute *significantly* to reducing carbon dioxide and nitrogen oxide emissions in the United States.

This ER has been developed in accordance with and via review of the following technical and environmental regulations, reports, and guidance documents:

Regulatory Programs

10 CFR Part 40, Appendix A

40 CFR Part 190

40 CFR Part 192

40 CFR Part 61, Subpart W

40 CFR Part 144

40 CFR Part 146

Nuclear Regulatory Commission or Other Federal

NUREG-0706

NUREG-1508

NUREG/CR-6733

NUREG/CR-6870

EPA, Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing

EPA, Regulatory Impact Analysis of Environmental Standards for Uranium Mill Tailings at Active Sites

Nuclear Regulatory Commission Guidance Documents

NUREG-1620

NUREG-1748

NUREG-1569

NUREG-1623

NUREG-3.46

NUREG-1569

NUREG-1910

Nuclear Regulatory Commission/Agreement State Licenses and Applications

Hydro Resources, Inc., SUA-1508

Crowe Butte Resources, Inc., SUA-1534

Power Resources, Inc., SUA-1548

Lost Creek ISR, LLC Docket No. 40-9068

The Proposed Action will be conducted in naturally occurring geologic and hydrologic conditions that are conducive to both the ISL method and to the limitation of potential adverse impacts consistent with the benign nature of the ISL method. The proposed action will utilize state-of-the-art ISL technologies and processes and well-tested standard operating procedures (SOPs) consistent with standard industry practices to satisfy the Atomic Energy Act's (AEA's) mandate to provide adequate protection of public health, safety and the environment.

1.2 Proposed Action

1.2.1 Background

Uranium was first discovered in the Edgemont Uranium District (District) in 1951, and recovery of such uranium was conducted for a number of years using conventional surface and underground mining methods. In the mid-1970s, the Tennessee Valley Authority (TVA) bought a major interest in the District and focused its attention on the Dewey-Burdock area, where approximately 4,000 exploration holes were drilled. Silver King Mines (SKM), a TVA wholly owned subsidiary, served as the operator for TVA and continued drilling until the early 1980s when depressed uranium prices led to a halt in exploration activities. A Draft Environmental Statement (DES) was prepared by TVA to address the impact of a proposed underground mine in the Dewey-Burdock area, but TVA never completed the NEPA process. Later, TVA relinquished all leases and claims in the Dewey-Burdock area and withdrew from uranium resource development by the late 1980s. In 1994, Energy Fuels Nuclear (EFN) acquired mineral interests within the Dewey-Burdock area, but relinquished them in the late 1990s due to low uranium prices. In 2005, Powertech (USA) acquired the mineral interests and plans to develop them as the proposed action.

1.2.2 Corporate Entities Involved

This license application, ER and TR are submitted by Powertech (USA) a corporation registered in South Dakota. Powertech (USA) Inc is the wholly owned USA subsidiary of Powertech (USA) Uranium Corporation, a British Columbia, Canada, registered company. The Canadian corporate office is located in Vancouver, British Columbia and the Corporate Headquarters of Powertech (USA) is located in Greenwood Village, Colorado. Powertech (USA) will hold the uranium recovery license and comply with the NRC financial and technical qualification requirements. Powertech (USA) maintains an exploration office in Hot Springs, South Dakota and operations offices in Wellington, Colorado, Edgemont, South Dakota, and Albuquerque, New Mexico. The Company's shares are publicly traded on the Toronto and Frankfort Stock Exchanges.

1.2.3 The Proposed Action Description

The PAA is located approximately 13 miles north-northwest of Edgemont, South Dakota and straddles the area between northern Fall River and southern Custer County line. The proposed project boundary encompasses approximately 10,580 acres (4,282 ha) of mostly private land on either side of Dewey Road (previously County Road 6463) and includes portions of Sections 1-5, 10-12, 14 and 15, Township 7 South, Range 1 East and Sections 20, 21, 27, 28, 29 and 30-35, Township 6 South, Range 1 East, Black Hill Meridian. Approximately 240 acres (97.1 ha) are under the control of the Bureau of Land Management (BLM) located in portions of sections 3, 10, 11, and 12. Figure 1.2-1 shows the land ownership status and the PAA boundary.

The PAA can be accessed from the northeast and the west via U.S. Highway 18 to Dewey Road. From the south, the site can be accessed from State Highway 471 to U.S. Highway 18 to Dewey Road. The main access road to the proposed plant facilities and well fields is located off Dewey Road in T7S, R1E, and Section 10. This access road joins with several preexisting roads that traverse the Burdock portion of the proposed project area. The access road for the Dewey portion of the proposed project area is located further to the north and joins with several other preexisting roads. These preexisting roads within the Burdock and Dewey portions of the proposed project area will be used to the extent possible to access facility structures and well fields. Secondary roads will be built from the existing roads to provide access to other facilities and well fields that are not currently accessible from the existing roads. While, the PAA encompasses 10,580 acres, the land potentially disturbed by the Proposed Action will be approximately 68 acres (facilities, piping, ponds, well fields and roads) during the year proceeding operation. The potentially disturbed area during the life of the project (production to restoration) is estimated to increase over time to a maximum of 108 acres. If the maximum area for land application of treated wastewater is included in the footprint of the Proposed Action, then a maximum of an additional 355 acres potentially would be affected by the Proposed Action for most of the project life. The maximum potential land disturbance at any given time is expected to be 463 acres.

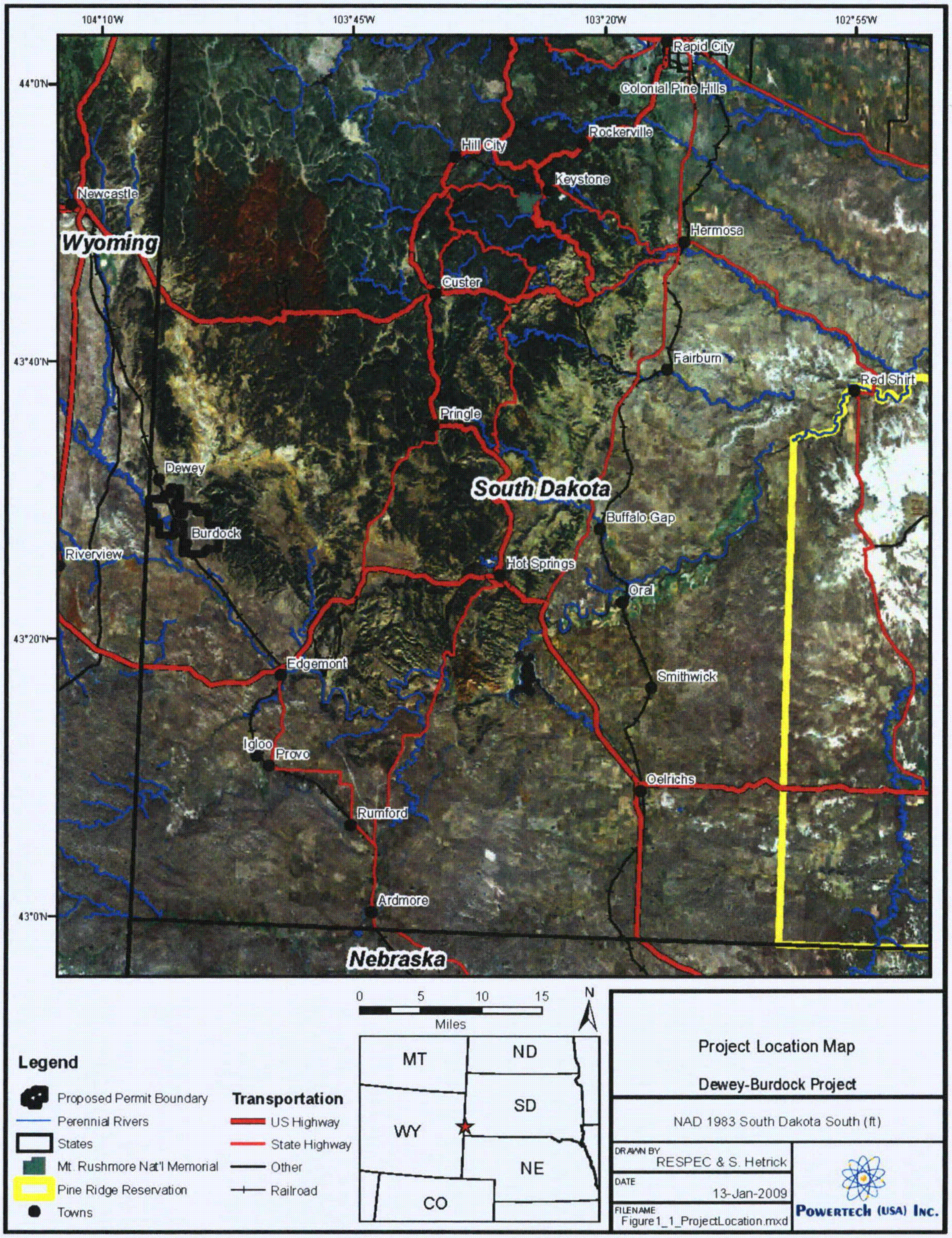

Figure 1.2-1: Proposed Project Location and Site Boundary

1.2.4 Ore Body

Operators must determine whether an ore body is commercially extractable before production commences. As part of this evaluation, geologic and hydrological characteristics demonstrated by ore bodies amenable to ISL methods are thoroughly studied. Well fields are defined based upon the geometric deposition and distribution. The permeability of an ore zone is one key factor evaluated for suitability to ISL methods. The geology both above and below the ore zone are studied for determination of existing confining layers; the confining layers inhibit movement of lixiviant into other geologic strata that may exist above or below the production zone of the exempted aquifer in which the ore is located. These are but a few of the important characteristics studied by operators to determine the suitability of the ore to be extracted economically and with minimal adverse environmental impacts (NUREG-1910, 2008).

The Proposed Action uranium deposit occurs in both the Fall River and Lakota formations of the lower Cretaceous age that make up the Inyan Kara Group. The Fall River and Lakota formations consist of permeable sandstones deposited in a major sand channel system that makes up a groundwater aquifer. The uranium occurs in the sandstones as classic roll front deposits with both oxidized and reduced zones located at both the Dewey and Burdock areas. These roll front deposits are usually "C" shaped in cross section, a few tens of feet wide and often thousands of feet long. Uranium minerals are deposited at the interface of the oxidized ground and reduced ground. As the uranium minerals precipitate, they coat the sand grains. Continual addition of uranium by oxidizing groundwater and re-solublization followed by re-deposition at the interface increases the uranium concentration of the ore body. Thickness of the ore body is generally a factor of the thickness of the sandstone host unit. Uranium mineralization has occurred in more than one horizon within the Inyan Kara Group resulting in multiple roll fronts. The estimated mineable resource (compliant with Form 43-101) within the PAA is 7.6 million pounds of U_3O_8 with an average grade of 0.21 percent.

It is anticipated that the well fields at the proposed Dewey and Burdock sites will operate at a nominal yearly average flow rate of 2000 gpm. Uranium will be extracted from groundwater and loaded onto ion exchange resin at both locations. Uranium extracted and loaded onto the ion exchange resin at the Dewey site will be transported by dedicated tanker trucks to the CPP at the Burdock site for elution, precipitation, drying and packaging. At the Burdock site, the transfer of loaded resin from the ion-exchange vessels to the processing facility will occur through resin transfer piping. The barren resin will be returned to the appropriate portion of the ion exchange circuit or, if exhausted, will be segregated as 11e.(2) byproduct material and transported pursuant to applicable DOT requirements to a licensed 11e.(2) disposal facility for final disposition per 10 CFR Part 40, Appendix A, Criterion 2 and Commission policy directives. Total production from both sites is expected to be approximately 1,000,000 pounds of U_3O_8 per year, essentially evenly divided into 500,000 pounds per year from the well fields located at each area.

1.2.5 Well Construction and Integrity Testing

Well construction materials, methods, development, and integrity testing are described in the following subsections.

1.2.5.1 Well Construction Materials

Well casing material will typically be thermoplastic such as polyvinyl chloride (PVC). Wells typically will be 4, 5 and 6-inch nominal diameter, with wall thickness appropriate for design conditions. In order to provide an adequate annular seal, the drill hole diameter will be at least two inches greater in nominal diameter than the outside diameter of the well casing. The annular seal will be pressure-grouted and sealed with either cement grout or bentonite grout. Casing will be joined by fittings or using methods recommended by the casing manufacturer.

1.2.5.2 Well Construction Methods

Typical well installation will begin with drilling a pilot bore hole through the ore zone to obtain a measurement of the uranium grade and the depth. The pilot bore hole will be geologically and geophysically logged. After logging, the pilot bore hole will be reamed to the appropriate diameter to the top of the ore zone. A continuous string of PVC casing will be placed into the reamed borehole. Casing centralizers will be installed as appropriate. With the casing in place a cement/bentonite grout will be pumped into the casing. The grout will circulate out the bottom of the casing and back up the casing annulus to the ground surface. The volume of grout necessary to cement the annulus will be calculated from the bore hole diameter of the casing with sufficient additional allowance to achieve grout returning to surface. Grout remaining inside the well casing may be displaced by water or heavy drill mud to minimize the column of the grout plug remaining inside the casing. Care will be taken to assure that a grout plug remains inside the casing at completion. The casing and grout will then be allowed to set undisturbed for a minimum of 24 hours. When the grout has set, if the annular seal observed from the ground surface has settled below the ground surface, additional grout will be placed into the annular space to bring the grout seal to the ground surface.

After the 24-hour (minimum) setup period, a drill rig will be mobilized to finish well construction by drilling through the grout plug and through the mineralized zone to the specified total well depth. As illustrated in Figures 1.2-2 and 1.2-3, the open borehole will then be under reamed to a larger diameter.

A well screen assembly will then be lowered through the casing into the open hole. The top of the well screen assembly will be positioned inside the well casing and centralized and sealed inside the casing using "K" packers. With the drill pipe attached to the well screen, a one-inch diameter tremie pipe will be inserted through drill pipe and screen, and through the sand trap check valves at the bottom of well screen assembly. Filter sand, comprised of well rounded silica sand sized to optimize hydraulic communication between the target zone and well screen, will then be placed between the well screen and the formation. The volume of sand introduced will be calculated such that it fills the annular space. The sand will not extend upward beyond the K packers due to packer design. A well completion report will then be prepared for each well. The reports will be kept available on-site for review. Copies will be submitted to regulatory agencies upon request.

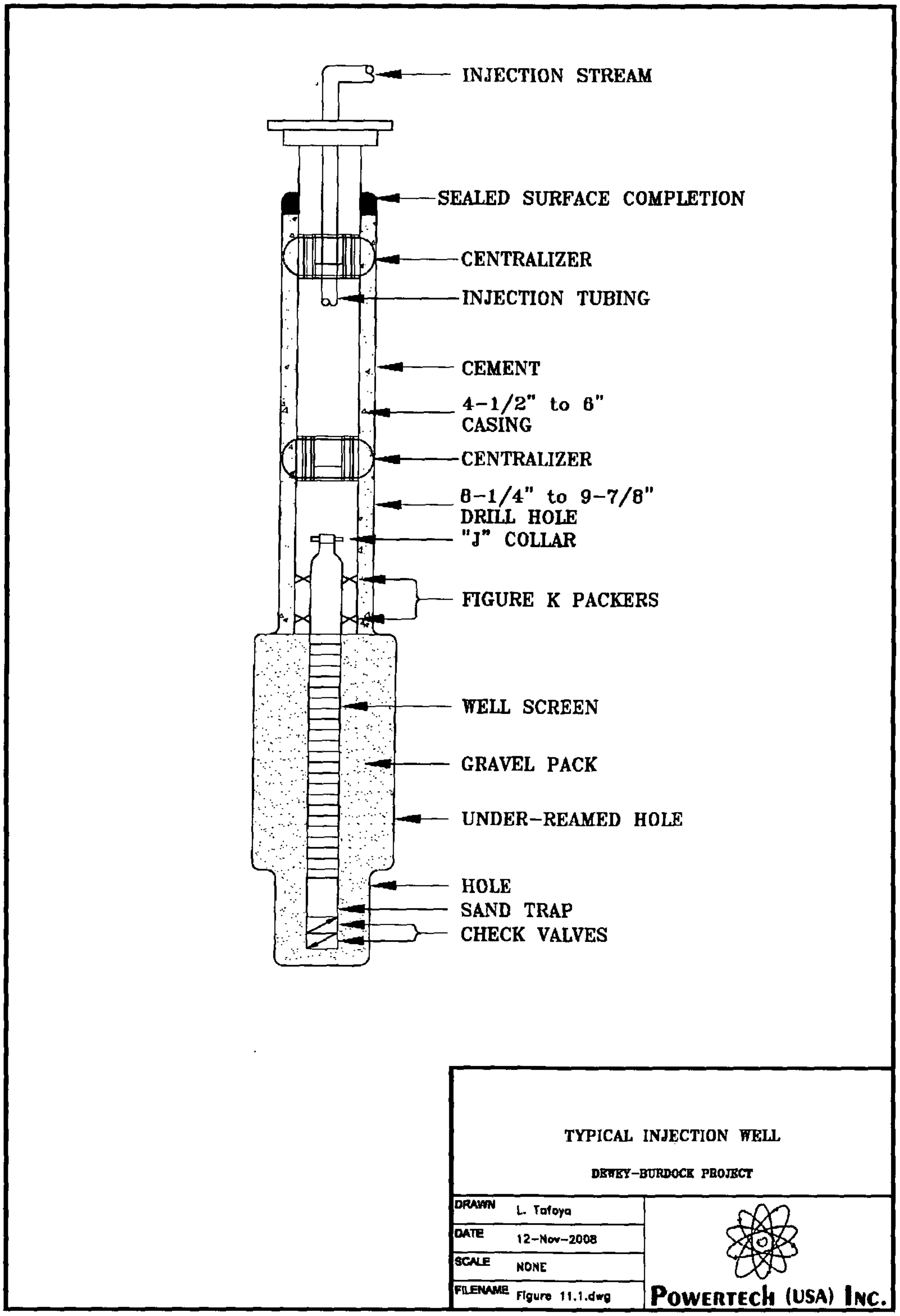

Figure 1.2-2: Typical Injection Well Construction Diagram

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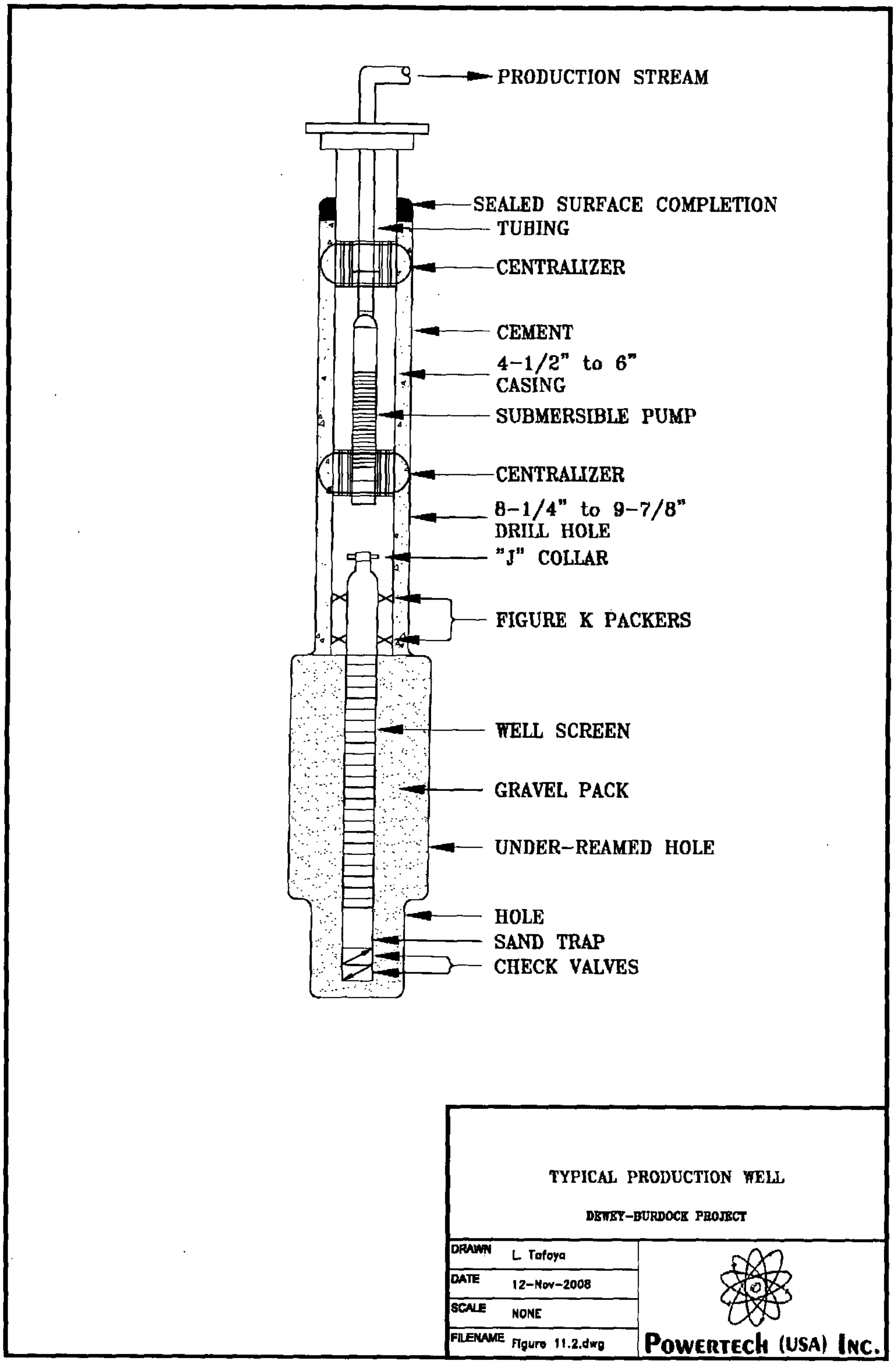

Figure 1.2-3: Typical Production Well Construction Diagram

1.2.5.2.1 Additional Construction Requirements

Prior to reaming the pilot holes to final diameter to run casing, ore grade gamma log, self potential and single point resistivity electric logs will be run in the pilot holes which will be drilled . These logs will determine the location and grade of uranium and the sand and clay units' depths to properly plan each wellfield pattern and to set the well screens in the proper depth to efficiently contact the uranium mineral deposit.

1.2.5.2.2 Well Development

The primary goals of well development are to allow formation water to enter the well screen and flush out drilling mud, or cement filtrate water and to develop the well bore to remove the finer clays and silts to reduce the pressure drop between the formation and the well screen. This process is necessary to allow representative samples of groundwater to be collected, if applicable, and to ensure efficient injection and recovery operations. Wells will be developed immediately after construction using air lifting, swabbing, pumping or other accepted development techniques which will remove water and drilling fluids from the casing and borehole walls along the screened interval. Prior to obtaining baseline samples from monitor or restoration wells, additional well development will be conducted to ensure that representative formation water is sampled. The water will be pumped sufficiently to show stabilization of pH and conductivity values prior to sampling and used to indicate that development activities have been effective.

1.2.5.3 Well Integrity Testing

Field-testing of all injection, recovery, and monitor wells will be performed to demonstrate the mechanical integrity of the well casing. The mechanical integrity test (MIT) will be performed using pressure-packer tests. The bottom of the casing will be sealed with a plug, downhole packer, or other suitable device. The casing will be filled with water and the top of the casing will be sealed with a threaded cap or mechanical seal. The well casing will then be pressurized with water or air and monitored with a calibrated pressure gauge. Internal casing pressure will be increased to 125 percent of the maximum operating pressure of the well field, 125 percent of the maximum operating pressure rating of the well casing (which is always less that the maximum pressure rating of the pipe), or 90 percent of the formation fracture pressure (which equates to approximately 1 psi per foot of overburden above the bottom of casing), whichever is less. A well must maintain 90 percent of this pressure for a minimum of 10 minutes to pass the test.

If there are obvious leaks, or the pressure drops by more than 10 percent during the 10 minute period, the seals and fittings on the packer system will be checked and/or reset and another test will be conducted. If the pressure drops less than 10 percent the well casing will have demonstrated acceptable mechanical integrity.

If a well casing does not meet the MIT criteria, the well will be removed from service. The casing may be repaired and the well re-tested, or the well may be plugged and abandoned. Plugging of wells will be in accordance with the EPA regulations located in Title 40 Part 146.10 which comply with the South Dakota Administrative Rules contained in Chapter 74:55:01:59. DENR will be notified of any well that fails the MIT. If a repaired well passes the MIT, it will be employed in its intended service following approval from EPA and/or DENR that the well has demonstrated mechanical integrity. If an acceptable test cannot be demonstrated following repairs, the well will be plugged and abandoned.

In addition to the integrity testing of new wells, a MIT will be conducted on any well following any repair where a downhole drill bit or under-reaming tool is used. Any injection well with evidence of suspected subsurface damage will require a new MIT prior to the well being returned to service. MITs will also be repeated once every five years for all active wells.

The mechanical integrity test of a well will be documented to include the well designation, date of test, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test. Results of the MITs will be maintained on-site and will be available for inspection by EPA and DENR. Results of MITs shall be reported within quarterly reports in accordance with the EPA UIC regulations in Title 40 Part 146.33 which also meet the DENR requirements in § 74:55:01:49.

1.2.6 Monitoring Well Layout and Design

As discussed in Sections 5 and 6 of this application, an extensive groundwater sampling program specific to each well field will be conducted prior to, during, and following ISL operations to identify any potential impacts to water resources of the area. The groundwater monitoring program for individual well fields is designed to 1) establish baseline water quality prior to production, 2) detect excursions of lixiviant either horizontally or vertically outside the of the target mineralization zone, 3) demonstrate compliance with groundwater quality standards, and 4) determine when the depleted mineralized zone has been adequately restored following ISL production. Objectives 1 (partially) and 4 will accomplished using injection and production wells. Objectives 1 (partially), 2, and 3 will be accomplished using perimeter and internal non-production zone monitoring wells.

The production wells are laid out in a regular grid to efficiently contact the mineralized deposit (Figure 1.2-4). Generally, the wells are laid out in regular geometric shapes, usually squares, rectangles, triangles, or hexagons. The important features are that the patterns cover the economically producible portions of the ore body, the production (pumping) well is in the center of each geometric shape, the injection wells are equally spaced from each other and from the production wells in each pattern (geometric shape). This is to ensure efficient contact with the ore by uniform flow distribution and to facilitate control of the flow to prevent excursion of leachate to the monitor well ring. The injection wells are on the outside of the well field patterns. A bleed withdrawing some 0.5 to 3 per cent of the leachate circulating maintains a cone of depression ensuring outside groundwater in the ore zone flows in toward the production well field to prevent flow of leachate outwards (NMA, 2007).

The production zone monitor wells are completed in the ore zone around the perimeter of the production well fields spaced 400 feet outside the production well field and evenly spaced around the perimeter of the well field with a minimum spacing either 400 feet or the spacing that will ensure a 70 degree angle between adjacent production zone monitor wells and the nearest injection well (NUREG/CR-6733; NUREG-1910, 2008; NUREG-1569).

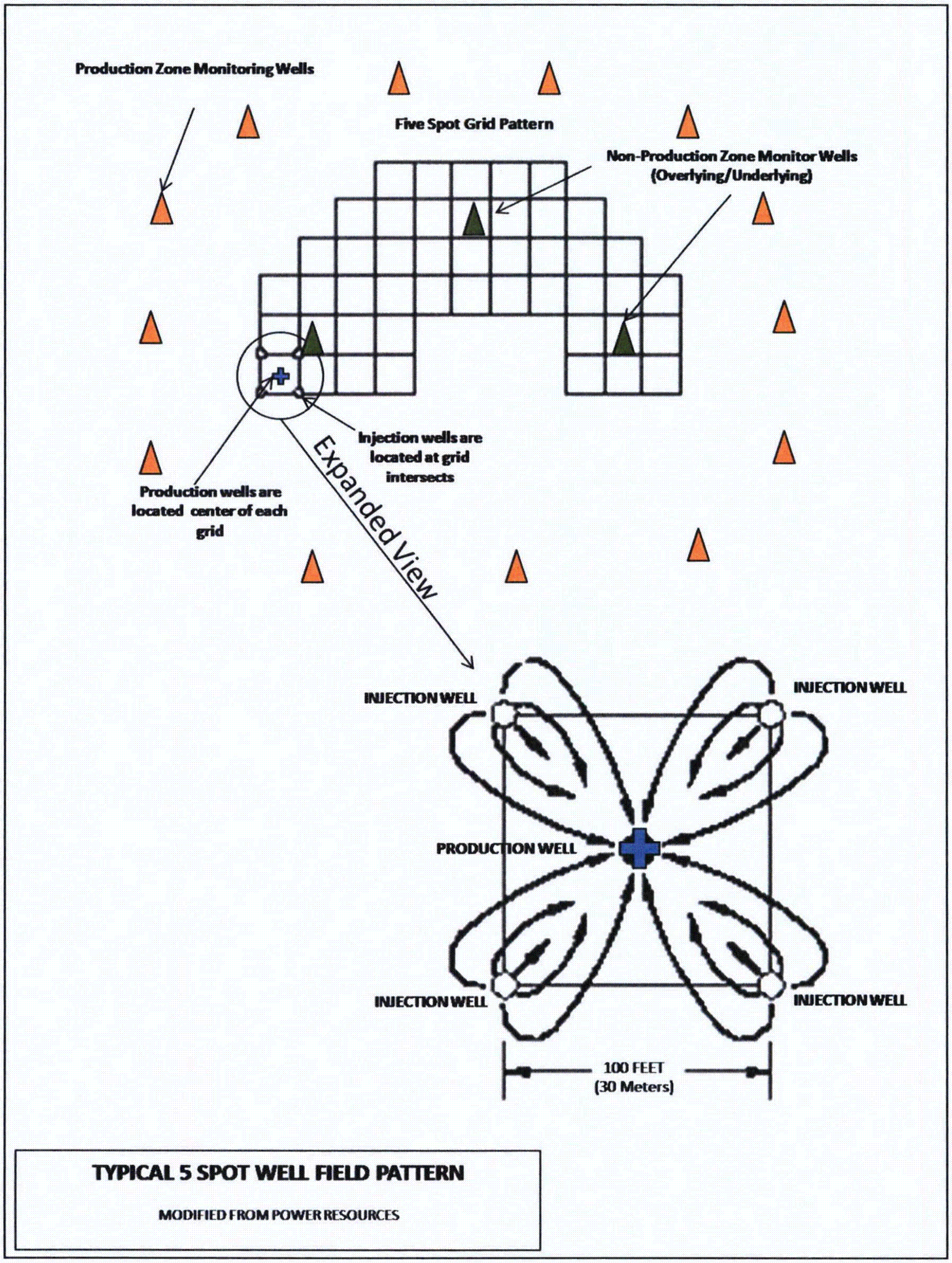

Figure 1.2-4: Typical 5 Spot Well Field Pattern

1.2.6.1 Well Field Operational Monitoring

The primary purpose of a monitoring well is to provide an early warning at the point of compliance (POC) of a potential excursion of leach fluids in accordance with NRC's interpretations of 10 CFR Part 40, Appendix A. The proposed monitoring system is described below.

1.2.6.1.1 Non-Production Monitoring Wells

Depending on site specific conditions, non-production monitoring wells may consist of two types of monitor wells termed "overlying" and "underlying". The screened intervals of overlying wells are located in the sand unit or aquifer immediately above the ore-bearing stratum. The overlying non-production monitoring wells are designed to provide monitoring of any upward movement of leach fluids that may occur from the production zone and to guard against potential leakage from production and injection well casing into any overlying aquifer. The overlying wells are used to obtain baseline water quality data and are used in the development of Upper Control Limits (UCL) for the overlying zones that will be used to determine if vertical migration of leach fluids is occurring.

Vertical monitoring is generally set up with a density of wells ranging from one every three or five acres but where confining layers are very thick and permeabilities are negligible, requirements for vertical excursion monitoring can be relaxed or eliminated (NUREG/CR-6733, 2001). The screened zone for the overlying wells is determined from electric logs by qualified geologists or hydrogeologists. The first layer of overlying non-production zone monitoring wells will be evenly distributed through the production area with a minimum of one well for every four acres of production area. Should additional aquifers exist above the first monitoring layer, additional overlying monitors will be located in these aquifers with a minimum of one well positioned for every eight acres of production area. The overlying wells will be placed within the geology just above the proposed project's upper confining layer the Skull Creek Shale; it has a thickness of approximately 200'. Core samples were collected from the lower Skull Creek Shale; analyses of these core samples demonstrate that the Skull Creek Clays have extremely low vertical permeabilities, in the range of 6.8×10^{-9} cm/sec (0.007 millidarcies).

A single layer of underlying monitor wells may be completed in the first sand unit or aquifer underlying the ore-bearing stratum similarly based on the local lithology. The underlying monitor wells are used to obtain baseline water quality data and are used in the development of UCL for the underlying aquifer that will be used to determine if vertical migration of leach fluids downward is occurring. The screened zone for the underlying monitor wells is determined from electric logs by qualified geologists or hydrogeologists. Underlying non-production monitoring wells will be evenly distributed through the production area with a minimum of one well for every four acres of production area. Underlying wells likely will not be installed below the Lakota formation, primarily due to the presence of the approximately 100' thick and relatively impermeable Morrison formation immediately below the Lakota formation.

Non-production zone monitoring wells will be designed and installed for detection of potential excursions of lixiviant, if such an excursion were to occur. Design of the monitor ring and overlying and underlying monitor wells will be performed for each well field according to site specific lithology and processes of the production zone(s) of each well field. Powertech (USA) will present each monitoring well program to NRC, EPA and the South Dakota Department of Environmental Natural Resources (DENR) before installation of proposed well placement to ensure administrative approval is obtained. After completion of the required hydrologic tests it may be necessary to revise the location and/or number of wells proposed. Each well field will be handled on a case-by-case basis in consultation with NRC, EPA and DENR.

After submission and approval of at least one well field package (including injection, production and monitoring wells) Powertech (USA)'s Safety and Environmental Review Panel (SERP) established under NRC requirements, will review hydrologic test results and documentation to demonstrate that the monitoring wells are not hydrologically connected to the injection or production wells. Based on current knowledge of site lithology and processes of the production area, and industry proven practices, the number and spacing of overlying and underlying monitoring wells meets criteria to protect human health and the environment. Wells completed in overlying and underlying aquifers will be subject to sampling, remedial action, and reporting requirements pertinent to NRC, EPA and DENR rules.

The fact that the upper confining layer is approximately 200' thick and the lower confining layer is approximately 100' thick, minimize concerns about vertical excursion of lixiviant escaping.

Approximate locations for both well types are illustrated on Figure 1.2-5 and discussed below. Additional information about sampling parameters, frequencies, and procedures is provided in Section 6 of this application.

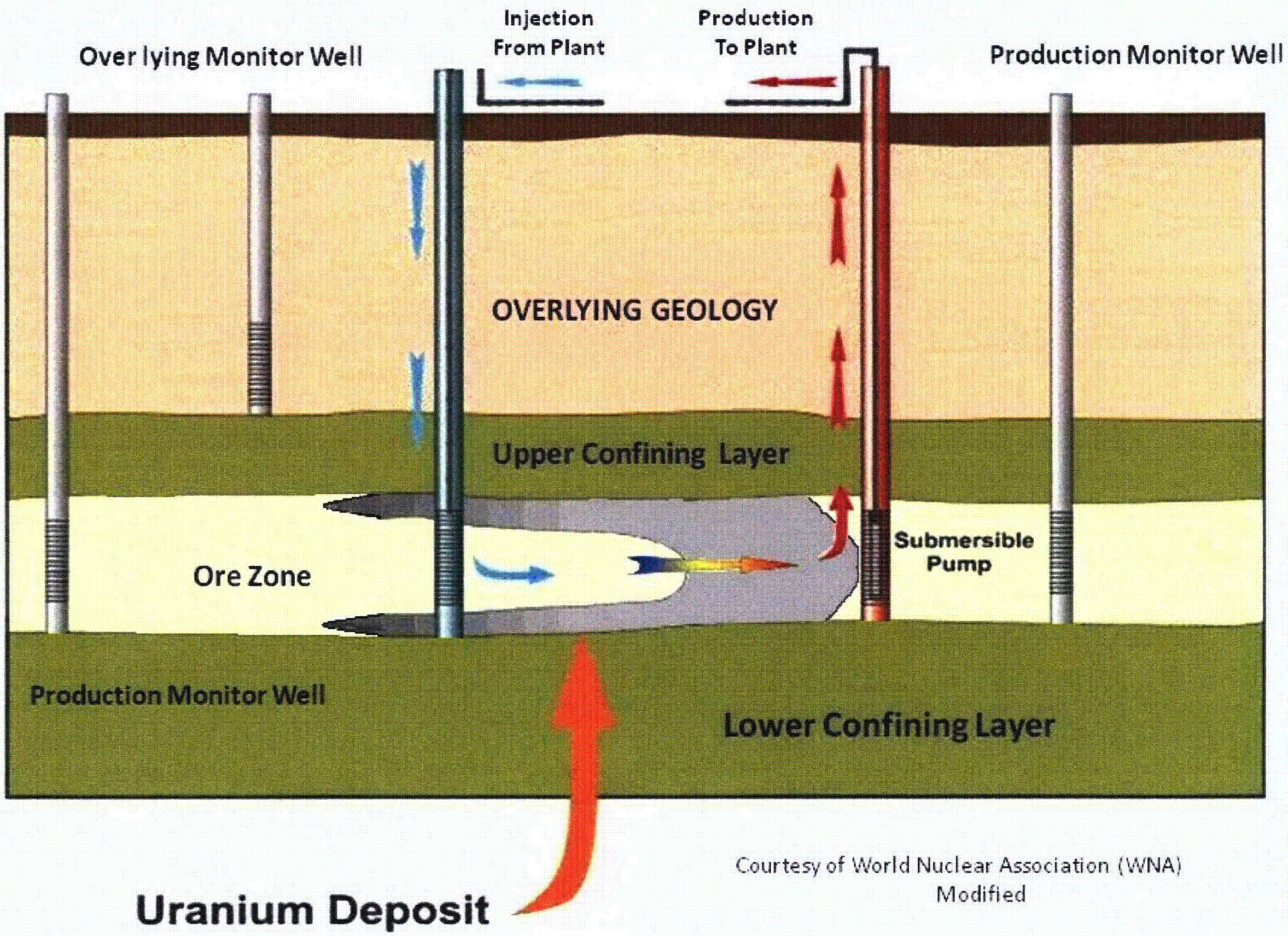

Figure1.2-5: Cross Section of Typical Well Placement

1.2.6.1.2 Production Monitoring Wells

Production zone monitoring wells are installed around the periphery of each production area to monitor for any fluids that might escape the hydraulic controls (Hunkin, G. G., 1977 and Dickinson, K. A., and J. S. Duval, 1977), with a screened interval open to the sand unit containing the production zone. This monitoring "ring" design serves two purposes: 1) to monitor any horizontal migration of fluid within the sand unit or aquifer where production is occurring, 2) to determine baseline water quality data and characterize the area outside the production pattern area. UCL are determined from indicator constituents that are selected due to their mobility to provide early warning with regards to potential excursions; these constituents are determined from the well field specific groundwater quality baseline data. By establishing UCL, the operator has the capability of early detection of an excursion at a monitor well and then has time to apply corrective action before water quality outside the aquifer exemption boundary is adversely affected (NUREG/CR-6733, 2001). Production zone monitor wells will be located no more than 400 feet from the production area, and spacing between production zone monitoring wells will be no more than 400 feet (NUREG/CR-6733; NUREG-1910, 2008; NUREG-1569). If the monitor wells are closer than 400 feet to the well field, the monitor wells will be located via a strategic distance to maintain a minimum angle between monitor wells and the nearest injection well of 70 degrees. This will ensure that no leach fluids will pass between the adjacent monitor wells undetected as the leach fluids flow radially outward from the initiation point of an excursion. Production zone monitoring wells are installed before the start of production activities in order that required baseline sampling and hydrologic tests can be conducted. Well design, construction, and development will be identical to those of injection and recovery wells, except well screens will be completed across the entire mineralized sandstone (Figure 1.2-6). As noted above, it is expected that NRC will review and accept at least one well field package (injection, production and monitoring wells) before Powertech's (USA) SERP becomes primarily responsible for formalizing packages. Additional information about sampling parameters, frequencies, and procedures is provided in Section 6 of this application.

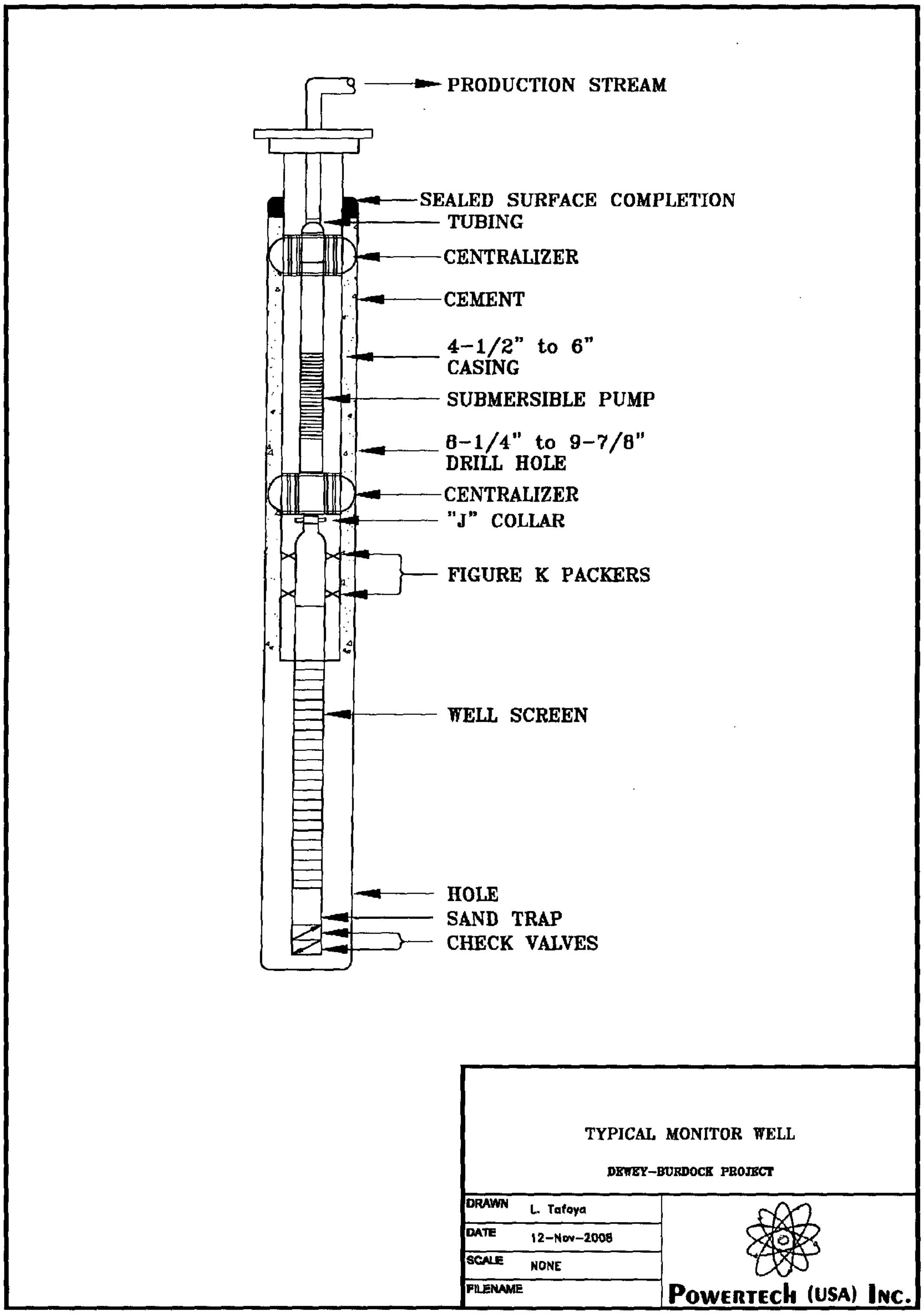

Figure 1.2-6: Typical Monitor Well Construction Diagram

1.2.6.2 Uranium Production

Recovery of the uranium from the uranium bearing or pregnant lixiviant solution will be accomplished via an ion exchange process. The pregnant lixiviant from the well field will be pumped through ion exchange vessels containing uranium-specific ion exchange resin beads (Dowex 21K XLT or equivalent). As the lixiviant flows through the resin beds, the complexed uranium molecules attach themselves to the beads of resin, displacing a chloride ion or bicarbonate ion as shown below:

$$2\ RCl + UO_2(CO_3)_2^{-2} \rightarrow R_2UO_2(CO_3)_2 + 2Cl^{-1}$$

$$2\ RHCO_3 + UO_2(CO_3)_2^{-2} \rightarrow R_2UO_2(CO_3)_2 + 2HCO_3^{-1}$$

Each resin bead has a finite number of sites where the uranium complex can attach. When most of the available sites on the beads in the resin bed are occupied by uranyl dicarbonate (UDC) or uranyl tricarbonate (UTC) ions, the resin will be considered to be "loaded" and will be ready for processing.

The ion exchange vessels will be designed to operate in pressurized downflow mode, and will each contain approximately 500 ft^3 of ion exchange resin. The ion exchange vessels will be arranged in pairs of two vessels in series. The lixiviant will be passed through the primary or lead vessel which will be where most of the resin loading takes place. The lixiviant will then pass through the secondary or lag vessel where the solution will be "polished" by removal of any remaining dissolved uranium. When the lead vessel becomes loaded, it will be taken off line and flow of lixiviant will be routed to the secondary vessel which will become the lead vessel. The resin in the off-line vessel will be removed and regenerated resin will be returned to the vessel. The vessel containing the regenerated resin will be then brought back on line in the lag position. The resin that was removed will be transferred to the elution and regeneration process in the CPP.

After passing through the ion exchange vessels, the barren lixiviant will be returned to the well field where oxygen and carbon dioxide will be added prior to reinjection. A booster pump station may be required to achieve the required injection pressure. A sidestream referred to as the production bleed will be removed from the barren lixiviant and routed to either the wastewater system or the production bleed reverse osmosis (RO) system, depending on which operating option, (land application or deep well disposal) is utilized. The flowrate of this sidestream will be approximately 0.5 percent to 3 percent of the pregnant lixiviant flowrate. The purpose of the production bleed stream is to maintain a hydraulic gradient towards the well field.

1.2.6.3 Resin Transfer and Elution

Once the resin in an ion exchange column is loaded to capacity with uranium complexes, the column will be taken out of service. The resin will then be transferred to an elution vessel where it is contacted with a brine solution containing sodium chloride and sodium carbonate. This will strip the uranium from the resin according to the following reactions:

$$R_2UO_2(CO_3)_2 + 2Cl^- \rightarrow 2\ RCl + UO_2(CO_3)_2^{-2}$$

$$R_4UO_2(CO_3)_3 + 4Cl^- \rightarrow 4RCl + UO2(CO_3)_3^{-4}$$

After the uranium has been stripped from the resin, the resin will be rinsed with water and potentially a sodium carbonate or bicarbonate solution. This rinse removes the high chloride eluate physically entrained in the resin and, if sodium carbonate or bicarbonate is used, partially converts the resin to carbonate or bicarbonate form. In this manner, chloride ion buildup in the lixiviant will be controlled if the resin is still useable, it will then be returned to the ion exchange columns.

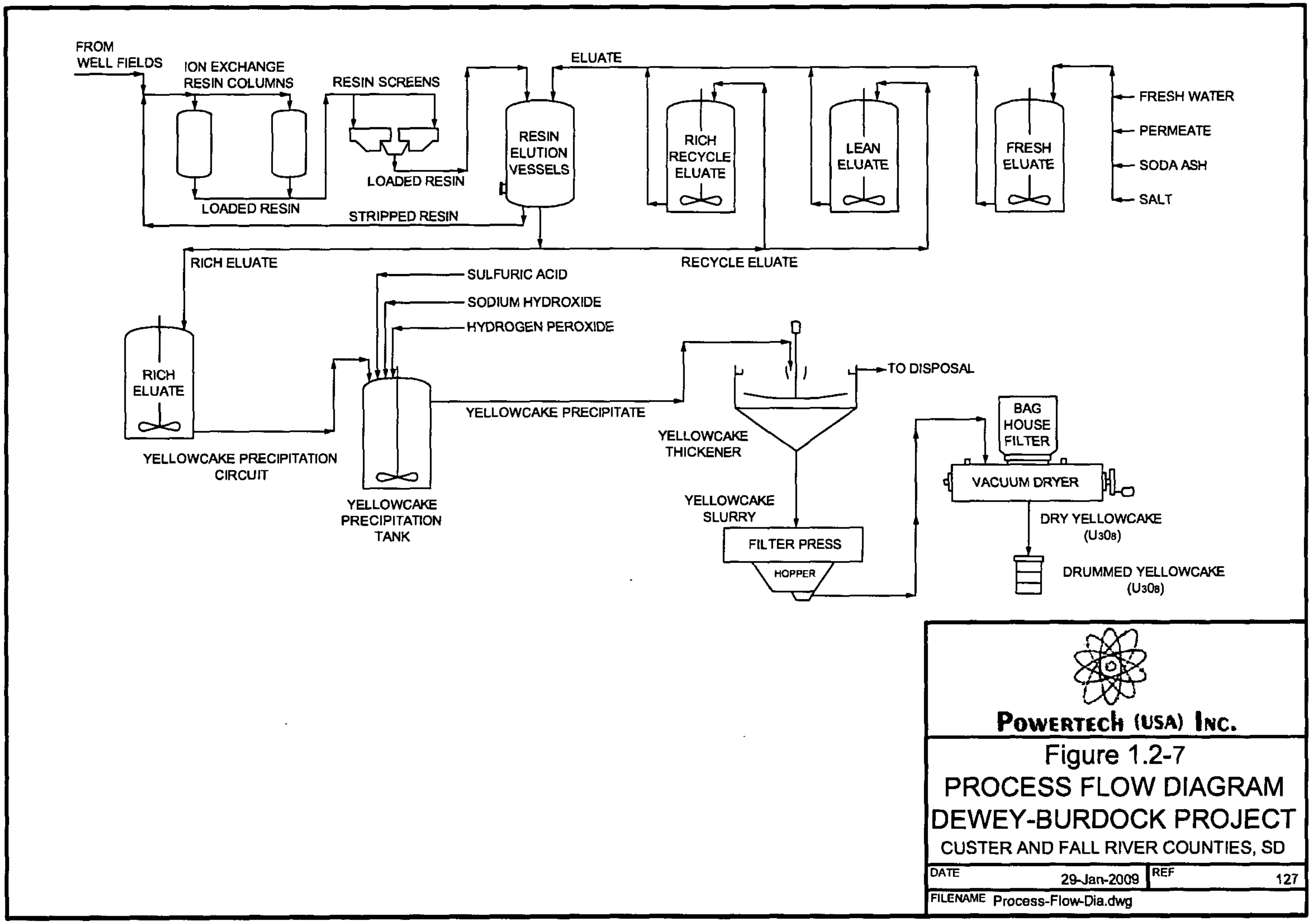

Figure 1.2-7: Overall Process Flow Diagram

1.2.6.4 Precipitation

The precipitation process will be designed to break the uranyl carbonate complex, precipitate the uranium as uranium peroxide, and settle the precipitated solids from the eluant solution. The precipitation process will be comprised of a series of chemical addition steps, each causing a specific change in the rich eluate solution.

Prior to beginning the precipitation process, the rich eluate transfer pump will be used to transfer the rich eluate from the rich eluate tank to the precipitation tank. The precipitation tank contents will be mixed via an agitator. The first stage of chemical addition will be to add sulfuric or hydrochloric acid to bring the pH down to a range of approximately 2-3 pH units. This change in pH will cause the uranyl carbonate complex to break, liberating carbon dioxide, which will be vented from the tank, as illustrated in the following chemical reaction.

$$UO_2(CO_3)_3^{-4} + 6H^+ \rightarrow UO_2^{++} + 3\ CO_2\uparrow + 3H_2O$$

Following completion of CO2 evolution, sodium hydroxide will be added to raise the pH of the solution to between 4 and 5 pH units. When the pH has stabilized, hydrogen peroxide (H2O2) will be added to the solution to form insoluble uranium peroxide (UO4). Following addition of H2O2 , the agitator speed will be slowed down to promote crystal growth.

$$UO_2^{++} + H_2O_2 + 2H_20 \rightarrow UO_4 \bullet 2H_2O + 2H^+$$

After a precipitation period of up to 8 hours, sodium hydroxide will be added to raise the pH to approximately 7, and the contents of the precipitation tank will be pumped into the thickener using the precipitation transfer pumps.

1.3 Proposed Operating Plans and Schedules

Following the issuance of the NRC Uranium Recovery License to Powertech (USA), it is anticipated that construction of the Burdock Well Field 1, the CPP and ancillary facilities, including storage ponds and land application pivots, if necessary, will commence. The construction of the Dewey Well Field 1 and Dewey satellite facility will also occur in the same timeframe. Restoration of the first well field at each site will commence immediately following the end of production activities in that well field. Subsequently, Powertech (USA) intends to simultaneously operate one well field in restoration for each well field in production at each site for the duration of the project, as additional well fields are completed along the roll fronts at both

Dewey and Burdock sites. The projected schedule for construction, operation, and decommissioning (including restoration) is provided in Figure 1.3-1.

In each well field, production activities will proceed until such time as the uranium concentration in the pregnant solution has declined to an uneconomic recovery level. After production ceases, Powertech (USA) will be restoring the groundwater consistent with baseline and in accordance with 10 CFR Part 40 Appendix A, Criterion 5(b)(5). Reclamation of surface disturbances will occur after completion of restoration activities in a well field and will continue the same manner after additional well fields are developed, produced and restored. Therefore, at any time there may be well fields in three different stages of the process: wellfields in production, well fields undergoing groundwater restoration, and well fields undergoing surface reclamation. Additionally, there also may be some small areas indirectly related to these process phases that are held unreclaimed for short periods of time (e.g., storage of top soil). This proposed operational and reclamation plan ensures minimal potential environmental impacts.

D&D of the well fields includes well abandonment, the removal of piping, tanks, ancillary buildings and equipment, cleanup of surface soil to radiological standards in 10 CFR Part 40, Appendix A, Criterion 6 and revegetation of disturbed areas. It is likely that the CPP at the Burdock site will continue to operate for several years following the D&D of the project well fields. The Proposed Action is for the plant to continue to receive and process uranium loaded resins from other Proposed Projects such as Powertech's nearby Aladdin and Dewey Terrace Proposed Satellite Facility Projects planned in Wyoming or from other licensed ISL operators or other licensed facilities generating uranium-loaded resins that are compatible with the Powertech (USA) production process.

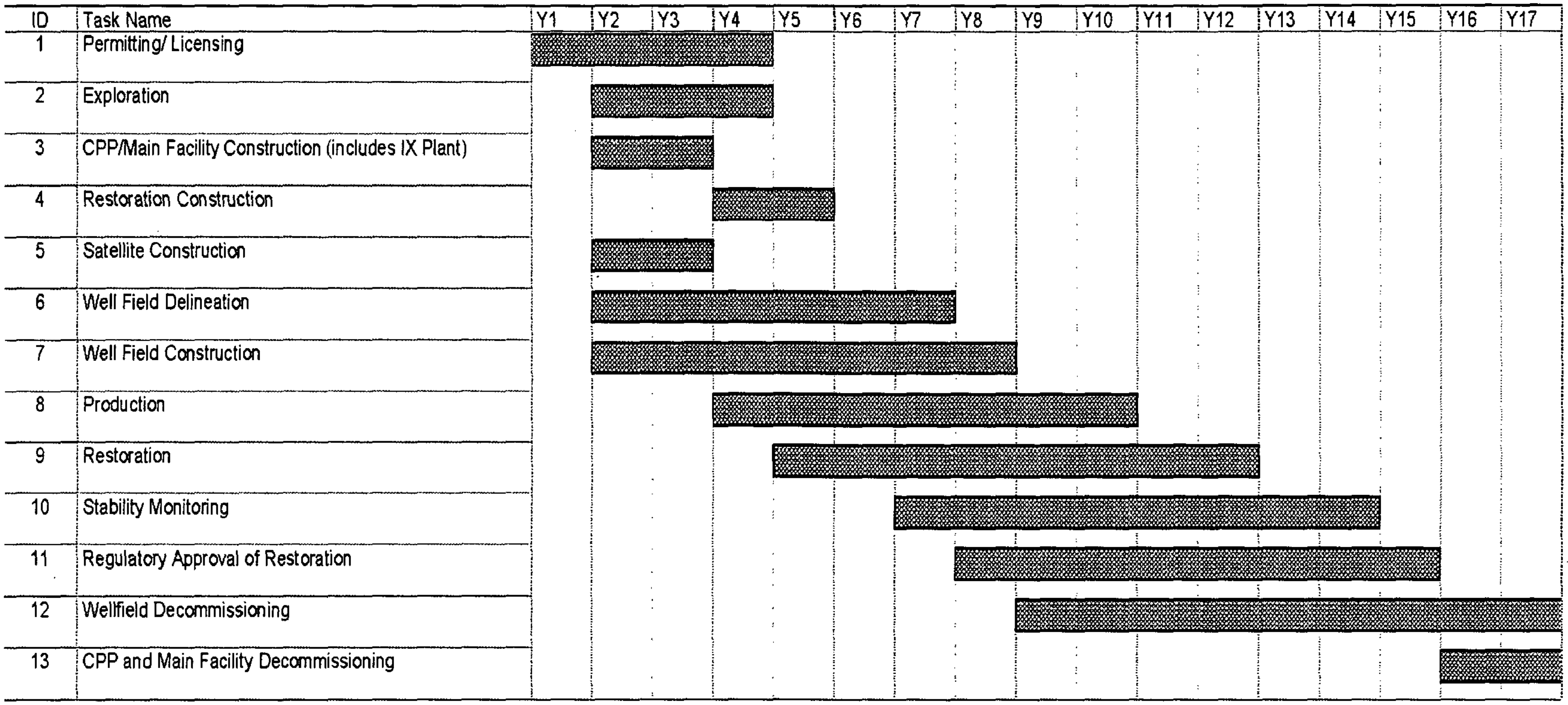

Figure 1.3-1: Projected Schedule for Construction, Operation, and Decommissioning (Including Restoration) Schedule

1.4 CPP SF, and Chemical Storage Facilities; Equipment used and Materials Processed

One SF will be located at the Dewey site and a combination SF/CPP facility will be located at the Burdock site (Figure 1.4-1). The downstream uranium recovery processes described in the preceding section will be accomplished in several steps. Uranium recovery from the solution by ion exchange, subsequent processing of the loaded ion exchange resin to remove the uranium (elution), the precipitation of uranium, thickening of the uranium slurry, and the dewatering, drying, and packaging of solid uranium oxide (yellowcake) will be performed at the CPP.

1.4.1 CPP Equipment

The CPP will be housed in a pre-engineered metal building. The CPP includes the following systems:

- Ion exchange
- Chemical addition
- Filtration
- Elution circuit
- Precipitation and thickening circuit
- Product dewatering, drying and packaging
- Liquid waste stream circuit

Based on preliminary design and site geotechnical evaluations, the proposed project CPP will be located within Section 2, T7S, R1E. Chemical storage and a septic tank and leachfield will also be located within this area. The Dewey SF will be located within Section 29, T6S, R1E. These plant locations are shown in Figure 1.4-1.

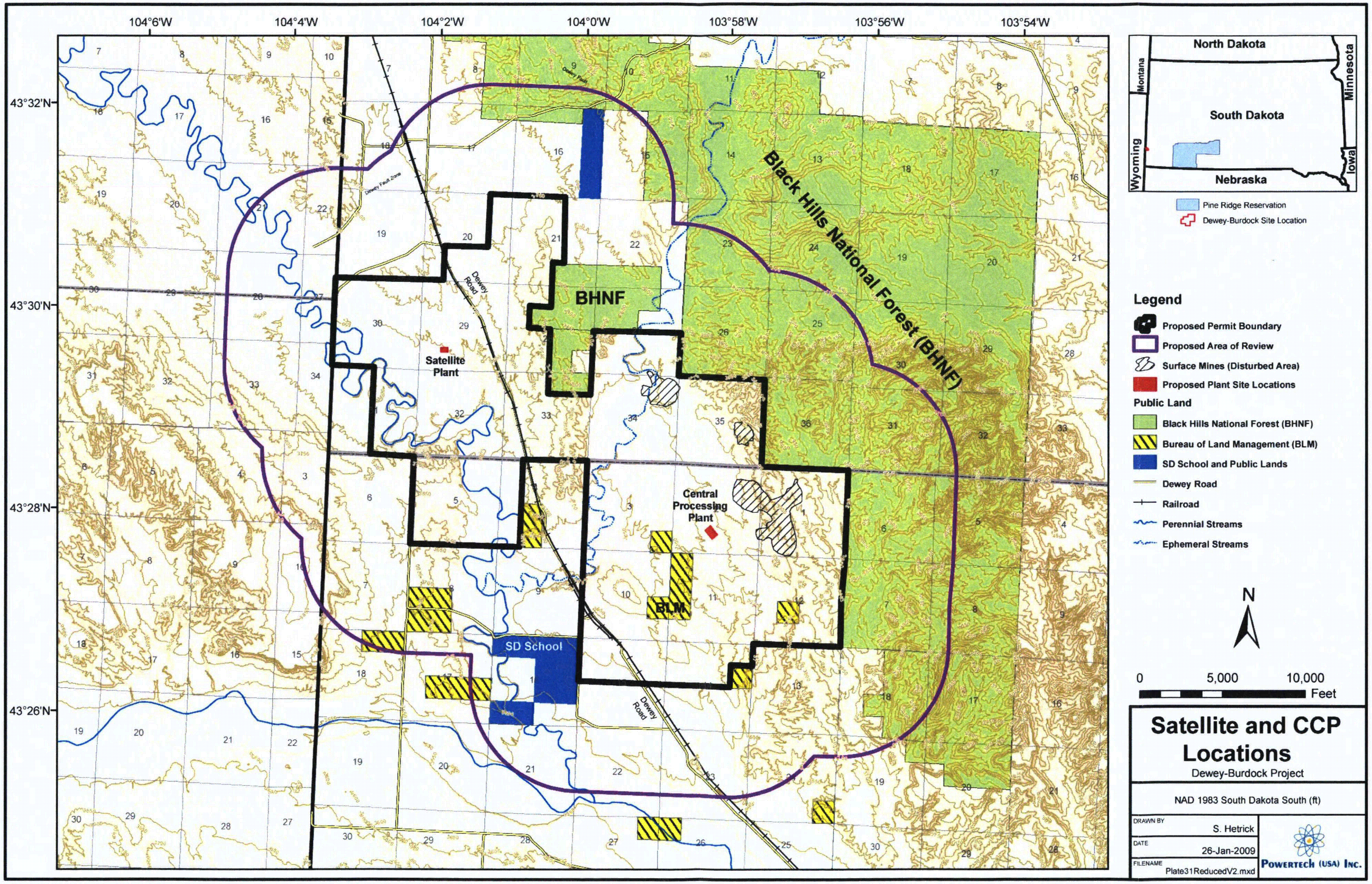

Figure 1.4-1: Satellite and CPP Locations

1.4.2 Ion Exchange System

The pregnant lixiviant pumped from the well field will be routed via underground piping to a satellite IX facility or to an IX facility within the CPP. Loaded resin from satellite IX facilities will be trucked to the CPP at the Burdock site in dedicated tanker trucks. Each IX system will consist of eight fixed bed IX columns. The columns will be operated as four sets of two vessels in series. The IX system is designed to process recovered solution at a rate of 2,000 gpm at each site with each vessel operated in a pressurized down-flow mode. As the pregnant lixiviant solution passes through the IX resin, the UDC and UTC are preferentially removed from the solution by exchanging with chloride ions on the resin sites. The barren lixiviant solution leaving the IX units normally contain less than 2 mg/l of uranium, expressed as U_3O_8.

After the barren lixiviant solution leaves the IX vessels, carbon dioxide is added as necessary to return the carbonate/ bicarbonate concentration to the desired operating level. The lixiviant solution is then pumped back to the well field, with oxygen added before it is reinjected into well fields.

1.4.3 Elution System

Using a three stage elution circuit, resin will be contacted with elution brine to strip the uranyl carbonate anions from the resin. The fresh eluant is prepared by mixing the proper quantities of a saturated sodium chloride (salt) solution and saturated sodium carbonate (soda ash) solution and water. In the first elution step intermediate eluant, from the previous batch of resin eluted, is passed through the elution vessel containing the loaded ion exchange resin, producing the most concentrated uranium-bearing solution, rich eluate. Next, lean eluant, from the previous batch of resin eluted, is contacted with the resin, producing intermediate eluant for the next batch of resin to be eluted. Finally, fresh eluant is passed through the resin, producing lean eluant for the next batch of resin to be eluted. Following the final flush of eluant, the resin is washed with fresh water to remove remaining eluant. This wash water is then used to prepare the next batch of fresh eluant.

1.4.4 Precipitation System

The precipitation process will be designed to break the uranyl carbonate complex, precipitate the uranium as uranium peroxide, and settle the precipitated solids from the eluant solution. The precipitation process will be comprised of a series of chemical addition steps, each causing a specific change in the rich eluate solution.

Prior to beginning the precipitation process, the rich eluate transfer pump will be used to transfer the rich eluate from the rich eluate tank to the precipitation tank. The precipitation tank contents will be mixed via an agitator. The first stage of chemical addition will be to add sulfuric or hydrochloric acid to bring the pH down to a range of approximately 2-3 pH units. This change in pH will cause the uranyl carbonate complex to break, liberating carbon dioxide, which will be vented from the tank, as illustrated in the following chemical reaction.

$$UO_2(CO_3)_3^{-4} + 6H^+ \rightarrow UO_2^{++} + 3\ CO_2\uparrow + 3H_2O$$

Following completion of CO2 evolution, sodium hydroxide will be added to raise the pH of the solution to between 4 and 5 pH units. When the pH has stabilized, hydrogen peroxide (H2O2) will be added to the solution to form insoluble uranium peroxide (UO4). Following addition of H2O2, the agitator speed will be slowed down to promote crystal growth.

$$UO_2^{++} + H_2O_2 + 2H_20 \rightarrow UO_4 \bullet 2H_2O + 2H^+$$

After a precipitation period of up to 8 hours, sodium hydroxide will be added to raise the pH to approximately 7, and the contents of the precipitation tank will be pumped into the thickener using the precipitation transfer pumps.

1.4.5 Yellowcake Dewatering and Drying and Packaging System

The gravity-thickened yellowcake solids will be pumped into a plate and frame filter press for dewatering. Dewatered yellowcake is transferred to an indirect fired (hot oil heated) rotary vacuum dryer.

The yellowcake will be dried in a rotary vacuum dryer at approximately 450°F. Angled paddles attached to a central shaft in the dryer will agitate the filter cake to promote even drying. The dryers will be heated with a thermal fluid (e.g., MultiTherm IG-4) that will be circulated through the dryer shell and the rotating central shaft. The thermal fluid (TF) will be heated by an electric heater with a pump for circulating the TF through the shell and central shaft of the dryer.

The vapor pulled from the dryer by the vacuum pump will be filtered through a baghouse filter located on the top of the dryer to remove particles down to approximately 1 micron in size. The vapor exiting the baghouse will be cooled using a condenser to remove water vapor and remaining small particles. Liquid ring vacuum pumps will provide the vacuum source. The water that will be collected from the condenser will be pumped to the solids removal tank in the wastewater system.

Two rotary vacuum dryers, baghouses, and packaging equipment will be housed in a separate room in the CPP. The vacuum pump and condenser system for each dryer, and the TF heaters and pumps will be located in the main CPP area to provide access for operation and maintenance. The vacuum pumps will discharge to the dryer room. Air in the dryer and packaging room will be monitored routinely for airborne dust. A dedicated air handler equipped with (HEPA) filters will ventilate the dryer and packaging room and will provide an additional level of controlling particulate emissions.

Packaging: The packaging system will be operated on a batch basis and will include conveyors, scales, and a spray booth. When the yellowcake is dried sufficiently, it will be discharged from the drying chamber through a knife gate valve on the bottom port of the dryer into steel containers, which will be sealed after the yellowcake has cooled sufficiently. Particulate emissions will be minimized by use a sealed hood that fits on the top of the drum. A weigh scale will be used to determine when a drum is full. A conveyor system will allow drums from both dryers to be moved from beneath the dryer to an enclosed spray booth where each drum will be rinsed with a spray of water. The conveyor system will then move the drum to a scanning station where the drum will be hand scanned for radioactivity and then placed in the storage area or rinsed further.

Effluent Monitoring: The drying process produces virtually no gaseous discharge since it operates as a batch process, and the water that evaporates from the wet yellowcake is condensed in the condenser. The water that is collected from the condenser will be recycled to the precipitation circuit, eluant makeup, or disposed with other process water. Room air will be monitored routinely for airborne dust.

Controls: The system will be instrumented and controlled sufficiently to operate automatically and to shut itself down for malfunctions such as heating or vacuum system failures.

1.4.6 Yellowcake Storage, and Shipment

The dried yellowcake product in the steel drums will be stored for shipment within a restricted storage area and shipped by truck to other licensed facilities for further processing. An enclosed warehouse room, adjacent to the yellowcake drying area, will be provided for the storage of yellowcake. On-site inventory of drummed yellowcake typically will be less than 200,000 pounds. However, in periods of inclement weather or other interruptions in product shipments, all production will be stored on-site in designated restricted storage areas.

The drummed yellowcake will be shipped by exclusive use transport to another licensed facility for further processing. All yellowcake shipments will be made in compliance with applicable DOT and NRC regulations.

A discussion of the areas in the proposed plant facility where vapors or gases could be generated can be found in Section 4.14. The potential sources are minimal in the ion exchange process area since the production solutions contained in the process equipment are maintained sealed under a positive pressure, and thus are not vented to the atmosphere except potentially during resin transfers. In any event, building ventilation in the process equipment area will be accomplished by the use of an exhaust system that draws in fresh air and sweeps the plant air out to the atmosphere.

1.4.7 Chemical Storage Facilities

The ISL process requires chemical storage and feeding systems to store and use chemicals at various stages in the extraction, processing, and waste treatment processes. Chemical storage and feeding systems will include sulfuric and/or hydrochloric acid, sodium hydroxide, hydrogen peroxide, carbon dioxide, oxygen, sodium chloride, sodium carbonate, barium chloride, and propane. Each chemical storage and feeding system will be designed to safely store and accurately deliver process chemicals to their intended delivery point in the process. Design criteria for chemical storage and feeding systems include applicable sections of the international building code, international fire code, OSHA regulations, Resource Conservation and Recovery Act (RCRA) regulations, and Homeland Security regulations.

1.4.7.1 Sodium Chloride Storage

Sodium chloride will be used to make up fresh eluant and will be stored in tanks as a saturated solution (approximately 26 percent by weight) in equilibrium with a bed of crystals in each storage tank. Dry sodium chloride will be delivered by truck and will be blown into the storage tanks using air pressure.

1.4.7.2 Sodium Carbonate Storage

Sodium carbonate will be used to make up fresh eluant and will be stored in tanks as a saturated solution in equilibrium with a bed of crystals in the storage tank. Sodium carbonate solution must be kept above 140 °F to prevent precipitation in the tank and piping. This will be accomplished by heating the water added to the tank, and continuously circulating liquid from the tank through a heat exchanger. An electric heater will be used to heat a thermal fluid to heat the exchanger. Dry sodium carbonate will be delivered by truck and will be blown into the storage tanks using air pressure.

1.4.7.3 Acid Storage and Feeding System

The acid storage and feeding system will include a storage tank and delivery pump. The storage tank will be located outside of the CPP building in a lined concrete secondary containment basin designed to contain 110 percent of tank volume plus a 25 year, 24 hour storm event. This secondary containment basin will be separate from the containment basins for other chemical systems. The acid feed pump will be located inside the building, directly adjacent to the storage tank.

1.4.7.4 Sodium Hydroxide Storage and Feeding System

The sodium hydroxide system will include a storage tank and delivery pump. The storage tank will be located outside of the CPP building in a concrete secondary containment basin designed to contain 110 percent of tank volume plus a 25-year, 24-hour storm event. This secondary containment basin will be separate from the containment basins for other chemical systems. The sodium hydroxide feed pump will be located inside the building, directly adjacent to the storage tank. Sodium hydroxide will be purchased as aqueous caustic soda, and will be pumped directly into the storage tank from the supplier's tanker trucks.

1.4.7.5 Hydrogen Peroxide Storage and Feeding System

The hydrogen peroxide system will include a storage tank and delivery pump. The storage tank will be located outside of the CPP building in a concrete secondary containment basin designed to contain 110 percent of tank volume plus a 25 year, 24 hour storm event. This secondary containment basin will be separate from the containment basins for other chemical systems. The hydrogen peroxide feed pump will be located inside the building, directly adjacent to the storage tank.

1.4.7.6 Oxygen Storage and Feeding System

Oxygen is typically stored near the central plant or within well field areas, where it is centrally located for addition to the injection stream in each header house. Since oxygen readily supports combustion, fire and explosion are the principal hazards that must be controlled. The oxygen storage facility will be located a safe distance from the CPP and other chemical storage areas for isolation. The storage facility will be designed to meet industry standards in NFPA-503.

1.4.7.7 Carbon Dioxide Storage and Feeding System

The carbon dioxide storage and feeding system will be used to dissolve carbon dioxide into the pregnant lixiviant to improve recovery of uranium in the ion exchange vessel. This system will be a vendor supplied packaged system including cryogenic tank, vaporizer, pressure gauges, and pressure relief devices.

1.4.7.8 Barium Chloride Storage and Feeding System

The barium chloride storage and feeding system includes a storage tank, agitator, and chemical metering pump. This system will be designed to dissolve solid barium chloride in water to make up the solution for feeding into the low total dissolved solids (TDS) wastewater for radium precipitation. This system will be located in a metal building located adjacent to the low TDS wastewater pond.

1.4.7.9 Non-Process Related Chemicals

Non-process related chemicals that will be stored at the project CPP include petroleum (gasoline, diesel) and propane. Due to the flammable and/or combustible properties of these materials, all bulk quantities will be stored outside of process areas at the facility. All gasoline and diesel storage tanks are located above ground and within secondary containment structures to meet EPA requirements.

1.4.7.10 Waste Management

There are several disposal options for the liquid waste generated during the production and restoration process including brine concentrators, discharge to surface waters, evaporation ponds, deep well injection and land application. The National Pollution Discharge Elimination System (NPDES) permitting process allows for the discharge of treated liquid effluents to surface waters that meet state and federal water quality standards, but surface discharge has been rejected because it is a poor use of water resources in a water sensitive region. The sole use of evaporation ponds was rejected because of the large surface impoundment area that would be required to evaporate the daily bleed water and the severe winters that would freeze the ponds for several months out of the year, thereby decreasing the evaporation rates. The use of evaporation process in conjunction with the transportation of liquid waste for disposal at an off-site deep disposal well is one consideration being explored to handle the CPP waste. However, Powertech (USA) considers the use of deep well injection and/or land application to be the best alternatives to dispose of these types of liquid waste. The deep well(s) identified by Powertech (USA) will isolate liquid waste generated during the production and restoration processes from any underground source of drinking water (USDW); in the case of land application the bleed stream will be treated with additional ion exchange to remove residual uranium, followed by contact with barium chloride to remove radium. Other treatments may also be required before the bleed stream can then be applied to the land through center-pivot irrigation systems and used to assist with production.

Non-radioactive solid waste will be managed in accordance with existing regulations and disposed of in a landfill that has been permitted under subtitle D of RCRA. Materials that cannot be decontaminated will be disposed of at a licensed 11e.(2) disposal facility.

1.5 Instrumentation and Control

The piping and metering system for production and injection solutions consists of buried trunk lines between the SF and the related operating well field areas and the CPP and its operating well field areas, with metering and flow distribution headers located in the well field header houses. The individual well flows and pressures are adjusted and controlled within the header houses. Well field instrumentation will be provided to measure total production and injection flow. In addition, instrumentation will be provided to indicate the pressure which is being applied to the injection wells. Well field header houses will be equipped with state-of-the-art water sensors and alarms to detect the presence of liquids in the well field header houses.

An integrated process control system will be utilized for monitoring and control of process variables in the well field, in the SF and in the CPP. Data from all sources will be available to personnel at the CPP. Instrumentation will be provided to monitor the total recovery flow into the CPP, the total injection flow leaving the facility, and the total waste flow leaving the CPP. Instrumentation will be provided on each injection and production well to produce an alarm in the event of a change in flow that might indicate a leak or rupture in the system. In the process areas within the CPP, storage and process tank levels will be equipped with automated level measuring instruments. A safety interlock system will be utilized to ensure that safe operating procedures are followed and to prevent releases of well field liquids or CPP streams. The control and monitoring system will be equipped with extensive alarms to alert the operations personnel of unsafe conditions or conditions that have the potential to release materials to the environment.

Handheld radiation detection instruments and portable samplers will be used to monitor radiological conditions at the SF and CPP.

1.6 Applicable Regulatory Requirements, Licenses, Permits, and Required Consultations

In order for Powertech (USA) to operate, license, permits and approvals from numerous Federal and State agencies will be required. This section identifies the issuing agencies, a description of the type of license, permit, or approvals needed, and the current status of securing these approvals.

Necessary environmental approvals from Federal and State Agencies required for the Proposed Action are listed in Table 1.6-1. The NRC licensing process for a uranium recovery license represents the most complex and broadest scope review process and, therefore, may require the longest lead-time for approval. The majority of the remaining approvals are in-progress or will be initiated within the next year. *All necessary approvals must be secured prior to commencement of commercial production at the site.*

1.6.1 Environmental Consultation

Over the course of license application preparation, consultations were conducted with several State and Federal agencies to ensure the technical and environmental aspects of their requirements are addressed within the application; these consultations will proceed with the various agencies through the entire licensing application review and acceptance process and continue throughout the life of the operation:

Table 1.6-1: Permits and Licenses for the Proposed Project

Issuing Agency	Description	Status
South Dakota Department of Environment and Natural Resources Joe Foss Building 523 E Capitol Pierre, SD 57501	Uranium Exploration Permit	Submitted
	Temporary Water Right for Testing	Submitted
	Temporary Discharge Permit for Testing	Submitted
	Scenic and Unique Lands Designation	Submitted
	Large Scale Mine Permit	Pending
	Water Appropriation Permit	Pending
	Class III Underground Injection Control Permit	Pending
	Air Quality Permit	Pending
	Groundwater Discharge Permit	Pending
	NPDES Water Discharge Permit	Pending
US Nuclear Regulatory Commission Washington, DC 20555	Uranium Recovery (Source and 11e. (2) Byproduct Material)	Application Submitted herein
US EPA Region 8 8OC-EISC 1595 Wynkoop St Denver, CO 80202-1129	Class III Underground Injection Control Permit and Aquifer Exemption	Submitted and deemed complete
Custer County 420 Mount Rushmore Road Custer, SD 57730-1934	Building Permits	Pending
Fall River County County Courthouse Hot Springs, SD 57747-1309	Building Permits	Pending
US Bureau of Land Management, South Dakota Field Office	Plan of Operations	Pending
State Historic Preservation Office	State and Federal Licensing/Permitting	Per NRC processing
Tribal Historic Preservation Office	State and Federal Licensing/Permitting	Per NRC processing

Table 1.6-2: Environmental Consultation

State Agency	Department	Location
South Dakota Game Fish and Parks	Wildlife	523 East Capitol Avenue Pierre, SD 57501
South Dakota State Archaeologist	Archaeologist	P.O. Box 1257 Rapid City, SD 57709-1257
South Dakota Department of Environment and Natural Resources	Minerals and Mining Program	523 E Capitol Ave. Pierre, SD 57501
Federal Agency		
U.S. Geological Survey	Dakota Mapping Partnership Office	1608 Mountain View Road Rapid City, SD 57702
U.S. Corps of Engineers	Resource Management	441 G. Street, NM Washington, DC 20314-1000
Natural Resources Conservation Service	Pierre Service Center	1717 N Lincoln Ave. Pierre, SD 57501-2398
U.S. Nuclear Regulatory Commission	Uranium Recovery Licensing Branch	Washington, DC 20555-0001
U.S. EPA Region 8	8P-W-GW	1595 Wynkoop Street Denver, CO 80202-1129
U.S. Bureau of Land Management	South Dakota Field Office	310 Roundup Street Belle Fourche, SD 57717
U.S. Forest Service	Forest Service, Supervisor's Office	Custer, SD 25041 North US Highway 16

2.0 Alternatives

2.1 No-Action Alternative

Under the provisions of the NEPA, one alternative that must be considered in each environmental review is the no-action alternative. In this case, the no-action alternative would be to not build or license the project facilities. This alternative will provide a baseline from which to compare the potential impacts of the other action alternatives.

2.2 Proposed Action

The project will use ISL technologies and processes to recover uranium deposited in typical "C" shaped roll-fronts within a stratabound deposit made up of sandstones amenable to the ISL method of extraction in the Fall River and Lakota formations of the Inyan Kara Group. ISL involves the circulation of native groundwater, fortified with oxygen and carbon dioxide to create leaching solutions (lixiviant). The lixiviant is pumped into the production zone through the injection wells and recovered by the production wells. At the surface, the pregnant lixiviant flows through IX columns where the uranium attaches to resin beads. Upon saturation the uranium loaded resin will be trucked or piped to the CPP where it will be stripped from the resin via the elution process. The stripped resin will be returned to IX columns for reuse unless exhausted. The eluted uranium will be precipitated, washed, filtered, pressed and dried into the final product -- yellowcake. This completes the first stage of the ISL uranium production cycle.

To minimize usage of native groundwater and maximize uranium production, the lixiviant is then re-fortified with oxygen and carbon dioxide re-circulated through the production zone in a continuous process until the uranium resources in a given well field are depleted. After uranium production is complete, groundwater in well-field production zones is restored consistent with baseline as reflected in NRC Appendix A, Criterion 5(b)(5); and the surface facilities are decontaminated and decommissioned such that ultimately there will be no visual evidence of site use and the entire disturbance area can be released for "unrestricted use." A detailed description of the proposed action is presented in Section 1 of this ER and Sections 3.4 and 5 of the TR.

2.3 Reasonable Alternatives

2.3.1 Proposed Location of Facilities

Locations of the CPP and the Satellite (SF) were strategically chosen based on site specific circumstances including, proximity to historical and current reserves within the northern Dewey and southern Burdock areas, historical environmental disturbance, wildlife concerns and the geology of the area. The CPP would be constructed in Section 2, T7S, R1E of the Burdock action area and the SF would be located in Section 29, T6S, R1E of the Dewey action area (see Figure 1.4-1).

- Based on the TVA data and current Powertech (USA) data, both the CPP and SF locations will be approximate to the center of ore reserves located within the proposed action areas although in locations that have little potential for ore directly beneath them.
- Environmental considerations were noted such as historical surface mining sites, nesting sites for raptors and drainage issues; the locations chosen will not have these issues.
- There were no issues with the surface or subsurface geology for either the CPP or the SF location.

2.3.1.1 Proposed Production Units and Production Zone Monitoring Well Rings

Typically, an ISL production unit consists of an ISL-amenable ore body located within a sandstone unit bounded by upper and lower hydrologic barriers. In the simplest scenario, there would be a single production zone and a monitor well ring radially bounding that production zone, which along with upper and lower hydrological barriers, including their monitor wells and proper well field generally are the means of ensuring control of leach fluids within a production unit. In more complex systems, there may be more than one production unit stacked vertically within a sandstone unit, and there may be more than one sandstone unit, with multiple production zones stacked vertically (Lost Creek Project, 2007).

Within the Dewey area, there exists at least one area where one production zone overlies another. There will be different scenarios concerning well completions within this type of production unit. The monitoring well rings will be adequate for production units containing approximately one million pounds of reserves. The basic scenario for well completion will be completion of injection, production and monitoring wells within the one sand that contains the ore. A more complex well completion scenario will exist for the area(s) that contain more than one ore bearing sand. In this case, the production wells will be completed within the lowest ore bearing sand. After the ore has been recovered in the lowest sand, the injection and production wells will be completed in the next ore bearing sand unit above. Upon recovering the ore from all ore bearing sands, restoration will commence in the reverse order by restoring the uppermost horizon sands first and working down to the lowermost horizon sand(s). The monitoring well ring design will conform to open intervals corresponding to the depths of each sand adjacent to each well. This type of well completion is preferred over other completion methods such as:

- Multiple Completions

  Completion of wells across multiple sands within the same horizon, using the same wells and the same monitor ring could be an alternative method. However, this is not considered an appropriate alternative due to the difficulties of ensuring the leach fluids are being efficiently distributed through the various sands in the horizon and of monitoring the performance of the production unit.

- Larger Rings Encompassing More Reserves

  The wells are completed in the same manner as with the preferred option, but due to the increase in scale, the construction time, evaluation of pump tests, and all other activities associated with installing the well field would increase dramatically. Final restoration/reclamation of the production unit would be delayed until all operations for the area are complete. Therefore, this option is not considered the most efficient approach (Lost Creek Project, 2007).

2.3.2 Process Alternatives

2.3.2.1 Lixiviant Chemistry

The lixiviant is prepared using native groundwater fortified with oxygen, and carbon dioxide. The lixiviant is pumped into the injection wells, flows between the injection and production wells in the mineralized zone by the imposed hydraulic gradient, and is extracted by production wells. Production flow rates are estimated at 20-30 gallons per minute (gpm) per well.

The groundwater restoration method proposed for the project is based on the successful programs implemented by other projects such as the Lamprecht, Cogema Irigaray Restoration Project or Crow Butte Resources Inc., which have received regulatory approvals for successfully restoring groundwater.

Groundwater restoration will be implemented as part of the routine ISL operation so that restoration can be performed after a well field is depleted of uranium but concurrently with the development of subsequent well fields as ISL operations advance within the exempted aquifer. The goal of the restoration program will be to return the water quality within the exempted aquifer consistent with pre-operational baseline quality conditions or other NRC approved standard in accordance with 10 CFR Part 40 Appendix A Criterion 5(b)(5). It is anticipated that one or a combination of land application and/or deep well injection may be utilized to dispose of operational bleed and restoration fluids.

2.4 Eliminated Alternatives

Open pit and underground production alternatives to ISL production were eliminated based on economics, health, safety and environmental impacts.

2.4.1 Open Pit Mining Alternative

Open pit mining requires the removal of all material covering the ore body (overburden) and then the ore itself. The ore would then be transported to a conventional mill for further processing and extraction through grinding, leaching, purifying, concentrating, and drying. From an economic point of view, open pit mining of the relatively low grade ore at the depth of the Dewey-Burdock orebodies would require a much larger investment than ISL, especially in the early phase, when a significant investment would be required for acquisition of heavy equipment to perform the earthwork to expose the ore body. The overall footprint of the operation would be larger because of greater manpower and material handling requirements. Waste rock piles from excavation of the overburden would be substantial and the mine pit would make permanent changes to the topography, with a disturbed area approximately three times the area of the ore body mined in order to maintain slope stability. Potential personnel injury rates and potential radiological exposures at the mining site would also be higher with open pit mining then would be experienced with ISL. A mill tailings impoundment would be required to contain the millions of tons of waste produced from the uranium mill. This tonnage would represent a large volume of radioactive tailings slurry covering a large area of ground surface. Conventional mill operation would involve higher risks of spillage and radiological exposure to both personnel and the environment than those associated with the proposed ISL operations. Open pit mining at the PAA would also require dewatering of the pit to depress the potentiometric surface of all aquifers. Large quantities of groundwater would be discharged to the surface with potentially little appreciable benefit. Some of this groundwater contains naturally elevated radium-226 (Ra-226), radon, and uranium, which would have to be treated before discharge and the residue disposed of as radioactive solid waste (Lost Creek Project, 2007).

2.4.2 Underground Mining Alternative

Underground mining of the uranium resources at the Proposed Action Area (PAA) would involve sinking shafts to the vicinity of the orebodies, horizontally driving crosscuts and drifts to the ore bodies at different levels, physically removing the ore and transporting the mined ore to the conventional mill for further processing. Processes for milling and uranium extraction from underground mined ores would be the same as those for ores mined from the open pit. When one considers the alternative of underground mining, the economic and environmental disadvantages closely parallel those of an open pit mine. These, as stated above, include large amounts' of initial investment, permanent changes to the topography (though in a smaller scale than open pit mining because less amounts of waste rock are being generated), generation of a significant amount of mine tailings, increased risks of injury and potential exposure to radioactive materials during mining and milling, and surface discharge of groundwater from mine dewatering with elevated radionuclide concentrations. One major concern for underground uranium mining is the potential exposure of miners to, radon gas if the gas -is not continuously vented to the atmosphere and such venting implicates Clean Air Act (NESHAPs) limits on radiation exposure to nearby residents (40 CFR Part 61, Subpart B). Subsequent land surface subsidence could also occur after the completion of underground mining.

Economic costs and environmental impacts associated with open pit and underground mining, demonstrate that ISL is the more benign and viable uranium recovery method to use. The initial investment is lower; the tailings problem is completely eliminated; radiation exposure and environmental impacts are minimized; and the groundwater resource is preserved. In addition, because of the reduced costs, lower grade ores can be recovered through ISL than can be recovered from open pit and underground mines (Lost Creek Project, 2007).

The NRC conducted a comparison of the overall impacts of open-pit and underground mining with ISL methods and concluded that ISL methods generate less potential adverse environmental impacts and more socioeconomic advantages. The relative advantages of ISL methods include:

- The degree and the quantity of disturbance to surface area are substantially less than with surface mining.
- No mill tailings are produced and the volume of solid waste is significantly less than conventional milling – typically more than 99 percent less waste is produced with ISL.
- The elimination of airborne emissions from overburden stockpiles or tailings stockpiles and the crushing and grinding processes, which are required for conventional mining.
- Exposure to radionuclides is markedly reduced with ISL methods because less than 5 percent of the radium in an ore body is brought to the surface compared with up to 95 percent with conventional mining techniques.

- Because of the lack of tailings and other significant sources of solid waste ISL facilities can be decontaminated readily and returned to unrestricted use within a relatively short time frame (12-15 years).
- ISL facilities typically consume much less water than conventional mining and milling, on the order of 1 percent of their production flow.
- The socioeconomic advantages of ISL include:

  2.5 Lower grade ores can be mined

  2.6 Requires less capital investment

  2.7 Provides a safer working environment for the miner

  2.8 Decreases amount of time before production begins

  2.9 Requires a smaller workforce

2.10 Cumulative Effects

2.10.1 Future Development

Powertech (USA) has identified other potential ore bodies near the project region that may be developed. Development of these facilities is dependent upon further site investigations by Powertech (USA), as well as the viability of the uranium market. If the ore bodies and markets prove to be favorable, Powertech (USA) may submit applications for permits to develop these additional resources.

2.11 Comparison of the Predicted Environmental Impacts

Table 2.11-1 outlines the predicted environmental impacts of the no-action alternative (Section 2.1) compared to the proposed action (Section 2.2), the process alternatives (2.3.2) mining alternatives (2.4). Potential environmental impacts are discussed in greater detail in Section 4.

Table 2.11-1: Comparison of Environmental and Socioeconomic Impacts based on Proposed Action and Alternatives

Impacts of Operation	Proposed Action	Process Alternatives		Mining Alternatives		No-Action Alternative
		Alternate Lixiviant Chemistry	Alternate Waste Management	Open-pit mining with a conventional mill	Underground mining with a conventional mill	
Land Surface Impacts	Minimal temporary impacts to the well field areas; significant temporary disturbance confined to a small portion of the project Site	Same as Proposed Action	Same as Proposed Action	Significant land disturbance with the potential for portions of the land surface to remain highly altered	Same as the open pit alternative	None
Land Use Impacts	Temporary loss of agricultural production (grazing livestock) and wildlife habitat within the PAA for the duration of the project	Same as Proposed Action	Same as Proposed Action	Land disturbance increases considerably and time required for reclamation is more extensive; Entire site may not return to unrestricted use	Same as the open pit alternative	None
Transportation Impacts	Minimal impact on current traffic levels	Same as Proposed Action	Same as Proposed Action	The traffic volume elevates substantially due to increased employment and vehicle requirements and considerable more opportunity for higher radiation exposure to the public due to transporting of uranium ores over public roads.	Same as the open pit alternative	None
Geology and Soil Impacts	No geologic impacts; temporary impacts to the soils from disturbance; possible impacts to soil from land application of treated wastewater	Same as the Proposed Action	Similar to the Proposed Action with minimal temporary soil impacts in disturbance areas from wind and water erosion	No geologic impacts; more potential land disturbance due to the possibility of long-term open pit mining	Same as the open pit alternative	None
Surface Water Impacts	None	None	None	Possible contamination of surficial water could result with the use of ponds	Possible contamination of surficial water could result with the use of ponds	None
Groundwater Impacts	Slight consumption of ore zone groundwater	Similar to Proposed Action but with increased difficulty in restoring water quality to baseline conditions	Same as the Proposed Action	Ore zone aquifer will be dewatered in order to mine	Ore zone aquifer will be dewatered in order to mine	None

Table 2.11-1: Comparison of Environmental and Socioeconomic Impacts based on Proposed Action and Alternatives (cont'd)

Impacts of Operation	Proposed Action	Process Alternatives		Mining Alternatives		No-Action Alternative
		Alternate Lixiviant Chemistry	Alternate Waste Management	Open-pit mining with a conventional mill	Underground mining with a conventional mill	
Ecological Impacts	Would only disturb ~ 108 (without land application) to 463 (with maximum amount of land application) acres per year over the life of the project with no substantial impact on the ecological or biological diversity (see ER 1.2.3 for details)	Same as the Proposed Action	Same as the Proposed Action	Similar to the Proposed Action, but considerably more time would be required for reclamation	Same as the open pit alternative	None
Air Quality Impacts	An increase of 10 tons per year of particulates due to increased traffic	Same as the Proposed Action	Same as the Proposed Action	Total dust emission would be increased significantly due to increased traffic and crushing and grinding processes	Same as the open pit alternative	None
Noise Impacts	Slight increase over background noise levels	Same as the Proposed Action	Same as the Proposed Action	Significant increase in noise levels due to explosions, excavation' and crushing and grinding of rock	Significant increase in noise levels due to crushing and grinding processes	None
Historical and Cultural Impacts	None	None	None	None	None	None
Visual/Scenic Impacts	Moderate and temporary impact; Well fields and Plants would negatively affect the aesthetics	Same as the Proposed Action	Same as the Proposed Action along with evaporation ponds that would further negatively affect the aesthetics	Large and temporary impact; open pit disturbs much more land area and requires much more heavy machinery that would negatively affect the aesthetics	Large and temporary impact; Mill, tailings pond, and increased use of heavy machinery would negatively affect aesthetics	None
Socioeconomic Impacts	Increased economic impact of $307M and the potential for 436 temporary and permanent jobs for Custer and Fall River Counties and the surrounding area	Same as the Proposed Action	Same as the Proposed Action	Similar to the Proposed Action but with an increase in economic impact and jobs created due to the larger workforce and required operation	Similar to the open pit alternative	Loss of positive economic impact of $307M along with potential for 436 temporary and permanent jobs for Custer and Fall River Counties and the surrounding area
Non-Radiological Health Impacts	None	None	None	None	None	None

Table 2.11-1: Comparison of Environmental and Socioeconomic Impacts based on Proposed Action and Alternatives (concl.)

Impacts of Operation	Proposed Action	Process Alternatives		Mining Alternatives		No-Action Alternative
		Alternate Lixiviant Chemistry	Alternate Waste Management	Open-pit mining with a conventional mill	Underground mining with a conventional mill	
Radiological Health Impacts	Estimated maximum TEDE at proposed project boundary is 12.5 mrem y^{-1} compared to the public dose limit of 100 mrem y^{-1} for the land application option; Estimated maximum TEDE at proposed project boundary is 2.5 mrem y^{-1} for the deep well disposal option.	Same as Proposed Action	Same as Proposed Action	Exposure to radioactive material is significantly increased because 95% of the radium in an ore body is brought to the surface	Same as open pit alternative	None
Waste Management Impacts	Generation of liquid and solid waste for disposal	Same as the Proposed Action, but potentially increased liquid waste due to the mobilization of additional hazardous elements in groundwater	Increased generation of 11e.(2) byproduct material for disposal	Waste generated is much greater than ISL and not all material can be removed from the site (e.g., tailings and waste rock)	Same as open pit alternative	None
Mineral Resource Recovery Impacts	Production of domestic energy resource	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action	Loss of domestic energy supply source; the current estimated reserves of uranium within the proposed permit area total 7.6 million pounds U_3O_8 currently valued at $456M (based on the spot market price of $60)