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United States Nuclear Regulatory Commission
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Environmental Impact Statement for the Dewey-Burdock Project in Custer and Fall River Counties, South Dakota

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

Final Report

Chapters 6 to 11 and Appendices

Office of Federal and State Materials and
Environmental Management Programs

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ABSTRACT

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

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

By letter dated August 10, 2009, Powertech (USA), Inc. (Powertech, referred to herein as the applicant) submitted a license application to NRC for a new source material license for the Dewey-Burdock ISR Project. The proposed Dewey-Burdock ISR Project will be located in Fall River and Custer Counties, South Dakota, which is in the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the GEIS. The NRC staff prepared this Supplemental Environmental Impact Statement (SEIS) to evaluate the potential environmental impacts from the applicant's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium facility at the proposed Dewey-Burdock ISR Project. This SEIS describes the environment potentially affected by the proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes the applicant's environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. NRC staff then determined relevant sections, findings, and conclusions in the GEIS that could be incorporated by reference and areas that required additional analysis. Based on its environmental review, the NRC staff recommendation is that a source material license for the proposed action be issued as requested, unless safety issues mandate otherwise.

Paperwork Reduction Act Statement

This NUREG contains and references information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB), approval numbers 3150-0014, 3150-0020, 3150-0021, and 3150-0008.

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References

10 CFR Part 40. Code of Federal Regulations, Title 10, *Energy*, Part 40. "*Domestic Licensing of Source Material*." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51. "*Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." ML091480244, ML091480188. Washington, DC: NRC. May 2009.

CONTENTS

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

Section Page

APPENDICXES

FIGURES

Figures Page

Figures Page

TABLES

Table Page

Table Page

EXECUTIVE SUMMARY

BACKGROUND

By letter dated August 10, 2009, Powertech (USA), Inc. (Powertech) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the Dewey-Burdock *In-Situ* Uranium Recovery Project, located in Fall River and Custer Counties, South Dakota. The applicant is proposing to recover uranium using the *in-situ* leach (ISL) [also known as *in-situ* recovery (ISR)] process. The proposed Dewey-Burdock ISR Project will include processing facilities and sequentially developed wellfields sited in two contiguous areas, the Burdock area and the Dewey area. Proposed facilities include a central processing plant in the Burdock area, a satellite facility in the Dewey area, wellfields, Class V deep injection wells and/or land application areas for disposal of liquid wastes, and the attendant infrastructure (e.g., pipelines and surface impoundments).

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

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

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

This SEIS was prepared in cooperation with the U.S. Bureau of Land Management (BLM). BLM has requested to be and is acting as a cooperating agency with NRC to evaluate the impacts of Powertech's Plan of Operations in accordance with the National Memorandum of Understanding with NRC. BLM manages 97 ha [240 ac] of land within the proposed Dewey-Burdock ISR Project area. Under 43 CFR Part 3809, BLM is required to review the environmental impacts of federal actions on surface lands to assure that there is no "unnecessary or undue degradation of public lands." To fulfill this requirement, the applicant submitted a Plan of Operations to BLM for the Dewey-Burdock ISR Project on August 26, 2009. Powertech modified the Plan of Operations and resubmitted it to BLM on January 28, 2011.

PURPOSE AND NEED FOR THE PROPOSED ACTION

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

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

The BLM purpose and need for the proposed action is to provide for orderly, efficient, and environmentally responsible mining of the uranium resource. The uranium resource is needed to fulfill market demands for this product for power generation and other needs. These public lands are open to mineral entry, and the applicant has filed mining claims on them. Within the proposed project area, Powertech maintains the mining claims associated with 1,708 ha [4,220 ac] of federal land that the U.S. Government reserved under the Stock-Raising Homestead Act. The BLM federal decision is to either approve the Powertech-modified Plan of Operations subject to mitigation included in the license application and this SEIS, or deny approval of the Plan of Operations. BLM's responsibility to respond to the Plan of Operations establishes the need for the action. The mining claimant has the right to mine and develop the mining claims as long as it can be done without causing unnecessary or undue degradation of the public lands and follows pertinent laws and regulations under 43 CFR Part 3800.

THE PROJECT AREA

The proposed Dewey-Burdock ISR Project is located in Custer and Fall River Counties, South Dakota, within the Great Plains physiographic province on the edge of the Black Hills uplift. The proposed site is located approximately 21 km [13 mi] north-northwest of the city of Edgemont, approximately 64 km [40 mi] west of the city of Hot Springs, and approximately 80 km [50 mi] southwest of the city of Custer. The total land area of the proposed Dewey-Burdock Project is 4,282 ha [10,580 ac]. Sections within the proposed project area are split estate, in which two or more parties own the surface and subsurface mineral rights. The surface rights are both publicly and privately owned. Approximately 4,185 ha [10,340 ac] of land is privately owned, and the remaining 97 ha [240 ac] of surface rights are owned by the U.S. Government and administered by BLM. The subsurface mineral rights are owned by various private entities and federally reserved by the U.S. Government.

The proposed Dewey-Burdock ISR Project will consist of processing facilities and sequentially developed wellfields in two contiguous areas: the Burdock area and the Dewey area. Planned facilities associated with the proposed project include buildings associated with a central processing plant in the Burdock area and a satellite facility in the Dewey area; surface impoundments; wellfields and their associated infrastructure (e.g., wells, header houses, and pipelines); Class V deep injection wells and/or land application areas for disposal of liquid wastes; and access roads. The applicant estimated that the land surface area that will be

affected by proposed ISR operations will be approximately 98 ha [243 ac] if Class V deep injection wells alone are used to dispose of process-related liquid wastes and approximately 566 ha [1,398 ac] if land application alone is used to dispose of liquid wastes.

IN-SITU RECOVERY PROCESS

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

During production, the uranium recovery solution continually moves through the aquifer from injection wells to recovery wells. These wells can be arranged in a variety of geometric patterns depending on the location and orientation of the orebody, aquifer permeability, and operator preference. Wellfields are typically designed in a five-spot or seven-spot pattern, with each recovery (i.e., production) well located inside a ring of injection wells. Monitoring wells are installed in the production zone aquifer and surround the wellfield pattern area. Monitoring wells are screened (i.e., open to allow water to enter) in the appropriate stratigraphic horizon to detect the potential migration of lixiviant away from the production zone. Monitor wells are also installed in the overlying and underlying aquifers to detect the potential vertical migration of lixiviant outside the production zone. The uranium that is recovered from the solution is processed, dried into yellowcake, packaged into NRC- and U.S. Department of Transportation (USDOT)-approved 208-L [55-gal] steel drums, and trucked offsite to a licensed conversion facility.

An underground injection control (UIC) program regulates the design, construction, testing, operation, and closure of injection wells at ISR facilities. Before ISR operations begin, the portion of the aquifer(s) designated for uranium recovery must be exempted from the underground source of drinking water (USDW) designation, in accordance with the Safe Drinking Water Act (SDWA). Once production is complete, the production zone groundwater is restored to NRC-approved groundwater protection standards, which are protective of the surrounding groundwater. The site is decommissioned according to an NRC-approved decommissioning plan and in accordance with NRC-approved standards. Once decommissioning is approved, the site may be released for public use.

ALTERNATIVES

The NRC environmental review regulations that implement NEPA in 10 CFR Part 51 require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action. The NRC staff considered a range of alternatives that would fulfill the underlying purpose and need for the proposed action. From this analysis, a set of reasonable alternatives was developed, and the impacts of the proposed action were compared with the impacts that would result if a given alternative was implemented. This SEIS evaluates the potential environmental impacts of the proposed action and the No-Action alternative and also considers

alternative wastewater disposal options to the proposed action. Under the No-Action alternative, the applicant would not construct and operate ISR facilities at the proposed site. Other alternatives considered at the proposed Dewey-Burdock ISR Project site but eliminated from detailed analysis include conventional mining and milling, conventional mining and heap leach processing, alternative lixiviants, alternative site locations, and alternative well completion methods. These alternatives were eliminated from detailed study because they either would not meet the purpose and need of the proposed project or would cause greater environmental impacts than the proposed action. This SEIS also discusses alternative wastewater disposal options (evaporation ponds and surface water discharge) that were not included in the proposed action.

SUMMARY OF ENVIRONMENTAL IMPACTS

This SEIS includes the NRC staff analysis that considers and weighs the environmental impacts from the construction, operation, aquifer restoration, and decommissioning of ISR operations at the proposed Dewey-Burdock ISR Project site and the No-Action alternative. This SEIS also describes mitigation measures for the reduction or avoidance of potential adverse impacts that (i) the applicant has committed to in its NRC license application, (ii) will be required under other federal and state permits or processes, or (iii) are additional measures NRC staff identified as having the potential to reduce environmental impacts but that the applicant did not commit to in its application. The SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

As discussed in the GEIS and consistent with NUREG–1748 (NRC, 2003), the significance of potential environmental impacts is categorized as follows:

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

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

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

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

Impacts by Resource Area and *In-Situ* Recovery Facility Phase

Land Use

Construction: Impacts will be SMALL. If deep well disposal via Class V injection wells alone is used to dispose of liquid wastes, approximately 98 ha [243 ac] or 2.3 percent of the proposed project area will be disturbed by the construction phase. If land application alone is used to dispose of liquid wastes, the construction phase will disturb approximately 566 ha [1,398 ac] or 13.2 percent of the proposed project area. Topsoil will be stripped and stockpiled prior to

building surface facilities, developing initial wellfields and attendant infrastructure, and constructing access roads. Livestock grazing and recreational activities will be excluded from fenced areas surrounding the central plant, satellite facility, surface impoundments, andwellfields.

Operation: Impacts will be SMALL. Land use impacts during the operations phase will be limited to the wellfields and will be similar to, or less than, those during the construction phase. Wellfields will be developed sequentially resulting in disturbance of approximately 57 ha [140ac]. Land disturbance and access restrictions will result from drilling new wells and constructing additional header houses and pipelines. Livestock grazing and recreational activities will continue to be restricted from the central plant, satellite facility, surface impoundments, and wellfields. Potential land application areas may also be fenced to control livestock access.

Aquifer Restoration: Impacts will be SMALL. Land use impacts will be similar to, or less than those described for the operations phase. Land use impacts will decrease as fewer wells and pump houses are used and overall equipment traffic and use diminish. Access to wellfields and surface facilities will continue to be restricted. No additional land will be disturbed to construct facilities.

Decommissioning: Impacts will be SMALL to MODERATE. Decommissioning the buildings, wellfields, storage ponds, and access roads and removing potentially contaminated soil will result in a temporary, short-term increase in land-disturbing activities. Upon completion of the plugging and abandonment of wells, the soil will be returned to areas in the wellfield where it had been removed and reseeded. At the end of decommissioning, because the reclaimed land will be released for other uses and no longer restricted, the land use impact in disturbed areas will be MODERATE until vegetation becomes reestablished. After vegetation is reestablished in reclaimed areas, the land will be returned to a condition that can support a variety of land uses; therefore, the impact will be SMALL.

Transportation

Construction: Impacts will be SMALL. Dewey Road, the unpaved gravel road nearest the proposed site, will experience a 42 percent increase over existing traffic considering both autos and trucks during the ISR construction phase. This increase in traffic will incrementally accelerate degradation of road surfaces, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. The well-traveled regional roads will not be impacted significantly by construction traffic.

Operation: Impacts will be SMALL. Dewey Road, the road nearest the proposed site, will experience a 24 percent increase in daily vehicle traffic during the ISR operations phase. This increase in traffic will incrementally accelerate degradation of road surfaces, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Additionally, the transport of yellowcake product, hazardous materials, uranium-loaded resins from the Dewey Unit to the Burdock Unit, and wastes could result in spills or leakage if an accident occurred; however, this risk was determined to be low and will be further limited by compliance with existing NRC and USDOT transportation regulations and the implementation of best management practices (BMPs) for containing leakage and spills.

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

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

Geology and Soils

Construction: Impacts will be SMALL. Earthmoving activities associated with construction of the Burdock central plant and Dewey satellite plant facilities, access roads, wellfields, pipelines, and surface impoundments will include topsoil clearing and land grading. Topsoil removed during these activities will be stored and reused later to restore disturbed areas. The limited areal extent of the construction area, the soil stockpiling procedures, the implementation of BMPs, the short duration of the construction phase, and mitigative measures such as reestablishment of native vegetation will further minimize the potential impact on soils.

Operation: Impacts will be SMALL. The uranium mobilization and recovery process will not remove rock matrix from production zone sandstones and will not dewater production zone aquifers. Therefore, no significant matrix compression or ground subsidence is expected. The occurrence of potential spills during transfer of uranium-bearing lixiviant to and from the Burdock central plant and Dewey satellite facility will be mitigated by implementing onsite standard procedures and by complying with NRC requirements for spill response and reporting of surface releases and cleanup of any contaminated soils. The U.S. Environmental Protection Agency (EPA) will determine the suitability of deep geologic formations for deep Class V disposal of liquid waste before issuing an UIC permit for Class V injection wells. Treated wastewater disposed of in Class V injection wells will be required to meet release standards as referenced in 10 CFR Part 20, Subparts D and K and Appendix B, Table 2, Column 2. Potential soil contamination in proposed land application areas will be monitored by implementing soil collection and sampling procedures. Treated wastewater applied to land application areas will be required to meet NRC release limit criteria, as referenced in 10 CFR Part 20, Appendix B, and applicable state groundwater quality standards under a Groundwater Discharge Plan (GDP) approved by South Dakota Department of Environment and Natural Resources (SDDENR).

Aquifer Restoration: Impacts will be SMALL. During aquifer restoration, the processes of groundwater sweep and groundwater transfer will not remove rock matrix from production zone sandstones. The formation groundwater pressure within the extraction zone will be decreased during restoration as groundwater is removed to ensure the direction of groundwater flow is into the wellfields to reduce the potential for offsite migration of constituents. However, the change in groundwater pressure will not result in collapse of overlying rock strata as it is supported by the rock matrix of the formation. The potential impact to soils from spills, leaks, and land application of treated wastewater will be comparable to that described for the operations phase.

The NRC requirements for spill response and recovery and routine monitoring programs will also apply.

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

Surface Waters and Wetlands

Construction: Impacts will be SMALL. The occurrence of surface water at the proposed Dewey-Burdock site is limited, and surface water flow in channels is ephemeral except for perennial Beaver Creek. The applicant will construct ISR processing and support facilities on level areas and outside the 100-year floodplain. National Pollutant Discharge Elimination System (NPDES) permits issued by SDDENR will set limits to control the amount of pollutants that can enter surface water bodies. Implementation of a stormwater pollution management plan (SWMP) will control stormwater runoff during construction and ensure that surface water runoff from disturbed areas meets NPDES permit limits. U.S. Army Corps of Engineers permits under Section 404 of the Clean Water Act will be required before conducting work in jurisdictional wetlands identified in the project area.

Operation: Impacts will be SMALL. The applicant's SDDENR-approved NPDES permit and SWMP will be in place to mitigate impacts to surface water from erosion, runoff, and sedimentation. The applicant will implement an emergency response plan to identify and clean up accidental spills and leaks. Processing facilities and chemical and fuel storage tanks will have secondary containment to contain potential spills. Operations will create liquid wastes that will be contained in radium-settling and storage ponds for eventual Class V injection well disposal and/or land application. Radium settling ponds will be constructed with liners, underdrains, and leak detection systems and storage ponds that contain treated wastewater will be constructed with geosynthetic and clay liners. Liquid waste applied to land application areas will be required to meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B. SDDENR will require liquid waste applied to land application areas to meet applicable state discharge requirements under a GDP.

Aquifer Restoration: Impacts will be SMALL. Impacts will be similar to those during the operations phase because the same infrastructure will be used and the same activities will be conducted. The applicant's SDDENR-approved NPDES permit and SWMP will be in place to mitigate impacts to surface water from erosion, runoff, and sedimentation. Restoration of groundwater aquifers will create wastewater that will be contained in radium settling and storage ponds for eventual Class V injection well disposal and/or land application. Radium settling ponds will be constructed with liners, underdrains, and leak detection systems and storage ponds that contain treated wastewater will be constructed with geosynthetic and clay liners. Treated wastewater applied to land application areas will be required to meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B. SDDENR will require wastewater applied to land application areas to meet applicable state discharge requirements under a GDP.

Decommissioning: Impacts will be SMALL. The impacts will be similar to those during the construction phase. Activities to clean up, recontour, and reclaim the land surface during decommissioning will mitigate long-term impacts to surface water. The applicant's

SDDENR-approved NPDES permit and SWMP will be in place to mitigate impacts to surface water from erosion, runoff, and sedimentation.

Groundwater

Construction: Impacts will be SMALL. The primary impact to groundwater during the construction phase will be from the consumptive use of groundwater, introduction of drilling fluids into the environment during well installation, and from surface spills of fuels and lubricants. The applicant is required to obtain water appropriation use permits from SDDENR prior to withdrawing water from aquifers. During well installation, drilling fluids (mud) will have the potential to impact surficial aquifers; however, all wells will undergo mechanical integrity tests of the casing and therefore ensure against well leakage prior to entering service. Impacts to groundwater from surface spills of fuels and lubricants will be mitigated by the applicant's implementation of BMPs and by following a spill prevention program that will require an immediate cleanup response to prevent soil contamination or infiltration to groundwater.

Operation: Impacts will be SMALL. The operations phase may impact near-surface (alluvial) aquifers, production zone aquifers containing the orebodies and surrounding aquifers, and deep aquifers below the ore production zone used for the disposal of liquid wastes.

Alluvial aquifers are separated from production zone and surrounding aquifers by thick aquitards (confining units) and, therefore, are not hydraulically connected to production zone and surrounding aquifers. In addition, alluvial aquifers do not serve as a water supply for domestic use or livestock. The impacts from spills and leaks will be SMALL. The applicant's leak detection and cleanup program will include rapid response and remediation to minimize impacts to soils and groundwater. Liquid waste applied to land application areas will be required to meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B and applicable state discharge requirements under a GDP issued by SDDENR.

The applicant has committed to removing and replacing existing domestic wells drawing water from production zone aquifers within the project area from private use prior to ISR operations. In addition, the applicant will monitor all domestic wells within 2 km [1.2 mi] of the wellfields during operations and replace these wells in the event of significant drawdown or degradation of water quality. Water levels in affected wells will recover with time after ISR operations and aquifer restoration activities are complete.

The establishment of an inward hydraulic gradient during wellfield operations along with the applicant-installed groundwater monitoring network to detect potential vertical and horizontal excursions will limit the potential for undetected lixiviant excursions that could degrade groundwater quality. Because the ore production zones are overlain and underlain by impermeable shale layers, this further ensures the hydraulic isolation of the ore production zones, which helps to limit potential groundwater contamination in surrounding aquifers.

Liquid wastes generated from operation of the proposed Dewey-Burdock ISR Project will be disposed of via Class V deep well injection, land application, or a combination of Class V deep well injection and land application. The groundwater in deep formations targeted for Class V deep well injection must not be a potential underground source of drinking water. Class V injection wells will be permitted in accordance with the EPA Underground Injection Control Program. Liquid wastes injected into Class V injection wells may not be classified as hazardous under the Resource Conservation and Recovery Act. NRC will require the liquid waste pumped

into Class V injection wells to be treated and monitored to verify it meets NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B, Table 2, Column 2.

Aquifer Restoration: Impacts will be SMALL. Groundwater restoration will be initiated once a wellfield is no longer being used to produce uranium. Larger withdrawals will produce larger drawdowns in production aquifers during aquifer restoration, resulting in a greater impact on yields of nearby wells. As with operations, the applicant will monitor all domestic wells within 2 km [1.2 mi] of the wellfields during aquifer restoration and replace these wells in the event of significant drawdown or degradation of water quality. Water levels in affected wells will recover with time after ISR operations and aquifer restoration activities are complete. Natural recovery and the well monitoring measures established by the applicant will reduce impacts to nearby wells, ensuring the long-term environmental impact from consumptive use will be SMALL.

During aquifer restoration, hydraulic control for the former production zone will be maintained; this will be accomplished by maintaining an inward hydraulic gradient through a production bleed. During aquifer restoration activities, water will be pumped from the wellfield (without reinjection), resulting in an influx of "fresh" groundwater into the affected (mined) portion of the aquifer. Disposal of liquid wastes via Class V injection wells, land application, or a combination of Class V injection wells and land application will occur as described for ISR operations. The goal of aquifer restoration will be to restore groundwater quality in the ore production zone to Commission-approved background conditions under 10 CFR Part 40, Appendix A, Criterion 5B(5). If the aquifer cannot be restored to background conditions, then NRC will require that either the production zone be returned to maximum contaminant levels in 10 CFR Part 40, Appendix A, Table 5C or to NRC-approved alternate concentration limits. Post-restoration groundwater quality will be protective of public health and the environment.

Decommissioning: Impacts will be SMALL. The potential impact to groundwater quality during decommissioning and reclamation is comparable to that described in the construction phase. Groundwater consumptive use will be less than that of the operation and restoration phases. All monitoring, injection, and production wells will be plugged and abandoned in accordance with UIC program requirements. Wells will be filled with cement and clay to ensure groundwater does not flow through the abandoned wells. Abandoned wells will be properly isolated from the flow domain. NRC will review and approve the wellfield restoration efforts to ensure that restoration standards were followed and public health and safety is protected.

Ecological Resources

Construction: Impacts will be SMALL to MODERATE. Construction disturbance under current development plans, which require vegetative removal, will affect approximately 98 ha [243 ac] if deep well injection is used to dispose of treated wastewater or approximately 566 ha [1,398 ac] if land application or a combination of deep well injection and land application is used to dispose of treated wastewater. Some habitat loss or alteration, displacement of wildlife, and mortality due to encounters with vehicles or heavy equipment will occur, though wildlife species will likely disperse from the area once construction commences. Following recommended fencing and power line construction designs will minimize impediments to game and avian movement. Mitigation will control the introduction and spread of undesirable and invasive, nonnative plants; reduce the likelihood of injury or mortality to wildlife; and ensure no loss of aquatic habitat. Impacts to wildlife and habitat will be minimized with mitigation measures and the timely reseeding of disturbed areas following construction. Any trees with raptor nests will not be removed, and following U.S. Fish and Wildlife Service (FWS) and South Dakota Game, Fish,

and Parks (SDGFP) seasonal noise, vehicular traffic, and human proximity guidelines will help to ensure the continued nesting success of area raptors. No federally threatened or endangered species are known to occur within the proposed project area. Impacts to state-protected species will not noticeably affect species' populations within the vicinity of the proposed project site.

Operation: Impacts will be SMALL to MODERATE. Ecological impacts due to noise, vehicles, structures, and the presence of humans will be similar to, but less than, those experienced during construction for either disposal option because fewer earthmoving activities will occur. However, larger areas of habitat will be converted to crops and animals will be disturbed with irrigation activities during the land application disposal option. Wastewater solutions include levels of chemical constituents that are potentially harmful to wildlife; however, proposed practices and state regulatory controls including permit conditions, monitoring requirements, and action levels would limit direct contact and potential impacts. Monitoring and action levels for environmental concentrations of wastewater constituents in land application areas will allow regulators to impose mitigations if constituents accumulate above levels of concern. The applicant will reseed disturbed areas with SDDENR- or BLM-approved seed mixtures to restore habitat. Spill detection and response plans will reduce the potential impact to terrestrial and aquatic species. Fencing would further limit wildlife access to liquid waste holding ponds. Potential conflicts between active raptor nest sites and project-related activities will continue to be mitigated by annual raptor monitoring and mitigation plans.

Aquifer Restoration: Impacts will be SMALL to MODERATE. Impacts will be similar to those experienced during the operations phase with no major differences in type or degree of impact. The existing infrastructure will be used during this phase, and mitigation measures will continue to apply from the construction and operations phases.

Decommissioning: Impacts will be SMALL to MODERATE. Temporary disturbances to land and soils during decommissioning could displace vegetation and wildlife species that had recolonized the proposed project area since initiation of ISR activities. Shrubland vegetative communities will be more difficult to reestablish and achieve full site recovery. The applicant commits to vegetation reestablishment efforts to be ongoing throughout the ISR facility life cycle. However, new vegetative growth could be affected by future grazing, droughts, or intense winters, thus reducing the rate of plant productivity and delaying full recovery, Revegetation and recontouring will restore habitat previously altered during construction and operations.

Air Quality

Construction: Impacts will be SMALL to MODERATE. The proposed Dewey-Burdock ISR Project is located in the Black Hills-Rapid City Intrastate Air Quality Control Region, which is classified as being in attainment for all National Ambient Air Quality Standards (NAAQS) primary pollutants. Air emissions during the construction phase of the proposed project will consist primarily of combustion emissions from drill rigs and fugitive road dust. The magnitude of the pollutant concentrations from the construction phase combustion emissions are below NAAQS and Prevention of Significant Deterioration (PSD) Class II regulatory thresholds except for the particulate matter PM_{10} 24-hour PSD Class II allowable increment. This also holds true for the peak year pollutant emission levels. The peak year refers to periods during which all four phases occur simultaneously and represents the highest level of emissions the proposed action will generate in any one project year. Fugitive dust emissions, the primary source for the

particulate matter PM_{10}, are spread out over a large area and tend to generate emissions sporadically. Due to the level and nature of these fugitive emissions, there is potential for short-term, intermittent impacts to localized areas in and around the site particularly when vehicles travel on unpaved roads. Wind Cave National Park, a Class I area located about 47 km [29 mi] northeast of the proposed project area, has experienced visibility impacts from air pollution. However, project specific modeling results for the Wind Cave National Park (e.g., Class I PSD, visibility, and acid deposition) are below applicable thresholds.

The deep Class V injection well disposal option has more combustion emissions than the land application option due to the contribution of the deep well drill rig. The land application option has more fugitive emissions due to the greater area of land disturbed. However, these differences are relatively small and appreciable differences in the overall air emission levels between the two disposal options are not expected. Therefore, the impact magnitudes are expected to be similar.

Operation: Impacts will be SMALL. Fugitive dust emission pollutant levels will be less than those experienced during construction. ISR facilities are not major point source emitters of regulated pollutants. Combustion emissions in this phase are basically evenly divided between light duty vehicles and construction and field equipment. The combustion and fugitive dust emissions will be below NAAQS and PSD Class II regulatory thresholds. Project specific modeling results for the Wind Cave National Park (e.g., Class I PSD, visibility, and acid deposition) are below applicable thresholds.

The land application disposal option has more fugitive emissions than the Class V injection well option due to the greater area of land disturbed. However, this difference is relatively small and appreciable differences in the overall air emission levels between the two disposal options are not expected. Therefore, the impact magnitudes are expected to be similar.

Aquifer Restoration: Impacts will be SMALL. Combustion emission and fugitive emission levels for the aquifer restoration phases are the lowest relative to the other three phases. For the aquifer restoration phase, combustion emissions are primarily from light duty vehicles; wind erosion can generate more fugitive emissions than travel on unpaved roads. The combustion and fugitive dust emissions will be below NAAQS and PSD Class II regulatory thresholds. Project specific modeling results for the Wind Cave National Park (e.g., Class I PSD, visibility, and acid deposition) are below applicable thresholds. The proposed project can contribute to visibility impacts at Wind Cave National Park, but the impact magnitude will be minimal.

The land application disposal option can generate up to approximately two times the amount of fugitive emissions compared to the Class V injection well disposal option. Although there is some difference in the overall fugitive dust emissions levels between the two disposal options, the impact magnitude is expected to be similar.

Decommissioning: Impacts will be SMALL. The decommissioning phase pollutant sources and emission levels closely match those from the operation phase. Therefore, the decommissioning phase will produce a similar impact magnitude as the operation phase. As in the operation phase described previously, appreciable differences in the overall decommissioning phase air emission levels between the Class V injection well and land application disposal options are not expected.

Noise

Construction: Impacts will be SMALL. Increased traffic, as well as use of drill rigs, heavy trucks, bulldozers, and other equipment to construct and operate the wellfields, drill wells, access roads, and build the central plant and satellite facility, will generate noise audible above ambient (background) levels. The sound from construction activities will be indistinguishable from background levels at a distance of approximately 305 m [1,000 ft]. Two onsite dwellings will be impacted by noise above background levels from heavy equipment use. The Daniel residence is within 305 m [1,000 ft] of wellfields B-WF6 and B-WF7 in the Burdock area, and the Beaver Creek Ranch Headquarters is within 305 m [1,000 ft] of land application areas in the Dewey area. Increased noise levels at these residences during construction will be short term (1 to 2 years) and mitigated by using sound abatement controls on operating equipment. Administrative and engineering controls will be expected to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits and be mitigated by use of personal hearing protection. Noise impacts to raptors will be mitigated by adhering to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

Operation: Impacts will be SMALL. Impacts from traffic-related noise will be similar to those during construction. Because wellfields will be developed and operated sequentially, potential noise impacts at the Daniels residence will be short term (1 to 2 years each for wellfields B-WF6 and B-WF7). In addition, the Daniel residence will not be occupied year round. Residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season (May 11 to September 24). Noise impacts will be mitigated by using sound abatement controls on operating equipment. The central plant and satellite facility will generate indoor noise audible to workers. OSHA regulatory limits will be maintained and mitigated by use of personal hearing protection. Potential noise-related impacts to active raptor nest sites will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

Aquifer Restoration: Impacts will be SMALL. Noise impacts will be similar to, or less than, those experienced during the operations phase. Pumps and other wellfield equipment contained in buildings would reduce the potential sound impact to an offsite individual. Because the aquifers in wellfields will be restored sequentially, potential noise impacts at the Daniel residence will be short term (1 to 2 years each for wellfields B-WF6 and B-WF7). In addition, the Daniel residence will not be occupied year round. During aquifer restoration, residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season (May 11 to September 24). Noise impacts will be mitigated by using sound abatement controls on operating equipment. Noise impacts from traffic will be SMALL because there will be fewer vehicular trips than during the operations phase. Potential noise-related impacts to active raptor nest sites will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

Decommissioning: Impacts will be SMALL. Noise impacts will either be similar to, or less than, those experienced during the construction phase. Noise during this phase will be temporary, and when decommissioning and reclamation activities are complete, the noise levels will return to baseline. Noise impacts from traffic will be SMALL because there will be fewer shipments to and from the proposed site as decommissioning progresses. Potential noise-related impacts to

active raptor nest sites will continue to be mitigated by adherence to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., FWS, SDGFP, and BLM).

Historic and Cultural Resources

Construction: Impacts will be SMALL to LARGE. Archaeological and historic sites have the potential to be disturbed during construction of ISR facilities and infrastructure. NRC's environmental review of historic and cultural resources included evaluating the results of (i) archaeological field investigations, (ii) tribal cultural surveys, and (iii) visual and auditory impacts assessments.

Archaeological field investigations identified 18 historic sites that are listed in the National Register of Historic Places (NRHP) or are eligible for listing in the NRHP. Six of these sites could experience LARGE potential impacts due to their location within the area of potential effect (APE) for facility construction and operations. Avoidance and mitigation measures, such as data recovery excavations and fencing, are recommended for these six NRHP-eligible sites. Avoidance of the remaining 12 sites during the construction phase is anticipated and for this reason no impacts are expected. Avoidance is also recommended for 15 unevaluated historic sites within or in close proximity to the APE for facility construction and operations, pending NRHP eligibility determination.

Tribal cultural surveys recommended 17 known archaeological sites as eligible for listing in the NRHP. Three of these sites could experience LARGE potential impacts due to their location within the APE for facility construction and operations. Avoidance is recommended for these three known archaeological sites. Avoidance of the remaining 14 sites during the construction phase is anticipated and for this reason no impacts are expected. Tribal cultural surveys recommended 12 newly discovered sites as eligible for listing in the NRHP. Four of these new discoveries could experience LARGE potential impacts due to their location within the APE for facility construction and operations. Avoidance of the remaining 8 new tribal sites during the construction phase is anticipated and therefore no impacts are expected.

NRC staff compiled a list of 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting. These sites are located within a 4.8-km [3-mi] radius of the Dewey satellite facility or the Burdock central processing plant. Based on a line-of-sight analysis which considered the site's significance and existing environmental factors and conditions, NRC determined that 19 historic properties could experience MODERATE potential visual impacts. All of the 31 historic properties are located more than 640 m [2,100 ft] from the nearest processing facility, which exceeds the estimated 305 m [1,000 ft] zone for potential auditory impacts. Therefore, NRC staff conclude that potential auditory impacts on historic properties during the construction phase will be SMALL.

Prior to construction, an agreement between NRC, South Dakota State Historic Preservation Office (SD SHPO), BLM, interested Native American tribes, the applicant, and other interested parties will be established outlining the mitigation process for each affected resource. By NRC license condition, the applicant is required to stop any work if historical or cultural resources are encountered during construction activities. All newly discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Operation: Impacts will be SMALL to MODERATE. Minimal impacts will result during the operations phase because impacts to cultural resources will have been mitigated before facility construction and identified resources will be avoided. Potential visual and auditory impacts on historic properties will be the same as described for the construction phase (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If historical or cultural resources are encountered during operations, the applicant is required by license condition to stop work. The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Aquifer Restoration: Impacts will be SMALL to MODERATE. Impacts to historical and cultural resources during the aquifer restoration phase will be similar to operational impacts. Potential impacts to identified historic and cultural resources will have been mitigated prior to facility construction. Potential visual and auditory impacts on historic properties will be the same as described for the construction and operations phases (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If historical or cultural resources are encountered during operations, the applicant is required by license condition to stop work. The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Decommissioning: Impacts will be SMALL. Minimal impacts are expected during the decommissioning phase because impacts to cultural resources will have been mitigated prior to facility construction. Potential visual impacts will be reduced to SMALL after processing facilities are dismantled and removed. If historical or cultural resources are encountered during operations, the applicant is required by license condition to stop work. The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

Visual/Scenic Resources

Construction: Impacts will be SMALL. During facilities construction, short-term (1 to 2 years) visual and scenic impacts will result from construction equipment and fugitive dust emissions. Temporary and short-term visual impacts during the construction period in each wellfield will result from header house construction, well drilling, and construction of access roads and electrical distribution lines. Dust suppression and selecting building materials and paint that complement the natural environment will reduce overall visual and scenic impacts of project construction. Center pivot irrigation systems in proposed land application areas in the Dewey area will be visible to travelers on Dewey Road; however, Dewey Road is a lightly traveled county road with few residences. Proposed activities at the project will be consistent with the BLM visual classification of this area.

Operation: Impacts will be SMALL. Visual impacts will be similar to, or less than, those experienced during construction. Less heavy machinery will be used, and standard dust control measures (e.g., water application and speed limits) will be implemented to reduce visual impacts from fugitive dust. Wellfields will be developed sequentially, and there will be no large expanse of land undergoing development at one time. Buildings and other structures will be painted so they blend in to the natural landscape, and power lines and pipelines will be buried where appropriate. Center pivot irrigation systems in proposed land application areas in the Dewey area will be visible to travelers on Dewey Road; however, Dewey Road is a lightly

traveled county road with few residences. Proposed activities at the project will be consistent with the BLM visual classification of this area.

Aquifer Restoration: Impacts will be SMALL. Visual impacts will be similar to, or less than, those experienced during the operations phase. Aquifer restoration activities will use in-place infrastructure; therefore, no modifications to either scenery or topography will occur. There will be less vehicular traffic, creating less of a visual impact. The applicant identified mitigation measures, such as dust suppression, which will be used to further reduce visual impacts.

Decommissioning: Impacts will be SMALL. Temporary impacts to the visual landscape will be comparable to those during the construction phase. Reclamation will return the visual landscape to baseline contours and will reduce the visual impact by removing buildings and the associated infrastructure. Implementation of mitigation measures (e.g., dust suppression) will further reduce the visual impacts from decommissioning.

Socioeconomics

Construction: Impacts will be SMALL. Because of the small size of the construction workforce (86 workers) and because of the short duration of the ISR construction phase (1 to 2 years), the overall potential socioeconomic impact, including the effects of ISR facility construction on demographic conditions, income, housing, employment rate, local finance, education, and health and social services, will be SMALL.

Operation: Impacts will be SMALL. Because of the small size of the operations workforce (84 workers), the migration of workers and their families to nearby towns will have a SMALL impact on demographics. Although wage rates will be higher for Dewey-Burdock employees than for workers in similar skilled positions in Fall River, Custer, and Weston Counties, the operations workforce will be small in comparison to the combined labor force in the counties; therefore, income impacts will be SMALL. The impact on housing will be SMALL because of available housing in the immediate area surrounding the proposed ISR facility. Operation of the proposed Dewey-Burdock ISR Project will create new jobs, but because of the small workforce size and because most skilled workers will be drawn from areas outside of the region of influence, impacts on employment will not be noticeable. The local economy will experience a SMALL to MODERATE beneficial impact from the purchasing of local goods and services and an increase in sales and income tax revenues. An increased demand for schools will have a SMALL impact on education because the current school systems are not at full capacity and can accommodate more students. Increased demand for health and social services will have a SMALL impact.

Aquifer Restoration: Impacts will be SMALL. Impacts will be less than those experienced during the operations phase. Fewer workers will be required, which will reduce pressure on housing, education, and health and social services.

Decommissioning: Impacts will be SMALL. Impacts will be less than those during the construction and operations phases because fewer workers will be required. Demand for housing, education, and health and social services will also be reduced.

Environmental Justice

All Phases: The percentage of minority populations living in affected block groups in the vicinity of the proposed Dewey-Burdock ISR Project site in Custer and Fall River Counties in South Dakota and Weston County in Wyoming does not significantly exceed the percentage of minority populations recorded at the state and county level and is well below the national level. Furthermore, the percentage of low-income populations living in affected census tracts in the vicinity of the proposed project site in Custer, Fall River, and Weston Counties does not significantly exceed the percentage of low-income populations recorded at the state or county level. Therefore, there will be no disproportionately high and adverse impacts to minority and low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR facility.

The population closest to the proposed Dewey-Burdock ISR Project that could be impacted by environmental justice concerns is the Pine Ridge Indian Reservation located approximately 80 km [50 mi] east in Shannon County, South Dakota. Based on 2010 United States Census Bureau data, this reservation has both minority {greater than 95 percent Native American (Oglala Sioux Tribe)} and low-income populations. Environmental justice impacts to Native American tribes living in the vicinity of the proposed project are not expected to differ from those experienced by other populations. The proposed action has the potential to affect certain sites of religious and cultural significance to Native American tribes; however, the impacts to such sites are expected to be reduced through mitigation strategies developed through the National Historic Preservation Act Section 106 consultation process.

Public and Occupational Health

Construction: Impacts will be SMALL. Construction activities, including the use of construction equipment and vehicles, will disturb the topsoil and create fugitive dust emissions. Fugitive dust generated from construction activities will be short term (1 to 2 years), and the levels of radioactivity in soils at the proposed project site are low; therefore direct exposure, inhalation, and ingestion of fugitive dust will not result in a radiological dose to workers and the public. Construction equipment will be diesel powered and will exhaust particulate diesel emissions. The potential impacts and potential human exposures from these emissions will be SMALL, because of the short duration of the release and because the emissions will be readily dispersed into the atmosphere.

Operation: The radiological impacts from normal operations will be SMALL. Public and occupational exposure rates at ISR facilities during normal operations have historically been well below regulatory limits. Dose assessments using the MILDOS computer code indicate that the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr] will not be exceeded at any property boundary. The remote location of the proposed Dewey-Burdock site and the use of the proposed ISR technology coupled with the applicant procedures to minimize exposure demonstrate that the potential impact on public and occupational health and safety from facility operation will be SMALL. The radiological impacts from accidents will be SMALL for workers (if the applicant's radiation safety and incident response procedures in an NRC-approved radiation protection plan are followed) and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health and safety impacts from normal operations and accidents, due primarily to risk of chemical exposure, will be SMALL if handling and storage procedures are followed.

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

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

Waste Management

Construction: Impacts will be SMALL. Small-scale and incremental wellfield development will generate small volumes of construction waste. Waste will primarily consist of building materials, piping, and other solid wastes. No byproduct material will be generated during construction. Nonhazardous solid waste will be disposed of at a nearby municipal solid waste landfill with available capacity to accommodate estimated construction-phase waste volumes.

Operation: Impacts will be SMALL. Liquid byproduct material, including production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant wash-down water, and laboratory chemicals will be treated and disposed using Class V injection wells. If a permit cannot be obtained from EPA for Class V injection, the applicant would pursue land application of treated liquid effluent. If the capacity of either method is limited, the applicant will pursue a combination of both Class V injection and land application. Deep well injection in a Class V well requires an EPA permit, and wastes will have to meet EPA permit conditions and NRC effluent discharge limits in 10 CFR Part 20, Appendix B (both would limit potential impacts). Land application will require SDDENR-permitting of discharge water, and the land application area would be monitored to assess compliance with NRC and SDDENR requirements that would limit impacts. Solids classified as byproduct material will be sent to a licensed facility for disposal. A preoperational agreement with a licensed facility to accept wastes the proposed action generates will avoid capacity impacts. Capacity is available for disposal of nonradiological, nonhazardous wastes at regional municipal landfills. Capacity will be sufficient for disposal of low volumes of generated hazardous wastes.

Aquifer Restoration: Impacts will be SMALL based on the type and quantity of waste expected to be generated and the available capacity for disposal. Waste disposal procedures will be the same as those during the operations phase, resulting in similar impacts. One exception is the addition of reverse osmosis treatment of aquifer restoration water if a Class V deep disposal well is used. The applicant proposal includes adequate disposal capacity, and the applicant is required to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations. Although the wastewater volume could increase during aquifer restoration activities, this will be offset by the reduction in production capacity from completion of wellfield production and removal from service.

Decommissioning: Impacts will be SMALL to MODERATE. Safe handling, storage, and disposal of decommissioning wastes will be described in a required decommissioning plan for NRC review before decommissioning activities begin. A preoperational agreement with a licensed disposal facility to accept solid byproduct material will ensure that sufficient disposal capacity will be available at the time of decommissioning. Equipment and building materials that meet release criteria will be reused, recycled, or disposed as construction waste at a landfill. The available local landfill capacity may be insufficient to accommodate all decommissioning nonhazardous solid waste from the proposed Dewey Burdock ISR Project.

The potential impacts on waste management resources will depend on the long-term status of the existing local landfill resources. If the capacity of the Newcastle or Custer-Fall River landfills is expanded prior to project decommissioning, the impacts to local landfills will be SMALL. If capacity at either landfill is not expanded prior to the Dewey-Burdock decommissioning, the NRC staff conclude the Newcastle landfill will have no disposal capacity at the time of decommissioning. Impacts to the Custer-Fall River landfill are expected to be MODERATE because the increase in solid waste disposal will more rapidly consume storage capacity during the last years of the landfill's projected operational life. The disposal of any waste from the Dewey-Burdock facility in the Rapid City landfill will have a SMALL impact due to the projected operational life and available capacity of that landfill.

CUMULATIVE IMPACTS

Chapter 5 of this SEIS provides the NRC evaluation of potential cumulative impacts from the construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project considering other past, present, and reasonably foreseeable future actions. Cumulative impacts from past, present, and reasonably foreseeable future actions were considered and evaluated in this SEIS, regardless of what agency (federal or nonfederal) or person undertook the action. The NRC staff determined that the SMALL to MODERATE impacts from the proposed Dewey-Burdock ISR Project are not expected to contribute perceptible increases to the SMALL to LARGE cumulative impacts, due primarily to ongoing uranium and oil and gas exploration activities, potential wind energy projects, and proposed infrastructure and transportation projects.

SUMMARY OF COSTS AND BENEFITS OF THE PROPOSED ACTION

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

COMPARISON OF ALTERNATIVES

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

FINAL RECOMMENDATION

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action (issuing a source material license for the proposed Dewey-Burdock ISR Project). Unless safety issues mandate otherwise, the NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that a source material license for the proposed action be issued as requested. This recommendation is based on (i) the license application, including the ER and supplemental documents the applicant submitted and responses to NRC staff requests for additional information; (ii) consultation with

federal, state, tribal, and local agencies; (iii) NRC staff independent review; (iv) NRC staff consideration of comments received on the draft SEIS; and (v) the assessments summarized in this SEIS.

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ABBREVIATIONS/ACRONYMS

ACHP	Advisory Council on Historic Preservation
ACL	alternate concentration limit
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act
AET, Inc.	American Engineering Testing, Inc.
ALAC	Archaeology Laboratory Augustana College
ALARA	as low as is reasonably achievable
APE	area of potential effect
ARC	Archaeological Research Center
ARPA	Archaeological Resources Protection Act
ARSD	Administrative Rules of South Dakota
ASLBP	Atomic Safety and Licensing Board Panel
AUM	animal unit month
AWEA	American Wind Energy Association
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BHAD	Black Hills Army Depot
BHNF	Black Hills National Forest
BLM	U.S. Bureau of Land Management
BMP	best management practice
BNSF	Burlington Northern Santa Fe
CAA	Clean Air Act
CAB	Commission-approved background
CCSDWPC	Custer County, South Dakota, Weed and Pest Control
CFR	*U.S. Code of Federal Regulations*
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQC	conditionally exempt small quantity generator
CNWRA	Center for Nuclear Waste Regulatory Analyses
CO	carbon monoxide
cpm	counts per minute
CPP	central processing plant
CWA	Clean Water Act
dBA	decibels
DM&E	Dakota Minnesota and Eastern (Railroad)
DOE	U.S. Department of Energy
Eco SSL	ecological soil screening levels
EFRC	Energy Fuels Resources Corporation
EIA	Energy Information Administration
EIS	environmental impact statement
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute

FACU	facultative upland
FACW	facultative wet
FHWA	Federal Highway Administration
FR	*Federal Register*
FRA	Federal Railroad Administration
FWS	U.S. Fish and Wildlife Service
GCRP	U.S. Global Change Research Program
GDP	Groundwater Discharge Plan
GEIS	generic environmental impact statement
GHG	greenhouse gas
GIS	Geographic Information System
GPS	global positioning system
HABS	Historic American Buildings Survey
HDPE	high-density polyethylene
ID	well identification
IML	Inter-Mountain Laboratories, Inc.
IQR	interquartile range
ISL	*in-situ* leach
ISR	i*n-situ* recovery
IX	ion exchange
KLJ	Kadramas, Lee, & Jackson
LA	Land Application
LOS	Line-of-Sight Analysis
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MILDOS	computer code
MIT	mechanical integrity test
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MW	megawatts
mya	million years ago
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAU	Rapid City Campus of the National American University
NCRP	National Council for Radiation Protection and Measurements
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966, as amended
NOGCC	Nebraska Oil and Gas Conservation Commission
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	national pollutant discharge elimination system

NPWRC	Northern Prairie Wildlife Research Center
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OBL	obligate
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
OTGR	Office of Tribal Government Relations
OW	Open Water
PA	Programmatic Agreement
PABJh	Palustrine Aquatic Bed Intermittently Flooded Diked
PEM	Palustrine Emergent
PEMC	Seasonally Flooded
POP	Perimeter of Operational Pollution
Powertech	Powertech (USA) Inc.
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
PUB	Palustrine Unconsolidated Bottom
PUS	Palustrine Unconsolidated Shore
PUSA	Palustrine Unconsolidated Shore Temporarily Flooded
R2EM	Riverine Lower Perennial Emergent
R4SB7	Riverine Intermittent Streambed Vegetated
R4US	Riverine Intermittent Unconsolidated Streambed
RCRA	Resource Conservation and Recovery Act
RMP	resource management plan
RO	reverse osmosis
ROI	region of influence
ROW	right of way
SARA	Superfund Amendments and Reauthorization Act
SDCL	South Dakota Codified Law
SDDA	South Dakota Department of Agriculture
SDDENR	South Dakota Department of Environment and Natural Resources
SDDLR	South Dakota Department of Labor and Regulation
SDDOE	South Dakota Department of Education
SDDOH	South Dakota Department of Health
SDDOL	South Dakota Department of Labor
SDDOT	South Dakota Department of Transportation
SDDRR	South Dakota Department of Revenue and Regulation
SDGFP	South Dakota Game, Fish, and Parks
SDGS	South Dakota Geological Survey
SDNHP	South Dakota Natural Heritage Program
SDRMP	South Dakota Resource Management Plan
SD SHPO	South Dakota State Historic Preservation Office
SDSMT	South Dakota School of Mines and Technology
SDSU	South Dakota State University

SDWA	Safe Drinking Water Act
SEA	U.S. Department of Transportation Section of Environmental Analysis
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SERP	safety and environmental review panel
SF	satellite facility
SHPO	State Historic Preservation Officer
SMCL	secondary maximum contaminant level
SNAP	Supplemental Nutrition Assistance Program
SO_2	sulfur dioxide
SOW	statement of work
SPAW	soil-plant-atmosphere-water
SQR	scenic quality rating
SRI	SRI Foundation
STB	Surface Transportation Board
SUNSI	sensitive unclassified non-safeguards information
SWMP	stormwater pollution management plan
TANF	Temporary Assistance for Needy Families
TCP	traditional cultural property
TDS	total dissolved solids
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Office
TLD	thermoluminescent dosimeter
TVA	Tennessee Valley Authority
UCL	upper control limit
UDEQ	Utah Department of Environmental Quality
UIC	underground injection control
UMTRCA	Uranium Mill Tailings Radiation Control Act
UPL	upland
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USDW	underground source of drinking water
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UXC	The Ux Consulting Company
VOC	volatile organic compound
VRM	Visual Resource Management
WDAI	Wyoming Department of Administration and Information
WDEQ	Wyoming Department of Environmental Quality
WDTI	Western Dakota Technical Institute
WDWS	Wyoming Department of Workforce Services
WGFD	Wyoming Game and Fish Department
WIA	walk-in hunting area

WIC	Supplemental Nutrition Program for Women, Infants, and Children
WSDOT	Washington State Department of Transportation
WUS	waters of the United States
WYOGCC	Wyoming Oil and Gas Conservation Commission
WY SHPO	Wyoming State Historic Preservation Office

SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
cm	centimeters	0.39	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm^2	square millimeters	0.0016	square inches	in^2
cm^2	square centimeters	0.155	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
m^3	cubic meters	0.0008107	acre-feet	ac-ft
ha-m	hectare-meters	8.107	acre-feet	ac-ft
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
t	metric ton	1.103	short tons (2000 lb)	T
Radiological Units				
Bq	becquerels	27.03	picocuries	pCi
GBq	gigabecquerels	0.027	curies	Ci
Sv	sieverts	100	rems	rem
mSv	millisieverts	100	millirems	mrem
Temperature (Exact Degrees)				
ºC	Celsius	1.8C + 32	Fahrenheit	°F

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

6 MITIGATION

6.1 Introduction

The Generic Environmental Impact Statement (GEIS) for *In-Situ* Leach Uranium Milling Facilities (NRC, 2009) described potential mitigation measures that a licensee or facility operator might use to reduce potential adverse impacts associated with construction, operation, aquifer restoration, and decommissioning of an *in-situ* recovery (ISR) milling facility. Under 40 CFR 1508.20, the Council on Environmental Quality defines mitigation to include activities that (i) avoid the impact altogether by not taking a certain action or parts of a certain action; (ii) minimize impacts by limiting the degree or magnitude of the action and its implementation; (iii) rectify the impact by repairing, rehabilitating, or restoring the affected environment; (iv) reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action; and (v) compensate for the impact by replacing or providing substitute resources or environments.

Mitigation measures are those actions or processes that will be implemented to control and minimize potential adverse impacts from construction, operation, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project. Potential mitigation measures can include general best management practices (BMPs) and more site-specific management actions.

BMPs are processes, techniques, procedures, or considerations that can be used to effectively avoid or reduce potential environmental impacts. While best management practices are not regulatory requirements, they can overlap and support such requirements. BMPs will not replace any U.S. Nuclear Regulatory Commission (NRC) requirements or other federal, state, or local regulations.

Management actions are active measures that a licensee or facility operator specifically implements to reduce potential adverse impacts to a specific resource area. These actions include compliance with applicable government agency stipulations or specific guidance, coordination with governmental agencies or interested parties, and monitoring of relevant ongoing and future activities. If appropriate, corrective actions could be implemented to limit the degree or magnitude of a specific action leading to an adverse impact (reducing or eliminating the impact over time by preservation and maintenance operations) and repairing, rehabilitating, or restoring the affected environment. The licensee may also minimize potential adverse impacts by implementing specific management actions such as programs, procedures, and controls for monitoring, measuring, and documenting specific goals or targets (for example, pollution prevention goals of reducing waste) and, if appropriate, instituting corrective actions. The management actions may be established through standard operating procedures that appropriate local, state, and federal agencies (including NRC) review and approve. NRC may also establish requirements for management actions by identifying license conditions. Standard license conditions for the proposed Dewey-Burdock ISR Project are listed in Appendix A of the safety evaluation report (SER) (NRC, 2013). These conditions are written specifically into the NRC source material license and then become commitments that are enforced through periodic NRC inspections.

The mitigation measures Powertech (USA) Inc. (Powertech) proposed to reduce and minimize adverse environmental impacts at the proposed Dewey-Burdock ISR Project are summarized in Section 6.2. Based on the potential impacts identified in Chapter 4 of this draft Supplemental

Environmental Impact Statement (SEIS), the NRC staff have identified additional potential mitigation measures for the proposed Dewey-Burdock ISR Project. These mitigation measures are summarized in Section 6.3. The proposed mitigation measures provided in this chapter do not include environmental monitoring activities. Environmental monitoring activities are described in Chapter 7 of this draft SEIS.

6.2 Mitigation Measures Proposed by Powertech

The applicant identified mitigation measures in its license application (Powertech, 2009a–c) as well as in response to NRC staff requests for additional information (Powertech, 2010a–c, 2011, 2012). Table 6.2-1 lists the mitigation measures proposed for each resource area. Because many of the applicant's proposed mitigation measures apply to all four phases of the ISR process, they are listed together in the table.

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech

Resource Area	Activity	Proposed Mitigation Measures
Land Use	Land disturbance	Reclaim the surface and reestablish vegetation in areas disturbed by drilling, pipeline installation, and facility construction as soon as construction activities are completed. Minimize construction of new and secondary access roads. Restrict normal vehicular traffic to designated roads, and keep traffic in wellfields to a minimum. Develop wellfields sequentially, and restore and reclaim wellfields in interim steps to minimize land area impacted at any one time.
	Access restrictions	Construct fences and signage around processing facilities and radium settling and storage ponds, and, potentially, around land application areas. Construct temporary fencing around injection and production wellfield patterns (remove fencing after operations and reclamation of each wellfield is completed). Limit access to monitoring wells, Class V deep injection wells, and header houses by (i) covering each monitoring well with a locking device, (ii) securing the well head and pumping equipment for Class V injection wells within locked buildings, and (iii) securing header houses within the fenced area of the wellfield. Implement fencing construction techniques to minimize habitat alteration and impediments to large game migration.

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		Work with the U.S. Bureau of Land Management (BLM), South Dakota Game, Fish, and Parks, and private landowners to limit recreational activities (primarily hunting) within the project area to the extent practicable.
Transportation	Transportation safety	Maintain access roads, and impose speed limits on unpaved roads to minimize or eliminate accidents. Comply with all applicable the U.S. Nuclear Regulatory Commission (NRC) and U.S. Department of Transportation packaging and transportation requirements for all shipments of yellowcake, process chemicals, ion-exchange resins, fuel, and radioactive materials to mitigate the potential impacts of a transportation accident. Use dedicated tanker trucks for transporting uranium-loaded or uranium-stripped resins between the central processing plant and satellite facilities. Survey the exterior and cab of the shipping truck for radiological contamination prior to each shipment of uranium-loaded or uranium-stripped resin or yellowcake. Equip both the transport vehicle and shipping facilities with communication devices that allow direct communication with Powertech (USA) Inc. personnel.
	Emergency response	Communicate with local and state authorities on transportation and emergency response procedures. Use standard operating procedures for transportation and emergency response. Require proper training for transport contractor personnel on transportation accident response based on the specific material(s) shipped. Written standard operating procedures would accompany all drivers to ensure proper response to accidents and spill containment. Supply both shipping and receiving facilities with emergency response kits. Ensure each resin or yellowcake transport vehicle carries an emergency spill kit that would help contain material in the event of a spill. Maintain shipping records (bill of lading) to identify the characteristics and quantity of material shipped.

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		Notify NRC if a radiological accident occurs pursuant to requirements of 10 CFR Part 20 §2202 and §2203.
Geology and Soils	Soil disturbance and contamination	Salvage and stockpile soil from disturbed areas. Reestablish temporary or permanent native vegetation as soon as possible after disturbance utilizing the most effective available technologies in reseeding and sprigging, such as hydroseeding. Decrease runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface runoff from undisturbed areas. Retain sediment within the disturbed areas by using silt fencing, retention ponds, and hay bales. Fill pipeline and cable trenches with appropriate material, and regrade surface soon after completion. Design drainages to minimize potential for erosion by keeping slopes less than 4 to 1, and/or provide rip-rap or other soil stabilization controls. Construct roads using techniques that will minimize erosion, such as surfacing with a gravel road base, building stream crossings at right angles with adequate embankment protection and culvert installation. Use a spill prevention and cleanup plan to minimize soil contamination from vehicle accidents and/or wellfield spills or leaks. Collect and monitor soils and sediments for potential contamination including areas used for land application of treated wastewater, transport routes for yellowcake and ion exchange resins, and wellfield areas where spills or leaks are possible. Treat liquid wastes applied to land application areas to comply with release standards for radiological constituents in 10 CFR Part 20, Appendix B. Obtain an approved South Dakota Department of Environment and Natural Resources (SDDENR) groundwater discharge plan (GDP), and comply with

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		applicable state discharge requirements for land application of treated liquid wastes.
Surface Water Resources	Erosion, runoff, and sedimentation	Refrain from consuming or discharging to surface waters. Obtain U.S. Army Corps of Engineers permits and authorization from SDDENR when filling and crossing jurisdictional waters. Obtain construction and industrial National Polllutant Discharge Eliminaiton System (NPDES) permits in accordance with SDDENR regulations, and implement mitigation measures to control erosion, runoff, and sedimentation. Construct the Burdock central plant and Dewey satellite facility and their supporting buildings outside the 100-year floodplain of Pass and Beaver Creeks and away from their tributaries. Construct a system of structures such as straw bales, collector ditches, and engineered diversion structures or berms to protect facilities and infrastructures (e.g., storage ponds, access roads, plant-to-plant pipelines, wellfields) that will be located within the 100-year inundation boundary to protect them from flood damage. Implement a stormwater management plan in accordance with SDDENR requirements to ensure that surface water runoff from disturbed areas meets NPDES permit limits. Minimize earthmoving activities at the proposed land-application sites. Divert potential runoff produced by snowmelt or precipitation in land application areas to adjacent catchment areas. Recontour land surface to restore surface drainage to blend with the natural terrain after completion of the proposed ISR project. Develop and implement emergency response procedures to correct and remediate accidental spills.
	Spills and leaks	Provide containment curbs around the processing facilities designed to contain the contents of the largest liquid-containing vessel. Place liners, underdrains, and leak detection systems underneath ponds associated with water treatment or

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		storage of untreated or partially treated water (i.e., radium settling ponds, spare ponds, and central plant pond), and place liners underneath ponds that contain treated water (i.e., storage ponds and spare storage ponds). Bury pipelines to avoid freezing, and monitor pipeline pressures for leak detection. In accordance with Administrative Rules of South Dakota (ARSD) 74:34:01:04, all regulated substance spills that occur at the site must be reported to SDDENR and remediated in accordance with state requirements.
Groundwater Resources	Water use	Obtain Class III UIC permit and aquifer exemption. Obtain Class V UIC permit for deep well disposal of treated liquid wastes, and monitor process effluents injected into Class V deep injections wells to comply with (i) release standards in 10 CFR Part 20, Subparts D and K and Appendix B and (ii) the drinking water standards, or contaminant-specific background concentrations for constituents regulated under the Safe Drinking Water Act, whichever is greater, if proposed injection zones are underground sources of drinking water (have total dissolved solids concentrations below 10,000 mg/L), unless the applicant applies for and is granted an aquifer exemption. Treat liquid wastes applied to land application areas to comply with release standards for radiological constituents in 10 CFR Part 20, Appendix B. Obtain an approved SDDENR GDP, and comply with applicable state discharge requirements for land application of treated liquid wastes. Obtain water appropriation permits to utilize groundwater from the Madison and Inyan Kara aquifers. Monitor private domestic, livestock, and agricultural wells as appropriate during operations, and provide alternative sources of water to landowners in the event of significant drawdown to wells within and adjacent to the proposed project area. Obtain construction and industrial NPDES permits from SDDENR, which require reporting of spills of petroleum products or hazardous chemicals.

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
	Spills and leaks	Implement a spill prevention and cleanup plan to minimize impacts to soils and groundwater, including rapid response cleanup and remediation. Construct pond lining systems appropriate to the pond usage and contents to prevent potential infiltration of liquid waste into soil and shallow aquifers. Bury pipelines to avoid freezing, and monitor pipeline pressures to detect leaks. In accordance with ARSD 74:34:01:04, all regulated substance spills that occur at the site must be reported to SDDENR and remediated in accordance with state requirements.
	Excursions	Conduct precise and periodic mechanical integrity testing of all injection, production, and monitoring wells prior to and during their use to limit the likelihood of well integrity failure during operations. Collect detailed lithologic and hydrogeological data for each proposed wellfield prior to i*n-situ* recovery (ISR) operations to ensure hydraulic control of the production zone. Plug and abandon or mitigate any of the following should they pose a potential to impact the control and containment of wellfield solutions within the proposed project area: (i) historical wells and exploration holes; (ii) holes drilled by the applicant for delineation and exploration; and (iii) any well failing mechanical integrity testing. Maintain production bleed rate at 0.5 to 3 percent to prevent lixiviant excursions. Conduct ISR operations only in confined portions of production aquifers. Install monitoring wells within and encircling the production zone for early detection of potential horizontal excursions. Install monitoring wells in aquifers above and below the production aquifer for early detection of potential vertical excursions. Implement corrective actions, and provide required

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		notifications and reports to NRC in the event of an excursion. Submit wellfield operational plans including well layouts for NRC and EPA approval before conducting operations in wellfields.
	Restoration/ reclamation	Return groundwater quality in the production zone to NRC-approved groundwater protection standards upon completion of ISR operations as required by 10 CFR Part 40, Appendix A, Criterion 5B(5). Plug and abandon all monitoring, injection, and production wells in accordance with applicable federal and state regulations, as part of decommissioning activities.
Ecology	Reduce land disturbance and contamination	Follow the Land Use mitigation measures for land disturbance activities and access restrictions, which will also minimize impacts to vegetation and wildlife. Minimize disturbance of surface areas and vegetation, where possible (also benefits wildlife). Construct new roads, power lines, and pipelines in the same above ground and below ground corridors to the extent possible to reduce overall disturbance and minimize new surface disturbance (also benefits wildlife). Impose dust control measures as described under Air Quality to limit dust deposition on vegetation, both on- and offsite, affecting the forageability for obligate species. Implement weed control as needed to limit the spread of noxious, invasive, and nonnative species on disturbed areas.
	Restoration/ reclamation	Reestablish temporary or permanent native vegetation as soon as possible after disturbance. Minimize the spread of undesirable, invasive, and nonnative species (weeds) in disturbed areas. Construct new overhead power lines using BMPs to reduce bird injuries and mortalities. Enforce speed limits to minimize collisions with wildlife.

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
	Transmission lines	Use existing roads when possible, and limit construction of new primary and secondary roads to provide access to more than one drill site to minimize wildlife and habitat disturbance.
	Reduce human disturbances	Restore diverse landforms; direct topsoil replacement; and construct brush piles, snags, and/or rock piles to enhance habitat for wildlife. Prepare U.S. Fish and Wildlife Service (FWS)-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur.
Air Quality	Fugitive dust and combustion emissions from construction equipment and vehicles	Use drill rigs with engines no larger than 300 horsepower (except for deep well drill rig) to limit combustion emissions. Use Tier 1 or higher drill rig engines and Tier 3 or higher construction equipment engines (see Supplemental Environmental Impact Statement Section 4.7.1.1.1 for an explanation of "Tiers") to limit combustion emissions. Spray water to mitigate fugitive dust accounting for a 60 percent reduction in emissions generated from onsite unpaved roads. Impose speed limits for travel on unpaved roads and areas. Implement an employee carpooling policy. Restore or reseed disturbed areas promptly to limit the exposed/disturbed area at any given time. Coordinate construction and transportation activities to reduce maximum dust levels. Maintain vehicles to meet applicable U.S. Environmental Protection Agency (EPA) emission standards.
Noise	Exposure of workers and public to noise	Avoid construction activities during the night. Use sound abatement controls on operating equipment and facilities. Use personal hearing protection for workers in high noise areas.

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		Adhere to regulatory timing and spatial restrictions with regard to construction activities near raptor nests. Locate all planned facilities outside of BLM-recommended buffer zones of raptor nests identified within the project area. Follow an FWS-approved raptor monitoring and mitigation plan to reduce conflicts between active raptor nests and project-related activities.
Cultural and Historic Resources	Disturbance of prehistoric archaeological sites and sites eligible for listing on the National Register of Historic Places	Conduct appropriate historic and cultural resource surveys as part of prelicensing application activities and eligibility evaluation of cultural resources for listing on the NRHP under criteria in 36 CFR 60.4(a)–(d). Conduct consultation under Section 106 of the National Historic Preservation Act (NHPA) with NRC, South Dakota State Historic Preservation Office, other government agencies (e.g., FWS, EPA, and BLM), and Native American tribes. Address any disturbances in compliance with any future agreements developed under the NHPA, including temporarily halting surface disturbance activities if historic or archaeological sites are discovered or unanticipated effects are found.
Visual and Scenic	Potential visual intrusions in the existing landscape character	Cover wellheads with low structures that present low contrast with existing landscape. Reclaim disturbed areas, and remove debris after construction is complete. Remove and reclaim roads and structures after operations are complete. Select building materials and paint that complement the natural environment. Consider landscape topography to conceal wellheads, plant facilities, access roads, potential land application areas, and other areas of disturbance from public vantage points. Use standard dust control measures including water application, speed limits, and coordinating dust-producing

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		activities to reduce fugitive dust impacts. Consider using exterior lighting only where needed, limiting the height of exterior lighting units, and using shielded or directional lighting to limit lighting to where it is needed and without jeopardizing site security and/or worker safety.
Socioeconomics	Effects on surrounding communities	Preferentially source the labor force from the surrounding region to reduce any burden on public services and community infrastructure (e.g., housing, schools) in nearby towns.
Occupational and Public Health and Safety	Effects from facility construction	Implement standard dust control measures, such as water application and speed limits, to reduce and control fugitive dust emissions. Comply with federal and state occupational safety regulations to limit nonradiological impacts of fugitive dust and diesel emissions to acceptable levels.
	Effects from facility operation	Reduce radiological exposure to workers by (i) installing ventilation designed to limit worker exposure to radon; (ii) installing gamma exposure rate monitors, air particulate monitors, radon daughter product monitors to verify that expected radiation levels are not exceeded; and (iii) conducting work area radiation and contamination surveys. Use vacuum dryer technology during normal operations to limit radiological emissions other than radon gas. Comply with an NRC-approved Radiation Protection Program that would include routine radiation surveys, respiratory protection, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response. Monitor radiation workers via use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and as low as is reasonably achievable. Implement engineering controls, such as concrete curbs and sumps, to contain process spills resulting from accidents. Comply with applicable EPA, OSHA, and SDDENR regulations concerning the use, inspection, and storage of hazardous and nonhazardous chemicals.

Table 6.2-1. Summary of Mitigation Measures Proposed by Powertech (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		Develop and implement standard operating procedures regarding receiving, storing, handling, and disposing of chemicals.
Waste Management	Disposal capacity	Establish a solid byproduct material disposal agreement with a licensed facility prior to the start of operations.
	Waste reduction	Recycle wastewater to reduce the amount of water needed for facilities and the amount of wastewater that could require disposal. Use decontamination techniques that reduce waste generation. Institute preventative maintenance and inventory management programs to minimize waste from breakdowns and overstocking. Recycle nonradioactive materials where appropriate. Salvage extra materials, and use them for other construction activities. Encourage the reuse of materials and use of recycled materials. Avoid using hazardous materials when possible.
	Waste storage and containment	Store and properly label solid byproduct material onsite to prevent any potential release. Isolate byproduct material inside a restricted area until a full shipment can be transferred to an NRC-approved disposal site. Install curbs or berms on all waste storage areas. Install leak detection and warning systems in all liquid waste facilities. Develop a spill prevention plan for petroleum products and other hazardous materials. Ensure that equipment is available to respond to spills, and identify the location of such equipment. Inspect and replace worn or damaged components.

6.3 Potential Mitigation Measures Identified by the U.S. Nuclear Regulatory Commission

The NRC staff has reviewed the mitigation measures the applicant proposed and has identified additional mitigation measures that could potentially reduce impacts (Table 6.3-1). NRC has the authority to address unique site-specific characteristics by identifying license conditions based on conclusions reached in the safety and environmental reviews. These license conditions could include additional mitigation measures, such as modifications to required monitoring programs. License conditions resulting from the safety review are documented in the NRC SER (NRC, 2013). While NRC cannot impose mitigation outside its regulatory authority under the Atomic Energy Act, the NRC staff has identified mitigation measures in Table 6.3-1 that could potentially reduce the impacts of the proposed Dewey-Burdock ISR Project. These additional mitigation measures are not requirements being imposed upon the applicant. For the purposes of the National environmental Policy Act, and consistent with 10 CFR 51.71(d) and 51.80(a), NRC is disclosing measures that could potentially reduce or avoid environmental impacts of the proposed project.

Table 6.3-1. Summary of Mitigation Measures Identified by the U.S. Nuclear Regulatory Commission

Resource Area	Activity	Proposed Mitigation Measures
Land Use	Land disturbance	Monitor and control potential irrigation areas, if used, to maintain levels of radioactive constituents in treated liquid wastes applied to land application areas to within allowable release limits to protect the agricultural and recreational integrity of the land. Use best management practices (BMPs) to control waste disposal, erosion, and runoff to limit the effect of facility operation on surrounding land use.
Transportation	Transportation safety	Use accepted industry codes and standards for handling and transporting hazardous chemicals. Implement safe driving training for personnel and truck drivers. Use check-in/check-out or global positioning satellite technology to track shipments. Construct turn lanes in both directions on Dewey Road for vehicles turning onto the main access roads to the central and satellite processing plants. Provide means of advance warning to oncoming traffic that large trucks are entering Dewey Road from site access roads (e.g., signage, flashing light, flagman).

Table 6.3-1. Summary of Mitigation Measures Identified by the U.S. Nuclear Regulatory Commission (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
Geology and Soils	Soils	Maintain a log of all spills occurring at the site whether or not these spills are reportable to NRC per 10 CFR 40.60. Implement alternatives or mitigation measures to manage drilling fluid during well drilling operations including (i) lining mud pits with an impermeable membrane, (ii) disposing of potentially contaminated drilling mud and other fluids offsite, and (iii) using portable tanks or tubs to contain drilling mud and other fluids.
Surface Water Resources	Water quality	Collect monthly preoperational water quality samples from streams and quarterly preoperational water quality samples from impoundments.
Groundwater Resources	Contamination and excursions	Submit results of the hydrogeological characterization and aquifer pump tests (hydrologic test data packages) for NRC review and written verification or approval prior to development of any proposed wellfields. Prior to ISR operations in partially saturated portions of the Chilson aquifer, demonstrate the ability to detect and remediate excursions in partially saturated production zones. Monitor potential mobilization and migration of contaminants from abandoned open pit mines into production zones during aquifer restoration.
Ecology	Restoration/reclamation	Use weed control techniques that incorporate BMPs approved by the U.S. Bureau of Land Management (BLM) and South Dakota Department of Environment and Natural Resources (SDDENR).
	Fencing and screening	Cover vent pipes with either netting or other devices to prevent bats, birds, or small mammals from being trapped.
	Transmission lines	Follow the Avian Power Line Interaction Committee guidance to avoid impacts (electrocution and perching) to birds, especially prior to the fledging of young (Avian Power Line Interaction Committee, 2006). Bury transmission lines after (step-down) transforming to minimize risks to raptors and large birds.

Table 6.3-1. Summary of Mitigation Measures Identified by the U.S. Nuclear Regulatory Commission (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
	Reduce human disturbances	Adhere to timing and spatial restrictions within specified distances of active raptor nests as determined by appropriate regulatory agencies [e.g., U.S. Fish and Wildlife Service, South Dakota Game, Fish, and Parks, and BLM). Allow snakes and lizards that are encountered to retreat. Inform employees of applicable wildlife laws and penalties associated with unlawful taking and harassment of wildlife. Train employees on (i) the types of wildlife in the area susceptible to collisions with motor vehicles, (ii) the circumstances when collisions are most likely to occur, and (iii) measures that should be taken to avoid wildlife–vehicle collisions. Sign and gate as needed all new and improved roads related to the proposed project to minimize public traffic. Comply with applicable state and local requirements to design or treat mud pits and ponds to prevent the development of favorable mosquito habitat (to reduce possible transmission of West Nile virus).
Air Quality	Fugitive dust and combustion emissions from construction equipment and vehicles	Implement fuel saving practices such as minimizing vehicle and equipment idle time. Utilize fossil-fuel vehicles that meet the latest emission standards. Utilize newer, cleaner running equipment. Minimize unnecessary travel. Ensure that diesel-powered construction equipment and drill rigs are properly tuned and maintained. Limit access to construction sites, staging areas, and wellfields to authorized vehicles only, through designated treated roads. Pave or put gravel on dirt roads and parking lots if appropriate.

Table 6.3-1. Summary of Mitigation Measures Identified by the U.S. Nuclear Regulatory Commission (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
		Cover trucks carrying soil and debris to reduce dust emissions from the back of trucks. Burn low-sulfur fuels in all diesel engines and generators. Train workers to comply with speed limits, use good engineering practices, minimize disturbed areas, and employ other BMPs as appropriate. To the extent practicable, avoid conducting soil-disturbing activities and travel on unpaved roads during periods of unfavorable meteorological conditions (e.g., high winds). Implement any permit conditions identified in the SDDENR air permit, if applicable. Limit the numbers of hours in a day that effluent-generating activities can be conducted. Perform road maintenance (i.e., promptly remove earthen material on paved roads). Apply erosion mitigation methods on disturbed lands.
Noise	Exposure of workers and the public to noise	Maintain noise levels in work areas to below Occupational Safety and Health Administration regulatory limits. Reduce noise levels generated by irrigation equipment in potential land application areas by (i) installing exhaust and inlet silencers on engines, (ii) using electric motor drives instead of internal combustion engines, and (iii) erecting acoustic barriers to block the line of hearing from the exhaust engine and inlet toward human and wildlife receptors.
Cultural and Historic Resources	Disturbance of prehistoric archaeological sites and sites eligible for listing on the National Register of Historic	Stop work upon discovery of previously undocumented historic and cultural resources, and notify appropriate federal, tribal, and state agencies with regard to mitigation measures. Avoid historic properties within the project area that

Table 6.3-1. Summary of Mitigation Measures Identified by the U.S. Nuclear Regulatory Commission (Cont'd)

Resource Area	Activity	Proposed Mitigation Measures
	Places (NRHP)	are currently listed or eligible for listing on the National Register of Historic Places.
		Avoid identified sites within the project area with burial or cairn features. Develop an agreement outlining the mitigation process for each affected resource and why sites cannot be avoided, if required. Prior to construction, develop an Unexpected Discovery Plan that will outline the steps required in the event that unexpected historical and cultural resources are encountered at the site. Submit a decommissioning plan for NRC review to ensure compliance with Section 106 of the National Historic Preservation Act of 1966, as amended during the decommissioning phase.
Visual and Scenic	Potential visual intrusions in the existing landscape character	Limit the number of drill rigs operating during wellfield construction. To the extent possible, use existing secondary roads within the project area to access wellfields, potential irrigation areas, and other facility infrastructure.
Socioeconomics	Effects on surrounding communities	Coordinate emergency response activities with local authorities, fire departments, medical facilities, and other emergency services before operations begin.
Occupational and Public Health and Safety	Effects from facility operation	Use high-efficiency particulate air filters or similar controls for particulates. Design task procedures to reduce potential accidents. Develop contingency plans with county and municipal governments to ensure adequate medical, fire, and emergency services are available in case of a major accident.
Waste Management	Disposal capacity	Dispose of decommissioning nonhazardous solid waste at the Rapid City landfill in the event that the disposal capacities of local landfills are limited or otherwise unavailable at the time of decommissioning.

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7 ENVIRONMENTAL MEASURES AND MONITORING PROGRAMS

7.1 Introduction

As discussed in Section 8.0 of NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS) (NRC, 2009), monitoring programs are developed for *in-situ* uranium recovery (ISR) facilities to verify compliance with standards for the protection of worker health and safety in operational areas and for protection of the public and environment beyond the facility boundary. Monitoring programs provide data on operational and environmental conditions so prompt corrective actions can be implemented when adverse conditions are detected. In this regard, these programs help to limit potential environmental impacts at ISR facilities and the surrounding areas.

Required monitoring programs can be modified to address unique site-specific characteristics by adding license conditions resulting from the conclusions of the U.S. Nuclear Regulatory Commission (NRC) safety and environmental reviews. The NRC staff are conducting the safety review of the proposed Dewey-Burdock ISR Project, which will be documented in a Safety Evaluation Report, and license conditions resulting from the safety review will be included as part of the final supplemental environmental impact statement (SEIS). The discussion of the proposed monitoring programs for the proposed Dewey-Burdock ISR Project is organized as follows:

- Radiological Monitoring (Section 7.2)
- Physiochemical Monitoring (Section 7.3)
- Ecological Monitoring (Section 7.4)
- Land Application Monitoring (Section 7.5)
- Class V Deep Injection Well Monitoring (Section 7.6)

The occurrence of spills and leaks at ISR facilities is considered in Section 2.11.2 of the GEIS (NRC, 2009), and the management of spills and leaks is not part of the routine environmental monitoring program described herein. Spills and leaks, including the design of the infrastructure to detect leaks, are described in the NRC safety evaluation.

7.2 Radiological Monitoring

This section describes Powertech (USA) Inc.'s (Powertech, referred to herein as the applicant) proposed radiological monitoring program as described in its license application, supporting documents for the proposed Dewey-Burdock ISR Project, and subsequent responses to NRC requests for additional information (Powertech, 2009a–c, 2010, 2011). The purpose of the monitoring program is to (i) characterize and evaluate the radiological environment, (ii) provide data on measurable levels of radiation and radioactivity, and (iii) provide data on the principal pathways of radiological exposure to the public (NRC, 2003). Although not a requirement, NRC Regulatory Guide 4.14 (NRC, 1980) provides guidance for establishing a radioactive effluent and environmental monitoring program for uranium mills. Although created for conventional uranium mills, guidance in Regulatory Guide 4.14 applies to ISR facilities, as appropriate. In accordance with NRC regulations in 10 CFR Part 40, Appendix A, Criterion 7, a preoperational monitoring program is required to establish facility baseline conditions. After establishing the baseline program, ISR facility operators must conduct an operational monitoring program to measure or evaluate compliance with standards and to evaluate environmental impacts of an ISR facility under operational conditions. In accordance with 10 CFR 40.65, the applicant must

submit to NRC a semiannual effluent and environmental monitoring report (Powertech, 2009b). This report would specify the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents during the previous 6 months of operation. This report would also provide other NRC required information to estimate the maximum potential annual radiation doses to the public resulting from effluent releases.

The results of the applicant's baseline radiological monitoring program are presented in SEIS Section 3.12.1. The following sections briefly describe the applicant's proposed operational monitoring program.

7.2.1 Airborne Radiation Monitoring

The applicant proposes to conduct continuous air particulate sampling at seven locations identified in Figure 7.2-1 (Powertech, 2011, 2012c). The filters from air samplers will be analyzed biweekly, or more frequently if required for dust loading, for natural uranium, Th-230, Ra-226, and Pb-210 in accordance with Regulatory Guide 4.14 (NRC, 1980; Powertech, 2011). Samplers will be equipped with sensors to measure total air flow within a sampling period and detect changes in air flow due to dust loading, barometric pressure, and temperature (Powertech, 2011).

Passive track-etch detectors will be deployed at 12 sample locations for monitoring Rn-222 on a monthly basis, consistent with Regulatory Guide 4.14 and NUREG–1569 (NRC, 1980, 2003; Powertech, 2011). Five of the Rn-222 sampling sites will be co-located with the air particulate samples.

Thermoluminescent dosimeters (TLDs) will be located with air particulate samplers at each station (Powertech, 2011). The TLDs will be exchanged quarterly and used to assess gamma exposure rates at each air monitoring station. Additionally, effluents from the yellowcake dryer and packaging stacks will be sampled quarterly. The effluent samples will be isokinetic in nature and would be analyzed for natural uranium, Th-230, Ra-226, and Pb-210 (Powertech, 2009a).

7.2.2 Soils and Sediment Monitoring

Samples of surface soil from a 0–5 cm [0–2 in] depth will be collected annually at each of the air monitoring stations shown in Figure 7.2-1. The samples will be analyzed for natural uranium, Ra-226, and Pb-210 (Powertech, 2009a). Sediments will also be collected annually at each of the 24 impoundments and 10 stream sampling sites proposed for operational surface water monitoring (see SEIS Sections 7.2.4 and 7.3.3). The sediment samples will be analyzed for natural uranium, Th-230, Ra-226, and Pb-210 (Powertech, 2011). The maximum lower limits of detection for the analyses will be consistent with the recommendations of Regulatory Guide 4.14 (NRC, 1980) unless matrix interferences prohibit attainment of these low detection limit goals.

7.2.3 Vegetation, Food, and Fish Monitoring

The applicant plans to annually collect samples of livestock raised within 3.2 km [2 mi] of the project area, consistent with the recommendations of Regulatory Guide 4.14 (NRC, 1980). The samples will include cattle, pigs, and other livestock present at the time of sampling. Currently, cattle and pigs are the only livestock within 3.2 km [2 mi] of the proposed project area. If other

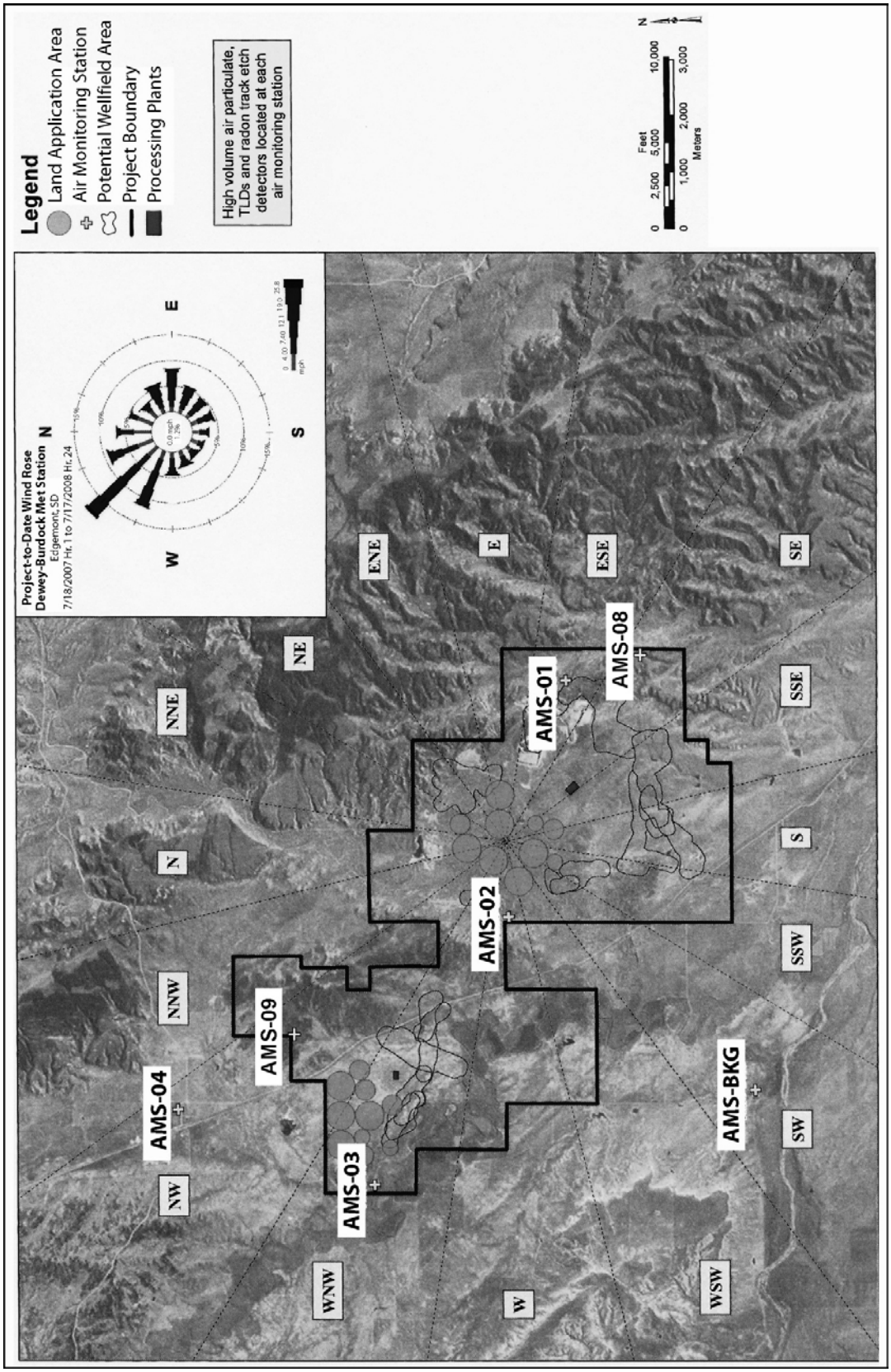

Figure 7.2-1. Locations of Operational Air Monitoring Stations at the Proposed Dewey-Burdock *In-Situ* Recovery Project Site
Source: Modified from Powertech (2011, 2012c)

livestock are found during annual land surveys, the applicant will seek the livestock owner's approval to collect tissue samples at the time of slaughter (Powertech, 2011). Consistent with Regulatory Guide 4.14 (NRC, 1980), fish will be collected semiannually provided they exist in water bodies that may be affected by seepage or surface drainage from potentially contaminated areas (Powertech, 2011). Livestock and fish samples will be analyzed for natural uranium, Th-230, Ra-226, Pb-210, and Po-210 (Powertech, 2011).

The applicant plans to collect samples of vegetation three times during the grazing season. The applicant will collect samples in the vicinity of each operational air monitoring station (Figure 7.2-1). The samples of vegetation will be analyzed for Ra-226 and Pb-210 (Powertech, 2009b). The applicant also plans to collect soil from vegetable gardens within 3.3 km [2 mi] of the project area (Powertech, 2011). The vegetable garden soil samples will be analyzed for natural uranium, Th-230, Ra-226, and Pb-210 (Powertech, 2011). The maximum lower limits of detection for the analyses will be consistent with the recommendations of Regulatory Guide 4.14 (NRC, 1980) unless matrix interferences prohibit attainment of these low detection limit goals (Powertech, 2009b).

7.2.4 Surface Water Monitoring

Operational surface water sampling will be conducted on (i) all surface impoundments located downgradient of proposed ISR facilities and activities and (ii) perennial and ephemeral streams passing through the site or located downgradient of proposed ISR activities (Powertech, 2011). The applicant plans to monitor 24 impoundments and 10 stream sampling sites as part of operational monitoring (Figure 7.2-2). Consistent with recommendations in Regulatory Guide 4.14 (NRC, 1980), grab samples will be collected quarterly from the impoundments and analyzed for dissolved and suspended natural uranium, Ra-226, Th-230, Pb-210, and Po-210. A grab sample is a sample of water, rock, or sediment taken randomly. Grab samples will also be collected quarterly from perennial stream sampling locations on Beaver Creek (BVC11 and BVC14) and the Cheyenne River (CHR01 and CHR05) (see Figure 7.2-2). Passive samplers will be installed at the six remaining stream sampling sites, which are located on ephemeral drainages (Pass Creek, Bennett Canyon, and unnamed tributaries), to automatically sample during flow events. All stream samples will be analyzed for dissolved and suspended uranium, Ra-226, Th-230, Pb-210, and Po-210 (Powertech, 2011).

7.2.5 Groundwater Monitoring

The operational groundwater monitoring program at the proposed Dewey-Burdock ISR Project site will sample domestic wells, stock wells, and monitoring wells located hydrologically upgradient and downgradient of proposed ISR facilities and wellfields (Powertech, 2011). Consistent with Regulatory Guide 4.14 (NRC, 1980), the applicant proposes to collect annual groundwater samples from all domestic wells within 2 km [1.2 mi] of the wellfields (Figure 7.2-3) (Powertech, 2011). Quarterly groundwater samples will be collected from stock wells within the project area (Figure 7.2-3) and from monitoring wells located hydrologically upgradient and downgradient of proposed ISR facilities and wellfields (Figure 7.2-4). The monitoring wells will be situated in the alluvium, Fall River Formation, Chilson Member of the Lakota Formation, and the Unkpapa Formation. Water samples collected from the domestic and monitoring wells will be analyzed for uranium and other radiological parameters, including gross alpha, gross beta, and Ra-226 (Powertech, 2011). SEIS Section 7.3.4 further details the applicant's preoperational and operational groundwater monitoring programs.

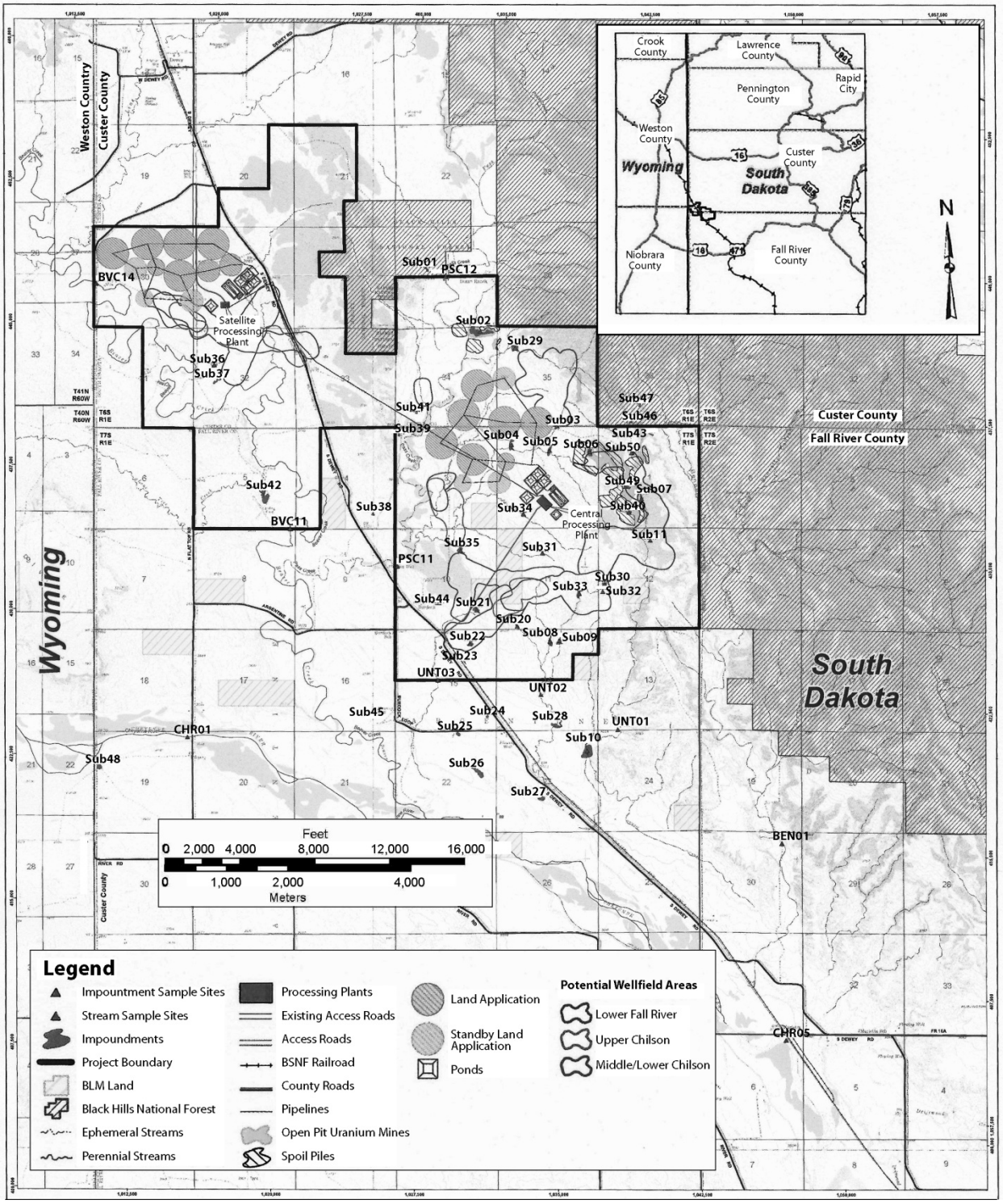

Figure 7.2-2. Locations of Operational Surface Water Monitoring Sites
Source: Modified From Powertech (2011)

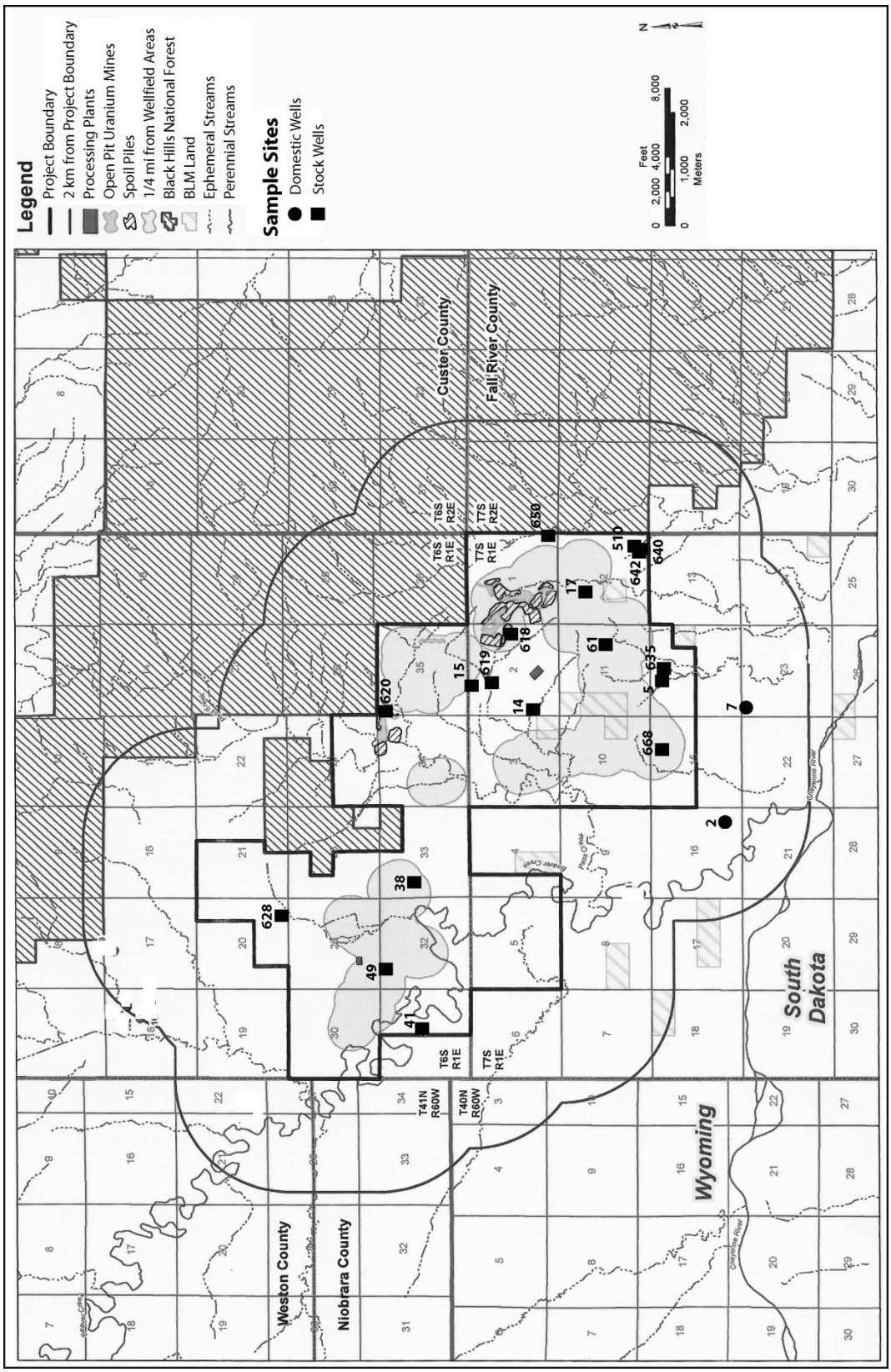

Figure 7.2-3. Locations of Operational Domestic and Stock Monitoring Wells
Source: Modified from Powertech (2011, 2012b)

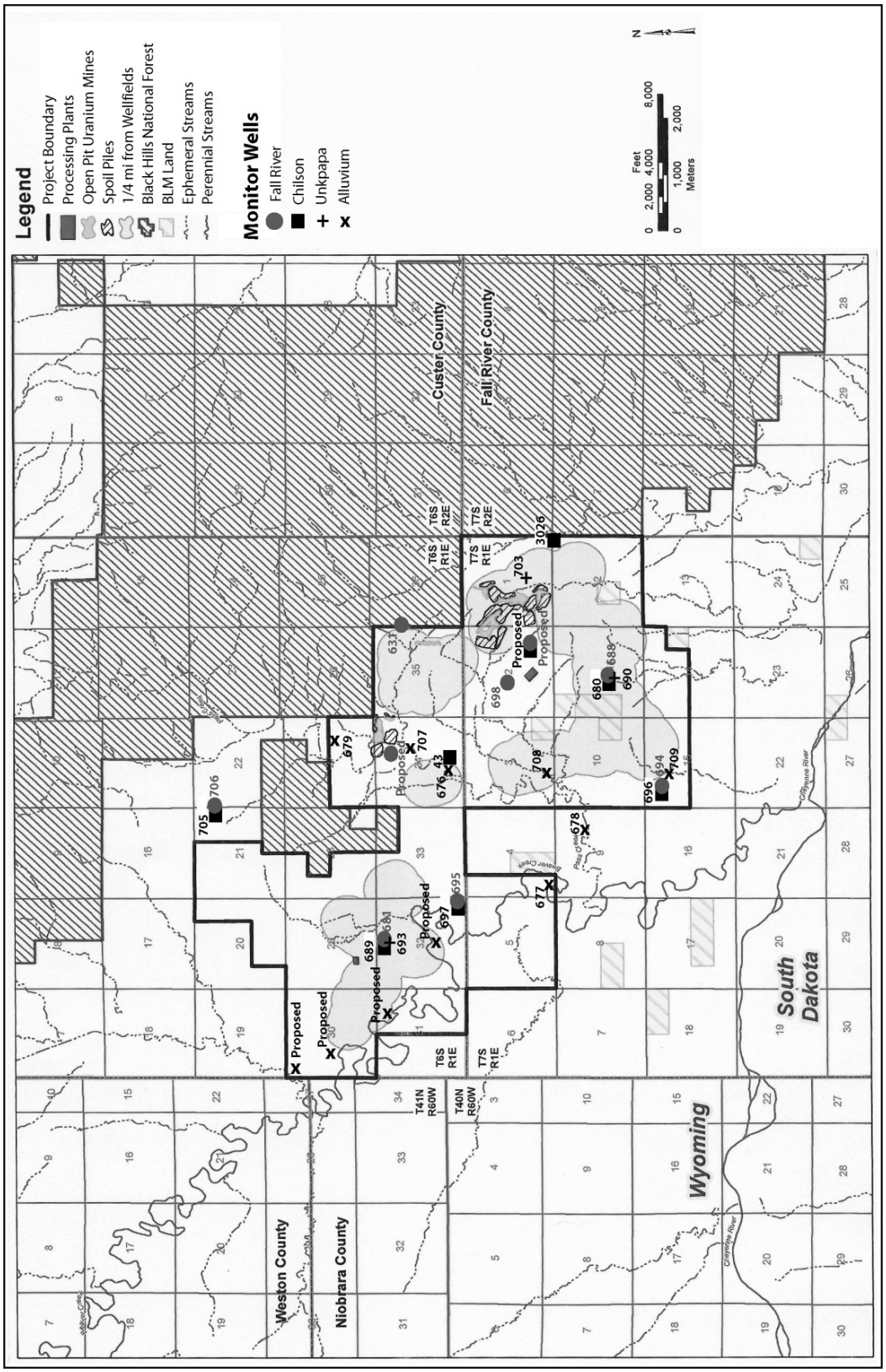

Figure 7.2-4. Locations of Operational Groundwater Monitoring Wells
Source: Modified from Powertech (2011)

7.3 Physiochemical Monitoring

This section describes the applicant's proposed physiochemical monitoring program as detailed in its license application and supporting documents (Powertech, 2009a–c, 2011). The purpose of this monitoring program is to (i) provide data on operational and environmental conditions so that prompt corrective actions can be taken when adverse conditions are detected and (ii) comply with environmental requirements or license conditions. In this regard, this monitoring program helps to limit potential environmental impacts at an ISR facility.

7.3.1 Wellfield Groundwater Monitoring

As discussed in GEIS Section 8.3, the ISR production process directly affects the groundwater within the operating wellfield. For this reason, groundwater conditions are extensively monitored both before and during operations. The groundwater monitoring program includes production zone monitoring wells and wells monitoring aquifers overlying and underlying the production aquifer zone (NRC, 2009). The background groundwater monitoring that will occur as part of the proposed Dewey-Burdock ISR Project is discussed in Section 7.3.1.1. The groundwater quality monitoring that will occur during operations is discussed in Section 7.3.1.2. The applicant's restoration groundwater monitoring and stabilization plan is provided in SEIS Section 2.1.1.1.4.2.

In accordance with 10 CFR Part 40, Appendix A, Criterion 5B(5), Commission-approved background groundwater quality values must be established before beginning uranium production in a wellfield. This is done to characterize the water quality in monitoring wells that are used to detect lixiviant excursions from the production zone. This is also done to establish standards for aquifer restoration after uranium recovery is complete. The requirements and details of sampling programs to establish background groundwater quality are described in GEIS Section 8.3.1.1 (NRC, 2009). Background water quality can be established through examining records and reports for existing local water wells and/or by sampling wells developed for the ISR project before production begins.

7.3.1.1 Commission-Approved Background—Production Zone

The applicant will establish Commission-approved background groundwater quality before beginning operations by sampling a subset of wells that will later serve as injection or production wells installed in the uranium mineralization zones (Powertech, 2011). The subset of wells will include at least one well per 1.6 ha [4.0 ac] of wellfield pattern area, or six wells, whichever is greater. In cases of wellfields smaller than 2.4 ha [6 ac], wells will be spaced at one well per 0.4 ha [1.0 ac]. These wells will be sampled four times for background characterization, with a minimum of 14 days between sampling events (Powertech, 2011). Consistent with NUREG-1569, Section 5.7.8.3 (NRC, 2003), the applicant will be expected to sample wells over sufficiently spaced intervals to indicate seasonal variability. The water level in each well will also be measured and recorded prior to each sampling event (Powertech, 2009a). Samples will be analyzed for the parameters shown in Table 7.3-1. The applicant's proposed well spacing, sampling frequency, and parameters for Commission-approved background production zone sampling are consistent with NUREG-1569 (NRC, 2003). The staff has included a license condition that memorializes the methods for assessing Commission-approved background concentrations (NRC, 2013).

Table 7.3-1. Background Water Quality Parameters and Indicators for Operational Groundwater Monitoring*

Test Analyte/Parameter	
Bulk Properties	pH Total Dissolved Solids (TDS) Conductivity
Cations/Anions	Bicarbonate Alkalinity (as $CaCO_3$) Calcium, Ca Carbonate Alkalinity (as $CaCO_3$) Chloride, Cl Magnesium, Mg Nitrate, NO_3^- (as Nitrogen) Potassium, K Sodium, Na Sulfate, SO_4 Total Alkalinity (as $CaCO_3$)
Trace Metals	Arsenic, As Barium, Ba Boron, B Cadmium, Cd Chromium, Cr Copper, Cu Fluoride, F Iron, Fe Lead, Pb Manganese, Mn Mercury, Hg Molybdenum, Mo Nickel, Ni Selenium, Se Silver, Ag Uranium, U Vanadium, V Zinc, Zn
Radionuclides	Gross Alpha=Alpha Particles Gross Beta=Beta Particles and Photons Radium, Ra-226

*All metals analyses are for dissolved metals.
Source: NRC (2003); Powertech (2011).

Prior to calculating background water quality statistics, the water quality data will be examined for differences between hydrogeologic units within each wellfield using visual screening, such as trilinear diagrams, and statistical analyses (Powertech, 2011). If heterogeneity exists in the data, then background water quality will be established for each hydrogeologic unit; otherwise, background water quality will be established for the entire production zone of the wellfield. After grouping the water quality data into hydrogeologic units and removing outliers (i.e., anomalously high or low values relative to other values) if necessary, the applicant will calculate background water quality as the arithmetic average for each sample parameter. Target restoration goals, which will be used to assess the effectiveness of groundwater restoration activities, will be

established as a function of the average background water quality and the variability in each parameter based on statistical methods. Before wellfield background evaluation, the applicant will consult with NRC for approval of the statistical methods used to determine target restoration goals (Powertech, 2011). NRC will consult with EPA before establishing water quality standards at the Dewey-Burdock site.

7.3.1.2 Excursion Monitoring

As discussed in GEIS Section 8.3.1.2, monitoring wells are situated around the wellfields, in the aquifers overlying and underlying the ore-bearing production aquifers, and within the wellfields. Wells are placed in these locations to ensure the early detection of potential horizontal and vertical excursions of lixiviants. Monitoring well placement is based on what is known about the nature and extent of the confining layer and the presence of drill holes, hydraulic gradient and aquifer transmissivity, and well abandonment procedures used in the region. The ability of a monitoring well to detect groundwater excursions is influenced by several factors, such as the thickness of the aquifer, the distance between the monitoring wells and the wellfield, the distance between the adjacent monitoring wells, the frequency of groundwater sampling, and the magnitude of changes in lixiviant migration indicator parameters. As a result, the spacing, distribution, and number of monitoring wells at a given ISR facility are site specific. The factors that control the spacing, distribution, and number of monitoring wells are detailed in GEIS Section 8.3.1.2 (NRC, 2009). The applicant's monitoring well design is described in SEIS Section 2.1.1.1.2.3.2 and summarized next.

The applicant proposes to install production and nonproduction zone monitoring wells to detect any horizontal or vertical lixiviant excursions at the proposed project site (Powertech, 2009a). The production zone monitoring wells will be located in the ore zone, in a ring around the perimeter of the production wellfields. They will be spaced at a maximum of 122 m [400 ft] outside the production wellfield and evenly spaced around the perimeter of the wellfield with (i) a minimum spacing of either 122 m [400 ft] or, (ii) the spacing that will ensure that no greater than a 70 degree angle exists between adjacent production zone monitoring wells and the nearest injection well (Mackin, et al., 2001; NRC, 2009, 2003; Powertech, 2009a, 2011). The applicant conducted numerical simulations using site-specific hydrologic data and proposed production flow rates to support the proposed spacing of monitoring wells (Powertech, 2011). Simulation results indicated that the proposed maximum monitoring well spacing of 122 m [400 ft] would be adequate to detect potential excursions (Powertech, 2011).

Nonproduction monitoring wells within the production area may consist of two types of monitoring wells: overlying and underlying (Mackin, et al., 2001; NRC, 2003, 2009). The screened intervals of overlying wells will be located in the sand unit or aquifer immediately above the ore-bearing stratum. The overlying nonproduction monitoring wells are designed to monitor any upward movement of leach fluids that may occur from the production zone and to guard against potential leakage from production and injection well casings into any overlying aquifer (Mackin, et al., 2001; NRC, 2003, 2009). The overlying wells are used to obtain background water quality data and to develop upper control limits (UCLs) for the overlying zones that will be used to determine whether vertical migration of leach fluids is occurring.

Vertical monitoring is generally set up with a density of wells ranging from one every 1.2 to 2 ha [3 to 5 ac]. However, where confining layers are very thick and permeabilities are negligible, requirements for vertical excursion monitoring can be relaxed or eliminated (Mackin, et al., 2001). The screened zone for the overlying wells is determined from electric logs by qualified geologists or hydrogeologists.

The applicant's nonproduction zone monitoring plan is described in SEIS Section 2.1.1.1.2.3.2. Following the previously outlined guidance, the applicant plans to design and install both overlying and underlying monitoring wells. The first layer of overlying nonproduction zone monitoring wells will be evenly distributed through the production area with a minimum of one well for every 1.6 ha [4.0 ac] of production area (Powertech, 2009a). Where additional aquifers exist above the first sand unit or aquifer above the ore-bearing sandstone, additional monitoring wells will be located in these aquifers, with a minimum placement of one well for every 3.2 ha [8 ac] of production area (Powertech, 2011). The overlying monitoring wells will be placed above the upper confining layer (the Graneros Group), where alluvium is present. As described in SEIS Section 4.5.2.1.1.2.1, the Graneros Group ranges in thickness from 61 to 168 m [200 to 550 ft], except where it has eroded in the eastern part of the proposed project area. Core samples collected from the lowermost unit in the Graneros Group, the Skull Creek Shale, demonstrate that the Skull Creek clays have extremely low vertical permeabilities. The thicknesses of the upper confining Graneros Group {approximately 61 to 168 m [200 to 550 ft]} and the lower confining Morrison Formation {approximately 30 m [100 ft]} minimize concerns about vertical excursions of lixiviant.

The monitoring ring and overlying and underlying monitoring wells will be designed for each wellfield according to site-specific lithology and processes of the production zone(s) of each wellfield. For adminstrative review, the applicant would present each wellfield monitoring well program and the results of hydrologic testing to NRC and the U.S. Environmental Protection Agency (EPA) before operating each wellfield (Powertech, 2009a). After the required hydrologic tests are complete, it may be necessary to revise the location and/or number of wells proposed. Each wellfield will be handled on a case-by-case basis in consultation with NRC and EPA.

UCLs are selected and set for chemical constituents or parameters that will be indicative of lixiviant migration from the wellfield (Mackin, et al., 2001; NRC, 2003, 2009). The constituents and parameters selected as lixiviant migration indicators and for which UCLs will be set at the proposed Dewey-Burdock ISR Project are chloride, conductivity, and total alkalinity (Powertech, 2011). Chloride is measured because the ion exchange process increases chloride concentrations in the lixiviant. In addition, chloride is highly mobile in groundwater and is not influenced by pH changes and oxidation-reduction reactions that occur in the production zone (Powertech, 2011). Conductivity is evaluated because it indicates changes in groundwater quality and is more reliably measured than parameters such as total dissolved solids. Total alkalinity will be examined because its concentration significantly increases during the ISR process and, therefore, provides a conservative indicator (Powertech, 2011).

The applicant followed guidance in NUREG–1569 (NRC, 2003) to establish and set UCLs in wellfields. All monitoring wells in the production zone aquifer and nonproduction zone aquifers (i.e., underlying and overlying aquifers) will be sampled 4 times with a minimum of 14 days between sampling events (Powertech, 2011). All samples will be analyzed for the parameters in Table 7.3-1. The mean concentration and standard deviation of the constituents or parameters selected as UCLs (i.e., chloride, conductivity, and total alkalinity) will be calculated for samples taken from the production zone aquifer and nonproduction zone aquifers. UCLs for each production zone monitoring well in a wellfield will be set at the mean concentration of the production zone aquifer plus five standard deviations for each excursion indicator. UCLs for each nonproduction zone monitoring well will be set at the mean concentration of the nonproduction zones aquifers plus five standard deviations for each excursion indicator. Some aquifers exhibit a low chloride concentration with an insignificant standard deviation (i.e., a narrow concentration range). Consistent with NUREG–1569 (NRC, 2003), when setting the

UCL for chloride the applicant will use either the mean plus five standard deviations or the mean plus 15 mg/L [15 ppm], whichever is greater (Powertech, 2011).

The applicant proposes to sample monitoring wells at the proposed Dewey-Burdock ISR Project at approximately 2-week intervals (at least 10 days apart) (Powertech, 2009a). The samples will be analyzed for and compared against the excursion parameter UCL values. The water level in each monitoring well will also be measured and recorded prior to each sampling event (Powertech, 2009a). Water level and analytical monitoring data for the UCL parameters will be reported to NRC quarterly and retained onsite for NRC review.

After operations are complete, the wellfields will be restored. As described in SEIS Section 2.1.1.1.4.2, as part of aquifer restoration the applicant will sample the same horizontal perimeter and overlying/underlying monitoring wells used during production. During restoration, lixiviant injection ceases, thereby reducing the potential for an excursion. The applicant will implement a reduced groundwater monitoring program during aquifer restoration because lixiviant injection will have ceased. During the aquifer restoration phase, wells located in the perimeter monitoring ring and completed in the overlying and underlying aquifers will be sampled every 60 days for chloride, alkalinity, and conductivity excursion parameters. An excursion will be defined in the same manner as during operations and subject to the same corrective action requirements.

7.3.2 Wellfield and Pipeline Flow and Pressure Monitoring

As indicated in GEIS Section 8.3.2, the operator typically monitors injection and production well flow rates to manage water balance for the entire wellfield. Additionally, the pressure of each production well and the production trunk line in each wellfield header house is monitored. Unexpected losses of pressure may indicate equipment failure, a leak, or a problem with well integrity (NRC, 2009).

The applicant's program will include monitoring of the injection well and production well flow rates and pressures at each header house. Individual well flow readings will be recorded during each shift, and the overall wellfield flow rates will be balanced daily (Powertech, 2009a,b). Flow and total volume data will be transferred to and checked automatically at the Burdock central processing plant and Dewey satellite facility. The recovery and injection trunk lines will have electronic pressure gauges. Information from these gauges will be monitored from each unit's control room. The control system will have both high and low alarms for pressure and flow. If the pressure and/or flow are out of range, the alarms will sound, alerting personnel to make adjustments. Certain high or low readings will signal automatic shutoffs or shutdowns. Activation of the flow alarms will prompt the applicant to take corrective actions, which include inspections for leaks and spills.

7.3.3 Surface Water Monitoring

The applicant will conduct surface water monitoring on all surface impoundments located downgradient from ISR activities. The applicant will also monitor surface waters passing through the site or located downgradient of ISR activities (Powertech, 2011). As described in SEIS Section 7.2.4, the applicant plans to monitor 24 impoundments and 10 stream sampling sites as part of the operational surface water monitoring program. The operational surface water sampling sites are shown in Figure 7.2-2 and listed in Table 7.3-2.

Table 7.3-2. Impoundments and Stream Sampling Locations Proposed for Operational Monitoring

Site ID	Type/Name
Impoundments	
Sub02	Triangle Mine Pit
Sub03	Mine Dam
Sub04	Stock Pond
Sub05	Mine Dam
Sub06	Darrow Mine Pit Northwest
Sub07	Stock Dam
Sub08	Stock Pond
Sub09	Stock Pond
Sub10	Stock Pond
Sub11	Stock Pond
Sub20	Stock Pond
Sub21	Stock Pond
Sub22	Stock Pond
Sub29	Stock Pond
Sub30	Stock Pond
Sub31	Stock Pond
Sub32	Stock Pond
Sub33	Stock Pond
Sub34	Stock Pond
Sub35	Stock Pond
Sub36	Stock Pond
Sub40	Darrow Mine Pit Southeast
Sub49	Darrow Mine Pit
Sub50	Darrow Mine Pit
Streams	
BVC11	Beaver Creek Downstream
BVC14	Beaver Creek Upstream
CHR01	Cheyenne River Upstream
CHR05	Cheyenne River Downstream
PSC11	Pass Creek Downstream
PSC12	Pass Creek Upstream
BEN01	Bennett Canyon
UNT01	Unnamed Tributary
UNT02	Unnamed Tributary
UNT03	Unnamed Tributary

Source: Powertech, 2011.

Prior to ISR operations, the applicant plans to sample each impoundment sampling site 4 times and each stream sampling site monthly for 12 consecutive months in accordance with preoperational monitoring recommendations in Regulatory Guide 4.14 (NRC, 1980). Water samples will be collected from the impoundments, when available, and analyzed for the constituents in Table 7.3-1. Grab samples will be collected from perennial stream sampling locations on Beaver Creek (BVC11 and BVC14) and the Cheyenne River (CHR01 and CHR05). Passive samplers will be installed at the remaining sites to collect samples during ephemeral flow events. All stream samples will be analyzed for the constituents listed in Table 7.3-1.

During ISR operations, water samples collected from the impoundment and stream sampling sites will be analyzed for pH, total and suspended solids, total hardness, chloride, sulfate, dissolved arsenic, cadmium, chromium, and selenium, and dissolved and suspended natural uranium, Ra-226, Th-230, Pb-210, and Po-210. In addition, the samples would be analyzed in the field for pH, conductivity, and temperature (Powertech, 2011).

7.3.4 Groundwater Monitoring (Project-Wide)

The groundwater monitoring program will include domestic wells, stock wells, and monitoring wells located hydrologically upgradient and downgradient of proposed ISR activities (Powertech, 2011). Consistent with Regulatory Guide 4.14 (NRC, 1980), all domestic and stock wells within 2 km [1.2 mi] of the wellfields and all monitoring wells will be sampled quarterly over a 1-year period to establish baseline water quality before operations begin. All the preoperational groundwater samples will be analyzed for the constituents listed in Table 7.3-1.

Prior to operations, all domestic wells within the proposed project boundary will be removed from private use (Powertech, 2011). The applicant will work with the well owners to provide an alternative water source such as a replacement well or alternate water supply for domestic use (Powertech, 2011). Depending on well construction, location, and screen interval, the applicant could continue to use the well for monitoring or plug and abandon the well. During operations, the applicant will monitor all domestic wells within 2 km [1.2 mi] of the wellfields (Figure 7.2-3). Samples will be collected annually and analyzed for the constituents listed in Table 7.3-1.

Prior to operation of nearby wellfields, all stock wells within 0.4 km [0.25 mi] of wellfields will be removed from private use (Powertech, 2011). In addition, all nearby stock wells that have the potential to be adversely affected by ISR operations or to adversely affect ISR operations will be removed from private use (Powertech, 2011). Depending on well construction, location, and screen interval, the applicant could continue to use the stock well for monitoring or plug and abandon the well. During operations, the applicant must monitor all stock wells within the project area (Figure 7.2-3). Water samples will be collected quarterly and analyzed for three excursion indicators: chloride, total alkalinity, and conductivity (Powertech, 2011).

During operations, the monitoring wells located hydrologically upgradient and downgradient of ISR activities will be sampled quarterly and analyzed for the constituents listed in Table 7.3-1. The operational monitoring wells proposed will be in the alluvium, Fall River Formation, Chilson Member of the Lakota Formation, and the Unkpapa Formation. The position of each well relative to site facilities and features is shown in Figure 7.2-4 and listed in Table 7.3-3.

7.3.5 Meteorological Monitoring

The applicant has committed to continue meteorological monitoring at the proposed project site during ISR operations (Powertech, 2012b). As part of the site characterization process, the applicant installed a weather station near the center of the proposed action area. This weather station was monitored from July 2007 through July 2008 to analyze and describe the long-term and site-specific meteorological conditions and trends. In addition, data sets from several regional weather stations were reviewed (see SEIS Section 3.7).

Table 7.3-3. Monitoring Wells Proposed for Operational Monitoring

Well Identification(ID)	Aquifer	Relative Position
676	Alluvium	Downgradient of Land Application
677	Alluvium	Downgradient
678	Alluvium	Downgradient
679	Alluvium	Upgradient
707	Alluvium	Downgradient of Triangle Pit
708	Alluvium	Downgradient of Land Application
Proposed	Alluvium	Downgradient of Wellfield
Proposed	Alluvium	Downgradient of Wellfield
Proposed	Alluvium	Downgradient of Land Application
709	Alluvium	Downgradient of Wellfield
Proposed	Alluvium	Upgradient
631	Fall River	Upgradient
681	Fall River	Production Zone
688	Fall River	Overlying Production Zone
694	Fall River	Upgradient
695	Fall River	Downgradient
698	Fall River	Downgradient
706	Fall River	Upgradient
Proposed	Fall River	Downgradient of Triangle Pit
Proposed	Fall River	Downgradient of Darrow Pit
43	Chilson	Downgradient of Triangle Pit
680	Chilson	Production Zone
689	Chilson	Production Zone
696	Chilson	Downgradient
697	Chilson	Downgradient
705	Chilson	Upgradient
3026	Chilson	Upgradient
Proposed	Chilson	Downgradient of Darrow Pit
690	Unkpapa	Production Zone
693	Unkpapa	Production Zone
703	Unkpapa	Production Zone
Source: Powertech, 2011		

7.4 Ecological Monitoring

This section describes the applicant's proposed ecological monitoring program as described in its license application (Powertech, 2009a–c). As discussed in GEIS Section 8.4, ecological monitoring may include surveys of habitat, species counts, or other measures of the health of endangered, threatened, and sensitive species (NRC, 2009). Records of all sampling activities and analyses will be maintained onsite for NRC review, and periodic reports of all sampling and analyses will be submitted to NRC.

7.4.1 Vegetation Monitoring

Site characterization studies (Powertech, 2009a) indicate the proposed project area consists of five vegetation communities: Big Sagebrush Shrubland, Greasewood Shrubland, Ponderosa Pine Woodland, Upland Grassland, and Cottonwood Gallery. Each community was investigated for baseline vegetation information in support of an NRC source material license and the South Dakota Department of Environment and Natural Resources (SDDENR) large-scale mine permit application. No threatened or endangered species were encountered within the proposed project area. The applicant noted the presence of the state-designated weed Canada thistle (*Cirsium avense*) within the Cottonwood Gallery community and the presence of the Fall River County-designated weed field bindweed (*Convolvulus arvensis*) within the Greasewood Shrubland vegetation community. The applicant proposes weed control to mitigate further intrusion of invasive species in disturbed areas.

7.4.2 Wildlife Monitoring

The applicant will conduct annual wildlife monitoring at the project site during the lifespan of the project (Powertech, 2009a). The annual wildlife monitoring surveys will follow the same regimen as other ISR operations in the region (NRC, 2009). This will facilitate comparisons among survey results and impact assessments. As described in SEIS Section 3.6, no federally listed threatened or endangered species were documented within the project area during the baseline study. However, eight raptor nests were identified within the proposed project area, including one active bald eagle nest. The bald eagle is currently listed as threatened and endangered by the South Dakota Department of Game, Fish, and Parks (SDGFP). The applicant's annual monitoring surveys will include the following:

(1) Early spring surveys for, and monitoring of, Greater sage-grouse leks {no sage-grouse leks were identified within 10 km [6 mi] of the proposed action area}; new and/or occupied raptor territories and/or nests; threatened and endangered species (federal and state); and species tracked by the South Dakota Natural Heritage Program, as directed, on and within 1.6 km [1 mi] of the proposed project area

(2) Late spring and summer surveys for raptor production at occupied nests, and opportunistic observations of all wildlife species, including threatened and endangered species, and other species of management concern

(3) Other surveys required by regulating agencies

The applicant will employ a number of possible mitigation strategies to reduce the impact of its activities on raptors in the project area (Powertech, 2009a). These strategies include possible relocation of raptor nests. In the unlikely event that the applicant determines it necessary to disturb a raptor nest, the applicant will develop a mitigation plan and consult with SDGFP and the U.S. Fish and Wildlife Service, at which time any applicable permits will be obtained from the appropriate agencies (Powertech, 2009a).

The applicant does not plan to sample aquatic species (Powertech, 2009a). As described in SEIS Section 3.6.2, aquatic species are limited within the proposed project area due to a lack of persistent aquatic resources (i.e., surface waters) and poor habitat conditions.

Because the proposed project area does not include any critical big game habitats (see SEIS Section 3.6) and is already included in SDGFP big game surveys, SDGFP did not require big

game surveys for the applicant's baseline wildlife surveys. Consequently, no long-term big game monitoring requirements are planned (Powertech, 2009a). A similar approach has been applied to other baseline projects (uranium, coal, bentonite, gold) in South Dakota and Wyoming and is the current policy of both states for annual monitoring at surface mines in the two-state region.

7.5 Land Application Monitoring

This section describes the applicant's proposed land application monitoring program as described in the applicant's Groundwater Discharge Plan (GDP) submitted to SDDENR (Powertech, 2012a). As described in SEIS Section 2.1.1.1.2.4, the applicant is proposing options for liquid waste disposal at the proposed Dewey-Burdock ISR Project that include deep well disposal, land application, or combined deep well disposal and land application. If land application is used for liquid waste disposal at the proposed project, the applicant will implement this program in a manner that ensures beneficial uses will not be impaired and there will be no hazard to human health and the environment (Powertech, 2012a). Records of all sampling activities and analyses will be maintained onsite for NRC review, and periodic reports of all sampling and analyses will be submitted to SDDENR (Powertech, 2012a).

7.5.1 Groundwater

The land application groundwater monitoring program will include alluvial monitoring wells within and hydrologically upgradient and downgradient of proposed land application systems. In addition, the shallowest bedrock aquifer, the Fall River Formation, will be monitored and suction lysimeters will be installed to monitor the vadose groundwater quality beneath the land application systems. The groundwater monitoring program is designed to provide a comprehensive evaluation of potentially affected groundwater quality within and near the proposed perimeter of operational pollution (POP) for proposed land application areas. Each land application area would include a designated POP zone, inside of which groundwater degradation would be permissible under a SDDENR water quality variance permit as long as South Dakota groundwater standards are met at the compliance points at the edges of the POP zones. Proposed POP zones in the Dewey and Burdock land application areas are shown in Figures 7.5-1 and 7.5-2, respectively.

7.5.1.1 Alluvial Monitoring Wells

Three types of alluvial monitoring wells are proposed to assess baseline conditions and impacts to alluvial water quality during operations: compliance wells, interior wells, and other wells. Proposed alluvial monitoring wells in the Dewey area are presented in Table 7.5-1 and depicted in Figure 7.5-1. Proposed alluvial monitoring wells in the Burdock area are presented in Table 7.5-2 and depicted in Figure 7.5-2. Compliance wells will be hydrologically downgradient from land application systems at the POP zone boundaries and will serve as compliance locations for potential impacts to alluvial water quality outside of the POP zone. Interior wells will be within each POP zone and will measure potential changes in alluvial water quality within the POP zones. Other wells are proposed to measure ambient alluvial water quality within the project area (see SEIS Section 7.2.5). These wells are outside of the POP zones both upgradient and downgradient of proposed land application systems.

Prior to operations of land application systems, all compliance, interior, and other wells will be sampled to determine baseline water quality. SDDENR's GDP permit will include a condition

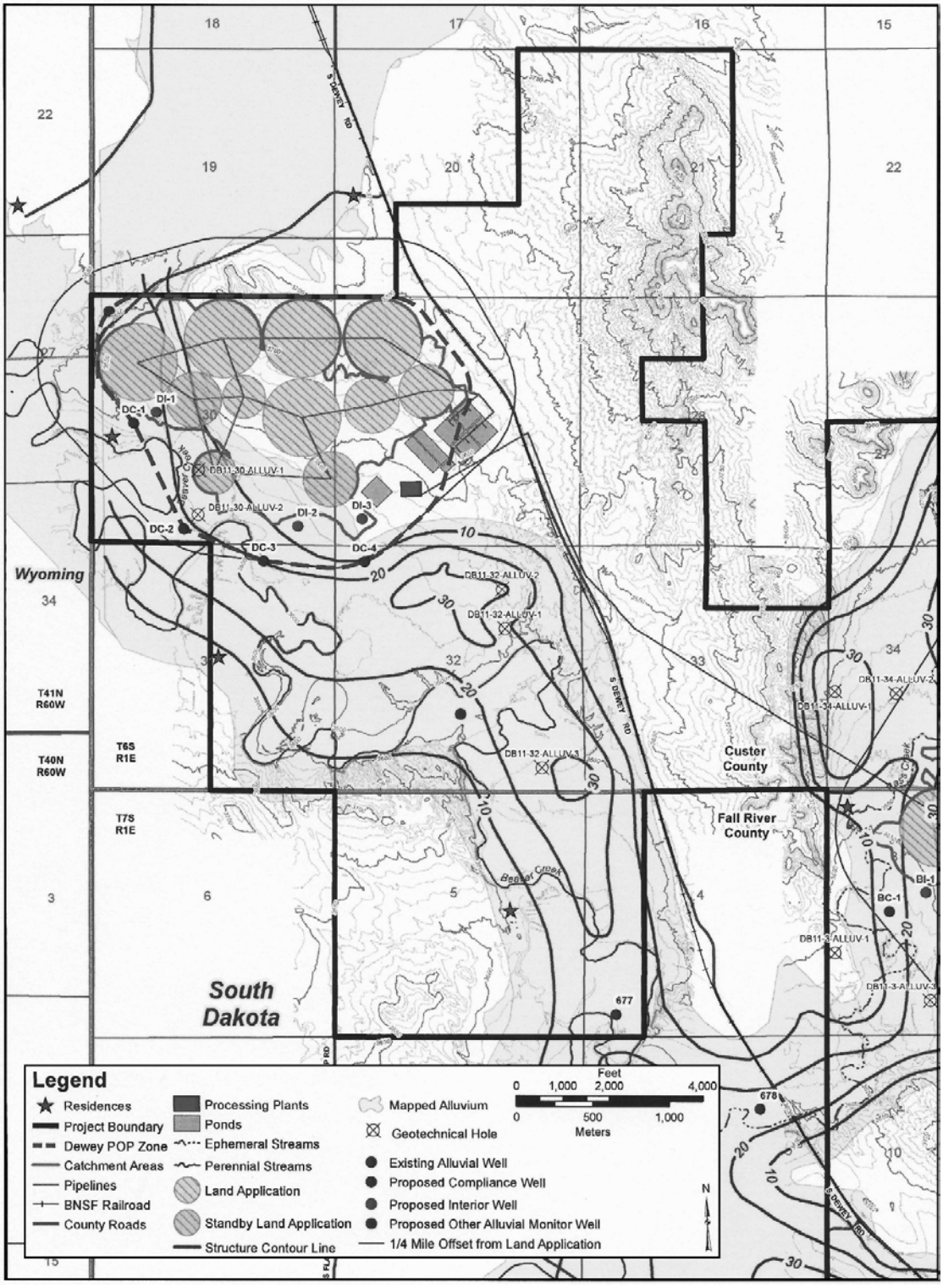

Figure 7.5-1. Map of Dewey Land Application Areas Showing the Perimeter of Operational Pollution and Proposed Alluvial Monitoring Wells Source: Powertech (2012a)

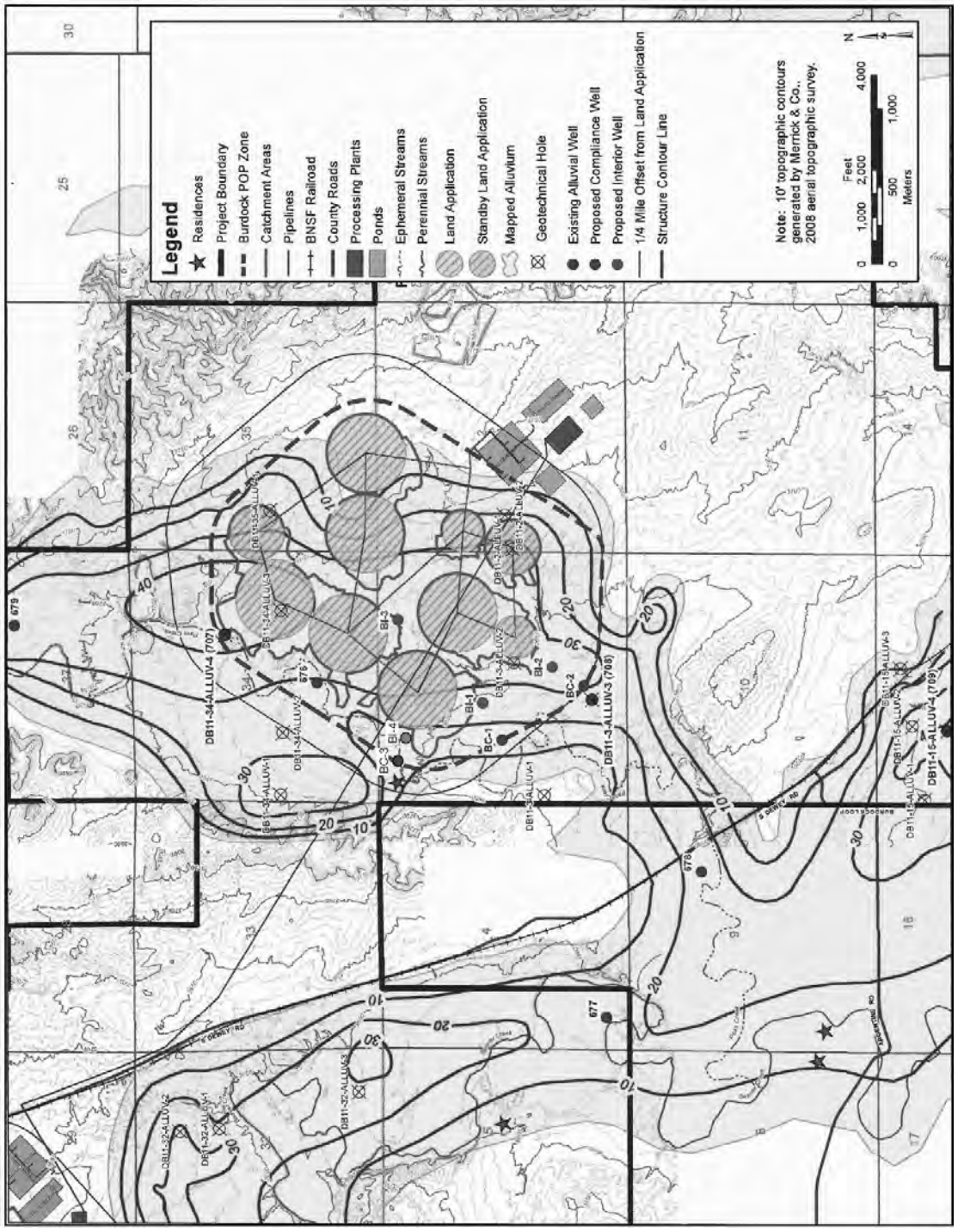

Figure 7.5-2. Map of Burdock Land Application Areas Showing the Perimeter of Operational Pollution and Proposed Alluvial Monitoring Wells
Source: Powertech (2012a, WWC, 2012)

Table 7.5-1. Proposed Alluvial Monitoring Wells in the Dewey Area

Monitoring Well Type	Well ID	Status
Compliance Wells	DC-1	Proposed
	DC-2	Proposed
	DC-3	Proposed
	DC-4	Proposed
Interior Wells	DI-1	Proposed
	DI-2	Proposed
	DI-3	Proposed
Other Wells	TBD	Proposed
	TBD	Proposed
	677	Existing
Source: Powertech, 2012a		

Table 7.5-2. Proposed Alluvial Monitoring Wells in the Burdock Area

Monitoring Well Type	Well ID	Status
Compliance Wells	BC-1	Proposed
	BC-2	Proposed
	BC-3	Proposed
Interior Wells	BI-1	Proposed
	BI-2	Proposed
	BI-3	Proposed
	BI-4	Proposed
Other Wells	676	Existing
	678	Existing
	679	Existing
	707	Existing
	708	Existing
Source: Powertech, 2012a		

requiring a minimum of one year of monthly ambient monitoring for the compliance wells and quarterly sampling of compliance wells until mining operations commence. During operations of land application systems, compliance, interior, and other wells will be sampled quarterly. All baseline and operational water samples will be analyzed for the parameters in Table 7.3-1.

For each compliance and interior well, baseline water quality for each parameter will be established as an arithmetic mean of baseline water samples plus one standard deviation of the sample data. Compliance limits for constituents in compliance wells will be established on a well-by-well basis as the human health standards in Administrative Rules of South Dakota (ARSD) 74:54:01:04 or baseline water quality. Out-of-compliance status will be defined in accordance with ARSD 74:54:02:28 as two consecutive samples that exceed the permitted allowable limit by two standard deviations. Interior wells will not have established compliance limits, but a contingency plan will be implemented if the monitored constituent concentrations increase (Powertech, 2012a).

7.5.1.2 Bedrock Aquifer Monitoring

The applicant proposes to provide monitoring results from operational monitoring wells in the shallowest bedrock aquifer, which occurs in the Fall River Formation. These Fall River

monitoring wells are listed in Table 7.3-3 and depicted in Figure 7.2-4. Prior to ISR operations, each of the Fall River monitoring wells will be sampled quarterly for 1 year. During ISR operations, the Fall River monitoring wells will be sampled quarterly and analyzed for the parameters in Table 7.3-1.

7.5.1.3 Vadose Zone Monitoring

The applicant proposes to install one suction lysimeter in each of the center pivot circles and catchment areas at both the Dewey and Burdock areas to obtain pore water samples from unsaturated soil. The suction lysimeters will be installed at depths of 2.4 to 3.7 m [8 to 12 ft]. Prior to operations of land application systems, pore water samples will be collected a minimum of four times within a 6-month period with no two samples taken in the same month. During operations, pore water samples will be collected once prior to each irrigation season, once during each irrigation season, and once after each irrigation season. Samples will be analyzed for the parameters in Table 7.3-1.

7.5.2 Surface Water

The locations of stream sampling sites on Beaver and Pass Creeks are BVC11, BVC14, PSC11, and PSC12. These sites are listed in Table 7.3-2 and depicted in Figure 7.2-2. The upstream sites on Beaver Creek (BVC14) and Pass Creek (PSC12) are approximately at the boundary of the proposed license area and will represent ambient water quality. The downstream site on Beaver Creek (BVC11) is downstream of the Dewey land application area, and the downstream site on Pass Creek (PSC11) is downstream of the Burdock land application area. Samples for each sampling site will be collected monthly for 12 consecutive months prior to ISR operations. Grab samples will be collected from sites BVC11 and BVC14. Passive samplers will be installed at sites PSC11 and PSC12 to collect samples during ephemeral flow events. Water samples will be analyzed for the constituents listed in Table 7.3-1. During ISR operations, including operation of land application systems, grab samples will be collected quarterly from perennial stream sampling locations on Beaver Creek and passive samplers installed on Pass Creek will automatically collect samples following runoff events from April through October. Grab samples will be analyzed in the field for pH, conductivity, and temperature. All stream samples will be analyzed for pH, total and suspended solids, total hardness, chloride, sulfate, dissolved arsenic, cadmium, chromium, and selenium and the constituents listed in Table 7.3-1 along with dissolved and suspended uranium, Ra-226, Th-230, Pb-210, and Po-210 to monitor for impacts to surface water from uranium ISR operations.

The applicant has proposed operational monitoring of all impoundments within and adjacent to the project area downgradient of proposed ISR facilities (e.g., wellfields, plants, pipelines, and land application areas). Impoundments downstream of land application areas in the Dewey and Burdock areas are listed in Table 7.3-2 and depicted in Figure 7.2-2. Prior to operations, ambient water samples will be collected, when available, from the impoundments four times and analyzed for the constituents listed in Table 7.3-1. All the impoundments will be sampled on a quarterly basis throughout construction and operations and analyzed for the same constituent list described previously for stream sampling sites.

7.5.3 Process-Related Liquid Waste

Grab samples of process-related liquid wastewater will be collected monthly during operation of each land application system and analyzed for the parameters listed in Table 7.3-1. In addition to the parameters in Table 7.3-1, monthly wastewater samples will be analyzed for compliance

with the 10 CFR Part 20, Appendix B radionuclide effluent discharge limits in Table 7.5-3. As discussed in SEIS Sections 2.1.1.1.6.2 and 4.5.1.1.2.2, SDDENR also regulates land application of treated wastewater, which requires the applicant to obtain a GDP permit and to comply with applicable state discharge requirements for land application of treated wastewater.

7.5.4 Soil

Two baseline soil samples will be collected from each quadrant of each center pivot (eight total samples per pivot) prior to operation of land application systems. During operations, a minimum of two soil samples will be collected each year for each land application pivot active during the year. Both the baseline and operational samples will be collected at depths of 0–46 and 46–91 cm [0–18 and 18–36 in] and analyzed for the parameters in Table 7.5-4.

7.5.5 Biomass

Samples of crops grown on three land application areas from each of the Dewey and Burdock sites will be collected at the end of each irrigation season during operations. If crops are not grown, samples of existing vegetation will be collected. Samples will be analyzed for the parameters in Table 7.5-5.

Livestock samples will be collected during operation of land application systems if livestock graze or consume crops grown on land application areas. The applicant will collect one grab sample per year taken at the time of slaughter and have it analyzed for the parameters in Table 7.5-5.

7.6 Class V Deep Injection Well Monitoring

This section describes the Class V deep injection well monitoring program the applicant proposed in its Class V underground injection control (UIC) permit application submitted to EPA (Powertech, 2011, Appendix 2.7-L). The proposed injection zones for the Class V deep injection wells are the Minnelusa Formation and the Deadwood Formation (Figure 3.5-5). The applicant estimates the need for disposal capacity of 1,135 Lpm [300 gpm] {about 1,635,120 L [432,000 gal] per day assuming 24 hour/7 day injection}. Two Class V injection wells are proposed in the Dewey area: one injecting into the Deadwood and one injecting into the Minnelusa. Two deep Class V injection wells are also proposed in the Burdock area: one injecting into the Deadwood and one injecting into the Minnelusa. In all, this totals four deep injection wells. If the disposal capacity for either the Deadwood Formation or the Minnelusa

Table 7.5-3. U.S. Nuclear Regulatory Commission Radionuclide Discharge Limits for Land Application

Radionuclide	µCi/ml	pCi/L
Pb-210	1E-8	10
Ra-226	6E-8	60
Uranium-natural	3E-7	300
Th-230	1E-7	100

Source: 10 CFR Part 20, Appendix B, Table 2, Column 2

Note: Compliance with 10 CFR Part 20, Appendix B, Table 2, Column 2 effluent discharge limits requires derivation of a limiting value based on the concentration each radionuclide in the effluent. The limiting value is derived as follows: determine, for each radionuclide in the mixture, the ratio between the concentration present in the mixture and the concentration otherwise established in Appendix B for the specific radionuclide when not in mixture. The sum of such ratios for all radionuclides in the mixture may not exceed “1” (i.e., “unity”).

Table 7.5-4. Soil Sampling Parameters

Parameter
Conductivity, paste extract
pH, paste extract
Chloride, soluble
Chloride
Sulfate
Arsenic
Barium
Boron
Cadmium
Chromium
Lead
Mercury
Selenium
Silver
Sodium
Sodium Adsorption Ratio (SAR)
Vanadium
Nitrate as N, KCl extract
Uranium-natural
Ra-226
Th-230
Pb-210
Po-210
Source: Powertech, 2012a

Table 7.5-5. Biomass Sampling Parameters

Constituent
Uranium-natural
Ra-226
Th-230
Pb-210
Po-210
Selenium
Arsenic
Source: Powertech, 2012a

Formation is not as great as anticipated, the EPA UIC Class V permit will allow up to four Class V wells each at the Dewey and the Burdock sites to increase the disposal capacity. The applicant's preference is to utilize the deep injection wells for the disposal of all process waste fluids, but if the deep injection wells cannot accommodate the total volume of waste fluids, land application will be used to dispose of the volume of waste fluids unable to be accommodated by the deep injection wells. EPA will not authorize injection into the Class V deep injection wells unless the permittee demonstrates the wells are properly sited, such that confinement zones and proper well construction minimize the potential for migration of fluids outside of the approved injection zone.

The deep injection wells are Class V wells because (i) Class I disposal wells are prohibited in South Dakota by state statute and (ii) the deep injection wells proposed for injection into the Minnelusa Formation would be injecting into or above an underground source of drinking water.

(The definition for underground source of drinking water is found at 40 CFR Part 144.3 and p. 2-15 of this SEIS.) Although the deep injection wells are Class V wells, many of the protective requirements found at 40 CFR Part 146 Subpart B, Criteria and Standards Applicable to Class I Wells, will be included in the EPA UIC Class V Permit. Because Class V deep injection wells are being used for disposal rather than Class I wells, the injectate will have to be treated to remove radioactive constituents to below the radioactive waste standards at 10 CFR Part 20, Appendix B, Table II. The injectate would not need to be treated for injection into a Class I well. If the Total Dissolved Solids concentration in the proposed injection zone is below 10,000 mg/L [10,000 ppm], the injection zone is an underground source of drinking water. In that case, the applicant will be required to obtain an aquifer exemption from EPA, or the EPA UIC Class V permit will require liquid wastes to be treated to meet drinking water standards, or contaminant-specific background concentrations for constituents regulated under the Safe Drinking Water Act (SDWA).

A variety of data will be collected to monitor the deep injection well operations. This monitoring will use both periodic and continuous techniques. The EPA UIC Class V permit will require the annulus between the tubing and the long string of casings to be filled with a fluid and adequate pressure maintained on the annulus. The EPA UIC Class V permit will require installation and use of continuous recording devices to monitor injection pressure, flow rate and volume, and the pressure on the annulus between the tubing and the long string of casing as required under 40 CFR 146.13(b)(2). The continuous monitoring of the pressurized fluid-filled annulus will provide the necessary information for the internal mechanical integrity test required under 40 CFR 146.8(a)(1), which determines whether there is any significant fluid leak in the casing tubing and packer. The permit will also require a demonstration of external mechanical integrity pursuant to 40 CFR 146.8(a)(2) at least once every 5 years during the life of the well as required under 40 CFR 146.13(b)(3).

7.6.1 Injection Pressure Monitoring

As required by 40 CFR 146.13(a)(1), injection pressure at the wellhead shall not exceed a maximum value, which shall be calculated so as to assure that the pressure in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone. In no case shall injection pressure initiate fractures in the confining zone or cause the movement of injection or formation fluids into an underground source of drinking water. A data acquisition system will be used to monitor injection rate, injection pressure, annulus pressure, and simultaneous differential pressure. Maximum, minimum, and average values for each of the four parameters, along with total volume, will be recorded at least once every 15 minutes. Pressure transducers located near the wellhead and downstream of any pumping devices will be used to measure pressures. Flow rate is to be measured utilizing an inline turbine meter and totalizer or equivalent. In the case of a manned operation, well operators will be required to visually inspect the recorder and computer on a weekly basis when injection occurs to verify proper operation.

A backup power source (battery) will be used to ensure continuous collection of operating and well alarm data for up to a minimum of 30 minutes should power failure occur. If a power failure persists past the ability of the battery systems to allow power, the wells will be shut in. Upon discovery of the shut in, readings will be recorded a minimum of once every day until power is restored to the monitoring equipment.

If any of the permit conditions are exceeded, including injection pressure or differential pressure between the annulus pressure and the injection pressure, a visual alarm light will be illuminated

at the well building. In addition, the computerized data acquisition system will be coupled to a telephone autodialer that will send a page to the operator to ensure that the condition is communicated. Upon an alarm condition, the operator will stop injection until the problem is identified and corrected and the system manually restarted.

7.6.2 Annulus Monitoring System

The permittee plans to fill the annulus area between the protective casings and injection tubing strings with fresh water containing an approved corrosion inhibitor. Annulus pressure will be continuously monitored to detect any potential leaks in the tubing or casing strings, and annulus pressures will be maintained at more than 100 psi above the tubing pressure.

The proposed annulus monitoring system will consist of an annulus fluid tank with a level indicator or site glass, pressure transducers and gauges, a nitrogen regulator, and a nitrogen supply cylinder. Annulus pressure in this system will be maintained with a nitrogen blanket supplied from pressurized nitrogen cylinders. In the event of power failure, positive pressure can still be maintained on the annulus.

The annulus tank will have sufficient reservoir capacity to accommodate double the anticipated volume fluctuations due to temperature and pressure limitations. The pressurized nitrogen cylinders will be replaced and recharged as required. The annulus tank is to be equipped with a level indicator or a full length armored reflex sight glass, a pressure relief valve, and an independent liquid fill nozzle. Well operators will record the annulus tank level and any annulus fluid added to the system.

The annulus pressure will be recorded continuously for each well. Electronic pressure transducers will be placed in pressure taps on the annulus system and injection flow lines. A signal will be sent from these transducers to a digital recorder and/or a chart recorder. The automated control system data will be visually inspected a minimum of once daily for anomalies when the well is operating. As part of the process and controls, the monitoring system will record maximum, minimum, and average information. Differential pressures (the difference between the pressure applied to the annulus and the injection pressure) are to be obtained by comparison of simultaneous readings of the annulus and injection pressure transducer readings obtained for the wells.

In addition to the annulus pressure operating and monitoring requirements, an interlock system will be installed to prevent the well from being operated if permit conditions are exceeded or if unsafe conditions exist.

7.6.3 Mechanical Integrity Demonstration

Under 40 CFR Part 146.8, periodic monitoring must be performed on both the internal and external mechanical integrity of the deep disposal wells to demonstrate (i) there is no significant leak in the casing, tubing, or packer and (ii) there is no significant fluid movement into an underground source of drinking water through vertical channels adjacent to the injection well bore.

7.6.3.1 Internal Mechanical Integrity Demonstration

To demonstrate mechanical integrity for the casing, tubing and packer, the EPA UIC Class V permit will require monitoring of the tubing–casing annulus pressure with sufficient frequency to be representative while maintaining an annulus pressure different from atmospheric pressure measured at the surface. Monitoring the pressure changes in the sealed annulus space is a means of verifying the continued mechanical integrity of the well. The annulus pressure is to be continually monitored to detect any leaks in the tubing or casing.

7.6.3.2 External Mechanical Integrity Demonstration

To demonstrate that there is no significant fluid movement into an underground source of drinking water through vertical channels adjacent to the injection well bore, the EPA UIC Class V permit will require one of the following logs to be recorded once each fifth calendar year: temperature, noise, or oxygen activation. If determined necessary because of operational or regulatory concerns, casing inspection logs may be conducted to investigate corrosion when tubing is already removed from the borehole during a workover or stimulation.

7.6.4 Injection Zone Pressure Monitoring

The EPA UIC Class V permit will require monitoring of the pressure buildup in the injection zone annually, including shutting down the well for a time sufficient to conduct a valid observation of the pressure fall off as described under 40 CFR 146.13(d).

7.6.5 Injectate Monitoring

The EPA UIC Class V permit will require the analysis of the injected fluids with sufficient frequency to yield representative data of their characteristics. If the proposed injection zones are demonstrated not to be underground sources of drinking water, the permit will require the injectate to be treated to meet radioactive waste standards at 10 CFR Part 20, Appendix B, Table II. If the proposed injection zones are underground sources of drinking water, the applicant will be required to obtain an aquifer exemption from EPA, or the permit will require the injectate to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the SDWA. Injectate characteristics will be monitored by collecting samples following procedures of a permittee-proposed waste analysis plan, which is reviewed and approved by EPA and becomes part of the permit requirements. At a minimum, the composition parameters listed in Table 7.6-1 will be monitored once quarterly for any quarterly period that fluid is injected.

7.7 References

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10 CFR Part 20, Appendix B. *Code of Federal Regulations*, Title 10, *Energy*, Part 20. "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage." Washington, DC: U.S. Government Printing Office.

Table 7.6-1. Composition Parameters for Class V Injectate Monitoring

Test Analyte/Parameter*
pH
total dissolved solids
total suspended solids
specific gravity
arsenic
barium
bicarbonate alkalinity
calcium
chloride
iron
lead
mercury
Ra-226
selenium
sodium
sulfate
Th-230
uranium
vanadium
*All metal analyses under the EPA UIC Class V permit are for total metals.

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Powertech. "Re: Powertech (USA) Inc.'s Supplemental Sampling Plan and Responses to Comments Regarding Draft License SUA-1600, Dewey-Burdock Project, Docket No. 40-9075, TAC No. J00606." Letter from R. Blubaugh, Vice President—Environmental, Health and Safety Resources, Powertech to R. Burrows, NRC. ML12305A056. October 19, 2012c.

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8 COST-BENEFIT ANALYSIS

8.1 Introduction

This chapter summarizes benefits and costs associated with the proposed action and the No-Action alternative. The proposed action is to issue the applicant, Powertech (USA) Inc., an U.S. Nuclear Regulatory Commission (NRC) license. The applicant will use the license for the construction, operation, aquifer restoration, and decommissioning of the proposed Dewey-Burdock uranium *in-situ* recovery (ISR) project. Section 4.11 of this Supplemental Environmental Impact Statement (SEIS) discusses the potential socioeconomic impacts of the proposed action.

Implementation of the proposed action will generate regional and local benefits and costs. The regional and local benefits of constructing and operating the proposed Dewey-Burdock ISR Project include increases in employment, economic activity, and tax revenues. The benefits of increased tax revenues will accrue primarily to Fall River and Custer Counties, South Dakota, and the surrounding towns of Edgemont, Hot Springs, and Custer. Increases in economic activity and employment may extend to Rapid City in neighboring Pennington County and the city of Newcastle in Weston County, Wyoming. Costs associated with the proposed Dewey-Burdock ISR Project will be, for the most part, limited to the area surrounding the site. Examples of these costs include changes to current land and water use, and increased road traffic.

8.2 Proposed Action (Alternative 1)

Under the proposed action, the NRC will issue the applicant an NRC license. With this license, the applicant will construct, operate, restore the aquifer, and decommission the proposed Dewey-Burdock ISR Project. Under the proposed action, the applicant is also seeking U.S. Bureau of Land Management (BLM) approval of its modified Plan of Operations subject to mitigation included in the license application and this SEIS. Following 2 years of site development and facility construction, there will be 8 years of wellfield and uranium recovery operations (see Figure 2.1-1). During the 8-year operations phase of the project, wellfield construction will continue as additional wellfields are sequentially developed along the uranium roll fronts in both the Dewey and Burdock areas. Wellfield restoration at the Dewey-Burdock site will begin immediately after production activities in the wellfields end. The applicant projects that restoration activities in the first wellfields will begin 2 years after production activities commence. Aquifer restoration activities, including restoration construction, stability monitoring, and regulatory approval of restoration, will continue for 11 years.

Some overlap between wellfield decommissioning and groundwater restoration activities is expected. Wellfield decommissioning is estimated to continue for 8 years. Decommissioning of the Burdock central processing plant and Dewey satellite facility will begin after aquifer restoration and wellfield decommissioning activities are complete. It is anticipated that these activities will take 2 years to complete (Powertech, 2009).

8.2.1 Benefits of the Proposed Action

The principal socioeconomic benefit expected to result from the Dewey-Burdock ISR Project is an increase in employment opportunities in the region. The applicant expects to directly employ 86 workers during construction and 84 workers during operations of the proposed project

(Powertech, 2009). Fewer workers will be involved in aquifer restoration and decommissioning activities (Powertech, 2010). The applicant expects nine workers will be directly involved in aquifer restoration activities and nine workers will be directly involved in decommissioning activities. As discussed in SEIS Section 4.11.1, the construction workforce will most likely not relocate permanently to the area because of the short duration (1 to 2 years) of these activities. Workers are expected to be more likely to relocate near the facility during the operations, aquifer restoration, and decommissioning phases of the proposed project.

The majority of jobs are expected to be filled by workers from outside the region. A standard employment multiplier of 0.7[1] was used to calculate the expected influx of approximately 60 jobs (i.e., 86 jobs × 0.7 = 60) during construction, 59 jobs (i.e., 84 jobs × 0.7 = 59) during operations, 6 jobs during aquifer restoration (i.e., 9 jobs × 0.7 = 6), and 6 jobs during decommissioning (i.e., 9 jobs × 0.7 = 6) activities.[1]

The town nearest to the proposed project is Edgemont, with a population of 774 (USCB, 2012). However, employees supporting project activities might prefer to reside in larger surrounding communities such as Hot Springs, Custer, and Newcastle, which have populations of 3,711, 2,067, and 3,532, respectively (USCB, 2012). The influx of jobs created by the Dewey-Burdock ISR Project and the anticipated reduction in unemployment are expected to have a MODERATE beneficial impact to the businesses of Edgemont and a SMALL beneficial impact to the businesses of larger towns surrounding the proposed site, such as Hot Springs, Custer, and Newcastle.

In addition to job creation, the proposed project's operations and the addition of regionally based employees are expected to contribute to local, regional, and state revenues. Revenues are expected to increase through the purchase of goods and services and through the taxes levied on goods and services. Overall, the project is expected to generate $13.54 million in total indirect business tax revenue over the lifetime of construction, operation, restoration, and decommissioning activities (Powertech, 2009). Sources of indirect business tax revenue include property taxes, sales taxes, and motor vehicle license charges.

The Special Tax Division of the Department of Revenue and Regulation of South Dakota levies a severance tax of 4.5 percent (South Dakota Codified Law 10-39A-1), as well as a 0.24 percent conservation tax (South Dakota Codified Law 10-39B-2), on the taxable value of the uranium produced from uranium milling and mining. The applicant's estimate of uranium resources to be recovered at the Dewey-Burdock ISR Project is 3.8 million kg [8.4 million lb] of uranium (as U_3O_8) (SRK Consulting, 2012). If the applicant fully recovers this quantity of uranium and sells it at market prices of approximately $52.00 per pound (two-year average of monthly long-term prices from January 2011 to December 2013), the severance tax is expected to yield $19,656,000 and the conservation tax is expected to yield $1,048,320 in economic benefits over the life of the project. The State of South Dakota collects the severance tax and the conservation tax. The State of South Dakota returns 50 percent of the severance tax to the county where the mineral was produced.

[1]The economic multiplier provides a statistical estimate of the total impact that is expected from a regional change in a given economic activity. The multiplier is a ratio of total change to initial change. The multiplier of 0.7 is used in these calculations because it is the standard employment multiplier for the milling/mining industry (Economic Policy Institute, 2003).

In addition, the proposed Dewey-Burdock ISR Project is expected to generate $186,700,000 in value-added benefits over the life of the project (Powertech, 2009). These include employee wages and benefits; payments to self-employed individuals; payments from interest, rents, royalties, dividends, and profits; and excise and sales taxes paid on retail and commercial transactions.

8.2.2 Benefits From Uranium Production

The taxes to be generated by operations at the proposed Dewey-Burdock ISR Project will be dependent on yellowcake production levels and the number of persons employed in facility operations. The applicant projects 3.8 million kg [8.4 million lb] of uranium will be recovered. However, production of yellowcake will depend on the market price for yellowcake (as uranium) and production costs. Since 2002, the spot market price for uranium has fluctuated significantly, from a high of more than $130 per pound in 2007 to a low of $20 per pound in 2002. As of November 18, 2013, the price was $36.00 per pound (UXC, 2013).

The project's potential benefits to the local community depend on the applicant's operating costs being lower than the future price of uranium. If the price of uranium falls below the costs of operation, then operations would likely be suspended or discontinued.

8.2.3 Costs to the Local Communities

Table 8.2-1 lists the towns within an 80-km [50-mi] radius of the proposed project. These towns are expected to provide the majority of the workers for the proposed project. The table also lists the population of the towns and the distances to the proposed project site. As stated in Section 8.2.1, the construction of the proposed project is expected to employ 86 workers, and if it is assumed that the majority of the construction employment requirements are filled by a workforce from outside the region, there could be an influx of 60 jobs (86 jobs × 0.7^2 = 60). Because of the short duration of construction (1 to 2 years) and small size of the construction force, the impact to housing demand would be SMALL (see SEIS Section 4.11.1.1). Workers would not be expected to bring families and school-aged children with them; therefore, there would be a SMALL impact on education services and on health and social services (see SEIS Section 4.11.1.1).

As mentioned in SEIS Section 8.2.1, the proposed project is expected to employ 84 workers during the period of operations, 9 workers during the period of aquifer restoration, and 9 workers during the period of site decommissioning. As described in SEIS Section 4.11.1.2, employment types are expected to be more technical during operations, and

Table 8.2-1. Towns Near the Proposed Dewey-Burdock *In-Situ* Recovery Project

Town	Population (2010 Estimate)	Distance From Project in km [mi]
Edgemont, South Dakota	774	21 [13]
Custer, South Dakota	2,067	80 [50]
Hot Springs, South Dakota	3,711	64 [40]
Newcastle, Wyoming	3,532	64 [40]

Source: USCB (2012)

[2]The multiplier of 0.7 is used in these calculations because it is the standard employment multiplier for the milling/mining industry (Economic Policy Institute, 2003).

as a result, the majority of the operational workforce is expected to be staffed from outside the region. Therefore, it is anticipated that there will be an influx of workers into the towns closest to the project area. Specifically, it is anticipated that there will be an influx of 59 workers (84 jobs × 0.7^3 = 59) during operations, 6 jobs during aquifer restoration (i.e., 9 jobs × 0.7 = 6), and 6 jobs during decommissioning (i.e., 9 jobs × 0.7 = 6) activities.

It is also expected that workers moving from outside the region to communities within commuting distance of the Dewey-Burdock project site for employment opportunities will arrive with their families. The average household size in the State of South Dakota is 2.42 persons (USCB, 2012). Therefore, newly created jobs have the potential to increase the local population by as many as 172 persons (59 + 6 + 6 = 71 workers from outside the region × 2.42 persons per household = 172 persons). The influx of workers and their families will increase the demand for housing and may spur an increase in the construction of new homes in towns surrounding the proposed site. It is anticipated that the impact of increased housing demand and construction may be MODERATE for small towns such as Edgemont. For larger towns such as Hot Springs, Custer, and Newcastle, which have more available housing, the impact will be SMALL.

The projected population growth from the proposed project will have a SMALL impact on education infrastructure and health and social services. As assessed in SEIS Section 4.11.1, the impact on schools and education-related services during operations, aquifer restoration, and decommissioning will be SMALL. As presented in SEIS Section 3.11.7, towns surrounding the proposed project have adequate medical facilities, social services, and police, fire, and emergency medical services to accommodate the projected project workforce and their families. NRC staff discussions with city and county planners indicate that current and planned upgrades to health care facilities and hospitals in the region will accommodate projected increases in population (NRC, 2009). Furthermore, as discussed in Section 4.11.1, local governments are expected to have the capacity to effectively plan for and manage increased demand for health and social services from workers and their families relocating to towns near the proposed project.

8.3 Evaluation of Findings of the Proposed Dewey-Burdock Project

If NRC issues the applicant a license, it is anticipated that the Dewey-Burdock ISR Project will have a SMALL to MODERATE overall economic impact on the region of influence and will generate primarily regional and local benefits and costs. As discussed earlier, the regional benefits of the project are increased employment opportunities and increased economic activity that will add to tax revenues in the region. Increases in tax revenues are expected to bring the largest benefit to Fall River and Custer Counties, although economic benefits will most likely be shared by neighboring counties and communities in South Dakota and Wyoming. Social and economic costs associated with the Dewey-Burdock project will, for the most part, be limited to communities within commuting distance of the site. Table 8.3-1 summarizes the costs and benefits of the proposed Dewey-Burdock ISR Project.

8.4 No Action (Alternative 2)

Under the No-Action alternative, NRC will not approve the license application for the proposed Dewey-Burdock ISR Project and the BLM will not approve the applicant's modified Plan of Operations. The No-Action alternative will result in the applicant not constructing and operating

[3] Ibid.

Table 8.3-1. Summary of Costs and Benefits of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Cost-Benefit Category	Proposed Action
Benefits	
Production Capacity	8.4 million pounds of yellowcake (as uranium)
Other Monetary: Severance and conservation taxes Indirect business tax revenues	 $20.7 million (estimated) $13.54 million (estimated)
Nonmonetary benefits (50% of jobs would be from Custer and Fall River Counties)	86 jobs—during construction 60 jobs—local jobs from economic multiplier during construction 84 jobs—during operations 59 jobs—local jobs from economic multiplier during operations 9 jobs—during aquifer restoration 6 jobs—local jobs from economic multiplier during aquifer restoration 9 jobs—during decommissioning 6 jobs—local jobs from economic multiplier during decommissioning
Costs	
Education Infrastructure	SMALL
Health and Social Services	SMALL
Housing Demand	SMALL for larger towns (Hot Springs, Custer, Newcastle) MODERATE for Edgemont
Emergency Response	SMALL

Source: Powertech (2009, 2010); SRK Consulting, 2012

the proposed project. No facilities, roads, or wellfields will be built, and no pipelines will be laid as described in SEIS Section 2.1.2. No uranium will be recovered from the subsurface orebody; therefore, injection, production, and monitoring wells will not be installed to operate the facility. No lixiviant will be introduced in the subsurface, and no buildings will be constructed to process extracted uranium or store chemicals involved in that process. Because no uranium will be recovered, neither aquifer restoration nor decommissioning activities will occur. No liquid or solid effluents will be generated. As a result, the proposed site will not be disturbed by proposed project activities and ecological, natural, and socioeconomic resources will remain unaffected. All potential environmental impacts from the proposed action will be avoided. Similarly, all project-specific socioeconomic impacts (e.g., employment, economic activity, population, housing, and local finance) will also be avoided.

8.5 References

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9 SUMMARY OF ENVIRONMENTAL IMPACTS

This chapter summarizes the potential environmental impacts of the proposed action and the No-Action alternative. The potential impacts of the proposed action are discussed in terms of (i) unavoidable adverse environmental impacts, (ii) irreversible and irretrievable commitments of resources, (iii) short-term impacts and uses of the environment, and (iv) long-term impacts and the maintenance and enhancement of productivity. The information is presented for each of the 13 resource areas that may be affected by the proposed Dewey-Burdock *In-Situ* Recovery (ISR) Project. This information addresses the impacts during each phase of the project (i.e., construction, operation, aquifer restoration, and decommissioning). The specific impacts are described in Table 9-1.

The following terms are defined in NUREG–1748 (NRC, 2003).

- Unavoidable adverse environmental impacts: applies to impacts that cannot be avoided and for which no practical means of mitigation are available
- Irreversible: involves commitments of environmental resources that cannot be restored
- Irretrievable: applies to material resources and will involve commitments of materials that, when used, cannot be recycled or restored for other uses by practical means
- Short-term: represents the period from preconstruction to the end of the decommissioning activities and, therefore, generally affects the present quality of life for the public
- Long-term: represents the period of time following the termination of the site license, with the potential to affect the quality of life for future generations

As discussed in Chapter 4, the significance of potential environmental impacts is categorized as follows:

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

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

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

The alternatives and their environmental impacts are summarized in the following sections. Section 9.1 describes the environmental impacts from implementing the proposed action, and Section 9.2 describes the environmental impacts from implementing the No-Action alternative.

9.1 Proposed Action (Alternative 1)

Powertech (USA) Inc. (Powertech, referred to herein as the applicant) is seeking an NRC source material license for the construction, operation, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project (Powertech, 2009a–c). Under

the proposed action, the U.S. Nuclear Regulatory Commission (NRC) would grant Powertech's request for a license. The proposed project will consist of processing facilities and sequentially developed wellfields sited in two contiguous areas: the Burdock area and the Dewey area.

Construction of the Dewey-Burdock ISR Project is expected to last about 2 years (see Figure 2.1-1). During this phase, the applicant will construct buildings, access roads, wellfields, pipelines, Class V injection wells, and potential land application areas to be used for liquid waste disposal. Operations are expected to last 8 years. Construction and operations activities would disturb approximately 98 ha [243 ac] if deep well disposal via Class V injection wells is used to dispose of treated wastewater and approximately 566 ha [1,398 ac] if land application is used to dispose of treated wastewater (Powertech, 2010).

During the operations phase, injection wells will be used to inject lixiviant (recovery) solutions into the orebody to recover uranium. Production wells will be used to recover the dissolved uranium, which then will be processed through the central plant. Finally, monitoring wells will be installed to monitor the performance of the wellfields and to mitigate potential excursions from the production zone.

Approximately 0.45 million kg [1 million lb] of U_3O_8 (triuranium octoxide) would be produced per year. After operations at a wellfield cease, the applicant will have to begin aquifer restoration, which will ensure that water quality and groundwater use from surrounding aquifers is not impacted by the proposed action.

The aquifer restoration process is expected to last about 9 years. The methods selected for aquifer restoration will depend on the liquid waste disposal option. For the Class V deep injection well disposal option, the primary restoration method will be groundwater treatment using reverse osmosis with permeate injection (Powertech, 2011). If land application is used for liquid waste disposal, then groundwater sweep with injection of clean makeup water from the Madison Formation will be used to restore the production zone aquifer. During wellfield and facility decommissioning (expected to last 10 years), disturbed lands will be returned to their prior uses. Wells will be plugged and abandoned, and the land surface will be reclaimed.

The potential environmental impacts from the proposed action are summarized in Table 9-1.

9.2 No Action (Alternative 2)

Under the No-Action alternative, NRC would not issue a license. The applicant will neither construct buildings, roads, or wellfields nor will the facility be operated at the proposed Dewey-Burdock ISR Project. Uranium ore will not be recovered from the site, and the applicant will not receive a license. Under the No-Action alternative, there will be no impact to any of the 13 resource areas from the proposed licensing action. There will be no unavoidable adverse environmental impacts attributable to the proposed action and no relationship between local short-term or long-term uses of the environment. Therefore, there will be no irreversible and irretrievable commitment of resources.

Table 9-1. Summary of Environmental Impacts of the Proposed Action

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Land Use (SEIS Section 4.2.1)	There will be a SMALL impact to land use. During construction and operation, the total amount of land affected by earthmoving activities to construct surface facilities, wellfields and associated infrastructure, and to build access roads will depend on the option used to dispose of liquid wastes. For Class V well injection, approximately 98 ha [243 ac] or 2 percent of the proposed license area will be disturbed. For land application, approximately 566 ha [1,398 ac] or 13 percent of the proposed license area will be disturbed. During decommissioning, land will be impacted by earthmoving activities to reclaim and reseed the affected areas.	No impact. There will be no irreversible and irretrievable commitment of land resources from implementing the proposed action. The duration of the project will be approximately 17 years after which time the land could be reclaimed and made available for other uses.	There will be a SMALL impact to land use from implementing the proposed action. Depending on the option used to dispose of liquid wastes, approximately 98 ha [243 ac] (Class V well injection) or 566 ha [1.398 ac] (land application) of the proposed license area will be unavailable for other uses such as grazing and recreation; oil and gas exploration could coexist with the applicant's proposed action.	There will be no long-term impact to land resources from implementing the proposed action. The land will be available for other uses at the end of the license period.
Transportation (SEIS Section 4.3.1)	During the construction and operation phases, there will be a SMALL increase in local traffic counts associated with project-related traffic on Dewey Road, the nearest road to the proposed project. The increased traffic	There will be an irreversible and irretrievable commitment of fuel for vehicle and equipment operation, heating, commuter traffic, and regional transport.	During construction and operations, there will be a SMALL impact due to increased traffic on Dewey Road, which will degrade the road surface, increase dust generation, and increase the	There will be no long-term impacts to transportation following license termination.

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	will incrementally degrade the road surface, increase dust generation, and increase the potential for traffic accidents and wildlife and livestock kills. During all phases, there will be a SMALL increase in traffic on the more well-traveled regional roads.		potential for traffic accidents and wildlife and livestock kills. During operation, aquifer restoration, and decommissioning, there will be a SMALL increased accident risk from transporting yellowcake, ion-exchange resin, byproduct material, and hazardous chemicals. During construction, no short-term hazardous material transportation impacts will occur because no chemical or radioactive material will be transported.	
Geology and Soils (SEIS Section 4.4.1)	There will be a SMALL impact on geology and soils. The construction, operations, and decommissioning phases will disturb surface soils during construction of the central and satellite plants, development of the wellfields, laying of pipelines, and construction of new access roads. These impacts will be temporary, and at the end of the decommissioning phase topsoil will be replaced and reseeded.	Soil layers will be irreversibly disturbed by the proposed action; however, topsoil salvaged during the construction phase will be stored and replaced during decommissioning. Therefore, the potential impact will be SMALL. Reseeding and recontouring will mitigate the impact to topsoil.	There will be a SMALL impact to geology and soils. No significant matrix compression or ground subsidence is expected because the net withdrawal of fluid from the production zone aquifers will be about 3 percent or less. Up to 98 ha [243 ac] of topsoil if deep Class V well injection is used to dispose of liquid waste and up to 175 ha [433 ac] of	There will be no long-term impacts to geology and soils following license termination.

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
			topsoil if land application is used to dispose of liquid waste will be stripped. Topsoil salvaged during the construction phase of the project will be replaced during the reclamation and reseeding processes.	
Surface Waters and Wetlands (SEIS Section 4.5.1.1)	There will be a SMALL impact to surface water and wetlands from the proposed action. The occurrence of surface water is limited, and surface water flow in channels is ephemeral except for perennial Beaver Creek. U.S. Army Corps of Engineers permits under Section 404 of the Clean Water Act will be required before conducting work in jurisdictional wetlands. The applicant will use best management practices and implement a storm water pollution management plan to ensure surface water runoff from disturbed areas meets NPDES permit limits.	There will be no irreversible and irretrievable commitment of either surface water or wetlands from implementing the proposed action. No drainage or body of water will be significantly altered by the proposed action. The impact to wetlands will be SMALL because stream flow is intermittent and the applicant will implement best management practices to control erosion, stormwater runoff, and sedimentation.	There will be a SMALL impact to surface waters and wetlands. The proposed action will not discharge to perennial or ephemeral surface water drainages.	No impact. The proposed action will not discharge to perennial or ephemeral surface water drainages.
Groundwater (SEIS Section 4.5.2.1)	There will be a SMALL impact on groundwater from implementing the proposed action by consumption of	There will be a SMALL impact on groundwater resources. Between 97 and 99.5 percent of	Short-term impacts to groundwater will include degradation of water quality in production zones	There will be no long-term impacts to groundwater resources. Both the State of South Dakota and NRC

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	groundwater, degradation of water quality in the ore production zone, and the drawdown in water levels in wells located outside the project boundaries that are drilled into the ore-bearing aquifer(s). The applicant will provide alternative water sources in the event of significant drawdown to private wells adjacent to the proposed project area. The establishment of an inward hydraulic gradient, as well as an applicant-installed groundwater monitoring network to detect potential vertical and horizontal excursions, will limit the potential for undetected groundwater excursions that could degrade groundwater quality.	groundwater used during the ISR process at the proposed project will be treated and reinjected into the subsurface and/or applied to land irrigation areas. Between 0.5 and 3 percent of groundwater will be consumed.	and the potential to draw down the water level in neighboring private wells. These impacts will be SMALL. The applicant will provide alternative water sources if water-level drawdowns affect water yields in domestic and livestock wells within and adjacent to the proposed project area.	require restoration of affected groundwater following operations. The groundwater quality will be restored to ensure that aquifers will not be affected. Although water levels will be affected in the short term, the water levels will eventually recover after operations and aquifer restoration are completed.
Ecological Resources (SEIS Section 4.6.1)	There will be SMALL to MODERATE impacts until vegetation has been reestablished, and then the impact will be SMALL. Construction and decommissioning of the proposed Dewey-Burdock Project will result in short-term loss (over the ISR facility	Vegetative communities directly impacted by earthmoving activities and wildlife injuries and mortalities will be irreversible. However, the implementation of mitigation measures, such as the use of fencing to limit wildlife	During any of the ISR phases, SMALL direct impacts to ecological resources could include injuries and fatalities to wildlife caused by either collisions with project-related traffic or habitat damage due to the removal of topsoil.	Some of the vegetative communities that exist within the proposed Dewey-Burdock Project could be difficult to reestablish through artificial plantings, and natural seeding could take many years resulting in

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	lifecycle) of vegetation on approximately 98 ha [243 ac] if deep Class V well injection is used to dispose of liquid wastes and approximately 566 ha [1,398 ac] if land application is used to dispose of liquid wastes. The short-term loss of vegetation could stimulate the introduction and spread of undesirable and invasive, nonnative species, and displacement of wildlife species. During operations and aquifer restoration, use of fences will limit wildlife ingress and egress to wellfields	movement and the applicant's enforcement of speed limits, will reduce potential impacts to wildlife. Furthermore, areas impacted by earthmoving activities will be reclaimed and reseeded.	Habitat disruption will consist of scattered, confined drill sites for the deep Class V injection well option. Large transformation of the existing habitat would be a MODERATE impact during the decommissioning phase of the deep Class V injection well disposal option and during all facility lifecycle phases of the land application option. Wildlife could be temporarily displaced by increased noise and traffic during either waste disposal option. The applicant has committed to implement mitigation measures to reduce the potential impact to SMALL for wildlife species.	MODERATE long-term impacts. Wildlife species associated with those communities could experience SMALL to MODERATE long-term impacts if animal populations are reduced in number or replaced by other species with broader habitat requirements.
Meteorology, Climatology, and Air Quality (SEIS Section 4.7.1)	There will be a SMALL to MODERATE impact to air quality. During all four phases, the generation of air pollutants results in the degradation of air quality. Pollutant concentrations will be lower than NAAQS and PSD Class II regulatory thresholds expect for the PM_{10} 24-hour	There will be no irreversible or irretrievable commitment of air resources from the proposed action.	There will be SMALL to MODERATE impacts. Fugitive dust generated from the construction phase and peak year (i.e., when all four phases occur simultaneously) has the potential to result in short-term, intermittent impacts in and	No impact. There will be no long-term effect on air quality either from the proposed project or following license termination.

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	Class II PSD increment for the construction and peak year when all four phases occur simultaneously. Due to the level and nature of fugitive emissions, there is potential for intermittent impacts to localized areas in and around the proposed site. Project specific modeling results for the Wind Cave National Park (i.e., Class I PSD, visibility, and acid deposition) are below applicable thresholds.		around the site particularly when vehicles travel on unpaved roads. The effect will be localized and temporary. Use of mitigation measures, such as applying water for dust suppression, will limit fugitive dust emissions.	
Noise (SEIS Section 4.8.1)	There will be a SMALL impact. Two onsite dwellings (Daniel residence and Beaver Creek Ranch Headquarters) will experience noise above background levels due to their proximity to wellfields and land application areas. However, noise impacts at these residences will be short term, intermittent, and mitigated by sound abatement controls on operating equipment. Noise impacts to raptors will be mitigated by adhering to timing and spatial restrictions within	Not applicable.	There will be a SMALL impact on two onsite dwellings (Daniel residence and Beaver Creek Ranch Headquarters) due to their proximity to wellfields and land application areas. However, noise impacts at these residences will be short-term, intermittent, and mitigated by sound abatement controls on operating equipment.	No impact. There will be no noise impact following license termination.

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	specified distances of active raptor nests as determined by appropriate regulatory agencies (e.g., BLM, FWS, and SDGFP).			
Historic and Cultural Resources (SEIS Section 4.9.1)	Impact on historic and cultural resources during the ISR construction phase will be SMALL to LARGE. To mitigate the impact, NRC, BLM, SD SHPO, tribes, and the applicant will develop and execute an agreement that will formalize treatment plans for adversely impacted resources during construction. If NRHP-eligible sites cannot be avoided, then treatment plans will be developed. If other historic and cultural resources are encountered during the ISR lifecycle, the applicant is required by license condition to stop work. Work will not restart without authorization from the NRC, SD SHPO, and BLM.	If archaeological and historic sites cannot be avoided, or the impacts to these sites cannot be mitigated, this could result in an irreversible and irretrievable loss of cultural resources.	There will be a SMALL to LARGE impact on historic and cultural resources during the ISR construction phase. The development of an agreement between NRC, BLM, SD SHPO, tribes, and the applicant will address adverse impacts to cultural and historic sites and historic properties of traditional religious and cultural importance to Native American tribes. If any unidentified historic or cultural resources are encountered, the applicant is required by license condition to stop work. Work will not restart without authorization from the NRC, SD SHPO, and BLM.	If potential impacts from implementation of the proposed action are not mitigated, then long-term impacts to cultural and historic resources will result.
Visual and Scenic Resources (SEIS Section 4.10.1)	There would be a SMALL impact on the visual landscape. Visual impacts from drilling and earthmoving activities that generate fugitive	No impact.	There will be a SMALL short-term impact to the visual landscape from implementing the proposed action. The activities will be consistent with	No impact. There will be no impact on the visual landscape following license termination.

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	dust will be short term. Mitigation measures will be implemented to reduce fugitive dust and visual impacts from buildings. Center pivot irrigation systems in proposed land application areas in the Dewey area will be visible to travelers on Dewey Road; however, Dewey Road is lightly traveled with few residences. Proposed activities will be consistent with the BLM VRM Class III and IV designation for the area.		the BLM VRM Class III and IV designation of the area and the existing natural resource exploration activities in the area.	
Socioeconomics (SEIS Section 4.11.1)	Implementing the proposed action will have a SMALL socioeconomic impact over the life of the project.	Not applicable.	Implementing the proposed action will have a SMALL impact on local communities.	Following license termination, workers who supported activities at the Dewey-Burdock site will need to find other employment. There will be a loss of revenue to nearby communities, Fall River and Custer Counties, and the state following license termination.
Environmental Justice (SEIS Section 4.12.1)	There will be no disproportionately high and adverse impacts to minority or low-income populations from the construction, operation, aquifer	Not applicable.	Implementing the proposed action will have a SMALL impact on environmental justice. There will be no disproportionately	There will be no long-term environmental justice impacts following license termination. While certain Native Americans have a

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	restoration, and decommissioning of the proposed Dewey-Burdock ISR Project. While certain Native Americans may have a heightened interest in cultural resources potentially affected by the proposed action, the impacts to Native Americans in this and other areas is not expected to be disproportionately high or adverse.		high and adverse impacts to minority or low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project.	heightened interest in cultural resources potentially affected by the proposed action, the impacts to Native Americans in this and other areas is not expected to be disproportionately high or adverse. To the extent there might be adverse impacts to historic and cultural sites of interest to Native Americans, these impacts will be mitigated by an agreement that will formalize treatment plans during construction. If NRHP-eligible sites cannot be avoided, treatment plans will be developed. If other historic and cultural resources are encountered during the ISR lifecycle, the applicant is required by license condition to stop work. Work will not restart without authorization from the NRC, SD SHPO, and BLM.
Public and Occupational Health (SEIS Section 4.13.1)	There will be a SMALL impact on public and occupational health. Construction and decommissioning will generate fugitive dust emissions that will not result in a	Not applicable.	There will be a SMALL impact from radiological exposure. Dose calculations under normal operations showed that the highest potential dose within the	No impact. There will be no long-term impact to public and occupational health following license termination.

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	significant dose to the public or site workers. The emissions from construction equipment will be of short duration and readily dispersed into the atmosphere.		proposed project area is 6 percent of the 1 mSv [100 mrem] per year public dose limit specified in NRC regulations. The radiological impacts from accidents will be SMALL for workers if procedures to deal with accident scenarios are followed, and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health impacts from normal operations, accidents, and chemical exposures will be SMALL if handling and storage procedures are followed.	
Waste Management (SEIS Section 4.14.1)	Solid byproduct material generation and disposal from activities implemented during all postconstruction phases of the Dewey-Burdock ISR Project will result in SMALL impacts on available disposal capacity, because permitted facilities are available to accept the wastes. Disposal of treated liquid byproduct	The energy consumed during the ISR phases, the construction materials used that could not be reused or recycled, and the space used to properly handle and dispose of all waste types (i.e., wells for liquid wastes and permitted disposal space of solid wastes) will represent an	During all phases, hazards associated with handling and transport of wastes will represent a short-term and SMALL impact.	During all phases, permanent disposal of liquid wastes in onsite injection wells will represent a SMALL impact on the long-term productivity of the land allocated for these wells. Buildup of constituents in soil from potential land application of treated liquid wastes could affect productivity of irrigated land, but

Table 9-1. Summary of Environmental Impacts of the Proposed Action (Cont'd)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
	material using Class V injection, land application, or a combination of both will be conducted in accordance with NRC effluent discharge limits in 10 CFR Part 20, Appendix B and EPA (Class V well) or state (land application) permit conditions, and impacts will be SMALL. During decommissioning, the amount of nonhazardous solid waste will exceed available local landfill capacity and will result in MODERATE impacts unless local capacity is expanded prior to decommissioning or waste is shipped to a larger regional landfill; then impacts will be SMALL.	irretrievable commitment of resources, resulting in a SMALL to MODERATE impact.		proposed monitoring is expected to detect potential problems early, resulting in a SMALL impact.

9.3 References

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Calvin Harlan
Omaha Tribe of Nebraska
Tribal Historic Preservation Office
Macy, NE

Marshall Gover
Pawnee Nation of Oklahoma
Tribal President
Pawnee, OK

Gordon Adams
Pawnee Nation of Oklahoma
Tribal Historic Preservation Office
Pawnee, OK

11.3 State Agency Officials

Matt Hicks
South Dakota Department of Environment and Natural Resources
Pierre, SD

Mike Cepak
South Dakota Department of Environment and Natural Resources
Pierre, SD

Paige Olson
State Historic Preservation Office
Pierre, SD

Stan Michals
South Dakota Game, Fish, & Parks Department
Pierre, SD

Mike Fosha
South Dakota State Historical Society, Archaeological Research Center
Rapid City, SD

Roger Campbell
Office of Tribal Government Relations
Pierre, SD

Mary Cerney
Governor's Office of Economic Development
Pierre, SD

11.4 Local Agency Officials

David Green
Custer County Planning and Economic Development
Custer, SD

Bill Curran
Edgemont Area Chamber of Commerce
Edgemont, SD

Lisa Scheinost
Edgemont Area Chamber of Commerce
Edgemont, SD

11.5 Other Organizations and Individuals

Richard Blubaugh
Powertech USA, Inc.
Greenwood Village, CO

Mark Hollenbeck
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The Lakota People's Law Project
Rapid City, SD

Cindy Gillis
Counsel for the Oglala Sioux Tribe
Gonzalez Law Firm
Rapid City, SD

Martha Graham
SRI Foundation
Rio Rancho, NM

Edgemont Public Library
Edgemont, SD

Rapid City Public Library
Rapid City, SD

Custer County Library
Custer, SD

Weston County Library
Newcastle, WY

Hot Springs Public Library
Hot Springs, SD

Susan Henderson
Edgemont, SD

Dayton Hyde
The Black Hills Wild Horse Sanctuary
Hot Springs, SD

APPENDIX A

CONSULTATION CORRESPONDENCE