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United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1910
Supplement 4, Vol. 2

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

Draft Report for Comment

Chapter 5 and Appendices

United States Nuclear Regulatory Commission Official Hearing Exhibit			
In the Matter of:	POWERTECH USA, INC. (Dewey-Burdock In Situ Uranium Recovery Facility)		
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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 and byproduct 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 draft Supplemental Environmental Impact Statement (SEIS) to evaluate the potential environmental impacts from the applicant proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium facility at the proposed Dewey-Burdock ISR Project. This draft SEIS describes the environment potentially affected by the proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes the applicant environmental monitoring program and proposed mitigation measures. In conducting its analysis in this draft 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 preliminary NRC staff recommendation is that a source and byproduct material license for the proposed action be issued as requested, unless safety issues mandate otherwise.

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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

CONTENTS (continued)

Section | Page

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

Section Page

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

Section Page

CONTENTS (continued)

Section Page

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

Section Page

CONTENTS (continued)

Section | Page

FIGURES

FIGURES (continued)

Figure Page

FIGURES (continued)

Figure Page

TABLES

Table Page

TABLES (continued)

Table Page

TABLES (continued)

Table Page

TABLES (continued)

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 and byproduct 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 would 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 the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specified geographic regions of the western United States. The proposed 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 draft 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 preliminary recommendation regarding the proposed action.

This draft 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 (POO) 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 POO to BLM for the Dewey-Burdock ISR Project on August 26, 2009. Powertech modified the POO 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 and byproduct 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. 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 minerals that the U.S. Government reserved under the Stock-Raising Homestead Act. The BLM federal decision is to either approve the Powertech-modified POO subject to mitigation included in the license application and this draft SEIS, or deny approval of the POO. BLM's responsibility to respond to the POO 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 would be

affected by proposed ISR operations would 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 ore body) through injection wells. Typically, a lixiviant uses native groundwater (from the production zone aquifer), carbon dioxide, and sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As the lixiviant circulates 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 ore body, 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.

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 draft 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 draft 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 draft 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 draft 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 ISR Facility Phase

<u>Land Use</u>

<u>Construction</u>: 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 to build surface facilities, develop the initial wellfields and the attendant infrastructure, and construct access roads. Livestock grazing and recreational activities will be excluded from fenced areas surrounding the central plant, satellite facility, surface impoundments, and wellfields.

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 sequentially developed resulting in the disturbance of approximately 57 ha [140 ac]. 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. Land use impacts during the decommissioning phase will be similar to those experienced during the construction phase. 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 to MODERATE. Dewey Road, the road nearest the proposed site, will experience a sixteenfold increase in daily vehicle traffic during the ISR construction phase. This increase in traffic will 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 significantly impacted by the construction traffic.

Operation: Impacts will be SMALL to MODERATE. Dewey Road, the road nearest the proposed site, will experience a fivefold increase in daily vehicle traffic during the ISR operations phase. This increase in traffic will 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 progressed. The decrease in the supply shipments, waste shipments, and employee

commuting (because fewer workers will be involved) will reduce the potential for spills or leakage from accidents.

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 operation phase will not remove rock matrix or structure 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 a underground injection control (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. Potential soil contamination in proposed land application areas will be mitigated by implementing soil collection and monitoring 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 Permit (GDP) issued by South Dakota Department of Environmental 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 or structure. 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 lateral 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 intermittent. 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 storm water pollution management plan (SWMP) will control storm water 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 and storage ponds will be constructed with liners, underdrains, and leak detection systems. 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 and storage ponds will be constructed with liners, underdrains, and leak detection systems. 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 cleanup, 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 project boundary 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.

Aquifer Restoration: Impacts will be SMALL to MODERATE. 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 project boundary 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. Hydraulic connection (leakage) between production aquifers (Fall River and Chilson aquifers) through the intervening confining unit (Fuson Shale) in the Burdock area may impact aquifer restoration. The Fall River aquifer is hydraulically connected to abandoned open pit mines in the Burdock area. Water in the abandoned open pit mines has elevated dissolved uranium and gross alpha concentrations exceeding EPA-regulated maximum concentration levels. If contaminants are drawn into production zones within the Chilson aquifer from abandoned open pit mines through the hydraulically connected Fall River aquifer during aquifer restoration, the impacts will be MODERATE.

During the aquifer restoration phase, 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. Postrestoration groundwater quality will be protective of public health and the environment.

<u>Decommissioning</u>: 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

<u>Construction</u>: 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. 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 and netting will 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 around the proposed project site from the construction phase combustion emissions are below NAAQS and Prevention of Significant Deterioration (PSD) Class II regulatory thresholds. This also holds true for the peak year pollutant emission levels. The peak year accounts for when all four phases occur simultaneously and represents the highest amount of emissions the proposed action will generate in any one project year. The construction phase and peak year fugitive dust concentrations are also below NAAQS and PSD Class II thresholds. However, the mass of particulate matter generated from fugitive emissions

is much greater than that generated from combustion emissions. In addition, these fugitive dust emission sources 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. The initial air dispersion modeling the applicant conducted only considered the area in and around the proposed site. The applicant committed to perform additional air dispersion modeling before the final SEIS is prepared (Powertech, 2012). Meanwhile, based on the modeling results from a similar project, the Dewey-Burdock ISR Project will contribute to visibility impacts at Wind Cave National Park but the impact magnitude will be minimal.

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 amount of land disturbed. However, these differences are relatively small and NRC staff do not expect to see any appreciable difference in the overall air emission levels between the two disposal options. Therefore, the impact magnitudes are expected to be the same.

<u>Operation</u>: Impacts will be SMALL to MODERATE. Combustion emission and 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 around the proposed site will be below NAAQS and PSD Class II regulatory thresholds. However, due to the level and nature of the 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. The Dewey-Burdock ISR Project will contribute to visibility impacts at Wind Cave National Park but the impact magnitude will be minimal.

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

<u>Aquifer Restoration</u>: Impacts will be SMALL to MODERATE. 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 and wind erosion can generate more fugitive emissions than travel on unpaved roads. Fugitive emissions can result in short-term, intermittent impacts to localized areas. 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 about twice 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 to MODERATE. The decommissioning phase pollutant sources and emission levels closely match those from the operation phase. Therefore, the decommissioning phase will produce the same impact magnitude as the operation phase. As in the operation phase described previously, NRC staff do not expect to see any appreciable difference in the overall decommissioning phase air emission levels between the Class V injection well and land application disposal options.

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 return to 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 Daniels 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 Health and Safety Administration (OSHA) regulatory limits and be mitigated by use of personal hearing protection. Noise impacts to raptors will be mitigated by adhering to FWS and SDGFP seasonal noise guidelines, locating all planned facilities outside of BLM-recommended buffer zones of all raptor nests, and following an FWS-approved raptor monitoring and mitigation plan.

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-WF-7). In addition, the Daniels 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 Daniels residence will be short term (1 to 2 years each for wellfields B-WF6 and B-WF7). In addition, the Daniels 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 progressed. 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 may potentially be disturbed during construction. Within the area of potential effect at the proposed Dewey-Burdock site, 18 historic sites are either listed in the National Register of Historic Places (NRHP) or eligible for listing in the NRHP. Based on the proposed location of ISR facilities and infrastructure, avoidance of 12 of these sites is possible during the construction phase and, therefore, no impacts are anticipated. Avoidance and mitigation, such as fencing and data recovery excavations, are recommended for the remaining six NRHP-eligible sites. In addition, avoidance is recommended for two unevaluated historic burial sites located in proximity to proposed construction activities until their NRHP eligibility is determined. Avoidance and mitigation is also recommended for 4 unevaluated site located within 76 m [250 ft] of proposed wellfields or land application areas.

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. Prior to construction, the applicant will also develop an Unexpected Discovery Plan that will outline the steps required if unexpected historical and cultural resources are encountered.

Consultation efforts to identify properties of religious and cultural significance to Native American tribes have not been completed. Thus, NRC cannot determine effects to these properties at this time. Section 106 consultation between NRC, SD SHPO, BLM, tribal representatives, and the applicant regarding potential impacts to these sites is ongoing.

Operation: Impacts will be SMALL. Minimal impacts will result during the operations phase because impacts to cultural resources will be mitigated before facility construction and identified resources will be avoided. If historical or cultural resources are encountered during operations, the Unexpected Discovery Plan will be implemented. Work would stop in the immediate area, and appropriate agencies would be notified.

Aquifer Restoration: Impacts will be SMALL. Impacts to historical and cultural resources during the aquifer restoration phase will be similar to operations. Minimal impacts will result because impacts to cultural resources will be mitigated before facility construction, and identified resources will be avoided. If historical or cultural resources are encountered during operations, the Unexpected Discovery Plan will be implemented. Work would stop in the immediate area, and appropriate agencies would be notified.

Decommissioning: Impacts will be SMALL. Minimal impacts will result during the decommissioning phase because impacts to cultural resources will be mitigated prior to facility construction. If historical or cultural resources are encountered during operations, the Unexpected Discovery Plan will be implemented. Work would stop in the immediate area, and appropriate agencies would be notified.

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 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 closest population 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 will be no different than those experienced by other populations. The proposed action may potentially affect certain sites of religious and cultural significance to Native American tribes; however, the impacts to such sites could 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 draft 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 would generate primarily regional and local costs and benefits. The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Costs associated with the proposed 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 would outweigh the economic, environmental, and social costs.

COMPARISON OF ALTERNATIVES

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

PRELIMINARY RECOMMENDATION

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.71(f), set forth its preliminary NEPA recommendation regarding the proposed action (issuing a source material license for the proposed Dewey-Burdock ISR Project). Unless safety issues mandate otherwise, the preliminary NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that a source and byproduct material license for the proposed action be issued as requested.

The NRC staff conclude that the overall benefits of the proposed action outweigh the environmental disadvantages and costs based on the following:

- Potential adverse impacts to all environmental resource areas are expected to be SMALL, with the exception of

    1. Land use resources during decommissioning. Land disturbance during decommissioning will be MODERATE until vegetation is reestablished in seeded areas (see SEIS Sections 4.2.1.1.4, 4.2.1.2.4, and 4.2.1.3).

    2. Transportation resources during construction and operation. Increases in traffic during construction and operations will have a MODERATE impact on Dewey Road, the road nearest the proposed site (see SEIS Sections 4.3.1.1.1, 4.3.1.2.1, 4.3.1.1.2, 4.3.1.2.2, and 4.3.1.3).

    3. Groundwater resources during aquifer restoration. During aquifer restoration in the Burdock area, drawdown-induced migration of contaminants into the production zone (i.e., the Chilson aquifer) from abandoned open pit mines could adversely affect restoration goals and have a MODERATE impact (see SEIS Sections 4.5.2.1.1.3, 4.5.2.1.2.3, and 4.5.2.1.3).

    4. Ecological resources during construction, operations, aquifer restoration, and decommissioning. Under the land application and combined Class V deep well disposal and land application options, construction, operations, and aquifer

restoration activities would have a MODERATE impact on vegetation, small- to medium-sized mammals, raptors, nongame and migratory birds, and reptiles (see SEIS Sections 4.6.1.2.1, 4.6.1.2.2, 4.6.1.2.3, and 4.6.1.3). Under all disposal options, land-disturbing activities during decommissioning would have a MODERATE impact on vegetation until it is reestablished (see SEIS Sections 4.6.1.1.4, 4.6.1.2.4, and 4.6.1.3).

5. Air quality during construction, operations, aquifer restoration, and decommissioning. During all phases of the ISR lifecycle, there will be the potential for MODERATE air impacts from short-term, intermittent fugitive dust emissions (see SEIS Sections 4.7.1.1.1 through 4.7.1.1.4, 4.7.1.2.1 through 4.7.1.2.4, and 4.7.1.3).

6. Historical and cultural resources during construction. Construction could have a MODERATE or LARGE impact on 18 historic properties—those sites currently listed or eligible for listing on the NRHP—and other unevaluated historic, cultural, and religious properties in the project area (see SEIS Sections 4.9.1.1.1, 4.9.1.2.1, and 4.9.1.3).

7. Waste management resources during decommissioning. Impacts from disposal of nonhazardous solid waste may be MODERATE depending on the long-term status of existing local landfill resources (see SEIS Sections 4.14.1.1.4 and 4.14.1.2.4).

- Regarding groundwater, the portion of the aquifer(s) designated for uranium recovery must be exempted as underground sources of drinking water prior to the start of ISR operations. Additionally, the applicant will be required to monitor for excursions of lixiviant from the production zones and to take corrective actions in the event of an excursion. Prior to operations, the applicant will be required to provide detailed hydrologic pump test data packages and operational plans for each wellfield at the proposed project. The applicant will also be required to restore groundwater parameters affected by ISR operations to levels that are protective of human health and safety.

- The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.

- The regional benefits of building the proposed project will be increased employment, economic activity, and tax revenues in the region around the proposed site.

This preliminary recommendation is based on NRC staff's independent review of (i) the license application the applicant submitted; (ii) applicant responses to NRC staff requests for additional information; (iii) consultation with federal, state, tribal, and local agencies; and (iv) the assessments summarized in this draft SEIS, including the potential mitigation measures identified in the license application and this draft SEIS.

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.

43 CFR Part 3800. Code of Federal Regulations, Title 43, *Public Lands: Interior*, Part 3800. *"Mining Claims Under the General Mining Laws."* Washington, DC: U.S. Government Printing Office.

43 CFR Subpart 3809. Code of Federal Regulations, Title 43, *Public Lands: Interior*, Subpart 3809. *"Subsurface Management."* 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.

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated With NMSS Programs." Washington, DC: NRC. August 2003.

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 reasonably achievable
AUM	animal unit month
APE	area of potential effect
ARC	Archaeological Research Center
ARPA	Archaeological Resources Protection Act
ARSD	Administrative Rules of South Dakota
ASLB	Atomic Safety and Licensing Board
AWEA	American Wind Energy Association
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BHNF	Black Hills National Forest
BLM	U.S. Bureau of Land Management
BMP	best management practice
BNSF	Burlington Northern Santa Fe
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
cpm	counts per minute
CPP	central processing plant
dBA	decibels
DM&E	Dakota Minnesota and Eastern (Railroad)
DOE	U.S. Department of Energy
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*

ABBREVIATIONS/ACRONYMS (continued)

FRA	Federal Railroad Administration
FWS	U.S. Fish and Wildlife Service
GCRP	U.S. Global Change Research Program
GDP	Groundwater Discharge Permit
GEIS	generic environmental impact statement
GHG	greenhouse gas
GPS	global-positioning-system
HABS	Historic American Buildings Survey
HDPE	high-density polyethylene
ID	well identification
IQR	interquartile range
ISL	*in-situ* leach
ISR	i*n-situ* recovery
IX	ion exchange
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MILDOS	computer code
MIT	mechanical integrity test
MOA	Memorandum of Agreement
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 on Radiation Protection and Measurements
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966, as amended
NOGCC	Nebraska Oil and Gas Conservation Commission
NPDES	national pollutant discharge elimination system
NPWRC	Northern Prairie Wildlife Research Center
NRC	U.S. Nuclear Regulatory Commission
NRCS	National 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
PABJh	Palustrine Aquatic Bed Intermittently Flooded Diked
PEM	Palustrine Emergent
PEMC	Seasonally Flooded
POO	Plan of Operations

ABBREVIATIONS/ACRONYMS (continued)

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	regional management plan
RO	reverse osmosis
ROI	region of influence
ROW	right of way
SDCL	South Dakota Codified Law
SDDENR	South Dakota Department of Environment and Natural Resources
SDDOA	South Dakota Department of Agriculture
SDDOE	South Dakota Department of Education
SDDOH	South Dakota Department of Health
SDDOL	South Dakota Department of Labor
SDDOT	South Dakota Department of Transportation
SDDLR	South Dakota Department of Labor and Regulation
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
SMCL	secondary maximum concentration limit
SNAP	Supplemental Nutrition Assistance Program
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	storm water pollution management plan

ABBREVIATIONS/ACRONYMS (continued)

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
UMTRCA	Uranium Mill Tailings Radiation Control Act
UIC	underground injection control
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
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
WSDOT	Washington State Department of Transportation
WUS	waters of the United States
WYOGCC	Wyoming Oil and Gas Conservation Commission

5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of the National Environmental Policy Act of 1969, as amended (NEPA), are found in 40 CFR Parts 1500–1508. Cumulative effects are defined in 40 CFR 1508.7 as

> "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

Cumulative effects or impacts[1] can result from individually minor but collectively significant actions taking place over a period of time. This SEIS considers the cumulative impacts of past, present, and future actions in the proposed project area. These actions include oil and gas production; coal mining and coal bed methane operations; gold, sand, gravel, and limestone mining; ISR operations; conventional uranium mining; wind farms; and livestock grazing.

The identification of cumulative impacts of the proposed action resulted from an analysis of an extensive body of publicly available information on ongoing and proposed federal projects, information presented in the Generic Environmental Impact Statement (GEIS) (NRC, 2009a), and review of the literature of the environmental and socio-economic conditions in South Dakota and in the nearby communities.

A number of uranium exploration and oil and gas operations are underway within 16 km [10 mi] of the proposed Dewey-Burdock ISR Project. Several ISR uranium projects within the broader region of the proposed Dewey-Burdock ISR Project are in the operation, licensing, or prelicensing stages. Oil and gas operations are underway throughout the area. There is potential for wind energy generation within and in the vicinity of the proposed project area. The Nuclear Regulatory Commission (NRC) anticipates growth in extraction of coal, coal bed methane, and limestone, as well as government support for and industry interest in developing transmission and transportation infrastructure at distances beyond 16 km [10 mi] from the Dewey-Burdock site.

The GEIS (NRC, 2009a) provides a methodology for conducting a cumulative impacts assessment following CEQ guidance (CEQ, 1997). SEIS Section 5.1.1 describes past, present, and reasonably foreseeable future actions identified and analyzed in the cumulative impacts analysis. The methodology NRC staff used in conducting the cumulative impact analysis in this SEIS is described in Section 5.1.2.

5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The proposed Dewey-Burdock ISR Project is located within the Nebraska-South Dakota-Wyoming Uranium Milling Region defined in the GEIS (NRC, 2009a). This region

[1]In this SEIS, "cumulative impacts" is deemed synonymous with "cumulative effects."

encompasses parts of Sioux and Dawes Counties in Nebraska; Fall River, Custer, Pennington, and Lawrence Counties in South Dakota; and Niobrara, Weston, and Crook Counties in Wyoming (Figure 5.1-1). The Nebraska-South Dakota-Wyoming Uranium Milling Region holds significant reserves of uranium and has a history of conventional uranium surface mining (NRC, 2009a). Other natural resources that are currently being exploited within the milling region and in surrounding counties include oil and gas, wind, coal, coal bed methane, limestone, and gold. Federal agencies have completed several environmental impact statements (EISs) related to activities within the Nebraska-South Dakota-Wyoming Uranium Milling Region. Most of these EISs are related to resource management actions on federal lands administered by the U.S. Forest Service (USFS) or U.S. Bureau of Land Management (BLM) and are focused on improving natural resources conditions and reducing adverse impacts from various human-related activities.

The various past, present, and reasonably foreseeable future actions in the vicinity of the proposed Dewey-Burdock ISR Project are discussed next.

5.1.1.1 Uranium Recovery Sites

Uranium milling operations within the Nebraska-South Dakota-Wyoming Uranium Milling Region exist in the Crow Butte Uranium District located in northwestern Nebraska, in the Southern Black Hills Uranium District in southwestern South Dakota and east-central Wyoming, and in the Northern Black Hills Uranium District in northeastern Wyoming (Figure 5.1-2). Existing and potential uranium recovery sites in the Nebraska-South Dakota-Wyoming Uranium Milling Region are listed in Table 5.1-1.

Seven ISR facilities and one uranium recovery and mill tailings facility licensed under Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II are in the region. The only operating ISR facility is at Crow Butte in Dawes County, Nebraska, approximately 105 km [65 mi] south-southeast of the proposed Dewey-Burdock ISR Project. Three satellite facilities or ISR expansions are planned for the Crow Butte site: North Trend, Three Crow, and Marsland. License applications for North Trend and Marsland were submitted to NRC in June 2007 and May 2012, respectively, and are under review. A license application for Three Crow was submitted in August 2010 and withdrawn and has not yet been resubmitted.

In addition to the proposed Dewey-Burdock ISR Project, the applicant has identified other potential uranium orebodies in the region at Dewey Terrace in Niobrara and Weston Counties, Wyoming, and at Aladdin in Crook County, Wyoming (Powertech, 2009b). Dewey Terrace is just west of the proposed Dewey-Burdock ISR Project in Weston and Niobrara Counties, Wyoming (Figure 5.1-3). The uranium orebodies at Dewey Terrace are a continuation of the mapped orebodies at the Dewey-Burdock site (Powertech, 2009b). To date, the applicant has not submitted a letter of intent to NRC for either Dewey Terrace or Aladdin. NRC therefore has no specific information that the applicant plans to go forward with these projects. It is also uncertain whether, if either project went forward, the applicant would seek to operate these projects as satellite facilities and ship uranium-loaded resins from Dewey Terrace or Aladdin to the proposed Dewey-Burdock site for processing into yellowcake. NRC staff and other local government agencies will monitor these potential projects, which will be discussed within the context of cumulative impacts in this SEIS based on the available information.

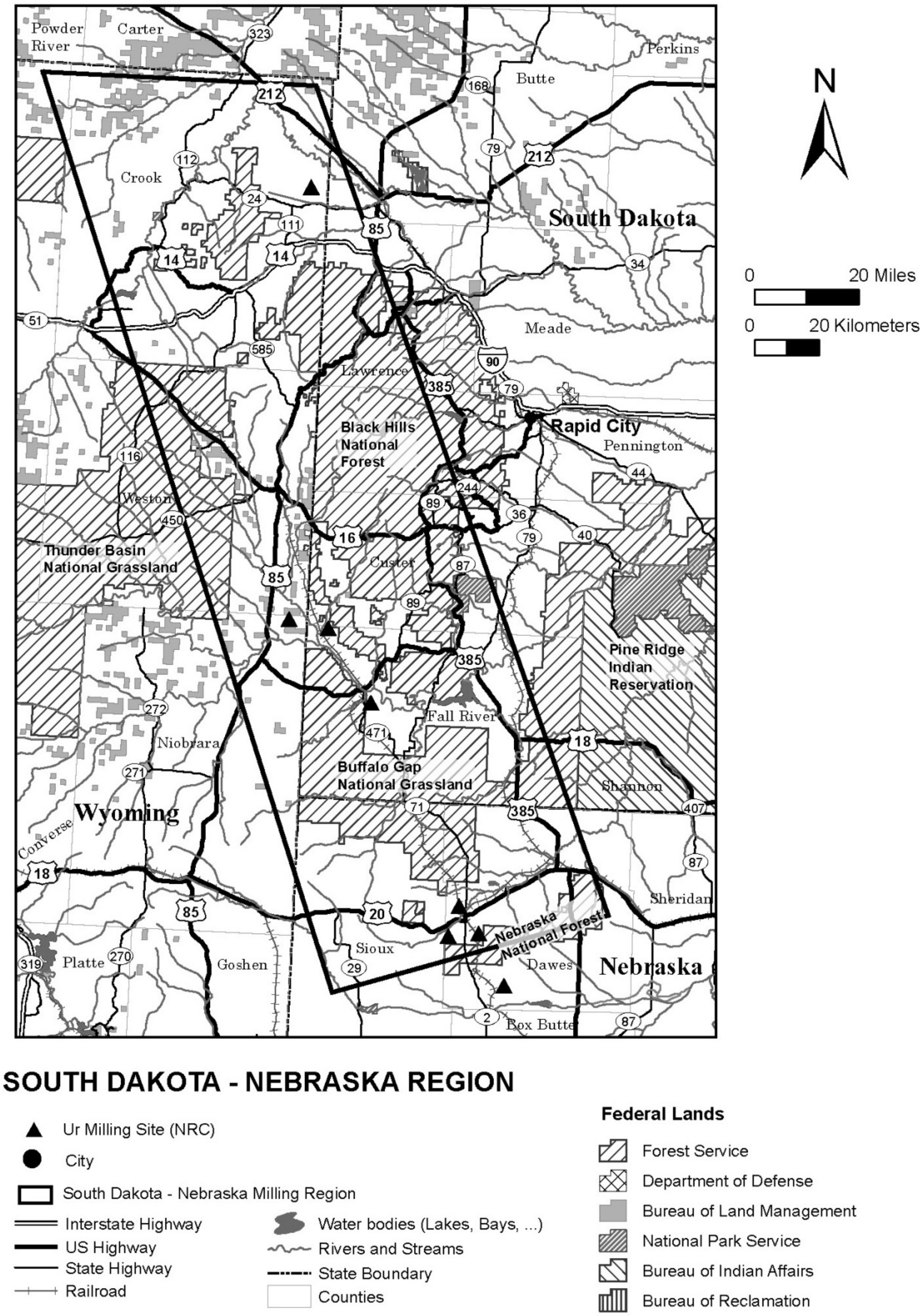

Figure 5.1-1. Nebraska-South Dakota-Wyoming Uranium Milling Region General Map With Current (Crow Butte, Nebraska) and Potential Future Uranium Milling Site Locations. Source: Modified from NRC (2009a).

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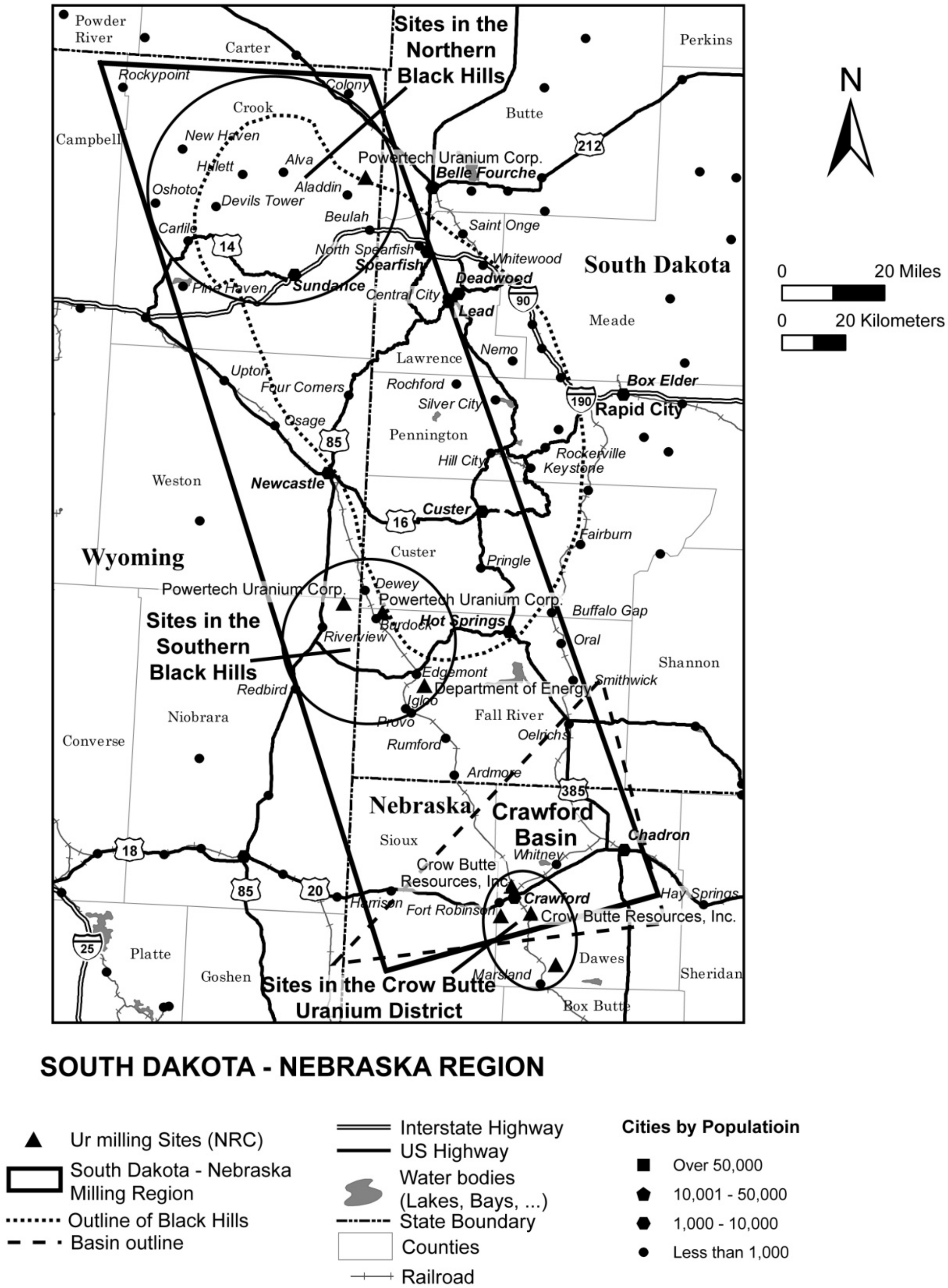

Figure 5.1-2. Map Showing the Nebraska-South Dakota-Wyoming Uranium Milling Region and Uranium Milling Sites in the Black Hills Uranium Districts in South Dakota and Wyoming and in the Crow Butte Uranium District in Nebraska.
Source: Modified from NRC (2009a).

Table 5.1-1. Past, Existing, and Potential Uranium Recovery Sites in the Nebraska-South Dakota-Wyoming Uranium Milling Region*

Site Name	Company/Owner	Type	County, State	Status†	Approximate Distance km (mi)	Direction
North Trend	Cameco (Crow Butte Resources, Inc.)	ISR—Expansion	Dawes County, Nebraska	Potential site—license application received June 2007 (under NRC review)	95 (59)	SSE
Three Crow	Cameco (Crow Butte Resources, Inc.)	ISR—Expansion	Dawes County, Nebraska	Potential site	101 (63)	SSE
Marsland	Cameco (Crow Butte Resources, Inc.)	ISR – Expansion	Dawes County, Nebraska	Potential site	129 (80)	SSE
Crow Butte	Cameco (Crow Butte Resources, Inc.)	ISR—Commercial scale	Dawes County, Nebraska	Operating	105 (65)	SSE
Edgemont	DOE	Conventional uranium mill	Fall River, South Dakota	UMTRCA† Title II disposal site	26 (16)	SSE
Dewey-Burdock	Powertech (USA) Inc.	ISR—Commercial scale	Fall River and Custer, South Dakota	Potential site—license application submitted to NRC in August, 2009	0	—
Dewey Terrace	Powertech (USA) Inc.	ISR—Expansion	Niobrara, Wyoming	Potential site	13 (8)	WNW
Aladdin	Powertech (USA) Inc.	ISR—Expansion	Crook, Wyoming	Potential site	137 (85)	NNW

*Sources: NRC (2009a, 2012); Powertech (2009b)
†Status: Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II sites are uranium mill processing or tailings sites that have been decommissioned. The U.S. Department of Energy is the long-term custodian of these sites.

The proposed Dewey-Burdock ISR Project is located within the Edgemont Uranium District on the southwestern flank of the Black Hills uplift. Uranium in the Edgemont Uranium District was first discovered in 1951 and mined until 1972. The district derived its name from the town of Edgemont, South Dakota, which was the closest population center to the district. Uranium was extracted from small conventional underground and surface mines in sandstone deposits within the Inyan Kara Group. The uranium ore was shipped to conventional mills for processing. The only uranium mill built in South Dakota was at Edgemont. The Edgemont uranium mill

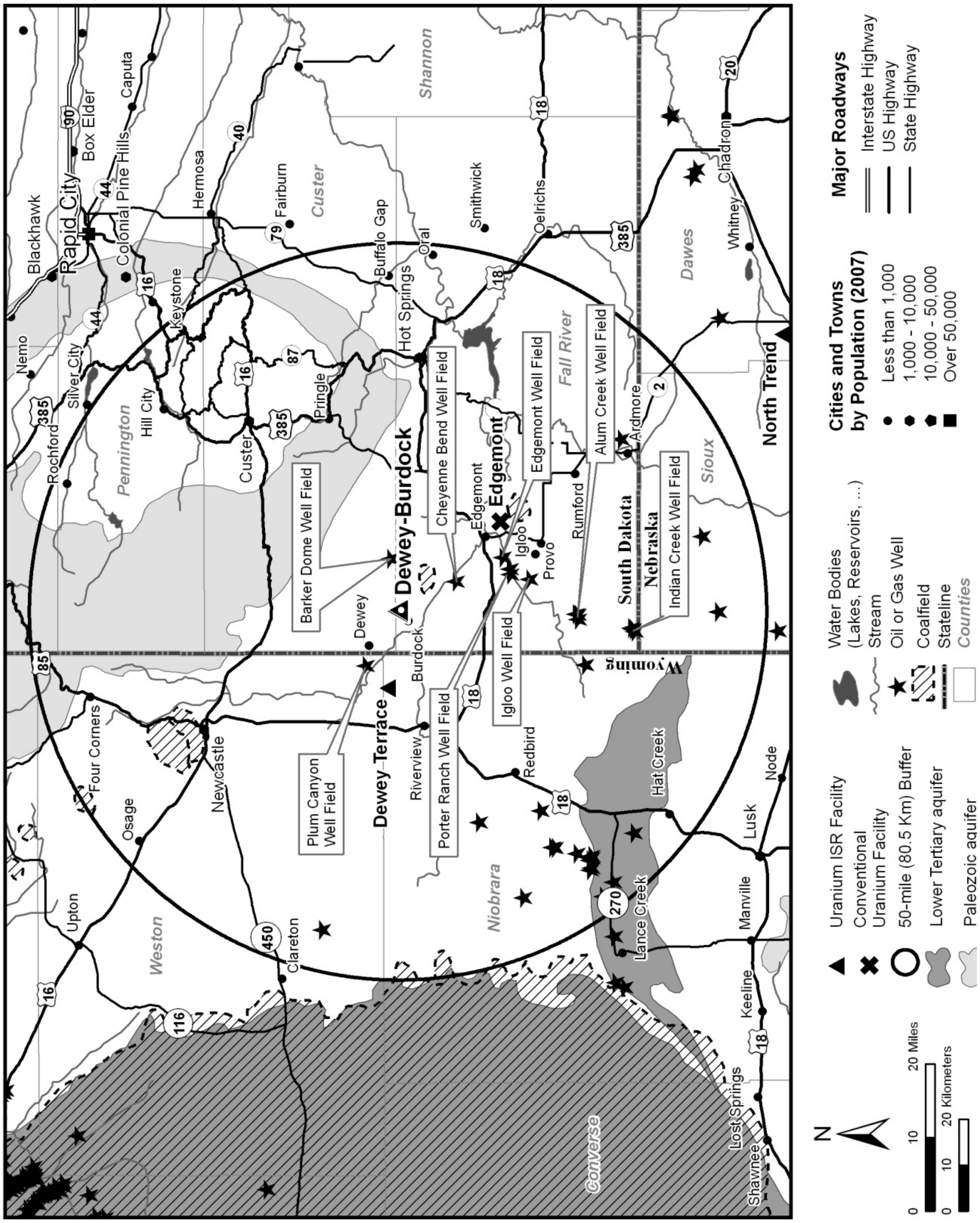

Figure 5.1-3. Oilfields, Coalfields, and Uranium Occurrences Near the Proposed Dewey-Burdock ISR Project.
Sources: ESRI (2008); National Atlas of the United States (2009); WYOGCC (2012); NOGCC (2012); SDDENR (2012a).

processed 1.78 million metric tons [1.98 million short tons] of ore and produced 3.11 million kg [6.86 million lb] of uranium oxide as U_3O_8 before it ceased production in 1974 (SDDENR, 2010). Approximately half the ore {0.9 million metric tons [1.0 million short tons] of ore containing about 1.45 million kg [3.2 million lb] of U_3O_8} processed at Edgemont was produced from deposits in South Dakota, and the other half came from out of state.

Most of the historic uranium mining operations within the Edgemont Uranium District were abandoned prior to the 1970s because they became uneconomical. Abandoned open pits and overburden piles associated with historic surface mining occur in the eastern portion of the proposed Dewey-Burdock ISR Project site (see Figure 3.2-3). Many of the abandoned mine sites in the Edgemont Uranium District are on USFS-managed property. In recent years USFS has reclaimed several abandoned mines in Fall River County, such as the Blue Lagoon, Gladiator, and Dead Horse mines (SDDENR, 2010).

The Tennessee Valley Authority (TVA) reclaimed the uranium mill at Edgemont from 1986 to 1989. The areas excavated during cleanup of the mill site at Edgemont were backfilled with clean soil, graded for proper drainage, and revegetated (SDDENR, 2010). Contaminated uranium mill buildings, tailings sands and slimes, and contaminated soil from the mill site and nearby areas were removed and placed in an engineered disposal site southeast of Edgemont (Figure 5.1-3) (SDDENR, 2010). The Edgemont disposal site is an UMTRCA Title II site owned and administered by U.S. Department of Energy (DOE) under a general NRC license for the custody and long-term care of uranium pursuant to 10 CFR Part 40.28.

Silver King Mines, Inc. (as Darrow Lease operator and manager for TVA) drilled approximately 4,000 exploration holes in the Dewey-Burdock area during the mid-1970s. TVA's uranium exploration activities in the Dewey-Burdock area ended in the early 1980s and did not result in conventional uranium mining or ISR uranium extraction (Powertech, 2009a).

5.1.1.2 Coal Mining

As discussed in GEIS Section 5.3.3, active or former coal mines have not been identified in the Nebraska-South Dakota-Wyoming Uranium Milling Region (NRC, 2009a). Based on information exchanged with BLM staff during a site visit to the project area in December 2009, past resource development in the region included exploitation of small bituminous coal deposits located east and south of the proposed Dewey-Burdock ISR Project site (NRC, 2009b). This information is consistent with isolated mapped coal fields located approximately 3 km [2 mi] southeast of the proposed project and approximately 6 km [4 mi] southeast of Edgemont (Figure 5.1-3).

Unlike the sedimentary formations that host commercially extractable coal deposits in the Powder River Basin in Campbell and Converse Counties, Wyoming (i.e., the Wasatch and Fort Union Formations), the sedimentary formations beneath the counties comprising the Nebraska-South Dakota-Wyoming Uranium Milling Region do not contain thick, continuous coal beds (NRC, 2009a). SEIS Section 3.4.1 describes the lithology of sedimentary formations beneath the proposed Dewey-Burdock ISR Project area as unable to support large-scale commercial coal mining.

5.1.1.3 Oil and Gas Production

Regional oil and gas exploration, production, and pipeline construction could potentially generate cumulative impacts. Coal bed methane gas extraction removes natural gas from coal beds. This form of mining is common in the Powder River Basin located 80 km [50 mi] west of the proposed Dewey-Burdock ISR Project (see Figure 5.1-3). Because the Nebraska-South Dakota-Wyoming Uranium Milling Region does not contain commercially viable coal beds, no ongoing or planned coal bed methane production occurs within an 80-km [50-mi] radius of the proposed site (Figure 5.1-3).

The status of permitted oil and gas wells in Fall River and Custer Counties in South Dakota and Niobrara and Weston Counties in Wyoming is provided in Table 5.1-2. In Fall River County, 11 oil wells are actively producing (SDDENR, 2012a). One producing oil well, one underground injection control (UIC) permitted well for salt water disposal, and six plugged and abandoned wells are located in the Cheyenne Bend oilfield 11 km [7 mi] southeast of the proposed site (Figure 5.1-3). The 10 remaining oil wells in production are located within the Edgemont, Porter Ranch, Igloo, and Alum Creek oilfields (Figure 5.1-3). The Edgemont, Porter Ranch, and Igloo oilfields are located immediately southwest of the city of Edgemont. The Alum Creek oilfield is located approximately 23 km [14 mi] southwest of Edgemont. All Fall River County producing wells are operating within the Minnelusa Formation at depths ranging from 1,081 m [3,547 ft] at the Alum Creek oilfield to 786 m [2,580 ft] at the Cheyenne Bend oilfield (SDDENR, 2012a).

In Custer County, four oil wells are in active production (SDDENR, 2012a). All four producing wells are located at the Barker Dome oilfield located 6 km [4 mi] east of the proposed site (Figure 5.1-4). The Barker Dome oilfield also contains one UIC permitted well for salt water disposal, one well that has been converted to water supply, and 18 plugged and abandoned wells. Three of the producing oil wells at Barker Dome are located in the Minnelusa Formation at total depths of 423 to 433 m [1,387 to 1,420 ft]. The fourth producing well is located in the Madison Formation at a total depth of 588 m [1,928 ft] (SDDENR, 2012a).

Weston and Niobrara Counties in Wyoming contain many more completed oil and gas production wells than Fall River and Custer Counties (Table 5.1-2). The closest producing wells to the proposed project are in the Plum Canyon oilfield 5 km [3 mi] to the northwest in Niobrara County (Figure 5.1-4) (WYOGCC, 2012). The Plum Canyon oilfield contains 4 producing wells, which are all located in the Leo Sandstone of the Minnelusa Formation at depths ranging from approximately 785 to 823 m [2,575 to 2,700 ft]. The total depths of completed wells generally increase from east to west across Weston and Niobrara Counties. For example, within the Powder River Basin, which encompasses the southwestern part of Weston County and the northwestern part of Niobrara County, many completed wells reach total depths of more than 1,981 m [6,500 ft] (WYOGCC, 2012).

Demand for drilling permits for oil and gas exploration in the vicinity of the proposed project has been low. Since 2005, South Dakota Department of Environment and Natural Resources (SDDENR) has issued 16 permits for oil and gas exploration drilling in Fall River County and no permits in Custer County (SDDENR, 2012b).

The potential effects of oil well drilling include the need to build temporary access roads to reach and construct 1.2-ha [3-ac] drill pads for each drill site (BLM, 2009a). The length of time

Table 5.1-2. Status of Permitted Oil and Gas Wells in Fall River and Custer Counties, South Dakota, and Niobrara and Weston Counties, Wyoming

County, State	Number of Plugged and Abandoned Wells	Number of Completed Wells	Number of New Permits to Drill	Permits Issued*
Fall River, South Dakota	342	11	2	396
Custer, South Dakota	72	4	0	86
Niobrara, Wyoming	1,661	383	21	2,281
Weston, Wyoming	5,252	1,568	7	7,317

Sources: SDDENR (2012a); WYOGCC (2012)
*The "Permits Issued" category includes wells currently being drilled, wells never drilled, Underground Injection Control (UIC) permitted wells, wells converted to water supply, dormant wells, and wells with expired permits

required for drilling varies with the depth of each drillhole. Seven tracts of USFS-managed land are available for oil and gas leasing in Custer County in the vicinity of the project area (BLM, 2009a). All the tracts are located within Township 6 South, Range 1 East immediately east of Dewey (see Figure 3.2-4). Two of the tracts (SDM79010BO and SDM79010BN) border the perimeter of the proposed project (Figure 5.1-4). If lease applications were filed and approved by USFS and if the leaseholders apply for SDDENR drilling permits, it is expected that exploratory drilling for oil would be conducted.

5.1.1.4 Wind Power

Because of the proximity of currently operating wind energy projects, the potential exists for the development of wind power facilities in the Nebraska-South Dakota-Wyoming Uranium Milling Region, and these facilities would contribute to meeting forecasted electric power demands. There are wind energy projects currently operating and under construction in South Dakota, Wyoming, and Nebraska (see Table 5.1-3). South Dakota's wind resource is 882,412 megawatts (MW), which ranks 5th in the United States (AWEA, 2012b). Wyoming's wind resource is 552,073 MW, which ranks 8th in the United States (AWEA, 2012c). Nebraska's wind resource is 917,999 MW, which ranks 4th in the United States (AWEA, 2012a). The current online capacity of wind energy projects is 784 MW in South Dakota, 1,412 MW in Wyoming, and 337 MW in Nebraska (AWEA, 2012a–c).

Wind projects in South Dakota, Wyoming, and Nebraska range in capacity from one turbine producing 0.1 MW to 105 turbines producing 210 MW (AWEA, 2012d). The wind power projects closest to the proposed Dewey-Burdock project site are 161 km [100 mi] to the west-southwest near Glenrock in Converse County, Wyoming. Wind power projects in Wyoming are located primarily in the southeastern part of the state (AWEA, 2012c). In South Dakota, wind power projects are located in the central and eastern parts of the state more than 241 km [150 mi] from the proposed Dewey-Burdock site (AWEA, 2012b). Wind power projects in Nebraska are located primarily in the north-central and eastern parts of the state and are also more than 241 km [150 mi] from the proposed Dewey-Burdock site (AWEA, 2012a).

The Dewey-Burdock Wind Association, LLC is a landowner group formed to explore the possibility of a wind farm (referred to herein as the Dewey-Burdock Wind Project) on privately owned land within and surrounding the proposed Dewey-Burdock ISR Project site (Powertech,

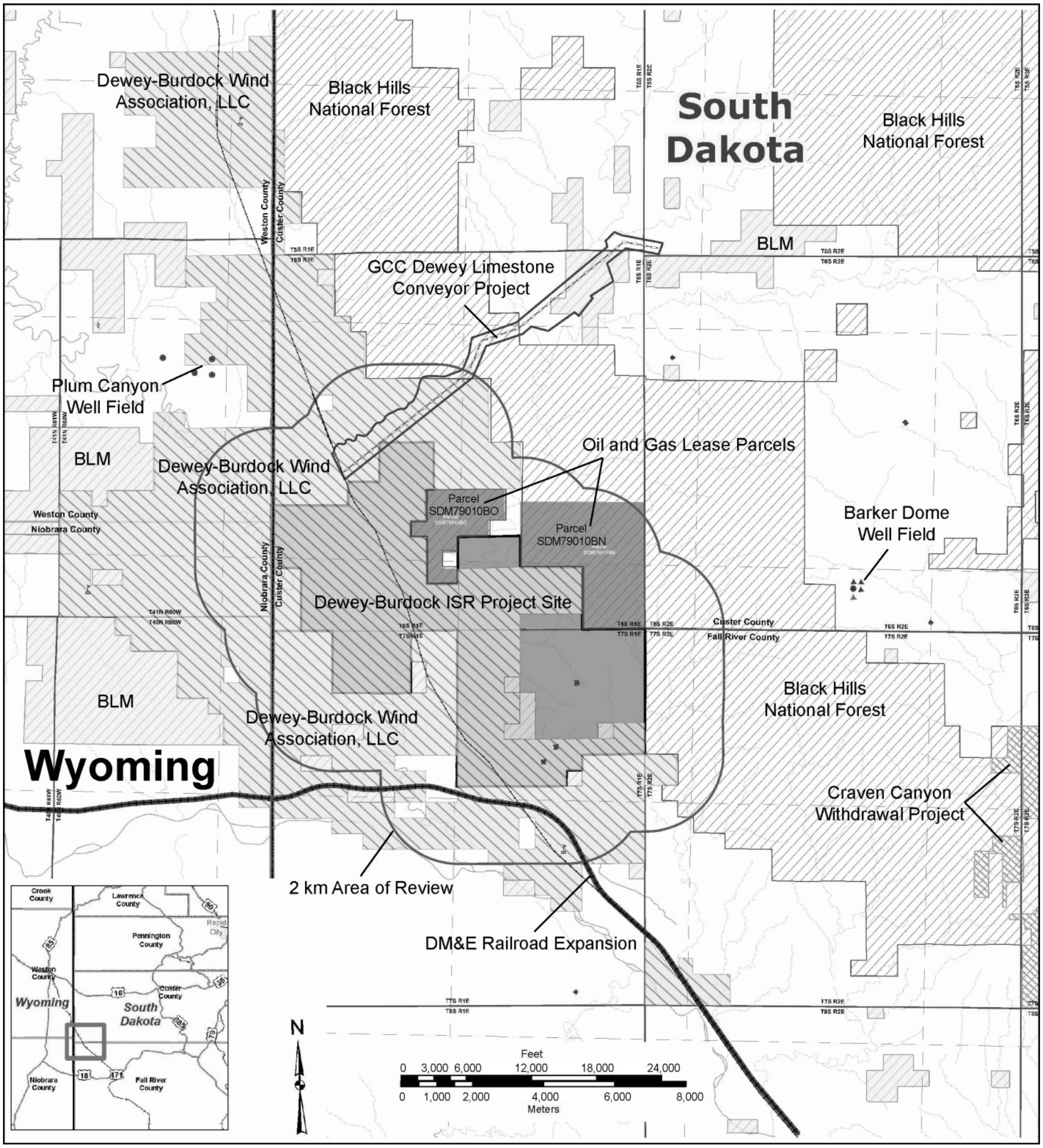

Figure 5.1-4. Existing, Pending, and Future Projects Within and in the Vicinity of the Proposed Dewey-Burdock ISR Project.
Source: Modified from Powertech (2010).

Table 5.1-3. Summary of Wind Energy in South Dakota, Wyoming, and Nebraska

State	Current Online Capacity (MW)	Capacity Added in 2010 (MW)	Wind Resource (MW at 80 m Hub Height)	U.S. Wind Resource Rank
South Dakota	784	396	882,412	5th
Wyoming	1,412	311	552,073	8th
Nebraska	337	60	917,999	4th
Source: AWEA, 2012a–c				

2010). Land designated as having potential for wind power electrical generation is shown in Figure 5.1-4. The Dewey-Burdock Wind Project is in the conceptual phase.

The development of wind energy projects in the Nebraska-South Dakota-Wyoming Uranium Milling Region is limited by availability of transmission lines to end users. Existing transmission capacity for wind-generated power is low, and there are no plans to expand existing or construct new transmission corridors in the Nebraska-South Dakota-Wyoming Uranium Milling Region (AWEA, 2012d).

5.1.1.5 Transportation Projects

Dewey Conveyor Project

In 2007, GCC Dacotah Inc. submitted an Application for Transportation and Utility Systems and Facilities on Federal Lands for the Dewey Conveyor Project. If constructed, the Dewey Conveyor Project will transport limestone mined from the Minnekahta Limestone to a rail load-out facility near Dewey, South Dakota (BLM, 2009a). The conveyor project lies north of the Dewey-Burdock Project area in portions of Township 5 South, Range 1 East, Section 36; Township 6 South, Range 1 East, Sections 1, 2, 9, 10, 11, 12, 15, 16, 17, 18, 19, and 20; and Township 5 South, Range 2 East, Section 31 (Figure 5.1-4). The area proposed for limestone quarrying operations is several kilometers [miles] north, where the Minnekahta Limestone lies at or close to the ground surface (BLM, 2009a). The town of Dewey is located along the existing Burlington Northern Santa Fe (BNSF) Railroad transportation corridor.

The proposed conveyor route crosses BLM-administered public lands, USFS-administered National Forest System land, and GCC Dacotah Inc.'s privately owned land (Figure 5.1-4). The project anticipates construction of an elevated, enclosed conveyor 10.6-km [6.6-mi] in length, a one-lane service road, and access points (BLM, 2009a). The elevated conveyor would be about 5 m [16 ft] high and would provide a minimum vertical clearance of 2 m [6 ft] beneath the structure. Depending on terrain, structural supports would be required at intervals of 7.6 to 12 m [25 to 40 ft]. BLM and USFS will evaluate the application and decide whether to approve it, grant GCC Dacotah Inc. a right-of-way (ROW) to allow the conveyor to cross federal lands, and issue a special use permit. BLM and USFS will decide whether stipulations or mitigation measures must be attached to the ROW grant and special use permit.

Powder River Basin Expansion Project

The Dakota Minnesota and Eastern (DM&E) railroad filed an application to construct the Powder River Basin (PRB) Expansion Project with the federal Surface Transportation Board (STB) in February 1998. The project seeks approval to construct and operate a new rail line and

associated facilities in east-central Wyoming and southwest South Dakota (STB, 2001). If approved and completed, the project will add rail coal-hauling capacity and establish a dedicated, direct route to transport coal from the Powder River Basin to Midwest markets. DM&E's proposed rail expansion will extend DM&E's existing northern line near Wall, South Dakota, southwest to Edgemont, then northwest to Burdock, and finally west into Wyoming. The extension will add 418 km [260 mi] of rail line and connect the northern DM&E line to operating coal mines located south of Gillette, Wyoming (see Figure 5.1-5). The proposed rail expansion route is south of the proposed Dewey-Burdock ISR Project site (see Figure 5.1-4).

At this time, Canadian Pacific—DM&E's parent company—has not yet decided whether to build the extension. The decision to build is contingent on several factors: (i) acquiring the necessary ROW to build the line, (ii) executing agreements with Powder River Basin mining companies for the right of DM&E to operate loading tracks and facilities, (iii) securing contractual commitments from prospective coal shippers to ensure revenues from the proposed line are economical, and (iv) arranging financing for the project.

5.1.1.6 Other Mining

Gold mining is not extensive in South Dakota; however, gold is the leading mineral commodity by dollar value. Only Wharf Resources Inc. actively mines gold in the state, and it holds four permits for gold operations in the northern Black Hills (Holm, et al., 2008). Wharf Resources is the only company to report silver production, which is a byproduct of its gold recovery process. Sand and gravel are the major nonmetallic mineral commodities produced in South Dakota. Sand and gravel are quarried in every county in South Dakota, mainly for road construction projects. Limestone is quarried in the Black Hills, primarily for the production of cement for use in construction projects.

5.1.1.7 Environmental Impact Statements as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

Indicators of present and reasonably foreseeable future actions are draft and final EISs federal agencies prepare within a recent time period. Using information in GEIS Section 5.2.2 (NRC, 2009a) and other publicly available information, several EISs were identified for the Nebraska-South Dakota Wyoming Uranium Milling Region (see Table 5.1-4). A majority of EISs in Table 5.1-4 are related to resource management actions in the Black Hills National Forest (BHNF) or associated management units. These EISs are for actions that are focused on improving natural resource conditions and reducing adverse impacts from various human-related activities. Three exceptions are the draft EIS that BLM prepared for the Dewey Conveyor Project (BLM, 2009a), the final programmatic EIS that BLM prepared for wind energy development on BLM-administered lands in the western United States (BLM, 2005b), and the final EIS that the STB prepared for the DM&E proposal to build the PRB Rail Expansion Project (STB, 2001).

5.1.2 Methodology

In calculating and assessing potential cumulative impacts, the NRC staff developed a methodology that follows CEQ guidance (see NRC, 2009a and CEQ, 1997).

1. Identify the potential environmental impacts of the federal action, and evaluate the incremental impact of the action when added to other past, present, and reasonably

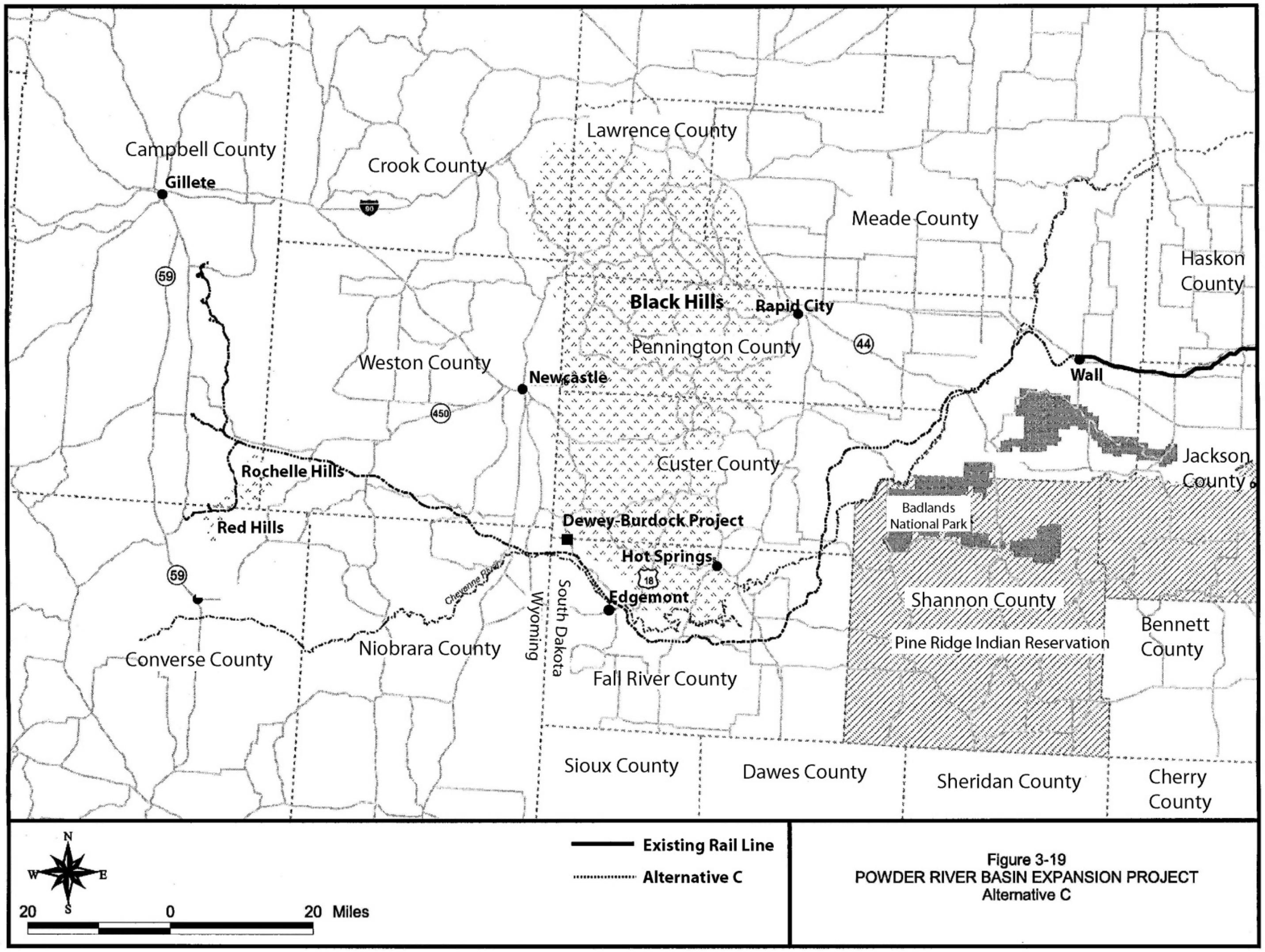

Figure 5.1-5. Map Showing Proposed New Rail Construction (Alternative C) for DM&E's Powder River Basin Expansion Project From Wall, South Dakota, West Into the Powder River Basin of Wyoming. Source: Modified from STB (2001).

Table 5.1-4. Draft and Final NEPA Documents Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region

November 19, 2001	Surface Transportation Board (STB), Final EIS, Dakota, Minnesota and Eastern Railroad Corporation Powder River Basin Expansion Project
June, 2005	BLM, Final Programmatic EIS on Wind Energy Development on BLM-Administered Lands in the Western United States
June 3, 2005	USFS, Final EIS, Dean Project Area, Proposes To Implement Multiple Resource Management Actions, BHNF, Bearlodge Ranger District, Sundance, Crook County, WY (resource management)
August 12, 2005	USFS, Final EIS, Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units, Implementation, Dawes, Sioux, Blaine, Cherry, Thomas Counties, NE, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, SD (resource management—prairie dog)
October 28, 2005	National Park Service, Draft EIS, Badlands National Park/North Unit General Management Plan, Implementation, Jackson, Pennington, and Shananon Counties, SD (resource management)
November 20, 2005	USFS, Final EIS, Deerfield Project Area, Proposes To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, SD (resource management)
November 25, 2005	USFS, Final EIS, Bugtown Gulch Mountain Pine Beetle and Fuels Projects, To Implement Multiple Resource Management Actions, BHNF, Hell Canyon Ranger District, Custer County, SD (resource management)
January 13, 2006	USFS, Final EIS, Black Hills, National Forest Land and Resource Management Plan Phase II Amendment, Proposal To Amend the 1997 Land and Resource Management Plan, Custer, Fall River, Lawrence, Meade, Pennington Counties, SD; Crook and Weston Counties, WY (resource management)
February 3, 2006	USFS, Final EIS, Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units, Implementation, Dawes, Sioux, Blaine, Cherry, Thomas Counties, NE, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, SD (resource management—prairie dog)
May 12, 2006	USFS, Final SEIS, Dean Project Area, Proposes To Implement Multiple Resource Management Actions, New Information To Disclose Direct, Indirect, and Cumulative Environmental Impacts, BHNF, Bearlodge Ranger District, Sundance, Crook County, WY (resource management)
June 1, 2007	USFS, Final EIS, Norwood Project, Proposes To Implement Multiple Resources Management Actions, BHNF, Hell Canyon Ranger District, Pennington County, SD, and Weston, Crook Counties, WY (resource management)

Table 5.1-4. Draft and Final NEPA Documents Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)

June 8, 2007	USFS, Draft EIS, Nebraska and South Dakota Black-Tailed Prairie Dog Management, To Manage Prairie Dog Colonies in an Adaptive Fashion, Nebraska National Forest and Associated Units, Including Land and Resource Management Plan Amendment 3, Dawes, Sioux, Blaine Counties, NE, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, SD (resource management—prairie dog)
June 29, 2007	USFS, Final EIS, Mitchell Project Area, To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, SD (resource management)
September 14, 2007	USFS, Final EIS, Citadel Project Area, Proposes To Implement Multiple Resource Management Actions, Northern Hills Ranger District, BHNF, Lawrence County, SD (resource management)
February 22, 2008	USFS, Draft EIS, Upper Spring Creek Project, Proposes To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, SD (resource management)
January 2009	BLM, Draft EIS, Dewey Conveyor Project

foreseeable future actions for each resource area. Potential environmental impacts are discussed and analyzed in Chapter 4 of this SEIS.

2. Identify the geographic scope for the analysis for each resource area. This scope will vary from resource area to resource area, depending on the geographic extent to which the potential impacts of the resource area could be at issue.

3. Identify the timeframe for assessing cumulative impacts. The NRC staff use the period from 2009 to 2030 for identifying and assessing cumulative effects. The timeframe begins with NRC acceptance of the application for an NRC source material license to operate the Dewey-Burdock ISR Project in October 2009. The cumulative impact analysis timeframe ends in 2030, the date estimated for license termination after completion of the decommissioning period (see Figure 2.1-1).

   NRC source material licenses for ISR facilities are typically granted for a 10-year period. The proposed Dewey-Burdock ISR Project has an estimated 17-year operational lifespan (see Figure 2.1-1). If NRC grants a source material license, the applicant must apply for license renewal before the initial license period expires to continue operations.

4. Identify ongoing and prospective projects and activities that take place or may take place in the area surrounding the project site. These projects and activities are described in Section 5.1.1 of this chapter.

5. Assess the cumulative impacts for each resource area from the proposed action and reasonable alternatives, and other past, present, and reasonably foreseeable future actions. This analysis would take into account the environmental impacts of concern identified in Step 1 and the resource-area-specific geographic scope identified in Step 2.

The following terms describe the level of cumulative impact:

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

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

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

The NRC staff recognize that many aspects of the activities associated with the proposed Dewey-Burdock ISR Project would have SMALL impacts on the affected resources. It is possible, however, that an impact that may be SMALL by itself, but could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline. The NRC staff determined the appropriate level of analysis that was merited for each resource area potentially affected by the proposed action and alternatives. The level of analysis was determined by considering the impact level to that resource, as described in Chapter 4, as well as the likelihood that the quality, quantity, and stability of the given resource could be affected.

Table 5.1-5 summarizes the cumulative impacts of the proposed Dewey-Burdock Project on environmental resources NRC staff identified and analyzed. The cumulative impacts are based on analyses the NRC staff conducted and take into account the other past, present, and reasonably foreseeable activities identified in SEIS Section 5.1.1.

Table 5.1-5. Cumulative Impacts on Environmental Resources

Resource Category	Cumulative Impacts	Comment
Land Use	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to land use.
Transportation	MODERATE	The proposed project will have a SMALL to MODERATE incremental impact when added to the MODERATE cumulative impacts to transportation.
Geology and Soils	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to geology and soils.

Table 5.1-5. Cumulative Impacts on Environmental Resources (continued)

Resource Category	**Cumulative Impacts**	**Comment**
Water Resources		
Surface Waters and Wetlands	MODERATE to LARGE	The proposed project will have a SMALL incremental impact when added to the MODERATE to LARGE cumulative impacts to surface waters and wetlands.
Groundwater	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts on groundwater.
Ecological Resources		
Terrestrial Ecology	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to terrestrial ecological resources.
Aquatic Ecology	SMALL	The proposed project will have a SMALL incremental impact when added to the SMALL cumulative impacts to aquatic ecological resources.
Threatened and Endangered Species	MODERATE	The proposed project will have a SMALL incremental impact when added to the MODERATE cumulative impacts to threatened and endangered species.
Air Quality	MODERATE	The proposed project will have a MODERATE incremental impact on air quality when added to the MODERATE cumulative impacts.
Noise	MODERATE	The proposed project will have a SMALL incremental impact on noise when added to the MODERATE cumulative impacts.
Historic and Cultural Resources	MODERATE to LARGE	The proposed project will have a SMALL to LARGE incremental impact on historical and cultural resources when added to the MODERATE to LARGE cumulative impacts.

Table 5.1-5. Cumulative Impacts on Environmental Resources (continued)

Resource Category	Cumulative Impacts	Comment
Visual and Scenic Resources	MODERATE to LARGE	The proposed project will have a SMALL incremental impact on visual and scenic resources when added to the MODERATE to LARGE cumulative impacts to the viewshed.
Socioeconomics	SMALL to MODERATE	The proposed project will have a SMALL to MODERATE incremental impact on socioeconomic resources when added to the SMALL to MODERATE cumulative impacts.
Environmental Justice	SMALL	The proposed project will have a SMALL incremental impact on environmental justice when added to the SMALL cumulative impacts.
Public and Occupational Health and Safety	SMALL	The proposed project will have a SMALL incremental impact on public and occupational health when added to the SMALL cumulative impacts.
Waste Management	SMALL to MODERATE	The proposed project will have a SMALL to MODERATE incremental impact on waste management when added to the SMALL to MODERATE cumulative impacts.

5.2 Land Use

NRC staff assessed cumulative impacts on land use within a 16-km [10-mi] radius of the proposed Dewey-Burdock ISR Project permit boundary, which includes parts of Custer and Fall River Counties, South Dakota, and Weston and Niobrara Counties, Wyoming. Land use impacts result from interruption to, reduction, or impedance of livestock grazing areas, open wildlife areas, and land access. The assessment of cumulative impacts on land use beyond 16 km [10 mi] was not undertaken, because at this distance the impacts on land use from the proposed project will be minimal. The timeframe for the analysis of cumulative impacts is 2009 to 2030, as described in SEIS Section 5.1.2.

The majority of land within the 16-km [10-mi] radius of the proposed project is in private ownership; however, USFS manages tracts of forest, grassland, and recreational land in the vicinity (see Figures 5.1-1 and 5.1-4). The BHNF borders the project to the north and east, and the Buffalo Gap National Grassland is 8 km [5 mi] south of the project. USFS-managed lands provide recreational activities, including camping, hiking, fishing, and hunting. BLM-administered lands are distributed among other federal and private lands to the north, west, and south of the proposed project site. Cattle grazing is the predominant land use on both public and private rangeland.

Short-term cumulative impacts from the loss of rangeland include a decrease in the area for foraging, temporary loss of animal unit months (AUMs), and temporary loss of water-related range improvements (e.g., improved springs, water pipelines, stock ponds). These impacts would be reduced after an area had been reclaimed. Long-term cumulative impacts result from the permanent loss of forage and forage/cropland productivity in un-reclaimed areas. Other impacts could include dispersal of noxious and invasive weed species both within and beyond areas where the surface had been disturbed, which reduces the area of desirable forage by livestock. The proposed Dewey-Burdock ISR Project will disturb 98 ha [243 ac] if Class V deep injection wells are used to dispose of liquid wastes or 566 ha [1,398 ac] if land application is used to dispose of liquid wastes (see SEIS Section 4.2.1). These amounts of land are small in comparison to the available grazing land within the land use study area {i.e., land within a 16-km [10-mi] radius of the proposed project site}. These amounts of land will also be fenced from grazing at different times over the life of the project.

Past, ongoing, and future conventional uranium mines and ISR facilities in the vicinity of the proposed Dewey-Burdock ISR Project and within the broader regional area are described in SEIS Section 5.1.1. The Crow Butte ISR facility lies 105 km [65 mi] to the south-southeast in Dawes County, Nebraska, and is the closest operational ISR facility to the Dewey-Burdock site. Three ISR expansion or satellite projects are in the planning or licensing stages in the immediate vicinity of the Crow Butte ISR facility (North Trend, Three Crow, and Marsland) (see SEIS Section 5.1.1.1).

In the land use study area, the applicant has identified a potential ISR project at Dewey Terrace. The Dewey Terrace project would be located approximately 13 km [8 mi] west of the proposed project area in Weston and Niobrara Counties, Wyoming (Figure 5.1-3). If developed, the potential Dewey Terrace project will have impacts on land use (i.e., surface disturbances and fencing to restrict livestock grazing) within the land use study area. To assess the projected land area that will be affected by the development of the potential Dewey Terrace project, the NRC staff assumed that approximately the same area affected by the proposed action {98 to 566 ha [243 to 1,398 ac]} will also apply to other potential ISR projects. Like the proposed Dewey-Burdock ISR Project, this amount of land area is small in comparison to the land use study area.

Land disturbed by past conventional surface mining is present in the eastern part of the proposed Dewey-Burdock site, where abandoned open mine pits and mine waste overburden piles are found (see SEIS Section 5.1.1.1). Wellfields are planned within these areas (see Figure 3.2-3). If wellfields in the mine waste areas are constructed and operated, additional land disturbance and access restrictions will occur.

Impacts on land use from oil and gas drilling include building temporary access roads and constructing 1.2-ha [3-ac] drill pads for each drill site (BLM, 2009a). There are no active oil- and gas-producing wells within the proposed Dewey-Burdock permit area. SEIS Section 3.2.3 identifies three plugged and abandoned oil and gas wells in the Burdock portion of the site in Fall River County. There are few producing oil wells in the land use study area {i.e., within a 16-km [10-mi] radius of the proposed Dewey-Burdock project area}. The Barker Dome oilfield in Custer County and the Plum Canyon oilfield in Weston County each have four producing oil wells (see Figures 5.1-3 and 5.1-4). The Cheyenne Bend oilfield in Fall River County has one producing oil well (see Figure 5.1-3). In addition, demand for oil and gas leasing in the vicinity of the proposed project is low (see SEIS Section 5.1.1.3). The majority of active oil and gas development in the region takes place on USFS-managed land (see Figure 5.1-3). This

development occurs west and south of Edgemont and in the Powder River Basin, which is more than 80 km [50 mi] west of the proposed project (see Figure 5.1-3).

Ongoing and proposed coal bed methane operations and wind energy operations in the region are located in the Powder River Basin west of the cumulative impacts land use study area (see SEIS Sections 5.1.1.2 and 5.1.1.4). Sedimentary formations hosting potential coal bed methane reserves are not present in the land use study area. The nearest existing wind power projects to the land use study area are located approximately 161 km [100 mi] to the west-southwest near Glenrock in Converse County, Wyoming. The potential Dewey-Burdock Wind Project is in the conceptual phase and would be located within and surrounding the proposed Dewey-Burdock site (Figure 5.1-4). If developed, the wind project will be constructed on ridges to exploit the best wind conditions rather than low areas where uranium deposits within and in the vicinity of the proposed project tend to be located (e.g., see Figure 4.5-1). Development of wind energy projects is generally compatible with other land uses, including livestock grazing, recreation, wildlife habitat conservation, and oil and gas production activities (BLM, 2005b).

Two proposed transportation projects are within the cumulative impacts land use study area: the GCC Dacotah Inc.'s Dewey Conveyor Project and the DM&E PRB Expansion Project (see SEIS Section 5.1.1.5).

Lands along the route of the Dewey Conveyor Project are owned by GCC Dacotah and private landowners or are public lands managed by BLM or USFS. About 16.2 ha [40 ac] of land disturbance will be created during the 1-year conveyor construction phase, resulting in temporary loss of forage. After construction, about 6.5 ha [16 ac] of land disturbance will remain, resulting in long-term losses in available forage. These long-term losses will be confined to the conveyor and maintenance road footprints. The conveyor will be designed to allow livestock and wildlife to freely cross beneath. Adequate signage will be posted to prevent potential trespass by GCC Dacotah employees, and GCC Dacotah employees will be trained regarding property boundaries. The conveyor project is designed so as not to interfere with the operation and maintenance of existing electric transmission and oil and gas distribution lines. In addition, changes in road easements and other infrastructure are not expected. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have a significant impact on use of private agricultural land by farmers and ranchers, grazing allotments leased by ranchers on federal lands, and mineral and mining rights on federal lands in western South Dakota and Wyoming. State-owned land and utility corridors are also expected to have impacts. Construction of the rail extension will involve direct and indirect takings of privately held land and the destruction of wells, windmills, corrals, fencing, outbuildings, irrigation systems, fire prevention and suppression systems, and other capital improvements. Access roads, hauling roads, and borrow pits will be built. DM&E will be required to mitigate adverse environmental impacts to private agricultural and ranch lands, federal lands, state lands, and utility corridors. DM&E will negotiate these mitigation measures with landowners and federal and state agencies. DM&E will be required to restore all federal, state, and privately held agricultural lands disturbed by the project to pre-construction conditions as promptly and fully as possible. (STB, 2001)

The NRC staff have determined that the cumulative impact on land use within the land use study area (i.e., Fall River, Custer, Weston, and Niobrara Counties) resulting from all past, present, and reasonably foreseeable future actions is MODERATE. This finding is based on the

assessment of existing and potential impacts on land use within the study area from the following actions:

- Land disturbance from past conventional surface mining in the eastern portion of the proposed Dewey-Burdock site
- Surface disturbance and restrictions on livestock grazing and recreational activities (e.g., hunting and off-road vehicle use) from development of potential ISR projects, such as the potential Dewey Terrace project
- Land disturbance from development of the proposed Dewey Conveyor Project
- Direct and indirect taking of privately held land tied to construction of the DM&E PRB Expansion Project, with resulting destruction of wells, windmills, corrals, fencing, outbuildings, irrigation systems, fire prevention and suppression systems, and other capital improvements

Other ongoing and reasonably foreseeable future actions are not expected to have a significant impact on land use within the cumulative impacts study area. There are few producing oil wells within the study area, and demand for oil and gas leasing is low. Coal bed methane reserves are not present within the study area. Potential wind energy projects, such as the Dewey-Burdock Wind Project, are generally compatible with the primary land uses in the study area, including livestock grazing, recreation, and wildlife habitat conservation (BLM, 2005b).

The NRC staff conclude the proposed Dewey-Burdock ISR Project will have a SMALL incremental effect on land use after evaluating its effects and those of all the other past, present, and reasonably foreseeable future actions in the land use study area. As discussed in SEIS Section 4.2.1, land use impacts related to the proposed Dewey-Burdock ISR Project will be SMALL for all stages of the project lifecycle. The estimated land disturbance of 98 to 566 ha [243 to 1,398 ac] for the proposed action is a small amount of land in comparison to the cumulative impacts study area. About this same amount of land will be fenced over the life of the proposed project to restrict livestock grazing and public access to the ISR facilities and to infrastructure, wellfields, and potential land application areas. Fencing around wellfields will be temporary. As wellfield production ends, fencing will be removed and the land reclaimed in accordance with applicable BLM and SDDENR requirements. At the end of operations, the applicant will decommission the site and restore the land to its previous use (with the possible exception of access roads that land owners may request to remain) in accordance with an NRC-approved decommissioning plan (see SEIS Section 2.1.1.1.5).

5.3 Transportation

Cumulative impacts on transportation systems of Custer and Fall River Counties, South Dakota, and Weston and Niobrara Counties, Wyoming, were identified and evaluated. Local highways, existing county roads, and access roads were the focus of this analysis over the 2009–2030 timeframe (see SEIS Section 5.1.2 for the estimated operating life of the facility).

As described in SEIS Section 4.3.1, the impacts to heavily traveled regional and local highways will be SMALL during all phases of the proposed Dewey-Burdock ISR Project. Dewey Road,

the principal access road to the Dewey-Burdock site, will be used throughout the project lifecycle. As described in SEIS Section 4.3.1, daily traffic on Dewey Road will increase sixteenfold during the construction phase and fivefold during the operations phase of the proposed project. The increase in traffic will accelerate the degradation of the road surface, increase fugitive dust emissions, and increase the potential for traffic accidents and wildlife or livestock kills, resulting in a MODERATE impact. Secondary access roads connecting Dewey Road with the proposed plant facilities and the plant facilities within the wellfields will also experience long-term transportation impacts. However, the transportation impacts to secondary access roads are not considered permanent, because the land will ultimately be returned to its natural condition when production and decommissioning are complete (Powertech, 2009b).

In the cumulative impacts study area, transportation will be impacted by ongoing and reasonably foreseeable future activities. These include impacts to livestock grazing, uranium exploration and mining, and oil and gas exploration and development. The many unimproved, two-track dirt roads and one lane gravel roads in the cumulative impacts transportation study area were constructed to access livestock grazing lands, to facilitate natural resource exploration and extraction, to provide access to recreational areas, and for off-road vehicle recreational activities. County roads in the transportation study area have intermittently provided access for uranium exploration and mining, as well as oil and gas exploration activities, since the mid-1970s. Reasonably foreseeable future uranium, oil, and gas exploration will result in additional trucks and heavy equipment using existing county roads. For example, the potential Dewey Terrace uranium project would be located 13 km [8 mi] west of the Dewey-Burdock ISR Project area in Weston and Niobrara Counties, Wyoming (see SEIS Section 5.1.1.1). If developed, the Dewey Terrace project may contribute to additional traffic on Dewey Road from commuting workers, construction and operations deliveries, and yellowcake and byproduct transport. These future activities may require or benefit from the construction of new road surfaces or the improvement of existing county roads, including Dewey Road.

As noted in SEIS Section 5.1.1, other reasonably foreseeable future projects, such as wind energy and transportation projects, contribute to the analysis of cumulative impacts.

Wind energy projects will impact transportation on local roads; however, these impacts would be temporary. During the 1- to 2-year construction period for a wind energy project, the vehicles of 100 to 150 workers and vehicles used to transport construction equipment, blades, turbine components, and other materials to the site will cause a relatively short-term increase in the use of local roadways. Shipments of materials, such as gravel, concrete, and water, are not expected to significantly affect local primary and secondary road networks. Shipments of overweight and/or oversized loads are expected to cause temporary disruptions on primary and secondary roads used to access construction sites. It is possible that local roads might require fortification of bridges and removal of obstructions to accommodate overweight and oversized shipments. Once completed, wind energy projects will require a relatively low number of workers to operate and maintain. For example, the operation and maintenance of a 180-megawatt capacity wind energy project with about 150 turbines will require 10 to 20 workers. Consequently, transportation activities will be limited to a small number of daily trips by pickup trucks, medium-duty vehicles, or personal vehicles. Shipments of large components required for equipment replacement in the event of major mechanical breakdowns are expected to be infrequent. Transportation activities during site decommissioning will be similar to those during construction. Heavy equipment will be required for dismantling turbines and towers, breaking up tower foundations, and regrading and recontouring the site. (BLM, 2005b)

The proposed Dewey Conveyor will not impact transportation on heavily traveled regional and local roadways but will temporarily impact transportation on Dewey Road. Dewey Road is the primary transportation corridor along the 10.6 km [6.6 mi] length of the proposed conveyor alignment (Figure 5.3-1). Dewey Road continues both north and south of the proposed conveyor project. The construction workforce for the conveyor project will come primarily from Hot Springs, Custer, and Edgemont and use Dewey Road to access the site from the south. Construction of the conveyor will involve approximately 50 workers and take 1 construction season. During construction, deliveries and commuting workers will increase traffic counts on Dewey Road between Edgemont and Dewey. Following construction, approximately 12 workers will oversee quarrying, transport, and load-out operation related to the project. Due to the short duration of construction and relatively low number of workers needed to operate the conveyor operation, the proposed Dewey Conveyor Project is not expected to have a significant impact on transportation in the cumulative impacts study area. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have temporary impacts on transportation in western South Dakota and Wyoming. The project will require the construction of temporary roads to access the rail line ROW. In the cumulative impacts study area for transportation, the rail line will parallel the BNSF rail line from Edgemont to Burdock before turning west toward Wyoming (see Figure 5.1-4). Therefore, the project will have an impact on Dewey Road from commuting workers and deliveries of equipment and materials during construction of the rail line. DM&E has proposed mitigation measures as part of the proposed PRB Expansion Project to address potential adverse impacts to transportation. To the extent possible, DM&E will confine all project-related construction traffic to a temporary access road within the ROW or established public roads. Any temporary access roads constructed outside the rail line ROW will be removed and the land reclaimed upon completion of construction. As a result of road closures after construction and during operation of railyards, DM&E will provide or develop alternative access for the safe movement of farm and ranch equipment and livestock to fields and pastures. (STB, 2001)

The NRC staff have determined that the cumulative impact on transportation within the transportation study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Regional and local highways in the transportation study area have sufficient capacity to accommodate the traffic of ongoing actions and increases in traffic from other reasonably foreseeable future actions. However, county roads will be impacted. County roads have been used to access uranium exploration and mining and oil and gas exploration activities in the transportation study area since the mid-1970s. Reasonably foreseeable future uranium, oil, and gas exploration and development in the transportation study area will result in additional trucks and heavy equipment using existing county roads. Construction and operation of potential wind energy and transportation projects will also impact county roads in the transportation study area. For example, the potential Dewey-Burdock Wind Project and the proposed Dewey Conveyor Project and DM&E PRB Expansion Project would utilize Dewey Road. Transportation impacts will be most significant during the construction phase of wind energy and transportation projects because construction activities involve more workers and deliveries of materials and equipment.

The NRC staff have concluded that the proposed Dewey-Burdock ISR Project will have a SMALL to MODERATE incremental effect on transportation when considered with all the other past, present, and reasonably foreseeable future actions in the transportation study area. As described in SEIS Section 4.3.1, increased vehicular traffic associated with the proposed

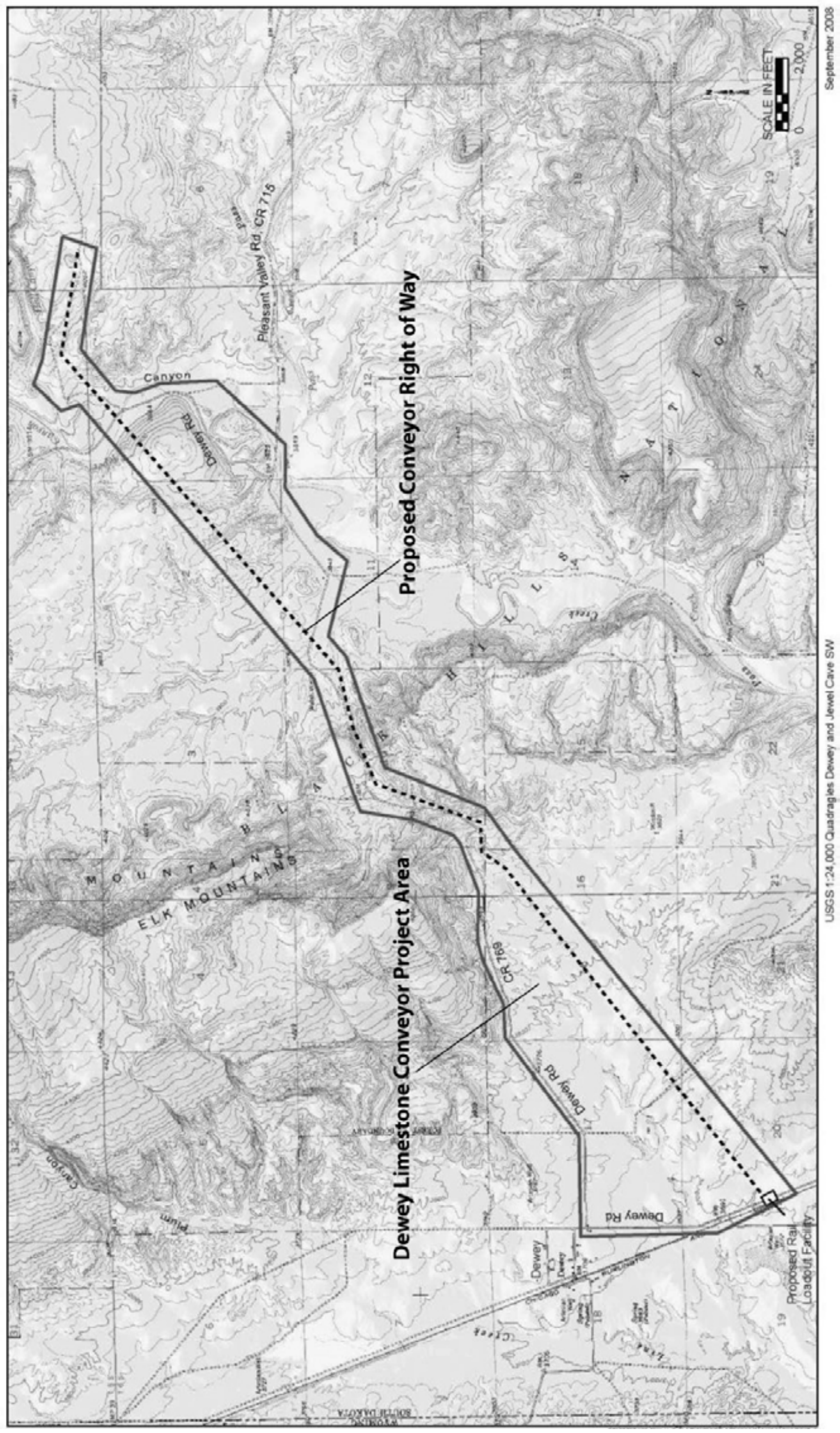

Figure 5.3-1. Map Showing Location of Dewey Road and Pass Creek in Relation to the Proposed Dewey Conveyor Project.
Source: Modified from BLM (2009a).

Dewey-Burdock ISR Project will have a SMALL to MODERATE impact. Because regional and local roadways have sufficient capacity to accommodate traffic associated with the proposed project, the proposed Dewey-Burdock project will have a SMALL incremental impact on regional and local roadways within the transportation study area. As described in SEIS Section 4.3.1, Dewey Road would experience a sixteenfold increase in daily traffic during the construction phase and a fivefold increase in daily traffic during the operations phase of the proposed Dewey-Burdock ISR Project. Therefore, the proposed Dewey-Burdock ISR Project will have a MODERATE incremental impact on Dewey Road within the transportation study area.

5.4 Geology and Soils

Cumulative impacts on geology and soils within Custer and Fall River Counties, South Dakota, and Weston and Niobrara Counties, Wyoming, were identified and evaluated focusing on an area within a 16-km [10-mi] radius of the proposed Dewey-Burdock ISR Project site. This area was chosen for the assessment of potential cumulative impacts on geology and soils because the uranium mineralization at other potential uranium deposits within 16 km [10 mi] of the proposed site would be located in the same geologic unit (the Inyan Kara Group). The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

As assessed in SEIS Section 4.4.1, all phases of the proposed Dewey-Burdock ISR Project will have a SMALL impact on geology and soils. The primary impacts on geology and soils will result from earthmoving activities. Earthmoving activities that might impact soils include the clearing of ground and topsoil and preparing surfaces for the Burdock central processing plant, Dewey satellite facility, header houses, access roads, drilling sites, and associated structures. Excavating and backfilling trenches for pipelines and cables, and preparing surfaces for potential land application of process-related liquid wastes, will also impact soils. Operations at the proposed site may produce spills of process fluids or chemical materials that may contaminate soils. Best management practices (BMPs) and required monitoring and mitigation, such as spill prevention and cleanup programs, will reduce these potential soil impacts. Subsurface impacts, such as subsidence and activation of nearby faults, will not occur at the proposed project site, because of the relatively small net withdrawal of fluids from production zone aquifers and because of the low pressures during operations relative to those needed to produce small earthquakes. As described in SEIS Section 3.5.3.2, data from aquifer pumping tests indicated a hydraulic connection between the Lakota and Fall River Formations through the intervening Fuson Shale in the Burdock area resulting from unidentified structural features or old, unplugged exploration holes.

Historical, present, and future natural resource development activities that relate to geology and soils in the geological and soil resources study area include stock grazing, uranium exploration/mining, and oil and gas exploration. Geologic formations hosting potential coal bed methane reserves are not present in the immediate vicinity of the proposed project. Surface-disturbing activities related to uranium, oil, and gas exploration activities, such as construction of new access roads and drill pads, will have direct effects on geological resources. During construction of these roads and drill pads, direct impacts on geology will be limited to excavation and relocation of disturbed bedrock and unconsolidated surficial materials associated with surface disturbances. Impacts from these activities include loss of soil productivity due primarily to wind erosion, changes to soil structure from soil handling, sediment delivery to surface water resources (i.e., runoff), and compaction from equipment and livestock pressure. No geological mineral resources will be lost due to grazing. BMPs and reclamation

and restoration of soils disturbed by historic livestock grazing and exploration activities will mitigate loss of soil and soil productivity. However, indirect long-term effects, such as cross-contamination of aquifers, may occur if boreholes associated with uranium, oil, and gas exploration are not properly abandoned.

Geology and soil resources have been impacted by past conventional uranium mining in the eastern part of the proposed Dewey-Burdock site, where abandoned open mine pits and mine waste overburden piles are found (see SEIS Section 5.1.1.1). Radiological conditions of soils in the areas of past conventional uranium mining are discussed in SEIS Section 3.12.1. There are underground mine workings associated with four former shallow underground uranium mines and two open pit adits (horizontal tunnels). The underground mines consist of declines (downward sloping ramps) ranging from 0 to 24 m [0 to 80 ft] below ground surface. The adits were driven into the sidewalls of the open pits. All of the underground workings were within sandstones of the Fall River Formation. At this time, there are no plans to reclaim or restore the abandoned open mine pits and mine waste overburden piles.

Development of future ISR projects in the geological and soil resources study area, such as the potential Dewey Terrace project, will have impacts on geology and soils due to increased vehicle traffic, clearing of vegetated areas, soil salvage and redistribution, discharge of ISR-produced groundwater, and construction and maintenance of project facilities and infrastructure (e.g., roads, well pads, pipelines, industrial sites, and associated ancillary facilities). The NRC staff assume that development of future ISR projects within the cumulative impacts study area will be similar to the proposed Dewey-Burdock site, with similar potential for surface impacts to geology and soils. The construction and operation of the infrastructure for these future projects, however, will be subject to the same monitoring, mitigation, and response programs required to limit potential surface impacts (e.g., erosion and contamination from spills) as at the proposed Dewey-Burdock ISR Project. With respect to compaction and surface subsidence, the groundwater will be from the same aquifers and at similar depths as those at Dewey-Burdock, with a small net withdrawal. BMPs and reclamation and restoration of disturbed areas will mitigate loss of soil and soil productivity associated with ISR activities. Salvaged and replaced soil will become viable soon after vegetation is established.

Other reasonably foreseeable future activities in the vicinity of the proposed Dewey-Burdock ISR Project site that may impact geological resources and soils include wind energy projects (see SEIS Section 5.1.1.4), and proposed transportation projects, such as the Dewey Conveyor Project and the DM&E PRB Expansion Project (see SEIS Section 5.1.1.5).

Impacts to geological resources and soils from wind energy projects, such as the potential Dewey-Burdock Wind Project, include use of geologic resources (e.g., sand and gravel), activation of geologic hazards (e.g., landslides and rockfalls), and increased soil erosion. Sand and gravel and/or quarry stone will be needed for access roads. Concrete will be needed for buildings, substations, transformer pads, wind tower foundations, and other ancillary structures. These materials will be mined as close to the potential wind energy site as possible. Tower foundations will typically extend to depths of 12 m [40 ft] or less. The diameter of tower bases is generally 5 to 6 m [15 to 20 ft], depending on the turbine size. Construction activities can destabilize slopes if they are not conducted properly. Soil erosion will result from (i) ground surface disturbance to construct and install access roads, wind tower pads, staging areas, substations, underground cables, and other onsite structures; (ii) heavy equipment traffic; and (iii) surface runoff. Any impacts to geology and soils will be largely limited to the project site. Erosion controls that comply with county, state, and federal standards will be applied.

Operators will identify unstable slopes and local factors that can induce slope instability. Implementation of BMPs will limit the impacts from earthmoving activities. Foundations and trenches will be backfilled with originally excavated material, and excess excavation material will be stockpiled for use in reclamation activities. (BLM, 2005b)

The construction of the proposed Dewey Conveyor Project will have direct impacts on geological resources, although these will be limited to surface disturbances associated with excavation and relocation of disturbed bedrock and unconsolidated surficial materials along the various ROWs during construction. The surface disturbances resulting from construction of the conveyor will not result in any loss of known mineral resources. Approximately 16.2 ha [40 ac] of soils along the conveyor route will be directly impacted due to excavation and disturbance. These impacts would include loss of soil to wind and water erosion and decreased soil biological activity. Implementation of BMPs and revegetation of disturbed areas and stockpiled topsoil will minimize soil erosion. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have a significant impact on the geology and soils of western South Dakota and Wyoming. Along the route of the proposed rail line, geology and soils will be disturbed by increased traffic, clearing of vegetated areas, and soil salvage and redistribution. To limit the impacts, DM&E has proposed mitigation measures as part of the proposed PRB Expansion Project to address potential adverse impacts on geology and soils. DM&E will limit ground disturbance to only the areas necessary for project-related construction activities and will commence reclamation of disturbed areas as soon as practicable after project-related construction ends. During project-related earthmoving activities, DM&E will stockpile topsoil for application during reclamation to minimize erosion. DM&E will implement appropriate erosion control measures at stockpiles to prevent erosion. DM&E will be required to restore and revegetate soils disturbed by the project to pre-construction conditions as promptly and fully as possible. (STB, 2001)

The NRC staff determined that the cumulative impact on geology and soils within the study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. Past conventional underground and open pit surface mining has impacted geology and soils in the eastern part of the proposed Dewey-Burdock site, where abandoned open pits and mine waste overburden piles are not reclaimed or restored. Surface-disturbing activities associated with ongoing and reasonably foreseeable future uranium and oil and gas exploration and development, wind energy, and transportation projects would have direct impacts on geology and soils. Direct impacts will result from increased traffic, clearing of vegetated areas, soil salvage and redistribution, and construction of project facilities and infrastructure. Indirect impacts, such as cross-contamination of aquifers, may also occur if boreholes associated with uranium and oil and gas exploration are not properly abandoned.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL incremental effect on geology and soils when considered with all the other past, present, and reasonably foreseeable future actions in the study area. As described in SEIS Section 4.4.1, limited areas of the proposed project site will be disturbed by construction, and implementation of BMPs will limit soil erosion and compaction. Systems and procedures will be in place to monitor and clean up soil contamination resulting from spills and leaks. EPA will evaluate the suitability of deep geologic formations proposed for deep well disposal of liquid wastes prior to granting a Class V UIC deep injection well permit. The EPA UIC Class V permit will impose an upper limit to the allowable injection pressure and will not allow injection at or above the fracture pressure of the injection zone formations. In potential land application areas, the applicant will be required to routinely collect and monitor soils for contamination and comply with discharge

limits for treated liquid wastes applied to irrigation areas. When production and aquifer restoration are complete at the proposed project, reclamation and decommissioning will return the site to preproduction conditions through return of topsoil, removal of contaminated soils, and reestablishment of vegetation.

5.5 Water Resources

The impact to surface and groundwater resources was evaluated within an 80-km [50-mi] radius of the proposed Dewey-Burdock ISR Project (Figure 5.1-3). The 80-km [50-mi] radius for the water resources study area encompasses the watersheds, including the Beaver Creek, Upper Cheyenne, and Angostura Reservoir watersheds, that would be potentially impacted by past, present, and reasonably foreseeable future actions (see Figure 3.5-1). The timeframe for the analysis is 2009 to 2030 (see Section 5.1.2 for the estimated operating life of the facility).

5.5.1 Surface Waters and Wetlands

The proposed Dewey-Burdock ISR Project is located in the Beaver Creek and Pass Creek watersheds (see SEIS Section 3.5.1). Beaver Creek is a perennial stream, while Pass Creek is dry for most of the year. Both creeks have ephemeral tributaries that flow after snowmelt or heavy rains. Pass Creek joins Beaver Creek southwest of the project area. Beaver Creek flows into the Cheyenne River 4.8 km [3 mi] south of this confluence, which eventually flows into the Missouri River. The U.S. Army Corps of Engineers (USACE) identified four jurisdictional wetlands within the proposed site (see SEIS Section 3.5.2). The jurisdictional sites were Beaver Creek, Pass Creek, and an ephemeral tributary to each. As described in SEIS Section 4.5.1.1, under Section 404 of the Clean Water Act the applicant must obtain a permit from USACE for any activities that may potentially impact jurisdictional wetlands. Prior to operations, the applicant must obtain construction and industrial storm water National Pollutant Discharge Elimination System (NPDES) permits from SDDENR. The NPDES permits will include plans and programs for spill prevention and cleanup, erosion control, and runoff control, which will mitigate the impacts to surface waters and wetlands.

There are no operating ISR facilities located within 80 km [50 mi] of the proposed site, which is the cumulative impacts surface water study area. Several abandoned open pits and overburden waste piles associated with past surface mining activities are located in the Burdock portion of the site (see SEIS Figure 3.2-3). Radiation surveys reveal that soils near old surface mines have higher than background radiation levels (see SEIS Section 3.12.1). Runoff from snowmelt and heavy rains may leach and transport contaminants from the waste piles associated with these mines to surface waters and wetlands in the Beaver Creek and Pass Creek watersheds (Powertech, 2009c). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, has been used to clean up uncontrolled or abandoned legacy uranium mines in western Colorado and eastern Utah. EPA is authorized to implement Superfund. Superfund site identification, monitoring, and response activities in South Dakota would be coordinated through SDDENR.

The potential Dewey Terrace ISR project in Weston and Niobrara Counties, Wyoming, would be located 13 km [8 mi] west of the Dewey-Burdock ISR Project site. This potential future project will necessitate new roads, power lines, facilities construction, underground piping, and well drilling, all of which may have adverse impacts on surface waters and wetlands. As discussed previously for the Dewey-Burdock ISR Project, potential impacts to surface waters and wetlands at the potential Dewey Terrace ISR project site will also be subject to mitigation through BMPs,

required NPDES storm water permits, and permits from USACE for any activities that may potentially disturb jurisdictional wetlands identified at the site.

Surface water quality within the 80-km [50-mi] area of the proposed site may be impacted by conventional oil and gas development, rangeland grazing, wind energy projects, and transportation projects. Cattle grazing is a source of nonpoint pollution to streams and wetlands in the Beaver Creek and Pass Creek drainages. SEIS Section 3.5.1.1 describes Beaver Creek as impaired for all beneficial uses because of high total dissolved and suspended solids, high salinity, presence of fecal coliform, high conductivity levels, and high water temperature. A water quality data report points to livestock as the source of fecal coliform in Beaver Creek (SDDENR, 2008). Poor management of livestock grazing may restrict flow in intermittent streams such as Pass Creek due to erosion and sedimentation resulting from decreased vegetative cover in the drainage area.

Oil wells within 80 km [50 mi] of the proposed Dewey-Burdock ISR Project site are shown in Figure 5.1-3. As discussed in SEIS Section 5.1.1.3, no producing oil and gas wells are located within the proposed Dewey-Burdock permit boundary and, at present, there is low demand for oil and gas leasing within the project boundary and in its immediate vicinity. Within 80 km [50 mi] of the proposed project site, oil wells are clustered west of the site in Weston and Niobrara Counties, southwest of Edgemont in Fall River County, and east of the site at Barker Dome in Custer County. Impacts to surface waters and wetlands from oil and gas exploration activities will be from surface runoff as new access roads and drill pads are constructed. Runoff degrades surface water quality, causes erosion, and leads to siltation of streambeds and wetlands.

Licensees must obtain construction and industrial NPDES permits from the Wyoming Department of Environmental Quality (WDEQ) in Wyoming and SDDNER in South Dakota prior to conducting oil and gas exploration and production activities. NPDES permits include plans and programs for spill prevention and cleanup, erosion control, and runoff control. These plans and programs significantly mitigate the potential impacts to surface sediment load and turbidity from exploration activities. USACE Section 404 permits are also required for any disturbances in or near jurisdictional wetlands. Section 404 permits include provisions that must be followed to mitigate impacts when conducting activities in and near jurisdictional wetlands.

Impacts to surface waters and wetlands from potential wind energy projects in the western United States, such as the Dewey-Burdock Wind Project, may include changes in water quality and alteration of natural flow systems. The quality of surface water could be degraded by soil erosion and runoff from construction activities that disturb the ground surface, and by heavy equipment traffic. Surface water flow may be diverted by access road systems or storm water control systems. Operation of a wind energy project uses very small amounts of water and results in virtually no discharges to surface water. Operators of these facilities implement storm water management plans to ensure compliance with applicable regulations and prevent offsite migration of contaminated storm water or increased soil erosion. (BLM, 2005b)

The proposed Dewey Conveyor Project is located principally within the Pass Creek drainage. Pass Creek and Hell Canyon merge near the southeast portion of the project area and flow southwest to the confluence of Beaver Creek (see Figure 5.3-1). The proposed conveyor project crosses several ephemeral tributaries within the Pass Creek drainage. Some sediment runoff from road and general construction activities associated with the 10.6-km [6.6-mi]-long conveyor is expected, and this could impact surface water bodies. Expected runoff contaminants will predominantly be in the form of suspended or dissolved solids and increases

in turbidity. These impacts will be partially mitigated by the fact that many area streambeds in the vicinity of the project area are dry for most of the year. Runoff potential will also be mitigated by the implementation of BMPs for runoff control. (BLM, 2009a)

The DM&E PRB Expansion Project will have a significant impact on surface water and wetlands, if completed. The new rail line will pass south of the proposed Dewey-Burdock ISR Project site (see Figure 5.1-4), through the Beaver Creek and Pass Creek watersheds. DM&E has proposed mitigation measures to address potential adverse impacts on surface waters and wetlands within the PRB Expansion Project area. Before project-related construction could begin, DM&E must obtain all federal permits, including Clean Water Act Section 404 permits and USACE permits required for project-related alteration or encroachment of wetlands, streams, and rivers. In addition, DM&E must obtain NPDES permits for regulation of storm water discharges to surface waters. DM&E will employ BMPs, such as silt screens and straw bale dikes, to minimize soil erosion, sedimentation, runoff, and surface instability during project-related construction. These mitigation measures will minimize sedimentation into streams and wetlands. (STB, 2001)

The NRC staff have determined that the cumulative impact on surface water and wetlands within the surface water study area resulting from past, present, and reasonably foreseeable future actions is MODERATE to LARGE. Leaching and transport of contaminants from overburden waste piles associated with past conventional uranium mining in the eastern part of the proposed Dewey-Burdock site may impact surface waters and wetlands in the Beaver Creek and Pass Creek watersheds. Livestock grazing will continue to have the potential to degrade water quality in streams within the study area. Construction activities associated with other ongoing and reasonably foreseeable future actions, including uranium and oil and gas exploration and development, wind energy projects, and transportation projects, will have impacts on surface water and wetland resources. All of these actions will necessitate construction of new roads, power lines, facilities, and infrastructure, which could degrade water quality and alter natural surface water flow systems.

The NRC staff conclude that the proposed Dewey-Burdock Project will have a SMALL incremental effect on surface water and wetlands when added to all other past, present, and reasonably foreseeable future actions in the surface water study area. As described in SEIS Section 4.5.1, potential impacts to surface waters at the proposed Dewey-Burdock site will be mitigated through proper planning and design of facilities and infrastructure, the use of proper construction methods, and implementation of BMPs. Prior to initiating ISR operations at the proposed project, the applicant must also obtain a construction and industrial storm water National Pollutant Discharge Elimination System (NPDES) permit from SDDENR. The NPDES permit will include plans and programs for spill prevention and cleanup, erosion mitigation, and runoff control. In addition, to comply with Section 404 of the Clean Water Act, the applicant must obtain a permit from USACE for any activities that may potentially disturb the four jurisdictional wetlands identified within the proposed project area.

5.5.2 Groundwater

As described in SEIS Section 3.5.3.3, ISR methods will be used to extract uranium from sandstone-hosted uranium ore bodies in the Fall River and Lakota aquifers at the proposed Dewey-Burdock site. The combined Fall River and Lakota aquifers are referred to as the Inyan Kara Group aquifer. Consumptive water use during construction at the Dewey-Burdock site will be generally limited to dust control, cement mixing, pump tests, delineation drilling, and

well drilling and completion. The applicant estimated that groundwater consumption during the construction phase in the Dewey and Burdock areas will be 0.8×10^5 m^3 and 1.2×10^5 m^3 [21.8×10^6 and 30.6×10^6 gal], respectively (Powertech, 2010). Initially, water for construction activities will be withdrawn from existing wells in the Inyan Kara Group aquifer. The applicant's estimated consumptive groundwater use during the construction phase is of the same magnitude as current withdrawals for domestic and livestock water use from the Inyan Kara Group aquifers within a 2-km [1.2-mi] radius of the proposed project (see Section 4.5.2.1.2.2). The applicant plans to install wells in the deeper Madison aquifer early in the construction phase, and once available, Madison water will become the primary water source for the construction, operation, and aquifer restoration phases (Powertech, 2010).

Assessments of environmental impacts to groundwater resources at the proposed Dewey-Burdock ISR Project are discussed in SEIS Section 4.5.2. Impacts to groundwater are most likely to occur during the operations and aquifer restoration phases of the ISR facility's lifecycle, but may occur during other phases. Potential groundwater impacts during the operations phase of the proposed project will be mitigated and reduced through implementation of leak detection and cleanup programs, mechanical integrity testing of wells, and adherence to EPA UIC permit requirements. During operations, the applicant commits to monitoring all domestic wells within 2 km [1.2 mi] of the project boundary and providing replacement wells to the well owners in the event of significant drawdown or degradation of water quality in these wells. The applicant's excursion monitoring program will ensure the protection of water quality in aquifers underlying production zone aquifers. After uranium production and aquifer restoration are completed and groundwater withdrawals are terminated at the proposed project, groundwater levels will recover with time. Groundwater restoration will also restore impacted aquifers to acceptable water quality levels. The proposed injection zones for the UIC Class V deep disposal wells are the Deadwood Formation and the Minnelusa Formation. EPA will not authorize injection into the Class V deep disposal wells unless the permittee demonstrates the well is properly sited, such that confinement zones and proper well construction minimize the potential for migration of fluids outside of the approved injection zone.

Rural population growth, oil and gas exploration development, and ISR uranium extraction are expected to contribute to the cumulative impact on groundwater resources within an 80-km [50-mi] radius of the Dewey-Burdock site. These activities create an increased demand for groundwater and have been the subject of the Black Hills Hydrology Study (USGS, 2010). The U.S. Geological Survey (USGS) conducted this study during 1992–2002 to assess the quantity, quality, and distribution of groundwater in the Black Hills area of South Dakota and to evaluate alternatives for management of water resources in the area. This study is used by federal, state, and local government agencies to set water development policy and protect area groundwater resources.

Groundwater in the Black Hills area of South Dakota is used for residential, municipal, industrial, and recreational purposes. Forty-five percent of the recent population growth in the Black Hills area of South Dakota has taken place in unincorporated areas without municipal water supply systems (Carter, et al., 2003). Population has grown mainly around Rapid City, but has occurred in rural areas in the southwestern Black Hills. Custer Highlands is a new housing development built approximately 16 km [10 mi] northeast of the proposed Dewey-Burdock site. Recent residential developments 19 to 24 km [12 to 15 mi] east of Dewey-Burdock include the Fundamentalist Church of Jesus Christ of Latter Day Saints facility (NRC, 2009c). The Southern Black Hills Water System proposes constructing a 24-km [15-mi] water transmission pipeline along Argyle Road northwest of Hot Springs, which will serve rural customers in south-central Custer County. The western extension of the pipeline will be 24 km [15 mi] east of

the Dewey-Burdock site boundary. The pipeline will transmit water pumped from a Madison aquifer well near Buffalo Gap, South Dakota, 72 km [45 mi] east of the Dewey-Burdock site (Figure 5.1-3).

The Madison aquifer is the most important regional aquifer supplying Rapid City, Edgemont, and numerous communities in southwestern South Dakota (see Figures 3.5-4 and 3.5-5). As described in SEIS Section 4.5.2, the applicant submitted an application for a water appropriation permit to SDDENR to pump groundwater from the Madison aquifer during ISR construction, operations, and aquifer restoration (Powertech, 2010). Edgemont is the closest community to the project site that obtains municipal water supply from the Madison aquifer. Edgemont lies 21 km [13 mi] southeast of the Dewey-Burdock site, and it is expected that any impacts on groundwater levels in the Madison aquifer at a regional level from the proposed project will be SMALL (SEIS Section 4.5.2). The applicant's excursion monitoring program described in SEIS Section 4.5.2.1.1.2 will ensure the protection of water quality in aquifers underlying the production zone. The Madison aquifer is separated from the Deadwood Formation, one of the proposed injection zones for the applicant's UIC Class V deep disposal wells, by the Englewood Formation (see Figure 3.5-5). The Englewood Formation is expected to provide confinement above the proposed Deadwood Formation injection zone (Naus, et al., 2001). The Minnelusa Formation is the other proposed injection zone for the UIC Class V deep disposal wells. Confining units at the base of the Minnelusa Formation are expected to provide hydraulic separation between the Minnelusa Formation and the Madison aquifer. Locally, these confining layers may be absent or provide ineffective confinement, which could allow hydraulic communication between the Minnelusa aquifer and the underlying Madison aquifer (Naus, et al., 2001). Although the Madison aquifer has far greater hydraulic pressure than the Minnelusa aquifer, EPA will not authorize injection into the Class V deep disposal wells unless the permittee demonstrates that there are adequate confining zones above and below the proposed injection zones.

Aquatic recreational areas, such as Cascade Springs and Keith Springs, are located approximately 40 km [25 mi] east-southeast of the proposed project site. These springs discharge groundwater from the Madison and/or Minnelusa aquifers (Driscoll, et al., 2002). Because Cascade Springs and Keith Springs are located 40 km [25 mi] from the project site, it is expected that estimated withdrawals of water from the Madison aquifer for operations and aquifer restoration at the proposed project will have a SMALL impact on groundwater discharge at Cascade Springs and Keith Springs. The applicant's excursion monitoring program will ensure the protection of water quality in aquifers underlying production zone aquifers.

Within an 80-km [50-mi] radius of the proposed project, ongoing and planned ISR facilities, oil and gas exploration, wind energy projects, and transportation projects activities may contribute to impacts on groundwater resources.

The applicant has identified a potential ISR project at Dewey Terrace in Wyoming (Powertech, 2009b). The Dewey Terrace project would be located about 13 km [8 mi] west of the Dewey-Burdock ISR Project area in Weston and Niobrara Counties, Wyoming (Figure 5.1-3). If future ISR operations occurred at Dewey Terrace, there will be uranium extraction from the same aquifer (i.e., the Inyan Kara aquifer) as the proposed Dewey-Burdock ISR Project. The combined ISR projects may impact groundwater levels in the ore zone aquifer and impact the water quality of the ore zone aquifer at the two sites. Licensees of ISR facilities are required to implement excursion detection, control, mitigation, and remediation plans under NRC regulations to reduce the potential impact on groundwater quality and quantity.

Impacts on groundwater resulting from the interaction of ISR activities and oil and gas exploration and production are not likely because these activities are conducted in stratigraphically separated aquifers. ISR activities at the Dewey-Burdock ISR Project will take place in sandstone aquifers of the Fall River and Lakota aquifers at depths of 61 to 244 m [200 to 800 ft] (see SEIS Section 3.4.1.2). Oil and gas producing wells in Fall River and Custer Counties are located in the Minnelusa and Madison Formations at depths ranging from 423 to 1,081 m [1,387 to 3,547 ft] (see SEIS Section 5.1.1.3). In Wyoming, the producing wells closest to the project are in Niobrara County and are located in the Leo Sandstone of the Minnelusa Formation at depths ranging from approximately 785 to 823 m [2,575 to 2,700 ft] (see SEIS Section 5.1.1.3). The NRC-required excursion monitoring programs at ISR facilities will ensure that water quality in aquifers underlying production zone aquifers, including the Madison, Minnelusa, and Deadwood aquifers, would be protected.

Deep well injection of process-related water is a disposal method ISR and oil production facilities use. For deep well disposal in South Dakota, the applicant must obtain UIC permits for the targeted deep aquifer from the EPA. The applicant has proposed injecting process-related effluents from the Dewey-Burdock Project into the Deadwood and Minnelusa Formations, below the Morrison Formation (see Figure 3.5-5), using Class V (nonhazardous) wells (Powertech, 2010). EPA will evaluate the suitability of the proposed deep injection wells and would only grant a permit if the deep disposal practice is safe for public health and safety and will not impact potential underground sources of drinking water. To ensure water quality, the liquid waste injected via Class V wells into deep aquifers must not be classified as hazardous under the Resource Conservation and Recovery Act and must be treated to meet NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B.

Impacts to groundwater from potential wind energy projects in the western United States, such as the Dewey-Burdock Wind Project, will not be significant. During construction, water is required for mixing of concrete and dust control along access roads and other areas of disturbance around the turbines, but these uses will be temporary. Development and construction of wind energy projects will include BMPs to mitigate impacts to both groundwater and surface water. Once a wind energy project is operating, minimal quantities of water are needed. (BLM, 2005b)

Groundwater for the Dewey Limestone Conveyor project will likely be used to suppress dust during road building and use activities, and for the construction of concrete foundation supports for the conveyor along its 10.6-km [6.6-mi] course. In addition, groundwater will be used for dust control/mitigation once the proposed quarry and conveyor are operational. This water demand will be supplied by one or more production wells (one at the quarry site and one at the rail load-out facility). The source for the supply well at the rail load-out facility will likely be developed in the Inyan Kara Group aquifer. This supply well will likely be used solely for dust suppression at the rail load-out area, and therefore the groundwater demand will be quite low, around 94.6 L/min [25 gpm] or less. (BLM, 2009a)

The proposed DM&E PRB Expansion Project (see SEIS Section 5.1.1.5) will have an impact on groundwater. Groundwater will be used to suppress dust during rail and bridge construction activities. Once operational, the PRB Expansion Project will use negligible amounts of groundwater. Water demand during construction activities will be supplied by existing municipal and private wells. DM&E will ensure that any wells that may be affected by project-related construction or reconstruction activities are appropriately protected or capped to prevent well and groundwater contamination. If wells are located on private land, DM&E will secure permission from the landowner before undertaking any actions. (STB, 2001)

The NRC staff have determined that the cumulative impact on groundwater resources within the water resources study area resulting from past, present, and reasonably foreseeable future actions is MODERATE. This finding is based on ongoing and reasonably foreseeable future actions that will (i) increase demand on the regional Madison aquifer, which is used for residential, municipal, and recreational purposes in the study area; (ii) impact groundwater quantity and quality in the Inyan Kara Group aquifer, which hosts uranium deposits surrounding the proposed Dewey-Burdock site; and (iii) potentially impact water quality in deep geologic formations that are used for deep disposal of liquid wastes. In addition, ongoing and reasonably foreseeable future actions will use groundwater for construction of concrete foundations and supports and for dust suppression during construction and operations activities, which will potentially impact water quantity in regional and local aquifers in the study area.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL incremental effect on groundwater resources when added to all other past, present, and reasonably foreseeable future actions in the groundwater study area. Based on the foregoing analysis, the potential impact of the proposed project on the existing and future use and quality of water for local and surrounding residential, municipal, and recreational purposes will be minimal. Impacts on groundwater resulting from interaction between ISR activities at the proposed Dewey-Burdock site and oil and gas production are unlikely because the ISR production zone aquifers are separated from underlying oil and gas bearing formations by hundreds to thousands of meters [hundreds to thousands of feet]. EPA permitting requirements will protect groundwater in aquifers used for deep well injection of process-related liquid effluents from the proposed action. The liquid waste injected via Class V wells into deep aquifers will have to be treated to meet NRC release standards in 10 CFR Part 20, Subparts D and K, and Appendix B. After uranium production and aquifer restoration are completed and groundwater withdrawals are terminated at the proposed Dewey-Burdock ISR Project, groundwater levels will recover with time. Groundwater restoration will restore impacted aquifers at the proposed project to acceptable water quality levels. Therefore, the NRC staff conclude that the potential impact on groundwater resources from operating the proposed Dewey-Burdock ISR Project will be SMALL (SEIS Section 4.5.2)..

5.6 Ecological Resources

The cumulative impact to ecological resources was evaluated for the area within an 80-km [50-mi] radius surrounding the proposed Dewey-Burdock ISR Project. The proposed project is located within the Great Plains physiographic province on the edge of the Black Hills uplift. The area under consideration includes the Sagebrush Steppe, Black Hills Foothills, Black Hills Plateau, and Black Hills core highland ecoregions. The timeframe for the analysis of cumulative impacts is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the proposed Dewey-Burdock project). Older data are considered where applicable to demonstrate historical trends.

5.6.1 Terrestrial Ecology

Activities occurring in the area of the proposed Dewey-Burdock ISR Project boundary include grazing and herd management, hunting, and uranium, oil, and gas exploration. There may be cumulative impacts to ecological resources, including both flora and fauna. These impacts include a reduction in wildlife habitat and forage productivity; modification of existing vegetative communities; and the potential spread of invasive species and noxious weed populations. Concerning wildlife, impacts may involve loss, alteration, or incremental fragmentation

of habitat; displacement of and stresses on wildlife; modification of prey and predator communities; and direct or indirect mortalities. Land disturbance resulting from reasonably foreseeable future actions (e.g., potential wind farm and transportation projects discussed in Sections 5.1.1.4 and 5.1.1.5) in the ecological resources cumulative impacts study area will have small ecological impacts, individually, if mitigative measures are employed (BLM, 2005b, 2009a; STB, 2001). However, assuming that adjacent habitats for each disturbed parcel of land will be at, or near, carrying capacity, and considering there will be an unavoidable reduction or alteration of the habitats, development activities in the Black Hills Foothills and Sagebrush Steppe ecoregions could cumulatively reduce wildlife and plant populations and alter population structure. For some species that may require specific conditions for their habitats, future use will be strongly influenced by the quality and composition of the remaining habitats. Additionally, grasses and noxious weeds tend to replace sagebrush after disturbances.

Loss and degradation of native sagebrush shrubland habitats has imperiled much of this ecosystem type as well as sagebrush-obligate species, including the Greater sage-grouse (*Centrocercus urophasianus*). Sage-grouse are found in the sagebrush shrubland habitats, and sagebrush is essential during all seasons and for every phase of their lifecycle (USGS, 2009). Most of the sagebrush lands in the region have been changed by land use, such as livestock grazing, agriculture, or resource extraction. These uses can influence habitats either directly or indirectly, and they can alter the disturbance regime by changing the frequency of fire (USGS, 2009). The long-term viability of the sage-grouse rangewide continues to be at risk because of population declines related to habitat loss and degradation. Sage-grouse populations have declined overall from 1965 to 2007 with the greatest decline occurring before the mid-1980s. The total rangewide population decline is estimated at 45 to 80 percent from historic levels (Becker, et al., 2009). Populations have been declining at 2.0 percent per year from 1956 to 2003 (Connelly, et al., 2011). Because of its spatial extent, oil and gas resource development is regarded as playing a major role in the decline of the sage-grouse species in the eastern portion of the species' range (Becker, et al., 2009). Future oil and gas development is projected to cause a 7 to 19 percent decline in sage-grouse lek population counts throughout much of the current and historic range of the sage-grouse (Connelly, et al., 2011). As of this writing, the U.S. Fish and Wildlife Service (FWS) has designated the Greater sage-grouse a “candidate species” under the Endangered Species Act (ESA). FWS will consider the bird on an annual basis for listing as a threatened or endangered species. The State of Wyoming is critical for sage-grouse as it currently contains 64 percent of all known sage-grouse habitat and more active leks than any other state (Doherty, et al., 2011).

According to the South Dakota Department of Game, Fish, and Parks, there are no crucial big game habitats or migration corridors in the ecological resources study. However, the area does contribute habitat for a variety of big game, including deer, antelope, turkeys, elk, and bighorn sheep. Destruction or alteration of portions of this habitat in conjunction with human disturbance associated with ongoing and reasonably foreseeable future actions could result in SMALL incremental impacts to herd animals.

As discussed in SEIS Section 4.6.1, the proposed Dewey-Burdock Project has the potential to impact vegetation, small- to medium-sized mammals, reptiles, and a number of avian species. These species include raptors, waterfowl, shorebirds, upland game birds, and nongame birds known to occur as seasonal, migratory, or year-round residents. Impacts may occur to species during all phases of the proposed project and are expected to be SMALL to MODERATE. Potential SMALL to MODERATE impacts to avian species (e.g., habitat loss, fragmentation, noise disturbance) will also be likely to occur at other present and reasonably foreseeable future actions (e.g., oil and gas facilities, wind energy projects, and transportation projects) throughout

the cumulative impacts study area and potentially impact other localized populations. Wind energy projects, such as the potential Dewey-Burdock Wind Project, have the potential to increase avian mortality resulting from bird collisions. BLM reported that the number of bird collisions at wind energy projects is relatively small, when compared with collisions from other human-made structures (BLM, 2005b).

The NRC staff have determined that the cumulative impact on terrestrial ecology within the ecological resources study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. This finding is based on habitat disturbance resulting from actions including (i) uranium and oil and gas exploration and development, (ii) potential ISR projects such as the Dewey Terrace ISR Project in Niobrara and Weston Counties in Wyoming, (iii) potential wind energy projects such as the Dewey-Burdock Wind Project, and (iv) potential transportation projects such as the Dewey Conveyor Project and the DM&E PRB Expansion Project. Habitat disturbance associated with these actions will impact vegetation by promoting the spread of noxious weeds and fragmenting vegetative communities. Impacts to wildlife could include loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and indirect mortalities.

The NRC staff conclude that the proposed Dewey-Burdock Project will have a SMALL incremental effect on terrestrial ecology when considered with all other past, present, and reasonably foreseeable actions in the ecological resources study area. The proposed action will disturb a maximum of 566 ha [1,398 ac] of habitat with most of the habitat disturbance consisting of scattered, confined drill sites for wells and potential land irrigation areas. These disturbances will not dramatically transform large expanses of habitat from their original character; therefore, no substantial long-term impact will generally be expected. Furthermore, the applicant will control and monitor potential land application areas to reduce impacts to soils and vegetation that could adversely affect flora and fauna. For vegetative species with specialized habitat requirements, future population viability will be strongly influenced by the quality and composition of the remaining habitat. Because the area of disturbed land will be a small percentage of the ecological resources study area, and because of stated mitigative measures the applicant has committed to as described in SEIS Section 4.6.1, impacts on vegetation from the proposed Dewey-Burdock project will have only a SMALL incremental impact when considered with all past, present, and reasonably foreseeable future actions. Although sage-grouse have been present in Fall River County in the past, and although a potential habitat for sage-grouse exists, Greater sage-grouse are not reported within 6.4 km [4 mi] of the proposed project boundary (SEIS Sections 3.6.3 and 4.6.1.1.1.2). Because NRC staff expect that similar habitat is present in the project area that FWS evaluated for the nearby Buffalo Gap National Grassland (see SEIS Sections 3.6.3 and 4.6.1.1.1.2) (Hodorff, 2005), it is unlikely that optimum canopy coverage of sagebrush habitat is present to support breeding and wintering populations within the proposed project area.

5.6.2 Aquatic Ecology

Potential impacts to aquatic species at the proposed Dewey-Burdock project site will occur primarily along Beaver Creek, Pass Creek, scattered stock ponds, and drainages. As described in SEIS Section 4.6.1.1.2, because of the limited and ephemeral nature of surface water at the proposed Dewey-Burdock Project, the occurrence of aquatic species is also limited. Beaver Creek is a perennial stream that supports aquatic habitat but does not support sensitive aquatic species due to annual low flow conditions. Further, U.S. Environmental Protection Agency (EPA) lists Beaver Creek as an impaired water body partially due to high dissolved and

suspended solids, high salinity, and fecal coliform (SDDENR, 2008). Therefore, ISR activities at the proposed Dewey-Burdock Project site are unlikely to further degrade the water quality of perennial streams in the areas. Pass Creek is an ephemeral stream that supports some intermittent habitat. However, Pass Creek does not provide a year-round source of surface water sufficient to maintain a population of aquatic species. No loss of aquatic habitat will result from planned construction activities or land application sites at the proposed Dewey-Burdock Project (Powertech, 2009a). In addition, no surface water will be diverted, no process water will be discharged into an aquatic habitat, and storm water runoff will be managed through the NPDES permit (as discussed in SEIS Section 4.5.1.1.1.2). Therefore, during all phases of the proposed Dewey-Burdock Project lifecycle, the potential impacts to aquatic species and habitats will be SMALL.

The NRC staff determined that the cumulative impact on aquatic ecology resulting from all past, present, and reasonably foreseeable future actions is SMALL. Cumulative impacts from oil and gas exploration and development, other ISR activities, wind energy projects, and transportation projects will not affect the aquatic ecosystem across the ecological resources study area. This conclusion is based on the limited and ephemeral nature of surface water in and surrounding the study area. The Beaver Creek and Pass Creek systems are the main surface water drainages in the study area. As discussed previously, Beaver Creek does not support sensitive aquatic species and is impaired due to high dissolved and suspended solids, high salinity, and fecal coliform (SDDENR, 2008). Pass Creek, on the other hand, does not provide a year-round source of water sufficient to maintain a population of aquatic species. In addition, all proposed activities in the study area will employ BMPs and comply with federal and state water quality regulations, which will reduce impacts on aquatic ecology.

The NRC staff have concluded that the proposed Dewey-Burdock Project will have a SMALL incremental effect on aquatic ecology when considered with all other past, present, and reasonably foreseeable actions in the study area. This conclusion is based on the limited and ephemeral nature of Beaver Creek and Pass Creek and other surface water features on the proposed Dewey-Burdock ISR Project site, and on the existing impaired status of Beaver Creek.

5.6.3 Protected Species

As discussed in SEIS Section 4.6.1.1.4, no federally listed species are present within the proposed Dewey-Burdock Project license area. Potentially suitable habitat for migrating whooping cranes exists where standing water is present, which will occur primarily along Beaver Creek and Pass Creek and their drainages, and old mine pits. Direct impacts are unlikely because whooping cranes are not known to breed in South Dakota; however, the proposed project could distress migrating cranes.

Potential suitable habitat for the black-footed ferret (*Mustela nigripes*) exists in the form of a black-tailed prairie dog (*Cynomys ludovicianus*) complex. However, no evidence of the presence of black-footed ferrets has been observed at the proposed site. Furthermore, it is unlikely that the species will recolonize the immediate area in the foreseeable future without FWS reintroducing it to the area. The prairie dog colony located on the proposed site will experience some unavoidable, direct disturbance. Displacement of the prairie dog colony could impact several federal- or state-listed species, including the mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), swift fox (*Vulpes velox)*, and burrowing owl (*Athene cunicularia*), which utilize burrows as habitat and/or prairie dogs as prey.

As described in SEIS Section 3.6.1, as of this writing, FWS has designated the Greater sage-grouse as a “candidate species” under the ESA and will consider the bird on an annual basis for listing as a threatened or endangered species. The State of Wyoming is critical for sage-grouse as it currently contains 64 percent of all known sage-grouse habitat and more active leks than any other state (Doherty, et al., 2011). No sage-grouse or leks were observed within a 6.4-km [4-mi] perimeter of the Dewey-Burdock site during wildlife surveys (Powertech, 2009a). As discussed in SEIS Section 3.6.3, although sage-grouse have appeared in Fall River County in the past, and although potential sage-grouse habitat is present, the small stands of sagebrush surrounded by grasslands and pine breaks in the project counties do not provide optimum canopy coverage to support breeding and wintering populations.

Rangewide, the long-term viability of the sage-grouse continues to be at risk because of population declines related to habitat loss and degradation. Because of its spatial extent, oil and gas resource development is regarded as playing a major role in the decline of the sage-grouse species in the eastern portion of species’ range (Becker, et al., 2009). Future oil and gas development is projected to cause a 7 to 19 percent decline in sage-grouse lek population counts throughout much of the current and historic range of the sage-grouse (Connelly, et al., 2011).

The NRC staff determined that the cumulative impact on protected species within the ecological resources study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE. This finding is based on habitat disturbance to potential protected species resulting from actions including (i) uranium and oil and gas exploration and development, (ii) potential ISR projects such as the Dewey Terrace ISR expansion project in Niobrara and Weston Counties in Wyoming, (iii) potential wind energy projects such as the Dewey-Burdock Wind Project, and (iv) potential transportation projects such as the Dewey Conveyor Project and the DM&E PRB Expansion Project. Impacts to protected and threatened species from these actions could include loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on species; and direct and indirect mortalities.

The NRC staff have concluded that the proposed Dewey-Burdock Project will have a SMALL incremental effect on protected species when considered with all other past, present, and reasonably foreseeable actions in the study area. No federally listed protected species are present within the proposed Dewey-Burdock Project license area, and the proposed license area does not contain critical habitat for any protected species. Furthermore, habitat disturbance at the proposed project site will consist primarily of scattered, confined drill sites for wells and potential land irrigation areas that will not result in large expanses of habitat being dramatically transformed, lost, or degraded.

5.7 Air Quality

Cumulative impacts to air quality were assessed primarily for the portions of the Black Hills-Rapid City Intrastate Air Quality Control Region located within an 80-km [50-mi] radius of the proposed Dewey-Burdock ISR Project. This area, hereafter called the air quality region of influence, covers the majority of Custer and Fall River Counties, the eastern portion of Pennington County (excluding Rapid City), and a very small portion of southwestern Lawrence County (see Figure 5.1.3).

5.7.1 Non-Greenhouse Gas Emissions

As described in Section 5.1.1, past, present, and foreseeable activities that may contribute to pollutant emissions include uranium exploration and extraction, oil and gas exploration and production, coal mining and coal bed methane operations, wind energy projects, the proposed Dewey Conveyor Project, and the proposed DM&E PRB Expansion Project. Air pollutants emitted by these sources potentially have a cumulative impact within the region and include, but are not limited to, carbon monoxide (CO) and nitrogen oxides (NO_x) from internal combustion engines used at natural gas pipeline compressor stations; CO, NO_x, particulates, SO_2, and volatile organic compounds (VOCs) from gasoline and diesel vehicle tailpipe emissions; dust generated by vehicle traffic on unpaved roads and agricultural activities; NO_2 and particulate emissions from railroad locomotives; and air pollutants transported from emission sources located outside the region. The contribution of past and present activities will be addressed first. Then the analyses will examine the foreseeable activities.

The past and present contributions of projects in the region that emit air pollutants are represented in the ambient air quality monitoring results described in SEIS Section 3.7.2. These monitoring results indicate the air quality is in attainment for all NAAQS. Table 3.7-3 contains data primarily from Wind Cave National Park, the nearest ambient air quality monitoring station, and a Prevention of Significant Deterioration (PSD) Class I site. This monitoring station was established in 2005 to determine air pollution background levels and whether the site was impacted by the long-range transport of air pollutants, such as pollution from the increase in oil and gas development in Colorado, Wyoming, and Montana (SDDENR, 2009). According to the South Dakota Ambient Air Monitoring Annual Network Plan (SDDENR, 2009), the annual PM_{10} concentrations at the Wind Cave site are the lowest in the state and the annual $PM_{2.5}$ concentrations are some of the lowest in the state. The nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) annual concentrations are very low and are at the monitoring equipment's detection limit (i.e., the ability of the equipment to detect the presence of a compound). The 8-hour average ozone levels at the Wind Cave station are similar to those at the state's other monitoring sites and are below NAAQS. Over the last couple of years, trends at the Wind Cave site, as well as some of the other monitoring sites, show decreasing ozone concentration levels. Ongoing ambient air monitoring, such as that conducted at Wind Cave Nation Park, provides an avenue to continually assess air quality from the cumulative emissions observed at a particular location. The air permitting process provides a mechanism for regulatory authorities such as SDDENR to protect air quality through permit conditions and restrictions. The permitting process, including the Prevention of Significant Deterioration, is described in SEIS Sections 2.1.1.1.6.1.1 and 3.7.2.

Regional air modeling and other studies in the region of influence often focus on Wind Cave National Park, the Class I area located in Custer County about 46.7 km [29 mi] from the proposed site. As a Class I area, these analyses examine impacts to visibility. Visibility impairment occurs when the pollution in the air either scatters or absorbs the light. Both natural and man-made sources contribute air pollution, which impairs visibility. Natural sources include windblown dust and smoke from fires. Man-made sources include electric utilities (i.e., power plants), industrial fuel burning, and motor vehicles.

The South Dakota Department of Environment and Natural Resource Regional Haze State Implementation Plan (SDDENR, 2011) provided pollution emission inventories and modeling results and also indentified the sources of the pollutants that affect the visibility. The plan provided information based on 2002 actual emissions and 2018 projections. This plan identified

sulfate, organic carbon, and nitrate as the major contributors to visibility impairment at Wind Cave National Park. The modeling indicates that only about 3 percent of the sulfur dioxide pollution affecting visibility at Wind Cave National Park comes from sources within South Dakota and at most, about 10 percent of the nitrogen dioxide pollution comes from sources within South Dakota. The state that contributes the most sulfur dioxide and nitrogen dioxide pollution that affects visibility at this Class I area is Wyoming. The state that contributes the most organic carbon is South Dakota, with the predominant source coming from natural fires. The state that contributes the coarsest particulate matter is South Dakota, accounting for up to 45 percent of the total. However, between 60 and 71 percent of this coarse particulate matter is attributed to natural sources.

BLM also evaluated potential long-range air impacts to the Wind Cave National Park from activities in Wyoming, specifically the Powder River Basin west of the proposed Dewey-Burdock ISR Project. Emission sources for these activities included coal-related facilities (i.e., mines, power plants, railroads, conversion facilities), permitted sources in Wyoming and Montana, coal bed methane production sources, and miscellaneous (i.e., roads, urban areas, conventional oil and gas, noncoal power plants). Emissions were developed for base year 2004 (NO_2, SO_2, $PM_{2.5}$, and PM_{10}) and were projected for year 2020. For the Wind Cave site, year 2020 projected impacts were well below NAAQS standards. All modeled NO_x and SO_2 levels were near or less than 1 percent of the NAAQS, and the highest PM level was about 12 percent of the NAAQS (BLM, 2009b). Visibility impacts were identified for the Wind Cave site. When comparing the year 2004 baseline case to the projected year 2020 impacts, the number of days with greater than a 10 percent change in visibility increases by 31 days per year. (BLM, 2009b)

The analyses will now consider the various reasonably foreseeable future actions starting with the proposed DM&E PRB Expansion project. This project would impact air quality in western Wyoming and southern South Dakota. Mitigation measures have been recommended as part of the proposed DM&E PRB Expansion Project to address potential adverse impacts to air quality. DM&E would be required to meet EPA emission standards for diesel-electric locomotives (40 CFR Part 92). To the extent practicable, DM&E would adopt fuel-saving practices, such as throttle modulation, dynamic braking, increased use of coasting trains, and shutting down locomotives when not in use for more than an hour, to reduce overall emissions during project-related operations. To minimize fugitive dust emissions during project-related construction activities, DM&E would implement fugitive dust suppression controls, such as spraying water, tarp covers for haul vehicles, and installation of wind barriers. (STB, 2001)

The only ISR site listed in Table 5.1-1 that occurs within the entire Black Hills-Rapid City Intrastate Air Quality Control Region is the proposed Dewey-Burdock ISR Project. The Edgemont site associated with conventional uranium milling is within the air quality region of influence and currently serves as a UMTRCA Title II disposal site under DOE ownership. As described in SEIS Sections 5.1.1.2 and 5.1.1.3, coal mining and oil and gas well development activities within the air quality region of influence are minimal.

None of the wind energy projects listed in Table 5.1-3 are within the air quality region of influence. The nearest existing wind power project is located about 161 km [100 mi] west-southwest in Converse County, Wyoming. As described in SEIS Section 5.1.1.4, a landowner group has organized to explore the possibility of a wind farm on privately owned land within and surrounding the proposed Dewey-Burdock ISR Project (see Figure 5.1-4). For wind energy projects, such as the potential Dewey-Burdock Wind Project, the construction phase would generate more air emissions than the operation phase (BLM, 2005b). Multiple concurrent

construction projects could contribute to regional pollutant emissions loads from construction and worker vehicle exhaust emissions. Localized incidences of fugitive dust along unpaved roads could occur if multiple construction projects occurred simultaneously. However, programmatic BMPs would include mitigation measures to reduce airborne dust at project sites. The dust emission contribution to cumulative impacts to regional air quality would be minimal, because they would be localized and temporary. Air emissions from vehicles involved in operational activities at wind energy projects would be minimal because of the small number of employees needed onsite at any one time (see SEIS Section 5.3). The small number of employees and associated trips during project operations would not have a noticeable effect on cumulative regional air quality (BLM, 2005b).

The proposed Dewey Limestone Conveyor project has the potential to cumulatively impact air quality in the vicinity of the proposed project. The aboveground conveyor system would be fully enclosed, preventing material and very little dust from escaping into the atmosphere. Fugitive dust would be monitored during construction and during the initial stages of operation using particulate dust collectors (PM_{10} and PM_{25} samplers). The State of South Dakota's Air Quality permit requires this monitoring for various facilities associated with the conveyor project. The rail load-out facility located approximately 1.6 km [1 mi] from the northwestern boundary of the proposed project site would require an air quality permit from SDDENR, which would include requirements for minimizing dust generation by using air pollution control equipment and other applicable operational BMPs (BLM, 2009a).

The NRC staff determined that the cumulative impact on air quality within the study area resulting from past, present, and reasonably foreseeable future actions is MODERATE. The current ambient air pollution concentrations relate to the air quality impacts from past and present actions. As described in SEIS Section 3.7.2, the area is classified as in attainment for each of the NAAQS pollutants. However, the Regional Haze State Implementation Plan and BLM regional analyses discussed in this SEIS section indicate that Wind Cave National Park does experience visibility impacts.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a MODERATE incremental effect on climate and air quality when added to all other past, present, and reasonably foreseeable future actions in the study area. On a local scale, fugitive emissions impact air quality from localized dust emissions that are short term and intermittent in nature. As discussed earlier in this section, the regional-scale air modeling and studies often focus on Wind Cave National Park and visibility impacts have been identified at this location. Fugitive dust contributes to visibility impacts. The pollutant with the largest emission levels from the proposed Dewey-Burdock ISR Project is fugitive dust, and cumulative visibility impacts (i.e., increasing regional haze) are possible. The fugitive dust emissions are not included in the modeling performed on the initial emission inventory. The applicant committed to perform air dispersion modeling using the revised emission inventory before the final SEIS is prepared (Powertech, 2012). The final SEIS analyses would be based on this updated modeling. SEIS Section 4.7.1 describes the scope of this update which would include Air Quality Related Values modeling for Wind Cave National Park. As described in Section C.4.2, the modeling results from a similar project are used to estimate the potential impacts from the proposed project. Similarities between the two projects include distance to the nearest Class I area and fugitive dust emission levels. The Dewey-Burdock peak year fugitive dust emission levels are about 68 percent for PM_{10} and 31 percent for $PM_{2.5}$ of the levels from the other project. Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change in visibility" when compared to background conditions. The potential visibility impacts from the other project to the Class I areas are predicted to be below the "just noticeable visibility change"

threshold (BLM, 2005a). This supports the notion that the proposed Dewey-Burdock ISR Project would contribute to visibility impacts, but the magnitude of the impact would be small.

5.7.2 Global Climate Change and Greenhouse Gas Emissions

NRC staff determined that a meaningful approach to address the cumulative impacts of greenhouse gas emissions, including carbon dioxide, is to recognize that (i) such emissions contribute to climate change, (ii) climate change is best characterized as the result of numerous and varied sources, each of which might seem to make a relatively small addition to global atmospheric greenhouse gas (GHG) concentrations, (iii) carbon footprint is a relevant factor in evaluating potential impacts of an alternative, and (iv) analysis may include both the proposed action's contribution to atmospheric GHG levels and the potential effects of climate change to the proposed action. These concepts are reflected in Sutley (2010).

GHG emissions are described in SEIS Sections 2.1.1.1.6.1.1, 3.7.2, and 4.7. As described in SEIS Section 4.7.1.1.1, the operation phase emissions bound the other phases in terms of GHG levels generated. The operation phase GHG annual emission estimate of 55,764 metric tons [61,469 short tons] is roughly evenly split between electrical consumption and mobile sources with a small amount attributed to stationary sources (Table 4.7-1). These mobile sources include equipment associated with the drilling activity with the primary contributor being the drill rig (Table C–12). As described throughout SEIS Section 4.7.1.2, NRC staff do not expect to see any appreciable difference in the overall greenhouse gas emission levels between the land disposal option and the deep well disposal option.

As described in SEIS Section 3.7.2, South Dakota accounted for approximately 36.5 million metric tons [40.2 short tons] of gross carbon dioxide equivalent (CO_2e) emissions in 2005 and forecast levels of 39.1 and 46.6 million metric tons [43.1 and 51.4 short tons] in 2010 and 2020, respectively (Center for Climate Strategies, 2007). The 2005 total is reduced to 34.9 million metric tons [38.5 short tons] as a result of annual sequestration (removal) due to forestry and other land uses (Center for Climate Strategies, 2007). The proposed Dewey-Burdock ISR Project emission estimate at 55,764 metric tons [61,469 short tons] equates to less than 1 percent (0.15 percent) to the overall GHG emissions for South Dakota in 2005. The low level of GHG emissions from the proposed Dewey-Burdock Project relative to the state estimates provides the basis for the NRC staff conclusion that the proposed Dewey-Burdock ISR Project would have a SMALL incremental impact on air quality in terms of GHG emissions when added to the MODERATE cumulative impacts anticipated from other GHG emissions from past, present, and reasonably foreseeable future actions.

NRC also examined the potential effect of climate change on the proposed Dewey-Burdock ISR Project. While there is general agreement in the scientific community that some climate change is occurring, considerable uncertainty remains in the magnitude and direction of some of the changes, especially predicting trends in a specific geographic location. As described in SEIS Section 3.7.2, the recent report from GCRP served as a source for climate change information (GCRP, 2009). The average temperature in the Great Plains increased by approximately 0.83 °C [1.5 °F] from the 1961 to 1979 baseline. South Dakota and the proposed Dewey-Burdock site are considered to be part of the Great Plains in this study. The projected change in temperature over the period from 2000 to 2020, which encompasses the period the proposed Dewey-Burdock ISR Project would be licensed, ranges from a decrease of approximately 0.28 °C [0.5 °F] to an increase of approximately 1.1 °C [2 °F]. Although GCRP did not incrementally forecast a change in precipitation by decade, it did project a change in

spring precipitation from the baseline period (1961 to 1979) to the next century (2080 to 2099). For the region of South Dakota where the proposed Dewey-Burdock ISR Project would be located, GCRP forecasted a 10 to 15 percent increase in spring precipitation (GCRP, 2009).

Based on the previous analyses, the overall effect of projected climate change on the proposed Dewey-Burdock ISR Project is SMALL. The predicted increases in temperature and precipitation over the next decade are small. Much of the activity associated with ISR milling occurs below ground, whereas the listed climate change parameters are associated with the surficial and atmospheric environments. The predicted increase in precipitation and subsequent infiltration into the groundwater could result in an increase in recharge to the aquifer in future. This could affect the proposed project by increasing the volume of groundwater in the ore body and improving the effectiveness of the aquifer restoration process. Similarly, potential changes to the site environment and resources, such as ecology during the period when the proposed activities would be conducted, would not be sufficient to alter the environmental conditions at the proposed site in a manner that would change the magnitude of the environmental impacts from what has already been evaluated in this SEIS.

5.8 Noise

Cumulative impacts from noise were assessed within an 8-km [5-mi] radius of the proposed Dewey-Burdock ISR Project. This area served as the cumulative assessment geographic boundary and was chosen because noise dissipates quickly from the source. GEIS Section 4.4.7 stated that sound levels as high as 132 dBA will taper to the lower limit of human hearing (20 dBA) at a distance of 6 km [3.7 mi] in this region, so a larger 8-km [5-mi] study area will be appropriate to evaluate potential cumulative impacts on noise (NRC, 2009a). The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

Noise associated with the proposed Dewey-Burdock ISR Project includes the operation of equipment such as trucks, bulldozers, and compressors; traffic due to commuting workers or material/waste shipments; and wellfield, central processing plant, and satellite facility activities and equipment. Other noises would include traffic noise from nearby roads and railroads. As detailed in SEIS Section 4.8.1, noise impacts to onsite and offsite residential and wildlife receptors and onsite workers from ISR activities at the proposed project would be SMALL for all stages of the project lifecycle.

Present and reasonably foreseeable future noise-generating activities in the vicinity of the proposed Dewey-Burdock ISR Project would primarily be from operating heavy equipment and traffic noise associated with (i) uranium and oil and gas exploration and development, (ii) wind energy projects, and (iii) transportation projects.

Oil and gas operations generate noise during construction, well drilling, and operation of compressor stations. However, noise levels from these activities are reduced to ambient levels at distances of approximately 488 m [1,600 ft] (BLM, 2003). Noise-related impacts are generally limited to the 610 m [2,000 ft] immediately surrounding each discrete source (e.g., drill rig, compressor station). Within the cumulative impacts from noise study area, there are four producing oil wells at the Barker Dome oilfield 6 km [4 mi] east of the proposed Dewey-Burdock site and another four producing oil wells at the Plum Canyon oilfield 5 km [3 mi] northwest of the proposed Dewey-Burdock site (see Figure 5.1-4). As described in SEIS Section 5.1.1.1, demand for oil and gas leasing in the vicinity surrounding the proposed Dewey-Burdock ISR

project area is low and the level of oil and gas exploration and development is not anticipated to increase significantly in the foreseeable future.

At this time, no future ISR projects have been identified within the cumulative noise impacts study area {i.e., within a 8-km [5-mi] radius of the proposed Dewey-Burdock site}. The applicant has identified a potential ISR project at Dewey Terrace located 13 km [8 mi] east of the Dewey-Burdock site (see SEIS Section 5.1.1.1). If developed, Dewey Road may be used to access the potential Dewey Terrace project from Edgemont, which is the nearest community to the south. Therefore, the potential Dewey Terrace project may contribute to noise within the study area from additional traffic on Dewey Road from commuting workers, construction and operations deliveries, and yellowcake and byproduct transport.

Construction of a wind energy project, such as the potential Dewey-Burdock Wind Project, will produce noise from activities including access road construction, grading, drilling and blasting (for tower foundations), construction of ancillary structures, cleanup, and revegetation. In general, construction activities will last for a short period (1 to 2 years at most) and will occur during the day; accordingly, their potential impacts will be temporary and intermittent in nature. Noise generated by turbines, substations, transmission lines, and maintenance activities during the operational phase of a wind energy project will approach typical background levels for rural areas at distances of 610 m [2,000 ft] or less. Like construction activities, decommissioning activities will occur during the day and would last for a short period compared with wind turbine operation, and therefore the potential impacts will be temporary and intermittent in nature. (BLM, 2005b)

Noise sources associated with the proposed Dewey Conveyor Project include the conveyor, conveyor drive motors, locomotives, and diesel-powered loaders. Noise levels from the proposed Dewey Conveyor Project are predicted to be below the EPA guideline of 55 dBA within 21 m [70 ft] from the conveyor drive motors and below the estimated existing 40 dBA within 111 m [365 ft] from the conveyor drive motors. Noise levels due to the rail load-out are predicted to meet the EPA guidelines of 55 dBA within 320 m [1,050 ft] from equipment and meet the existing ambient 40 dBA within 1,288 m [4,225 ft] from equipment. Mitigation measures the conveyor operator, GCC Dacotah, proposes to reduce noise impacts include installing high-grade mufflers on diesel-powered equipment, combining noisy operations to occur for short durations, and limiting rail loading to daytime hours. (BLM, 2009a)

The proposed DM&E PBR Expansion Project will have a significant impact on noise in western South Dakota and Wyoming. Noise will be produced by heavy equipment use and vehicular traffic during construction and by locomotive engine and wheel/rail noise during rail line operations. DM&E has proposed mitigation measures as part of the proposed expansion project to address potential adverse impacts on noise. DM&E will maintain project-related construction and maintenance vehicles in good working condition with properly functioning mufflers to control noise. DM&E will comply with Federal Railroad Administration regulations (49 CFR Part 210) for decibel limits for train operations. DM&E will mitigate train wayside noise (locomotive engine and wheel/rail noise) for noise-sensitive receptors along project-related new rail line construction to within 70 dBA. To minimize noise, DM&E will properly maintain rails and regularly service locomotives, keeping mufflers in good working order to control noise. (STB, 2001)

The NRC staff have determined that the cumulative impact on noise within the noise study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE.

Operation of reasonably foreseeable future actions, such as the Dewey Conveyor Project and DM&E PBR Expansion Project, would have significant noise impacts within the cumulative impacts study area. Noise associated with operation of the conveyor project will include the conveyor, conveyor drive motors, locomotives, and diesel-powered loaders. Locomotive engine and wheel/rail noise will have long-term noise impacts during operation of the DM&E rail line project. In addition, the potential Dewey Terrace ISR project may contribute to noise along Dewey Road from commuting workers, equipment and materials deliveries, and yellowcake and byproduct transport. Other ongoing and reasonably foreseeable future actions are not expected to have a significant impact on noise within the cumulative impacts study area. There are only eight producing oil wells within the study area, and demand for oil and gas leasing is low. Coal bed methane reserves are not present within the study area. Potential wind energy projects, such as the Dewey-Burdock Wind Project, are generally compatible with the primary land uses in the study area, including livestock grazing, recreation, and wildlife habitat conservation (BLM, 2005b). During operation of a wind energy project, noise generated by turbines, substations, transmission lines, and maintenance activities will approach typical background levels for rural areas at distances of 610 m [2,000 ft] or less (BLM, 2005b).

The NRC staff have concluded that the proposed Dewey-Burdock Project would have a SMALL incremental effect on noise when considered with all other past, present, and reasonably foreseeable actions in the noise study area. There are few sensitive noise receptors (e.g., residences, communities) in the cumulative impacts noise study area. As described in SEIS Section 4.8.1, noise generated by construction and operational activities at the proposed Dewey-Burdock ISR Project will dissipate or be reduced by mitigation measures before reaching onsite and offsite residential and sensitive wildlife receptors. Additionally, noise levels will be mitigated by administrative and engineering controls to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits.

5.9 Historic and Cultural Resources

Cumulative impacts on historic and cultural resources were assessed within a 16-km [10-mi] radius of the proposed Dewey-Burdock ISR Project. This area delineates the geographic boundary utilized for the cumulative analysis of historic and cultural resources and will be collectively referred to as the “historic and cultural resources study area.” The assessment of cumulative impacts on historic and cultural resources beyond 16 km [10 mi] was not undertaken because at this distance the impacts on historic and cultural resources from the proposed Dewey-Burdock ISR Project on other past, present, and reasonably foreseeable future actions will be minimal. The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility). In 2009, the applicant submitted a license application to NRC; year 2030 represents the license termination at the end of the decommissioning period.

Potential impacts to cultural and historic resources could result from energy development, erosion, and grazing activities. These impacts would result primarily from the loss or damage to historical, cultural, and archaeological resources, but also from temporary restrictions on access to these resources. Applicants for ISR facilities would conduct appropriate historic and cultural resource surveys as part of prelicense application activities. Impacts to cultural resources are often minimized for projects located on federal or tribal lands or that are part of a federal action, because such projects are subject to the National Historic Preservation Act (NHPA), the Section 106 consultation process, and other applicable statutes.

Cultural resources may be affected indirectly by the consequences of nearby projects, such as erosion, destabilization of land surfaces, increased area access, and increased vibration from locomotive and heavy truck traffic. As discussed in SEIS Section 4.9, the impact of the proposed ISR project on historic and cultural resources in the Dewey-Burdock project area has been categorized as SMALL to LARGE, depending on the phase of the facility lifecycle.

The analysis of cumulative impacts on historic and cultural resources at the proposed project focused on identification and the assessment and implementation of mitigative measures to protect resources within the area of potential effect (APE). As described in SEIS Section 3.9, the APE is defined as the area that may be directly or indirectly impacted by construction, operations, aquifer restoration, and decommissioning activities associated with the proposed action. As described in SEIS Section 4.9.1, 18 historic sites listed or recommended as eligible for listing on the National Register of Historic Places (NRHP), including two sites with burial or cairn features, are located within the proposed project area (see Tables 4.9-1 and 4.9-2). In addition, Tables 4.9-2 and 4.9-3 list sites with burial and cairn features and sites within 76 m [250 ft] of project activity areas that are unevaluated. Mitigative measures that will be implemented to protect the NRHP-eligible and unevaluated sites are described in SEIS Section 4.9.1. Efforts to identify properties of religious and cultural significance to Native American tribes at the proposed Dewey-Burdock site through Section 106 consultation involving NRC, SD SHPO, BLM, tribal representatives and the applicant are ongoing, but have not been completed (see SEIS Section 1.7.3.5 and Appendix A). The NRC cannot determine effects to these properties at this time.

The applicant stated that site avoidance is the goal during development and production of the proposed project (Powertech, 2009a, Section 3.8.1). Sites in areas of activity where ground disturbance is planned will be fenced to avoid accidental disturbance. Furthermore, personnel will be made aware of the presence of sites prior to the start of ground-disturbing activities (Powertech, 2009a). If it is determined that NRHP-eligible or unevaluated sites listed in Tables 4.9-1, 4.9-2, and 4.9-3 cannot be avoided, then treatment plans will require that the applicant complete mitigation prior to construction. As described in SEIS Section 4.9.1, treatment plans will be established following the development of an agreement between the applicant, NRC, SD SHPO, interested federal and state agencies (e.g., BLM and EPA), and interested Native American tribes. Prior to construction, the applicant will also develop an Unexpected Discovery Plan that would outline the steps required in the event that unexpected historical and cultural resources are encountered.

The rock art sites in Craven Canyon are the most significant cultural resource that has been identified in the vicinity of the proposed Dewey-Burdock ISR Project. Craven Canyon is located approximately 10 km [6 mi] east of the proposed Dewey-Burdock ISR Project boundary (see Figure 5.1-3). The rock art in Craven Canyon consists of both petroglyphs, the oldest form of rock art, and pictographs. Recently, there have been increased prohibitions on the extraction of uranium and other minerals in the Craven Canyon area, which is designed to protect cultural resources such as rock art.

Past, present, and reasonably foreseeable future actions that have the potential for cumulative effects on historic and cultural resources identified in the cumulative impacts study area include uranium exploration and extraction, oil and gas exploration, wind energy projects (e.g., the Dewey-Burdock Wind Project), and transportation projects (e.g., the proposed Dewey Conveyor Project and the proposed DM&E PRB Expansion Project) (see SEIS Sections 5.1.1.1 through 5.1.1.5).

Uranium extraction, and oil and gas exploration and drilling have occurred in the cumulative impacts study area, and additional drilling is likely to occur in the future. In the case of oil and gas exploration, areas have been proposed for lease sales, but neither applications nor permits to drill have been filed to date (see SEIS Section 5.1.1.3). Activities associated with exploration drilling will include access road and drill pad construction. All access roads and drill sites proposed for any type of exploration drilling will need to be surveyed for historic and cultural resources. Surveys by professional archaeologists and cultural specialists to identify and evaluate NRHP eligibility prior to project construction activities will need to be conducted. In addition, identification of properties of importance to Native American tribes will also need to be undertaken as part of consultation. If NRHP-eligible sites are found, appropriate levels of evaluation and mitigation will be required prior to construction.

One project that may have a cumulative impact on historic and cultural resources in the vicinity of the proposed Dewey-Burdock ISR Project is the potential Dewey Terrace ISR project. As with the current proposed project, the potential Dewey Terrace ISR project will be surveyed for historic and cultural resources prior to licensing and, if NRHP-eligible sites are indentified, appropriate levels of evaluation and mitigation will be required.

Surface-disturbing activities from wind energy developments, such as the potential Dewey-Burdock Wind Project, could uncover and destroy cultural resources. However, the development and implementation of programmatic agreements and BMPs will limit the potential impacts at a wind energy project site. For example, a cultural resources management plan will be developed to determine the mitigation activities needed for cultural resources found at a site. Avoidance of the historic and cultural resources will be the preferred mitigation option. Other mitigation options will include archaeological surveys and excavation (as warranted), monitoring, and inadvertent discovery procedures. The programmatic agreements and BMPs will also require consultation under NHPA Section 106, including consultation with SD SHPO and Native American tribes. The implementation of agreements and BMPs would greatly limit impacts from wind energy projects on cultural resources, which are expected to be mainly archaeological sites. However, impacts to cultural resources with a visual component (i.e., sacred landscapes) may occur. (BLM, 2005b)

As described in SEIS Section 5.1.1.5, the proposed GCC Dacotah Inc. Dewey Conveyor Project would use an elevated, enclosed conveyor to transport limestone quarried from the Minnekahta Limestone to a rail load out facility near Dewey, South Dakota (see Figure 5.3-1). GCC Dacotah Inc. controls minerals rights to areas of potential limestone exploitation north of the proposed conveyor, where the Minnekahta Limestone lies at or near the ground surface (BLM, 2009a). These mineral rights are controlled either by ownership or leasing of private lands, or have been acquired by the staking of claims on lands underlain by federally held mineral rights. To date, the location of quarrying operations has not been finalized. However, federal mineral lands acquired by GCC Dacotah Inc. for potential limestone mining have been previously surveyed for cultural resources and over 60 sites were identified (Buechler, 1999; Sundstrom, 1999; Winham, et al., 2001). It is expected that many sites would be impacted during quarrying activities. Therefore, appropriate measures would be required to ensure that identified cultural resource sites are avoided and protected during quarrying operations (BLM, 2009a).

NRHP-eligible historic or cultural resource sites have not been identified along the proposed Dewey Conveyor Project route or within a 30-m [100-ft]-wide buffer zone on either side of the proposed construction zone (see Figure 5.3-1). However, the implementation of alternatives for the proposed Dewey Conveyor Project will result in direct impacts to NRHP-eligible properties. To address these impacts, the following mitigation measures have been proposed: (i) GCC

Dacotah Inc. will make a reasonable effort to design the project in a manner to avoid NRHP-eligible properties; (ii) unless authorized by BLM, USFS, and SD SHPO, no surface disturbance will occur within 30 m [100 ft] of the boundary of identified NRHP-eligible properties; and (iii) unless authorized by BLM, USFS, and SD SHPO, no surface disturbance will occur within 30 m [100 ft] of the boundary of 14 unevaluated sites and until their NRHP eligibility has been determined. GCC Dacotah Inc. has also indicated that measures will be taken to ensure that even those sites that are not NRHP-eligible will be avoided and protected, wherever possible. (BLM, 2009a)

The proposed DM&E PRB Expansion Project will have a significant impact on cultural and historical resources. The project area has a long history of human occupation. Known sites of archaeological and historical significance occur throughout the area. The Department of Transportation Section of Environmental Analysis (SEA) identified 408 cultural resources sites within 0.6 km [1.0 mi] of Alternative C for the proposed DM&E project (see Figure 5.1-5). Of these, 96 sites were in South Dakota and 312 were in Wyoming. Within 0.6 km [1.0 mi] of an alternate route (Alternative B) for the proposed project, SEA identified 298 cultural resources sites, 70 in South Dakota and 228 in Wyoming. SEA determined that the project will have significant impacts to these resources because of the likelihood that construction of the proposed project will encounter significant cultural resources. To address potential adverse impacts on cultural resources, DM&E has proposed mitigation measures, including (i) informing workers of applicable federal, state, and local requirements for the protection of archaeological resources, graves, and other cultural resources and training them on how to recognize and treat resources; (ii) complying with a programmatic agreement and identification plan developed through the NHPA Section 106 consultation process; and (iii) implementing mitigation measures documented in an memorandum of agreement (MOA) developed to ensure that the concerns of Native Americans are considered and addressed. (STB, 2001)

Because the cumulative impacts study area has a long history of human occupation, it is expected that historic properties of religious and cultural importance to Native American tribes occur throughout the area and that many will be affected by the ongoing and reasonably foreseeable future actions discussed previously. Certain historic properties may be eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that are rooted in its history and are important in maintaining its continuing cultural identity (National Register Bulletin 38). Historic properties that might be present within the cumulative impacts study area include camp and burial sites, plant collection areas, and sacred and worship sites.

The NRC staff have determined that the cumulative impact on cultural and historic resources within the cultural and historic resources study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE to LARGE. Archaeological and historic sites and artifacts are present in the area of the proposed site, and any present and future projects could potentially cause adverse impacts to these sites and artifacts.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL to LARGE incremental impact on historic and cultural resources when added to the MODERATE to LARGE cumulative impact to these resources expected from other past, present, and reasonably foreseeable future actions. As discussed previously, 18 historic sites listed or recommended as eligible for listing on NRHP are within the proposed Dewey-Burdock project area. ISR activities, especially ground-disturbing activities during the construction phase at the proposed project, may result in a cumulative loss of historic and cultural resources. The

mitigation of adverse impacts at the proposed project will be addressed in an agreement between the applicant, NRC, SD SHPO, interested federal and state agencies (e.g., BLM, SDDENR), and interested Native American tribes.

5.10 Visual and Scenic Resources

Cumulative impacts to visual and scenic resources were assessed within a 3.2-km [2-mi] radius of the proposed Dewey-Burdock ISR Project. Beyond this distance, any changes to the landscape would be in the background distance zone for the purposes of visual resource management (VRM) defined by BLM, and would be either unobtrusive or imperceptible to viewers (BLM, 1984, 1986). The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

As described in SEIS Section 2.1.1.1, the proposed Dewey-Burdock site encompasses 4,282 ha [10,580 ac] of mostly private land in northern Fall River and southern Custer Counties, South Dakota. BLM has not assigned a VRM class to the region that encompasses the proposed project area. However, similar areas adjacent to the proposed project in Wyoming are identified as VRM Classes III and IV (BLM, 2000). At present, human-made features within and in the immediate vicinity of the proposed site include roads, power lines, ranch residences, fence lines, and abandoned open pits and overburden piles associated with past conventional uranium mining. The primary visual feature superimposed on the proposed project landscape is the transportation and utility corridor consisting of Dewey Road, the BNSF railroad, and overhead power lines. The abandoned open pits and overburden piles from historical mining that are located within the eastern and northeastern parts of the proposed project site contribute adversely to the scenic and visual quality of the area. However, the abandoned open pits and overburden piles are not visible from surrounding county roads and highways.

As described in SEIS Section 4.10.1, potential impacts on visual and scenic resources from the proposed Dewey-Burdock ISR Project will be the contrast of surface facilities and infrastructure (e.g., drilling rigs, powerlines, process buildings, header houses, wellheads, irrigation center pivots) with the existing visual inventory. These types of visual impacts are consistent with the management objectives of the VRM Class III and IV areas that include similar areas adjacent to the proposed project in Wyoming (BLM, 2000). As described in detail in SEIS Section 4.10.1, the impacts to visual and scenic resources from the surface structures and equipment will be SMALL for all phases of the proposed Dewey-Burdock ISR Project. NRC staff base this conclusion on the remote location of the project site and mitigation measures that will be used to reduce potential visual and scenic impacts (e.g., selecting building materials and paint that blend with the natural environment, dust suppression).

Past, present, and reasonably foreseeable future activities that could have cumulative impacts on the visual and scenic resources in the vicinity of the proposed Dewey-Burdock Project include uranium exploration/extraction, potential oil and gas exploration and development, wind energy projects, and potential transportation projects (i.e., the proposed Dewey Conveyor Project and the proposed DM&E PRB Expansion Project).

Surface disturbances and fugitive dust emissions associated with access roads and drill pad construction developed for uranium and oil and gas exploration should have only a minor cumulative impact on the visual and scenic resources in the area. Access road segments will be considerably shorter than Dewey Road. Truck and equipment traffic for both construction and drilling activities will be relatively minor, consisting of one or two pieces of equipment per

day for construction and two to four pick-up truck trips per day to support drilling activities. All surface disturbances and equipment associated with exploration drilling will be temporary, and the affected ground surface will be fully reclaimed after use. Demand for oil and gas leases is low, and there are no producing oil wells within the 3.2-km [2-mi] radius that could potentially contribute to cumulative impacts related to visual and scenic resources (see SEIS Section 5.1.1.3). Furthermore, there are no reasonably foreseeable future ISR operations in the 3.2-km [2-mi] radius that could potentially impact visual and scenic resources (see SEIS Section 5.1.1.1).

Wind energy projects, such as the potential Dewey-Burdock Wind Project (see Figure 5.1-4), will have an impact on visual and scenic resources within the cumulative impacts study area. The heights, type, and color of turbines, together with their placement with respect to local topography (i.e., on a ridge or mesa), are factors that will contribute to visual intrusion on the landscape. Also, the need for additional transmission lines to connect wind energy projects to the regional power grid could contribute to cumulative impacts. On U.S. government-owned lands, flexibility in locating turbines and transmission line towers to avoid visual impacts to important view sheds will be considered through consultation with the wind energy developer and the managing federal agency (e.g., BLM, USFS) on a project-specific basis. (BLM, 2005b)

The proposed 10.6-km [6.6-mi]-long Dewey Limestone Conveyor project will have an impact on visual and scenic resources within the cumulative impacts study area (see Figure 5.1-4). The proposed conveyor will consist of elevated 1.5 m by 2.4 m by 12.2 m [5 ft by 8 ft by 40 ft] conveyor segments attached to supporting concrete piers or foundations spaced 7.6 to 12.2 m [25 to 40 ft] apart. The average conveyor height will be 4.9 m [16 ft] with approximately 2.7 m [9 ft] of clearance beneath the conveyor segments. The conveyor alignment is proposed to begin at Dewey Road approximately 1.8 km [1.1 mi] south of the town of Dewey and approximately 1.6 km [1 mi] north-northwest of the proposed Dewey-Burdock Project boundary. The alignment will head east-northeast, progressively away from the proposed Dewey-Burdock Project area. (BLM, 2009a)

The DM&E PRB Expansion Project will impact visual and scenic resources in the cumulative impacts study area by the visual intrusion of the railroad on the landscape (see Figure 5.1-4). Construction and operation will affect the current scenic character of the cumulative impacts study area as well as the remoteness and feeling of vastness this undeveloped area provides. Some visual mitigation will be accomplished by the use of nonreflective rails and color matching of facilities where possible. For example, DM&E will comply with USFS color coordination requirements for facilities associated with the railroad. Any facility more than 41 cm [16 in] tall will be required to be olive drab, flat tan, or desert brown except where they are required by law to be a specific color. (STB, 2001)

The NRC staff have determined that the cumulative impact on visual and scenic resources in the study area resulting from all past, present, and reasonably foreseeable future actions is MODERATE to LARGE. This finding is based on the structures and infrastructure from potential future actions that could significantly alter the viewshed within 3.2 km [2 mi] of the proposed Dewey-Burdock ISR Project including (i) turbines and transmission lines associated with future wind energy projects (e.g., the Dewey-Burdock Wind Project), (ii) the elevated conveyor and supporting concrete piers associated with the Dewey Conveyor Project, and (iii) rails and facilities associated with the DM&E PRB Expansion Project.

The NRC staff have concluded that the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on visual and scenic resources when considered with all the other past, present, and reasonably foreseeable future actions in the study area. As described in SEIS Section 4.10.1, visual and scenic impacts from the equipment used to construct buildings and drill wells will be temporary and visual impacts from structures and fugitive dust will be mitigated by the rolling topography and BMPs (e.g., color consideration for structures and dust suppression).

5.11 Socioeconomics

As described in SEIS Section 5.1.2, the timeframe for this cumulative impacts analysis for socioeconomics resources begins in 2009 and ends in 2030. The following socioeconomic indicators were evaluated as part of this analysis.

- Population
- Employment
- Housing
- School enrollment
- Public services
- Fiscal revenue

The geographic boundary varies for the socioeconomic resource indicators listed and is described as part of the analyses for each subcategory. The potential socioeconomic impacts for the proposed Dewey-Burdock ISR Project will be SMALL. These impacts are described in SEIS Section 4.11.

5.11.1 Population

The geographic boundary for the cumulative population analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. Population change over time is generally an excellent indicator of cumulative social and economic change in a given area. South Dakota’s population has grown from 696,004 in 1990 to 814,180 in 2010 and is estimated to decline modestly to 801,939 in 2020 (Brooks, 2008; USCB, 2012). Population in Custer County grew from 6,179 in 1990 to 8,216 in 2010 and is projected to decline slightly to 8,186 in 2020 (Brooks, 2008; USCB, 2012). In Fall River County, population decreased slightly from 7,353 in 1990 to 7,094 in 2010 and is projected to increase to 7,423 in 2020 (Brooks, 2008; USCB, 2012). Wyoming population has grown from 453,588 in 1990 to 563,626 in 2010 and is projected to increase to 622,360 in 2020 and 668,830 in 2030 (WDAI, 2011, 2012). Niobrara County population has declined slightly from 2,499 in 1990 to 2,484 in 2010 and is projected to increase to 2,660 in 2020 and 2,710 in 2030 (WDAI, 2011, 2012). Weston County population has grown from 6,518 in 1990 to 7,208 in 2010 and is estimated to increase to 7,900 in 2020 and 8,120 in 2030 (WDAI, 2011, 2012).

The relatively flat county population projections do not take into account the current economic conditions, climate change legislation (including cap and trade components), and future technological changes (e.g., wind energy and clean coal innovations). If the reasonably foreseeable future actions described in SEIS Section 5.1.1 go forward and become functional within the boundary of the cumulative population analysis study area, workers will be required to build and operate these facilities. These future actions include potential wind energy projects, such as the Dewey-Burdock Wind Project, and proposed transportation projects, which include

the Dewey Conveyor Project and the DM&E PRB Expansion Project. Additional workers will also be required to staff any expansion in uranium extraction projects, such as the development of the potential Dewey-Terrace project in Weston and Niobrara Counties. It is likely that any additional workers will desire to live closer to their place of employment and become active in their community. The towns of Custer (population 2,067), Hot Springs (population 3,711), Edgemont (population 774), and Newcastle (population 3.532) may see population increases associated with future actions in the population analysis study area. Assuming that energy development and transportation projects are developed and constructed, the addition of new workers in these towns will have a MODERATE cumulative impact on population. The relatively small pool of workers associated with the proposed Dewey-Burdock ISR Project (86 short-term positions during construction, 84 positions during operations, 9 positions during aquifer restoration, and 9 positions during decommissioning) will have only a SMALL incremental impact on population. If a disproportionate number of workers associated with the proposed Dewey-Burdock project elect to reside in small towns like Edgemont, the incremental impact on population could be MODERATE.

5.11.2 Employment

The geographic boundary for the cumulative employment analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. While no individual county employment projections are available, the State of South Dakota is expected to experience modest growth through 2020, with an average annual growth rate of 0.9 percent (SDDLR, 2012). Employment in mining is expected to increase annually by 4 jobs or 0.5 percent through 2020, while employment in heavy construction is expected to increase annually by 50 jobs or 1.5 percent through 2020. The State of Wyoming is expected to experience modest growth through 2021, with an average annual growth rate of 1.5 percent (WDWS, 2012). Employment in mining (including oil and gas extraction) is expected to increase annually by 846 jobs or 3.2 percent through 2021.

The cumulative employment analysis study area may experience an increased rate of employment from ongoing and reasonably foreseeable future actions that may occur (see SEIS Section 5.1.1). If the potential Dewey-Burdock Wind Project and the proposed Dewey Conveyor Project and DM&E PRB Expansion Project are financed and developed, workers will be required to build and operate these projects. Wind energy projects are expected to employ 100 to 150 workers during a 1 to 2 year construction period and 10 to 20 workers to operate and maintain the project (BLM, 2005b). The proposed Dewey Conveyor project is expected to employ 50 workers during the 1 year construction period and about 12 workers afterwards to operate the project (BLM, 2009a). The proposed DM&E project will employ more than 900 workers over the 2 to 3 year construction phase (STB, 2001). However, only a small portion of the overall construction workforce will be located in a single location at any one time. Once a particular phase of DM&E project is complete, workers will relocate to other job locations (STB, 2001). Workers will also be required to staff potential ISR facilities in the study area, such as the potential Dewey-Terrace project. It is assumed that potential ISR facilities in the study area will employ the same number of workers as the proposed Dewey-Burdock ISR Project (86 during construction, 84 during operations, 9 during aquifer restoration, and 9 during decommissioning). This projected growth related to future actions will result in SMALL to MODERATE cumulative impacts to employment in the form of additional job opportunities. Based on the number workers expected at the proposed action, the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on employment.

5.11.3 Housing

The geographic boundary for the cumulative housing analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. With the projected growth from ongoing and reasonably foreseeable future actions, new employees moving into the study area will require housing. Smaller communities, such as Edgemont, are likely to experience MODERATE cumulative impacts due to limited housing availability. Assuming, however, that new employees relocate to one of the larger communities, such as Custer, Hot Springs, or Newcastle, there should be adequate housing opportunities to absorb the influx of facility workers. Therefore, the cumulative impact will be SMALL. Given the number of Dewey-Burdock ISR facility employees (86 during construction, 84 during operations, 9 during aquifer restoration, and 9 during decommissioning), there will be SMALL incremental impacts to housing markets, prices, and real estate development in larger communities such as Custer, Hot Springs, and Newcastle. However, housing impacts may be MODERATE if a disproportionate number of employees at the proposed Dewey-Burdock ISR project elect to reside in smaller communities, such as Edgemont.

5.11.4 Education

The Custer School District, Hot Springs School District, Edgemont School District, Weston County School District No. 1, and Weston County School District No. 7 represent the geographic boundary for the school enrollment resource analysis. These school districts were selected because most permanent Dewey-Burdock ISR facility employees will be likely to live in one of these districts. Most of the construction workforce, however, is not expected to relocate entire families during the relatively brief construction phase (1 to 2 years). Student enrollment in these school districts totaled 2,915 in 2010 and ranged from 150 students in the Edgemont School District to 882 students in the Custer School District (see Table 3.11-5).

Most of the construction workforce for the ongoing and reasonably foreseeable future actions described in SEIS Section 5.1.1 is not expected to relocate entire families into the school enrollment study area. The construction phases of future actions, such as wind projects, ISR facilities, and transportation projects, are relatively brief, ranging from 1 to 3 years. During operations of ongoing and reasonably foreseeable future actions, new employees will be more likely to move their families and send their children to schools in the study area. The potential increase in school-aged children will likely be split between the school districts in the school enrollment study area. Based on the number of permanent employees needed to operate reasonably foreseeable future actions (e.g., 84 for ISR facilities, 10 to 20 for wind projects, and about 12 for transportation projects), cumulative impacts to school enrollment are expected to be SMALL. Based on the number of workers (84) needed for the proposed Dewey-Burdock ISR Project, the proposed action will have a SMALL incremental impact on school resources in the larger school districts within the school enrollment study area, such as the Custer and Hot Springs school districts. However, school enrollment impacts may be MODERATE if a disproportionate number of employees at the proposed Dewey-Burdock ISR project elect to reside in smaller communities, such as Edgemont.

5.11.5 Public Services

The geographic boundary for the public services socioeconomic resource cumulative impact analysis includes Custer and Fall River Counties in South Dakota and Niobrara and Weston Counties in Wyoming. There may be incremental impacts to local government facilities and public services as population increases in affected counties and communities, which generally

result in across-the-board increases in the demand on services. Even small changes in population size may result in additional demand for health and human services, such as doctors, hospitals, police, and fire response. Additionally, the various reasonably foreseeable future actions described in SEIS Section 5.1.1 may result in increased demand for specific services (e.g., road maintenance). Operational impacts to public services and public infrastructure, as a result of the workers relocating with their families, will be area-specific, and may be long term. As described in SEIS Section 3.11.7, there are a number of existing medical and emergency facilities that will be capable of handling issues related to increased population. Additionally, the State of South Dakota Social Services has offices located throughout the state, including in Custer and Hot Springs. The State of Wyoming has numerous social services offices located throughout the state as well. There is an office for Niobrara and Weston Counties, as well as other local offices located in Newcastle. It is not anticipated that additional population from ongoing and reasonably foreseeable future actions will stress the current social services capabilities in the public services resource study area. Therefore, cumulative impacts to public services are expected to be SMALL. Given the number of workers required for the proposed Dewey-Burdock ISR Project (86 during construction, 84 during operations, 9 during aquifer restoration, and 9 during decommissioning), incremental impacts from the proposed action will have a SMALL impact on public services.

5.11.6 Local Finance

The geographic boundary for the local finance socioeconomic resource is Fall River and Custer Counties. Tax revenue will accrue mainly in Fall River and Custer Counties and to the State of South Dakota, and because of the structure of the taxing system, taxes may not accrue or be distributed to the localities proportionate to the population/public service impacts experienced by those entities. The tax system in place helps capture tax revenue during construction, operation, and decommissioning of industrial facilities. Additionally, a county ad valorem tax from current and future mineral extraction operations will contribute to local government revenue. Indirectly, counties and municipalities will benefit from increased sales tax revenue from increases in population and resultant demand for goods and services. If reasonably foreseeable future actions are constructed and operated, there will be a MODERATE cumulative impact on local finance. Given that the proposed Dewey-Burdock ISR Project is only one of numerous potential future projects, contributions from the Dewey-Burdock ISR Project are expected to have a SMALL incremental impact on local finance.

The NRC staff determined that the cumulative impact on socioeconomic resources resulting from past, present, and reasonably foreseeable future actions ranges from SMALL to MODERATE. Impacts to population and local finance will be MODERATE; impacts to employment will be SMALL to MODERATE, and impacts to housing, education, and public services will be SMALL.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL to MODERATE incremental effect on socioeconomic resources when considered with other past, present, and reasonably foreseeable actions. Impacts to population, housing, and education will be SMALL to MODERATE, while impacts to employment, public services, and local finance will be SMALL.

5.12 Environmental Justice

Impacts relating to environmental justice for the proposed Dewey-Burdock ISR Project are described in detail in SEIS Section 4.12. The geographic boundary for this resource includes Custer and Fall River Counties in South Dakota, Weston County in Wyoming, and the Pine Ridge Indian Reservation in Shannon County, South Dakota. The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the proposed project).

As described in SEIS Section 4.12.1, NRC staff determined that the percentage of minority populations living in affected block groups in the vicinity of the proposed Dewey-Burdock ISR Project site in Custer, Fall River, and Weston Counties does not significantly exceed the percentage of minority populations recorded at the state and county levels and is well below the national level. Furthermore, NRC staff determined 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. Based on an analysis of potential impacts to minority and low-income populations described in SEIS Section 4.12.2, NRC concluded that there will be no disproportionally high or adverse impacts to minority or low-income populations residing near the proposed project area.

In GEIS Section 6.4, NRC staff identified the Native American Oglala Sioux Tribe as a minority population in the Nebraska-South Dakota-Wyoming Milling Region and the Pine Ridge Indian Reservation as a low-income population (NRC, 2009a). The Pine Ridge Indian Reservation is located in Shannon County, South Dakota, approximately 80 km [50 mi] from the proposed Dewey-Burdock ISR Project. Environmental justice impacts related to the protection of cultural and religious resources of significance to the Oglala Sioux Tribe and other potentially affected Native American tribes are being addressed through the NHPA Section 106 consultation process as described in SEIS Sections 1.7.3.5 and 4.9.1. As described in SEIS Section 4.12.1, environmental justice impacts to Native American tribes will primarily be no different than those experienced by other populations within the vicinity of the project area. Although the proposed action may potentially affect certain sites of religious or cultural significance to the tribes, the impacts to such sites would be reduced through mitigation strategies developed during Section 106 consultations.

Because the economic base of the study area is largely ranching and resource extraction, low income areas are not only widely dispersed but small in size. Furthermore, it is unlikely that race and poverty characteristics in regions surrounding the proposed Dewey-Burdock ISR Project area will change significantly as a result of past, present, and reasonably foreseeable future projects discussed in Section 5.1.1. For reasonably foreseeable future actions, the extent to which there will be potential environmental impacts (e.g., visual impacts of wind turbines and transmission infrastructure associated with wind energy projects) and health and safety risks that create an environmental justice concern will depend on the precise location of low-income and minority populations in relation to specific projects. Full analysis of the potential impacts of specific projects on low-income and minority populations will be undertaken as part of site-specific environmental justice reviews of each proposed development site.

Based on available minority and low income population information and the analysis of human health and environmental impacts presented in Chapters 4 and 5, NRC staff conclude that the potential for adverse incremental impacts within the study area will be SMALL. The NRC staff also conclude that the proposed project will have a SMALL incremental impact on

environmental justice populations when added to the SMALL cumulative impacts from other past, present, and reasonably foreseeable future actions.

5.13 Public and Occupational Health and Safety

Cumulative impacts on public and occupational health and safety were evaluated within a 105-km [65-mi] radius of the proposed Dewey-Burdock site. This distance was chosen because the nearest operating ISR facility to the proposed Dewey-Burdock site is located approximately 105 km [65 mi] south at Crow Butte in Dawes County, Nebraska. The timeframe for the analysis is 2009 to 2030 (see SEIS Section 5.1.2 for the estimated operating life of the facility).

The public and occupational health and safety impacts from the proposed Dewey-Burdock ISR Project will be SMALL and are discussed in detail in SEIS Section 4.13.1. During normal activities associated with all phases of the project lifecycle, radiological and nonradiological worker and public health and safety impacts will be SMALL. Annual radiological doses to the population within 105 km [65 mi] of the proposed project will be far below applicable NRC regulations. For accidents, radiological and nonradiological impacts to workers may be MODERATE if the appropriate mitigation measures and other procedures intended to ensure worker safety are not followed. Typical protection measures, such as radiation and occupational monitoring, respiratory protection, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response, will be required as a part of the applicant’s NRC-approved Radiation Protection Program (Powertech, 2011). These procedures and plans will reduce the overall radiological and nonradiological impacts to workers from accidents to SMALL.

Past, existing, and anticipated future uranium recovery facilities in the vicinity of the proposed Dewey-Burdock ISR Project and within the broader regional area are described in Section 5.1.1.1. Abandoned open pits and overburden waste piles associated with past surface mining activities occur in the Burdock portion of the proposed site (see Figure 3.2-3). Radiation surveys have revealed that soils in and near the old surface mining works have elevated radiation levels (see SEIS Section 3.12.1), which could potentially increase radiological doses to onsite workers. Within a 105-km [65-mi] radius of the proposed project, there is one operating ISR facility at Crow Butte in Dawes County, Nebraska. In addition, three satellite facilities or ISR expansions for the Crow Butte site are in the planning or prelicensing stages: North Trend, Three Crow, and Marsland. The applicant has also identified a potential ISR project at Dewey Terrace in Niobrara and Weston Counties, Wyoming (Powertech, 2009b). If constructed and operated, all of these facilities will have similar radiological and nonradiological impacts on public and occupational health and safety to those at the proposed Dewey-Burdock site. Potential cumulative impacts from these facilities will result from incremental increases in annual radiological doses to the population when combined with the impacts of the proposed Dewey-Burdock ISR Project.

As stated in Section 4.13.1, for normal operations, Rn-222 will be the only significant radionuclide anticipated to be released at the proposed Dewey-Burdock ISR Project; the primary sources will be from wellfield venting and releases from within the central plant for process operations (predominantly via vent stacks on the ion-exchange columns and various tanks). As further described in SEIS Section 4.13.1, the maximum expected exposure to a member of the public is located southeast of the Dewey satellite facility within the proposed Dewey-Burdock project permit boundary (see Figure 4.13-1). This maximum exposure is estimated to be 0.06 mSv/yr [6.0 mrem/yr] and is consistent with estimates of expected

exposure levels at other operating ISR facilities in the United States (NRC, 2009a). This exposure, combined with exposures from other operating and potential ISR facilities in the study area, will remain far below the 10 CFR Part 20 public dose limit of 1.0 mSv/yr [100 mrem/yr] and have a negligible contribution to the 6.2 mSv [620 mrem] average yearly dose received by a member of the public from all sources.

As described in SEIS Section 4.13.1, both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20. Licensees are required to implement an NRC-approved radiation protection program to protect occupational workers and ensure that radiological doses are “as low as reasonably achievable” (ALARA). The applicant’s radiation protection program includes commitments for implementing management controls, engineering controls, radiation safety training, radon monitoring and sampling, and audit programs (Powertech, 2011). Measured and calculated doses for workers and the public are commonly only a fraction of regulated limits. Analysis of three separate accident scenarios (thickener failure and spill, pregnant lixiviant and loaded resin spills, and yellowcake dryer accident release) will also result in hypothetical exposures that are less than NRC regulatory limits and produce SMALL potential impacts (SEIS Section 4.13.1.1.2.2).

The types and quantities of chemicals (hazardous and nonhazardous) for proposed use at the Dewey-Burdock ISR Project do not differ from those evaluated in the GEIS. The use of hazardous chemicals at ISR facilities is controlled under several regulations (see SEIS Section 4.13.1.1.2.3 for a list of these regulations) that are designed to provide adequate protection to workers and the public. The handling and storage of chemicals at the facility will follow standard industrial safety standards and practices. Industrial safety aspects associated with the use of hazardous chemicals are regulated by the South Dakota Occupational Safety and Health Administration. Nonradiological worker safety will be addressed through occupational health and safety regulations and practices.

Other past, present, and reasonably foreseeable future actions in the vicinity of the Dewey-Burdock Project that could contribute to nonradiological public and occupational health and safety include oil and gas exploration, wind energy projects, the proposed Dewey Conveyor Project, and the proposed DM&E PRB Expansion Project (see SEIS Sections 5.1.1.3, 5.1.1.4, and 5.1.1.5). Increased risk to human health and safety will occur during development and operation of these projects from the inherent hazards associated with construction and maintenance activities. However, these risks will be minimized by implementation of BMPs, development and implementation of health and safety programs, safety setbacks to nearest residences, mitigation measures, and compliance with applicable federal and state occupational and public safety regulations (BLM, 2005b, 2009a; STB, 2001). Hazardous materials that are likely to be used during these ongoing and reasonably foreseeable future projects include diesel fuel, gasoline, hydraulic fluids, motor oil/grease, and compressed gasses used for welding (e.g., acetylene or propane). A large-scale release of diesel fuel or several of the other substances used at the projects may have implications for public health and safety. The location of the release will be the primary factor in determining its importance. However, the probability of a release anywhere along a proposed transportation route is extremely low, the probability of a release within a populated area will be even lower, and the probability of a release involving an injury or fatality will be still lower (BLM, 2009a). Therefore, it is not anticipated that a release involving a severe effect on human health and safety will occur during these ongoing and potential future actions. In addition, ongoing and potential future actions will have federal- and/or state-mandated spill prevention and control plans to prevent spills of oil and other petroleum products and other hazardous materials during construction and operation activities (BLM, 2009a; STB, 2001).

The NRC staff have determined that the cumulative impact on public and occupational health and safety in the study area resulting from all past, present, and reasonably foreseeable future actions is SMALL. This finding is based on estimates of combined radiological exposures from currently operating and proposed future ISR facilities in the study area, which are estimated to remain far below the regulatory public limit of 1.0 mSv/yr [100 mrem/yr] and have a negligible contribution to the 6.2 mSv [620 mrem] average yearly dose for a member of the public from all sources. Nonradiological exposures to workers and the general public from hazardous chemicals and materials resulting from past, present, and reasonably foreseeable future actions will be minimized by implementation of BMPs, mitigation measures, and compliance with applicable federal and state occupational and public safety regulations.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL incremental impact on public and occupational health when considered with all the other past, present, and reasonably foreseeable future actions in the study area. The maximum expected exposure to a member of the public at the proposed Dewey-Burdock Project is estimated to be 0.06 mSv/yr [6.0 mrem/yr] and is consistent with estimates of expected exposure levels at other operating ISR facilities in the United States (NRC, 2009a). Because the facility is located in a remote, sparsely populated area, the exposure to members of the public will be limited. Occupational health hazards will be limited because licensees are required to implement an NRC-approved radiation protection program to protect workers. As described in SEIS Section 4.13.1.1.2.3, the handling, storage, and disposal of chemicals at the proposed project would follow standard industrial safety standards and practices and the applicant must comply with EPA, SDDENR, and OSHA regulations regarding the industrial and environmental safety aspects associated with the use of chemicals.

5.14 Waste Management

Waste management impacts from the proposed Dewey-Burdock ISR Project would be SMALL to MODERATE and are detailed in SEIS Section 4.14.1. Cumulative impacts on waste management were considered within a 105-km [65-mi] radius of the proposed Dewey-Burdock Project site, and the timeframe for the analysis is 2009 to 2030 (see Section 5.1.2 for the estimated operating life of the facility). This distance was chosen because the nearest operating ISR facility that could generate waste volumes consistent with those projected for the proposed Dewey-Burdock site is located approximately 105 km [65 mi] south at the Cameco Crow Butte operation in Crawford, Nebraska.

The proposed Dewey-Burdock ISR Project will generate radiological and nonradiological liquid and solid wastes that must be handled and disposed of properly. Waste streams and the types and volumes of wastes to be disposed are described in SEIS Section 2.1.1.1.6. The primary radiological wastes are process-related liquid wastes, waste treatment solids, and process-contaminated structures and soils, all of which are classified as byproduct material waste. As discussed in SEIS Section 4.14.1, liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution, laundry water, plant washdown water, laboratory chemicals, and aquifer restoration water. Liquid byproduct material will be treated onsite using a combination of ion exchange, reverse osmosis, and radium settling followed by deep disposal in Class V injection wells, land application, or combined deep well disposal in Class V injection wells and land application. State- and federal-permitting actions, NRC license conditions, and NRC and state inspections ensure that proper waste disposal practices will be used to comply with safety and environmental requirements to protect workers, the public, and the environment.

As described in SEIS Section 4.14.1, the overall impacts from the disposal of process-related liquid wastes at the proposed Dewey-Burdock ISR Project will be SMALL. In addition, impacts associated with disposal of solid radioactive wastes will be SMALL based on the required preoperational disposal agreements made between the licensee and the licensed byproduct material waste disposal facility. Hazardous waste disposal impacts at the proposed Dewey-Burdock Project will be SMALL based on the low volumes of waste generated. Impacts from disposal of nonradioactive, nonhazardous solid wastes will be SMALL during the construction, operations, and aquifer restoration phases of the proposed project based on estimated volumes and the available capacity of local municipal solid waste landfills. However, impacts from disposal of nonhazardous solid wastes will be SMALL to MODERATE during the decommissioning phase depending on the long-term status of existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning phase, impacts will be MODERATE because the projected capacity of the local landfill (i.e., the Custer-Fall River landfill) will be insufficient to accommodate all the decommissioning nonhazardous solid waste. If local landfill capacity is expanded prior to the decommissioning phase, impacts from disposal of nonhazardous solid wastes will be SMALL.

Past, existing, and anticipated future uranium recovery facilities in the vicinity of the proposed Dewey-Burdock ISR Project and within the broader regional area are described in Section 5.1.1.1. Abandoned open pits and overburden waste piles associated with past surface mining activities occur in the Burdock portion of the Dewey-Burdock site (see SEIS Figures 3.2-3). Radiation surveys reveal that soils near the old surface mining works have higher than background radiation levels (Powertech, 2009a). At present, there are no plans to clean up and reclaim the old surface mines. However, potential future state- or federal-funded cleanup and reclamation of the abandoned open pits and overburden waste piles will have an impact on waste management if the radioactive soils require disposal in a licensed byproduct disposal facility. As noted previously, within a 105-km [65-mi] radius of the proposed Dewey-Burdock ISR Project, there is one operating ISR facility at Crow Butte in Dawes County, Nebraska, which will generate waste volumes consistent with those projected for the proposed Dewey-Burdock ISR project. In addition, three satellite facilities or ISR expansions are in the planning and licensing stages at the Crow Butte site: North Trend, Three Crow, and Marsland (see SEIS Section 5.1.1.1). Powertech has also identified a potential ISR project at Dewey Terrace in Niobrara and Weston Counties, Wyoming (Powertech, 2009b). All of these potential ISR facilities will generate solid and liquid waste volumes consistent with those projected for the proposed Dewey-Burdock ISR Project, which could contribute to waste management impacts within the cumulative impacts study area. Generation of nonhazardous solids wastes at the planned and potential ISR facilities could impact landfill resources in the cumulative impacts study area. Impacts to landfill resources will be MODERATE if current landfill capacities are not adequate to accept nonhazardous solid wastes generated by the planned and potential ISR facilities and an expansion is necessary to accommodate added volume. Before ISR operations begin, NRC requires ISR facilities to have an agreement in place with a licensed disposal facility to accept byproduct material. Because radioactive wastes are so closely monitored throughout the United States, the impact on waste management from these potential facilities is anticipated to be SMALL.

Regarding the potential cumulative impacts of liquid waste disposal, the applicant is seeking permits from EPA for four to eight Class V deep disposal wells for liquid byproduct materials (Powertech, 2011, Appendix 2.7–L). Additional deep disposal well use in the region is anticipated as additional ISR facilities are licensed. The EPA-permitting process for these wells evaluates the suitability of proposals to ensure groundwater resources are protected and potential environmental impacts are limited to acceptable levels. Based on the assumption that

EPA will not permit deep injection wells that will have a significant potential to impact groundwater resources, the NRC staff conclude the cumulative impacts of using deep disposal wells for the proposed action along with the potential impacts from present and reasonably foreseeable future actions will be SMALL.

Other ongoing and reasonably foreseeable future activities in the vicinity of the proposed Dewey-Burdock ISR Project site that may generate nonradiological hazardous wastes include oil and gas exploration, wind energy projects, and proposed transportation projects, such as the Dewey Conveyor Project and the DM&E PRB Expansion Project (see SEIS Sections 5.1.1.3, 5.1.1.4, and 5.1.1.5). Each of these projects will require shipment, storage, use, and disposal of hazardous materials and generation of solid and hazardous wastes; however, BMPs addressing these activities will effectively mitigate potential impacts. Each project will also be responsible for complying with applicable federal and state regulations and site-specific license agreements that manage generated wastes. For example, applicants will be required to comply with Department of Transportation Hazardous Materials regulations (49 CFR Parts 171 and 179) when handling, storing, and disposing hazardous materials. The types of hazardous substances that will likely be present during activities associated with these projects include diesel fuel, gasoline, hydraulic fluids, motor oil/grease, and compressed gases used for welding (e.g., acetylene, propane). Potential impacts will result from accidental releases of these substances during transportation, or during use and storage. The environmental effects of a release will depend on the substance, quantity, timing, and location of the release. The event could range from a minor oil spill on the project site where cleanup equipment will be readily available, to a severe spill during transport involving a large release of fuel or other hazardous substance. Some of the chemicals could have immediate adverse impacts on water quality and aquatic resources if a spill entered a flowing stream. With rapid cleanup actions, contamination will not result in a long-term impact to soils, surface water, or groundwater.

The NRC staff have determined that the cumulative impact on waste management in the study area resulting from all past, present, and reasonably foreseeable future actions is SMALL to MODERATE. All present and reasonably foreseeable future actions will implement BMPs to address shipment, storage, use, and disposal of radiological and nonradiological hazardous materials (both liquid and solid) and will be required to comply with applicable federal and state regulations and site-specific license agreements that manage generated wastes. Impacts to landfill resources will be MODERATE if current landfill capacities are not adequate to accept nonhazardous solid wastes generated by the planned and potential ISR facilities and an expansion is necessary to accommodate added volume.

The NRC staff conclude that the proposed Dewey-Burdock ISR Project will have a SMALL to MODERATE incremental impact on waste management when considered with all the other past, present, and reasonably foreseeable future actions in the study area. The applicant will be required to obtain the necessary permits and contractual agreements for disposing of its solid byproduct material, hazardous waste, and nonradiological, nonhazardous solid and liquid wastes. In addition, the applicant will be required to comply with applicable federal and state regulations and site-specific license agreements for the management and disposal of process-related liquid wastes. Impacts from disposal of nonradioactive, nonhazardous solid wastes will be SMALL during the construction, operations, and aquifer restoration phases of the proposed project based on estimated volumes and the available capacity of local municipal solid waste landfills. However, impacts from disposal of nonhazardous solid wastes will be SMALL to MODERATE during the decommissioning phase depending on the long-term status of existing local landfill resources. If local landfill capacity is not expanded prior to the proposed

decommissioning phase, impacts will be MODERATE because the projected capacity of the local landfill (i.e., the Custer-Fall River landfill) will be insufficient to accommodate all the decommissioning nonhazardous solid waste. If local landfill capacity is expanded prior to the decommissioning phase, impacts from disposal of nonhazardous solid wastes will be SMALL.

5.15 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20. "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

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

40 CFR Part 92. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 92, "Control of Air Pollution from Locomotives and Locomotive Engines." Washington, DC: U.S. Government Printing Office.

40 CFR Part 1500 to 40 CFR Part 1508. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Parts 1500–1508. "Council on Environmental Quality." Washington, DC: U.S. Government Printing Office.

49 CFR Part 171. *Code of Federal Regulations,* Title 49, Transportation, Part 171. "General Information, Regulations, and Definitions." Washington, DC: U.S. Government Printing Office.

49 CFR Part 179. *Code of Federal Regulations*, Title 49, Transportation, Part 179, "Specifications for Tank Cars." Washington, DC: U.S. Government Printing Office.

49 CFR Part 210. *Code of Federal Regulations*, Title 49, Transportation, Part 210. "Railroad Noise Emission Compliance Regulations." Washington, DC: U.S. Government Printing Office.

AWEA (American Wind Energy Association). "Wind Energy Facts: Nebraska." ML12243A234. Washington, D.C.: American Wind Energy Association. 2012a. <http://www.awea.org/learnabout/ publications/upload/4Q-11-Nebraska.pdf> (20 August 2012).

AWEA. "Wind Energy Facts: South Dakota." ML12243A243. Washington, D.C.: American Wind Energy Association. 2012b. <http://www.awea.org/learnabout/publications/upload/4Q-11-South-Dakota.pdf> (20 August 2012).

AWEA. "Wind Energy Facts: Wyoming." ML12234A254. Washington, D.C.: American Wind Energy Association. 2012c. <http://www.awea.org/learnabout/publications/upload/4Q-11-Wyoming.pdf> (20 August 2012).

AWEA. "U.S. Wind Energy Market Reports." Washington, D.C.: American Wind Energy Association. 2012d. <http://www.awea.org/learnabout/publications/reports/AWEA-US-Wind-Industry-Market-Reports.cfm> (20 August 2012).

Becker, J.M., C.A. Duberstein, J.D. Tagestad, and J.L. Downs. “Sage-Grouse and Wind Energy: Biology, Habits, and Potential Effects of Development.” Prepared for the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Wind & Hydropower Technologies Program under Contract DE-AC05-76RL01830. ML12243A257. 2009. <http://www.pnl.gov/main/publications/external/technical_reports/pnnl-18567.pdf> (28 April 2010).

BLM (U.S. Bureau of Land Management). “Draft Environmental Impact Statement, Dewey Conveyor Project.” DOI–BLM–MT–040–2009–002–EIS. ML12209A089. Belle Fourche, South Dakota: BLM Field Office, U.S. Department of Interior. January 2009a. <http://www.blm.gov/pgdata/etc/medialib/blm/mt/field_offices/south_dakota/dakotah.Par.28318.File.dat/DeweyDEIS.pdf> (25 July 2012).

BLM. “Update of Task 3A Report for the Powder River Basin Coal Review Cumulative Air Quality Effects for 2020.” ML12243A338. December 2009b. <http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/energy/coal/prb/coalreview/task_3a_-_2020.Par.91798.File.dat/Task-3A_2020.pdf> (23 April 2010).

BLM. “Draft Environmental Impact Statement for the Atlantic Rim Natural Gas Field Development Project Carbon County, Wyoming.” ML12243A274. Rawlins, Wyoming: BLM Field Office. December 2005a. <http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/rfodocs/atlantic_rim.Par.61741.File.dat/00deis.pdf> (20 August 2012).

BLM. “Chapter 5: Potential Impacts of Wind Energy Development and Analysis of Mitigation Measures.” *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States*. FES 05-11. ML12243A271. Washington, DC: BLM, U.S. Department of the Interior. June 2005b. <http://windeis.anl.gov/documents/fpeis/maintext/Vol1/Vol1Ch5.pdf> (20 August 2012).

BLM. “Mineral Occurrence and Development Potential Report, Rawlins Resource Management Plan Planning Area.” Rawlins, Wyoming: BLM, Rawlins Field Office. 2003. ML12243A327. <http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/planning/rmps/rawlins/modp.Par.49482.File.dat/Rawlins_Report.pdf> (20 August 2012).

BLM. “Newcastle Resource Management Plan.” ML12209A101. Newcastle, Wyoming: BLM, Newcastle Field Office. 2000. <http://www.blm.gov/rmpweb/Newcastle/rmp.pdf> (16 October 2009).

BLM. “Visual Resource Inventory.” Manual H–8410–1. ML12237A196. Washington, DC: BLM. 1986. <http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.31679.File.dat/H-8410.pdf> (16 October 2009).

BLM. “Visual Resource Management.” Manual 8400. ML12237A194. Washington, DC: BLM. 1984. <http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.34032.File.dat/8400.pdf> (16 October 2009).

Brooks, T., M. McCurry, and D. Hess. “South Dakota State and County Demographic Profiles.” ML12237A222. Brookings, South Dakota: South Dakota Rural Life and Census Data Center. May 2008. <http://www.sdstate.edu/soc/rlcdc/i-o/reports/upload/South-Dakota-State-and-County-Demographic-Profiles-B755.pdf> (22 August 2012).

Buechler, J.V. “An Intensive (Class III) Cultural Resources Inventory Survey of the Dacotah Cement Land Exchange Proposal in Southwestern Custer County, South Dakota.” Project No. 99-9. Rapid City, South Dakota: Dakota Research Services. (Submitted to Dacotah Cement, Rapid City, South Dakota). 1999.

Carter, J.M., D.G. Driscoll, and J.F. Sawyer. “Ground-Water Resources in the Black Hills Area, South Dakota.” U.S. Geological Survey Water Resources Investigations Report 03-4049. ML12243A344. 2003. <http://pubs.usgs.gov/wri/wri034049/wri034049_files/wri034049p0_10.pdf> (20 August 2012).

Center for Climate Strategies. “South Dakota Greenhouse Gas Inventory and Reference Case Projections 1990–2020.” 2007. <http://www.climatestrategies.us/ewebeditpro/items/O25F18227.pdf> (21 December 2009).

CEQ (Council on Environmental Quality). “Considering Cumulative Effects Under the National Environmental Policy Act.” ML13343A349. Washington, DC: Executive Office of the President, CEQ. 1997. <http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf> (20 August 2012).

Connelly, J.W., C.A. Hagen, and M.A. Schroeder. “Characteristics and Dynamics of Greater Sage-Grouse populations.” In *Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and Its Habitats.* S. T. Knick and J. W. Connelly, eds. *Studies in Avian Biology*. Vol. 38. pp. 53–67. ML12250A648. Berkeley, California: University of California Press. 2011. <http://wdfw.wa.gov/publications/01310/wdfw01310.pdf> (22 August 2012).

Doherty, K.E., D.E. Naugle, H. Copeland, A. Pocewicz, and J. Kiesecke. “Energy Development and Conservation Tradeoffs: Systematic Planning for Sage-Grouse in Their Eastern Range.” In *Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and Its Habitats.* S. T. Knick and J. W. Connelly, eds. *Studies in Avian Biology*. Vol. 38, pp. 505-516. ML12250A651. Berkeley, California: University of California Press. 2011. <http://www.blm.gov/pgdata/etc/ medialib/blm/wy/programs/energy/og/leasing/protests/2012/may/Appeals.Par.95895.File.dat/AUDExb8.pdf> (22 August 2012).

Driscoll, D.G., J.M. Carter, J.E. Williamson, and L.D. Putnam. “Hydrology of the Black Hills Area, South Dakota.” U.S. Geological Survey Water Resources Investigation Report 02-4094. ML12240A218. 2002. <http://pubs.usgs.gov/wri/wri024094/pdf/mainbodyofreport-1.pdf> (22 December 2009).

ESRI (Environmental Systems Research Institute). “ArcGIS 9 Media Kit, ESRI Data and Maps 9.3.” Redlands, California: ESRI. 2008.

GCRP (U.S. Global Change Research Program). *Global Climate Change Impacts in the United States*. Washington, DC: Cambridge University Press. 2009.

Hodorff. “Habitat Assessment and Conservation Strategy for Sage Grouse and Other Selected Species on Buffalo Gap National Grassland.” ML120240626. Hot Springs, South Dakota: U.S. Department of Agriculture, Forest Service. September 2005.

Holm, E.H., T. Cline, Jr., and M. Lees. “South Dakota—2008 Mineral Summary Production, Exploration, and Environmental Issues.” ML12243A352. Pierre, South Dakota: South Dakota Department of Environment and Natural Resources, Minerals and Mining Program. 2008. <http://denr.sd.gov/ documents/Goldrpt08a.pdf> (20 August 2012).

National Atlas of the United States. “Map of the United States.” September 17, 2009. <http://nationalatlas.gov> (29 October 2010).

Naus, C.A., D.G. Driscoll, and J.M. Carter. “Geochemistry of the Madison and Minnelusa Aquifers in the Black Hills Area, South Dakota.” ML12240A265. U.S. Geological Survey Water Resources Investigation Report 01-4129. 2001. <http://pubs.usgs.gov/wri/wri014129/ pdf/wri014129.pdf> (17 August 2012).

NOGCC (Nebraska Oil and Gas Conservation Commission). “Oil and Gas Conservation.” 2012. <http://nogcc.ne.gov> (22 August 2012).

NRC (U.S. Nuclear Regulatory Commission. “Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated August 13, 2012.” ML12243A367. 2012. <http://www.nrc.gov/ materials/uranium-recovery/license-apps/ur-projects-list-public.pdf> (20 August 2012).

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

NRC. “Site Visit to the Proposed Dewey-Burdock Uranium Project, Fall River and Custer Counties, South Dakota, and Meetings with Federal, State, and County Agencies, and Local Organizations, November 30–December 4, 2009.” ML093631627. Washington, DC: NRC. 2009b.

Powertech [Powertech (USA) Inc.]. “Dewey-Burdock Project Emissions Inventory Revisions.” E-mail (July 31) to B. Werling, Southwest Research Institute® from R. Blubaugh. ML12216A220. Greenwood Village, Colorado: Powertech. 2012.

Powertech. “Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota.” Technical Report RAI Responses. ML112071064. Greenwood Village, Colorado: Powertech. June 2011.

Powertech. “Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota ER_RAI Response August 11, 2010.” ML102380516. Greenwood Village, Colorado: Powertech. August 2010.

Powertech. “Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota—Environmental Report.” Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. August 2009a.

Powertech. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota—Technical Report." Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. August 2009b.

Powertech. "Dewey-Burdock Project, Supplement to Application for NRC Uranium Recovery License Dated February 2009." Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. August 2009c.

SDDENR (South Dakota Department of Environment and Natural Resources). "Online Oil/Gas/Injection Well Data." Rapid City, South Dakota: Minerals and Mining Program, Oil and Gas. 2012a. <http://www.sddenr.net/oil_gas/> (07 August 2012).

SDDENR. "Oil and Gas Drilling Permits Issued From 2005-2011." South Dakota Department of Natural Resources. 2012b. <http://denr.sd.gov/des/og/newpermit.aspx> (21 August 2012).

SDDENR. "South Dakota's Regional Haze State Implementation Program." ML12243A371. 2011. <http://denr.sd.gov/des/aq/aqnews/RHSIP20110818.pdf> (31 May 2012).

SDDENR. "Uranium Question and Answer Fact Sheet." ML12243A369. 2010. <http://denr.sd.gov/powertech/ UraniumQuestion&AnswerSheet92508.pdf> (30 November 2010).

SDDENR. "South Dakota Ambient Air Monitoring Annual Network Plan 2009." 2009. <http://denr.sd.gov/des/aq/aqnews/South%20Dakota%20AP2009.pdf> (14 December 2010).

SDDENR. "The 2008 South Dakota Integrated Report for Surface Water Quality Assessment." ML12240A378. Pierre, South Dakota: 2008. <http://denr.sd.gov/documents/08IRFinal.pdf> (05 November 2009).

SDDLR (South Dakota Department of Labor and Regulation). "South Dakota Industry Employment Projections." Pierre, South Dakota: SDDLR Labor Market Information Center. 2012. <http://dlr.sd.gov/lmic/industry_projections.aspx> (25 June 2012).

STB (Surface Transportation Board). "Final Environmental Impact Statement, Finance Docket No. 33407—Dakota, Minnesota & Eastern Railroad Corporation, Construction into the Powder River Basin, Powder River Basin Expansion Project." ML12243A381. Washington, DC: Surface Transportation Board, Section of Environmental Analysis. 2001. <http://stb.dot.gov/stb/docs/dme/feis/Ch03-1.pdf> (27 May 2010).

Sundstrom, L. "Living on the Edge: Archaeological and Geomorphological Investigations in the Vicinity of Tepee and Hell Canyons, Western Custer County, South Dakota." Day Star Research, Shorewood, Wisconsin. 1999.

Sutley, N. "Draft NEPA Guidance on Consideration of Effects of Climate Change and Greenhouse Gas Emissions." Memorandum (February 18) to Heads of Federal Departments and Agencies. Washington, DC: Council on Environmental Quality. 2010.

USCB (U.S. Census Bureau). "American FactFinder, Census 2000 and 2010, 2006–2010 American Community Survey 5-Year Estimate, State and County QuickFacts." ML12248A240. 2012. <http://factfinder.census.gov, http://quickfacts.census.gov> (17 April 2012).

USGS (U.S. Geological Survey). “Black Hills Hydrology Study.” Pierre, South Dakota: USGS, South Dakota Water Science Center. 2010. <http://sd.water.usgs.gov/projects/bhhs/Intro.html> (09 November 2010).

USGS. “Scientific Information for Greater Sage-Grouse and Sagebrush Habitats.” U.S. Department of Interior, United States Geological Survey, Briefing Paper. ML12250A713. September 29, 2009. <http://sagemap.wr.usgs.gov/Docs/SAGRBriefingPaper1.pdf> (22 August 2012).

WDAI (Wyoming Department of Administration and Information). “Population of Wyoming, Counties and Municipalities: 1980 to 1990.” ML12250A719. Cheyenne, Wyoming: WDAI, Economic Analysis Division. 2012. <http://eadiv.state.wy.us/pop/C&SC8090.pdf> (25 June 2012).

WDAI. “Population of Wyoming, Counties, Cities, and Towns: 2010 to 2030 .” ML12250A716. Cheyenne, Wyoming: WDAI, Economic Analysis Division. 2011. <http://eadiv.state.wy.us/pop/wyc&sc30.htm> (25 June 2012).

WDWS (Wyoming Department of Workforce Services Research and Planning). “Wyoming Occupational Projections, 2011-2021.” ML12243A386. Cheyenne, Wyoming: WDWS Research and Planning, 2012. <http://doe.state.wy.us/lmi/projections/WY_Occ_Proj_2011_2021.pdf> (25 June 2012).

Winham, R.P., L. Palmer, F. Sellet, and E.J. Lueck. “Intensive (Class III) Cultural Resouces Inventory Survey of the Dacotah Cement Land Exchange Proposal with the Bureau of Land Management in Southwestern Custer County, South Dakota.” Volumes 1–6. Prepared by Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. 2001.

WYOGCC (Wyoming Oil and Gas Conservation Commission). “County Reports.” Casper, Wyoming: WYOGCC. 2012. <http://wogcc.state.wy.us/> (07 August 2012).

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. These conditions are written specifically into the NRC source and byproduct 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 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). 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, radium settling and storage ponds, and potential 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. Work with BLM, SDGFP, and private landowners to limit recreational activities (primarily hunting) within the project area to the extent practicable.

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

Resource Area	Activity	Proposed Mitigation Measures
Transportation	Transportation safety	Maintain access roads, and impose speed limits on unpaved roads to minimize or eliminate accidents.
		Comply with all applicable NRC and DOT 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) 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.
		Notify NRC if a radiological accident occurs pursuant to requirements of 10 CFR Part 20 §2202 and §2203.

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

Resource Area	Activity	Proposed Mitigation Measures
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 latest 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 creating 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 SDDENR groundwater discharge plan permit, and comply with applicable state discharge requirements for land application of treated liquid wastes.

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

Resource Area	Activity	Proposed Mitigation Measures
Surface Water Resources	Erosion, runoff, and sedimentation	Refrain from consuming or discharging to surface waters. Obtain USACE permits and authorization from SDDENR when filling and crossing jurisdictional waters. Obtain construction and industrial 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 storm water management plan (SWMP) in accordance with SDDENR requirements to ensure that surface water runoff from disturbed areas meets NPDES permit limits. Avoid earthmoving activities at the proposed land-application sites. Divert potential runoff produced by snowmelt or precipitation in land application areas to adjacent catchment areas.
	Spills and leaks	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. Place liners, underdrains, and leak detection systems underneath settling and holding ponds. Bury pipelines to avoid freezing, and monitor pipeline pressures for leak detection.

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

Resource Area	Activity	Proposed Mitigation Measures
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 if proposed injection zones are underground sources of drinking water (have total dissolved solids concentrations below 10,000 mg/L). 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 SDDENR groundwater discharge permit, and comply with applicable state discharge requirements for land application of treated liquid wastes. Obtain water appropriation permit to access groundwater from the Madison aquifer. 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.
	Spills and leaks	Obtain construction and industrial NPDES permits from SDDENR, which require reporting of spills of petroleum products or hazardous chemicals. Implement a spill prevention and cleanup plan to minimize impacts to soils and groundwater, including rapid response cleanup and remediation. Place liners, underdrains, and leak detection systems underneath settling and holding ponds to prevent potential infiltration of liquid waste into soil and shallow aquifers. Bury pipelines to avoid freezing, and monitor pipeline pressures for leak detection.

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

Resource Area	Activity	Proposed Mitigation Measures
	Excursions	Conduct periodic mechanical integrity testing at the injection, production, and monitoring wells to limit the likelihood of well integrity failure during operations.
		Collect detailed lithologic and hydrogeological data in each proposed wellfield prior to ISR operations to ensure hydraulic control of the production zone.
		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 notifications and reports to NRC in the event of an excursion.
	Restoration/reclamation	Submit wellfield operational plans including well layouts for NRC and EPA approval before conducting operations in wellfields.
		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.

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

Resource Area	Activity	Proposed Mitigation Measures
Ecology		Follow the Land Use mitigation measures for land disturbance activities and access restrictions, which will also minimize impacts to vegetation and wildlife.
	Restoration/reclamation	Minimize disturbance of surface areas and vegetation, where possible (also benefits wildlife).
		Construct new roads, power lines, and pipelines in the same 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.
		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.
	Transmission Lines	Construct new overhead power lines using BMPs to reduce bird injuries and mortalities.
	Reduce Human Disturbances	Enforce speed limits to minimize collisions with wildlife.
		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.
		Restore diverse landforms; direct topsoil replacement; and construct brush piles, snags, and/or rock piles to enhance habitat for wildlife.
		Prepare FWS-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur.

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

Resource Area	Activity	Proposed Mitigation Measures
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 SEIS Section 4.7.1.1.1 for an explanation of “Tiers”) to limit combustion emissions. Spray water to mitigate fugitive dust accounting for a 50 percent reduction in emissions generated from onsite unpaved roads. Impose speed limits for travel on unpaved roads and areas. Encourage carpooling. 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 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. Adhere to FWS and SDGFP seasonal noise, vehicular traffic, and human proximity guidelines to limit noise impacts to raptors. 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.

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

Resource Area	Activity	Proposed Mitigation Measures
Cultural and Historic Resources	Disturbance of prehistoric archaeological sites and sites eligible for listing on the National Register of Historic Places (NRHP)	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 (SD SHPO), other government agencies (e.g., FWS, EPA, and BLM), and Native American tribes.
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 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.
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.

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

Resource Area	Activity	Proposed Mitigation Measures
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.
	Effects from facility operation	Comply with federal and state occupational safety regulations to limit nonradiological impacts of fugitive dust and diesel emissions to acceptable levels.
		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 reasonably achievable (ALARA).
		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.
		Develop and implement standard operating procedures regarding receiving, storing, handling, and disposing of chemicals.

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

Resource Area	Activity	Proposed Mitigation Measures
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.
	Waste Storage and Containment	Avoid using hazardous materials when possible.
		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 NRC

The NRC staff have reviewed the mitigation measures the applicant proposed and have 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

Table 6.3-1. Summary of Mitigation Measures Identified by NRC

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 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).
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 quarterly preoperational water quality samples from surface waters.
Groundwater Resources	Contamination and excursions	Locate all boreholes and wells within 305 m [1,000 ft] of a wellfield, if possible, and properly plug and abandon them. Submit results of the hydrogeological characterization and aquifer pump tests (hydrologic

Table 6.3-1. Summary of Mitigation Measures Identified by NRC (continued)

Resource Area	Activity	Proposed Mitigation Measures
		test data packages) for NRC review and approval prior to development of any proposed wellfields. Prior to ISR operations in partially saturated portions of the Chilson aquifer, require the applicant to 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 BLM and SDDNER.
	Fencing and screening	Cover vent pipes with either netting or other methods 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.
	Reduce Human Disturbances	Adhere to BLM timing and distance restrictions provided in SEIS Table 4.6-3. Avoid drilling activity in Sections 29 and 30 T6S-R1E between February 1 and August 31 annually to prevent disruption of the active bald eagle nest and redtail hawk nest in the vicinity of these sections. Require the applicant to contact SDGFP if exploration activity is conducted between February 1 and August 31 in Sections 30 and 29 T6S-R1E so that additional distance and/or timing restrictions may be issued. Allow snakes and lizards that are encountered to retreat.

Table 6.3-1. Summary of Mitigation Measures Identified by NRC (continued)

Resource Area	Activity	Proposed Mitigation Measures
		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. 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 the speed limit, use good engineering practices, minimize disturbed areas, and employ other BMPs as appropriate.

Table 6.3-1. Summary of Mitigation Measures Identified by NRC (continued)

Resource Area	Activity	Proposed Mitigation Measures
		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 OSHA 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 Places (NRHP)	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 are currently listed or eligible for listing on the NRHP. Avoid identified sites within the project area with burial or cairn features. Develop an agreement between all interested parties 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

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Table 6.3-1. Summary of Mitigation Measures Identified by NRC (continued)

Resource Area	Activity	Proposed Mitigation Measures
		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 NHPA 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.

license conditions could include additional mitigation measures, such as modifications to required monitoring programs. The NRC staff is 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 SEIS. While NRC cannot impose mitigation outside its regulatory authority under the Atomic Energy Act, the NRC staff have 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 NEPA, 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.

6.4 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20. "*Standards for Protection Against Radiation*." Washington, DC: U.S. Government Printing Office.

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

10 CFR Part 40. Appendix A. Code of Federal Regulations, Title 10, *Energy*, Part 40. Appendix A. "*Criteria Relating to the Operation of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction and Concentration of Source Material from Ores Processed Primarily from their Source Material Content*." Washington, DC: U.S. Government Printing Office.

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

36 CFR Part 60. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 60. "*National Register of Historic Places*." Washington, DC: U.S. Government Printing Office.

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of the Environment*, Part 1508. "*Terminology and Index*." Washington, DC: U.S. Government Printing Office.

Avian Power Line Interaction Committee. "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006." ML12243A391. Washington, DC: Edison Electric Institute and Sacramento, California: Avian Power Line Interaction Committee and the California Energy Commission. 2006. <http://www.aplic.org/uploads/files/2643/SuggestedPractices2006(LR-2).pdf> (13 October 2009).

NRC (U.S. Nuclear Regulatory Commission). NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." ML091480244, ML091480188. Washington, DC: NRC. May 2009.

Powertech [Powertech (USA) Inc.]. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota, Technical Report RAI Responses, June, 2011." ML112071064. Greenwood Village, Colorado: Powertech. 2011.

Powertech. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota ER_RAI Response August 11, 2010." ML102380516. Greenwood Village, Colorado: Powertech. 2010a.

Powertech. "Subject: Powertech (USA), Inc.'s Responses to the U.S. Nuclear Regulatory Commission (NRC) Staff's Verbal and Email Requests for Clarification of Selected Issues Related to the Dewey-Burdock Uranium Project Environmental Review Docket No. 40-9075; TAC No. J 00533." Letter (November 4) to R. Burrows, Project Manager, Office of Federal and State Materials and Environmental Management Programs, U.S. Nuclear Regulatory Commission, from R. Blubaugh, Vice President-Environmental Health and Safety Resources. ML110820582. Greenwood Village, Colorado: Powertech. 2010b.

Powertech. . "Subject: Powertech (USA), Inc.'s Responses to the U.S. Nuclear Regulatory Commission (NRC) Staff's Verbal Request for Clarification of Response Regarding Inclusion of Emissions from Drilling Disposal Wells; Dewey-Burdock Uranium Project Environmental Review Docket No. 40-9075; TAC No. J 00533." Letter (November 17) to R. Burrows, Project Manager, Office of Federal and State Materials and Environmental Management Programs, U.S. Nuclear Regulatory Commission from R. Blubaugh, Vice President-Environmental Health and Safety Resources. ML103220208. Greenwood Village, Colorado: Powertech. 2010c.

Powertech. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota—Environmental Report." Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. August 2009a.

Powertech. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota—Technical Report." Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. August 2009b.

Powertech. "Dewey-Burdock Project, Supplement to Application for NRC Uranium Recovery License Dated February 2009." Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. August 2009c.

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, which includes ISR facilities. 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 five locations identified in Figure 7.2-1 (Powertech, 2011). 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 each air monitoring station for monitoring Rn-222 on a monthly basis, consistent with Regulatory Guide 4.14 and NUREG–1569 (NRC, 1980, 2003; Powertech, 2011). 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 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

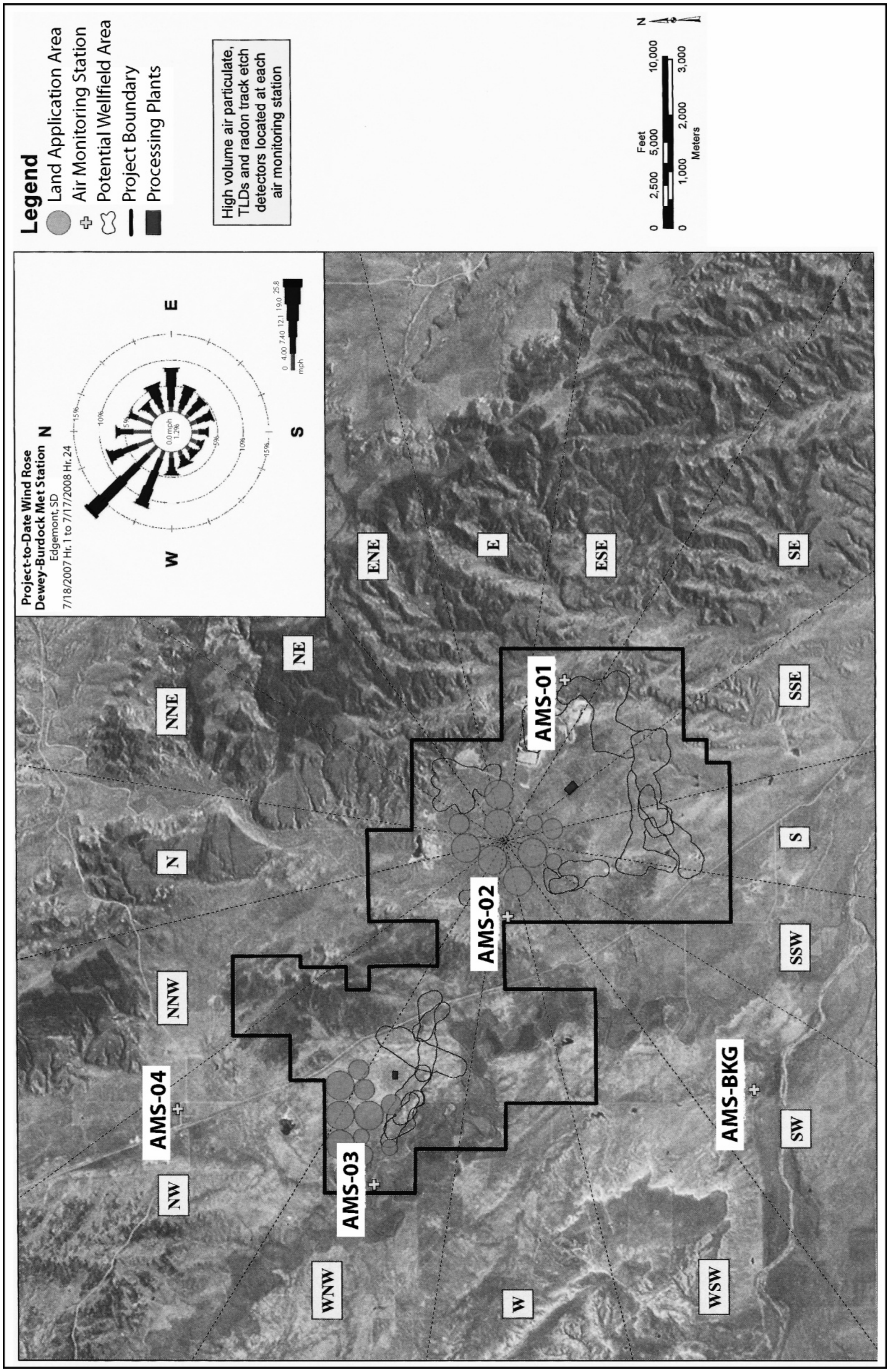

Figure 7.2-1. Locations of Operational Air Monitoring Stations at the Proposed Dewey-Burdock ISR Project Site.
Source: Modified from Powertech (2011).

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 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 more or less indiscriminately. 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 project boundary (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.

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

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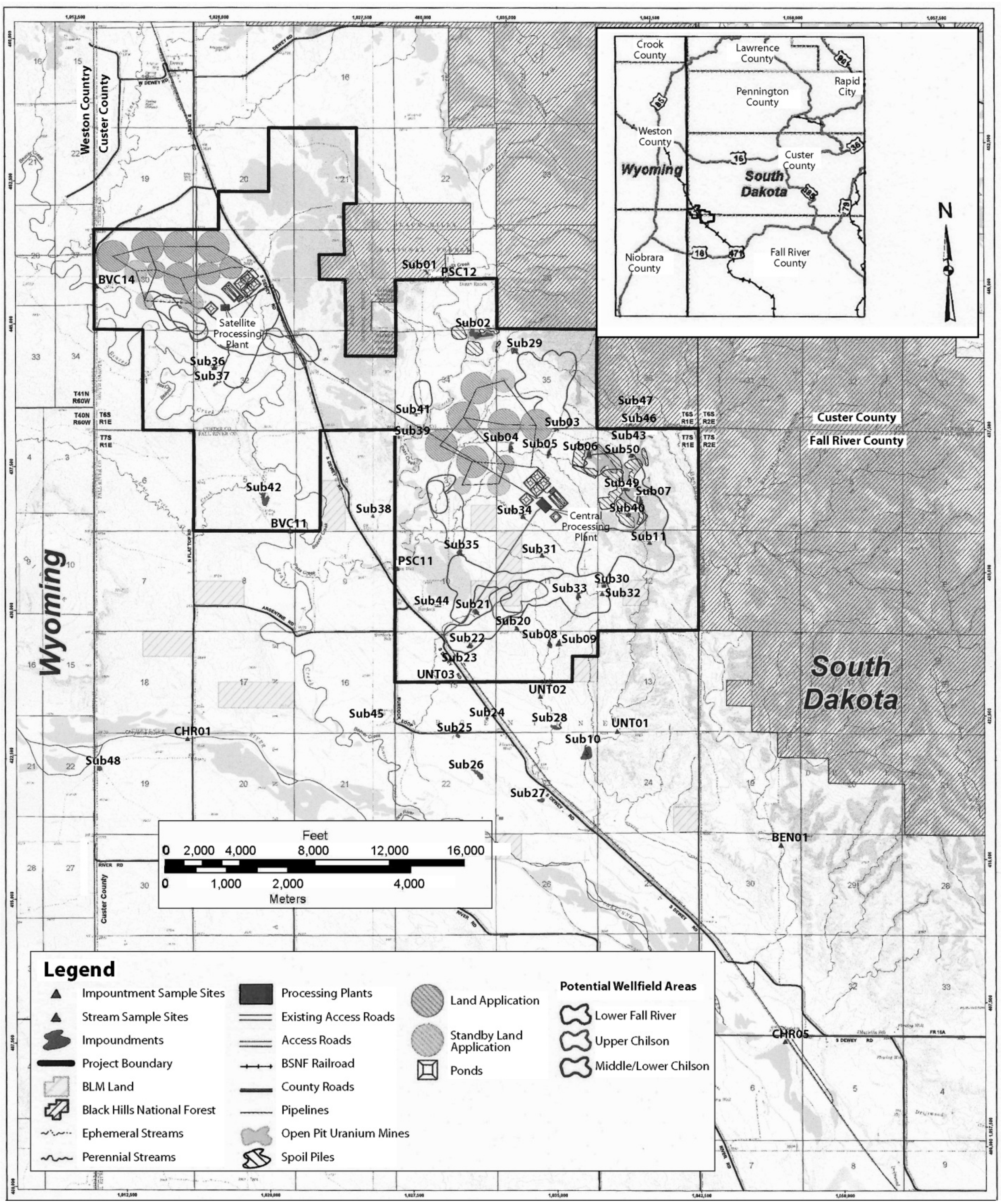

Figure 7.2-2. Locations of Operational Surface Water Monitoring Sites. Source: Modified from Powertech (2011).

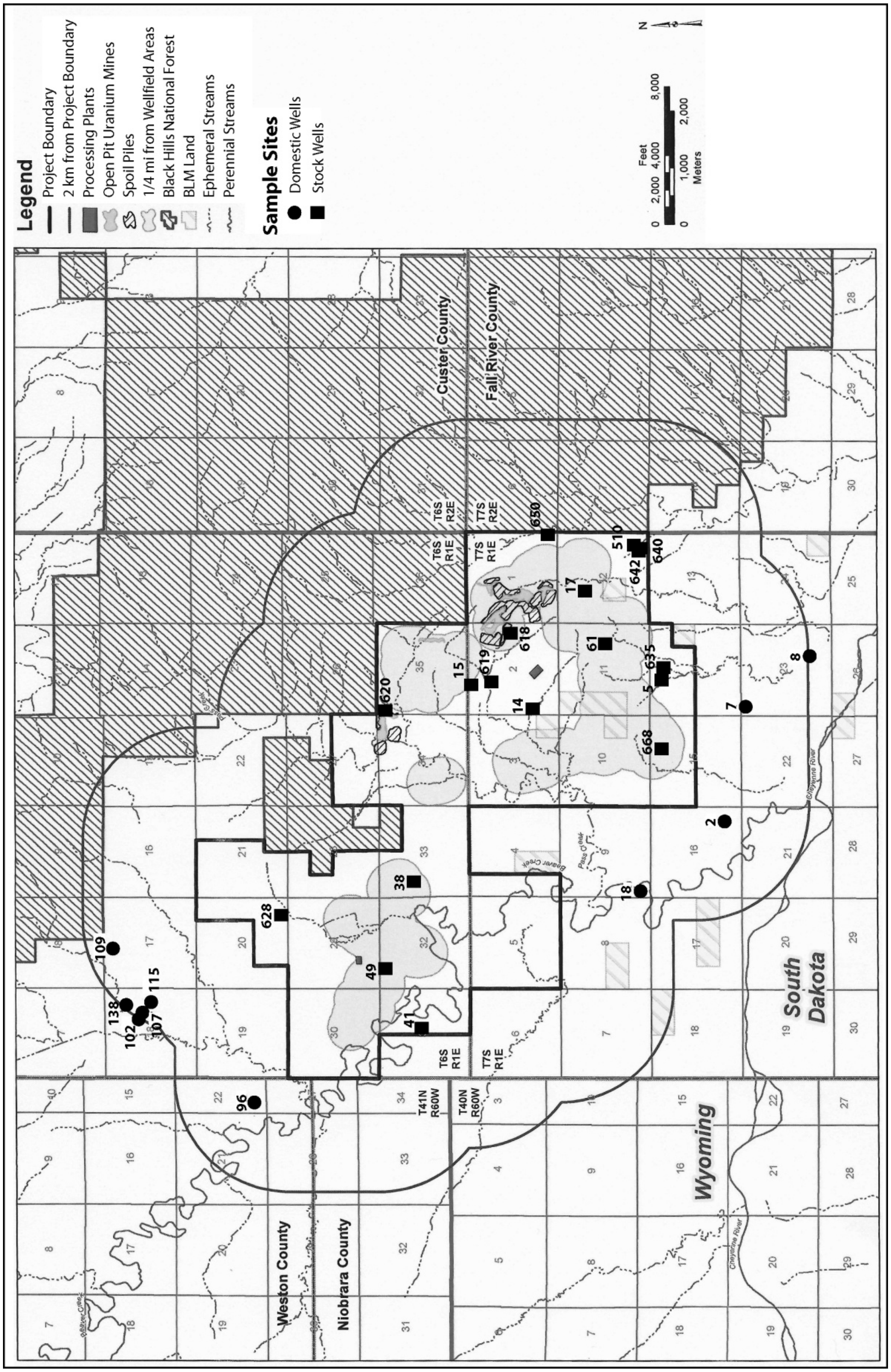

Figure 7.2-3. Locations of Operational Domestic and Stock Monitoring Wells.
Source: Modified from Powertech (2011).

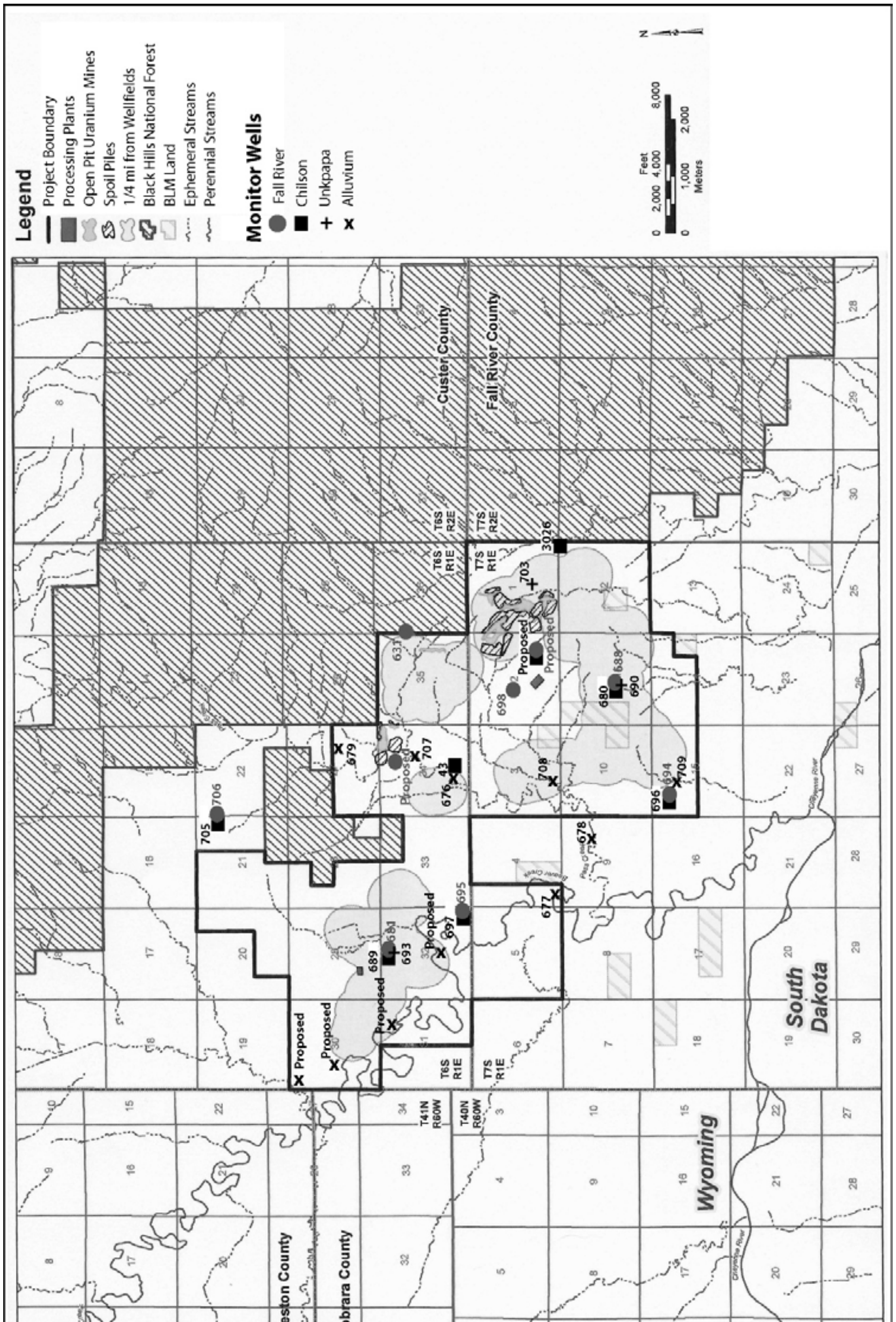

Figure 7.2-4. Locations of Operational Groundwater Monitoring Wells.
Source: Modified from Powertech (2011).

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 near 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.

7.3.1.1 Background Groundwater Sampling

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.

The applicant will establish 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. The applicant will sample these wells at least four times over a sufficiently spaced interval to indicate seasonal variability (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. These wells will be sampled four times for baseline characterization, with a minimum of 14 days between sampling events. 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.

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

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).

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 Groundwater Quality 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 and 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 a minimum spacing of either 122 m [400 ft] or the spacing that will ensure that no greater than a 70 degree angle 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 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). The overlying wells will be placed within the geology just above the proposed project's upper confining layer (the Skull Creek Shale), which has a thickness of approximately 61 m [200 ft]. Core samples collected from the lower Skull Creek Shale demonstrate that the Skull Creek clays have extremely low vertical permeabilities. The thicknesses of the upper confining layer {approximately 61 m

[200 ft]} and the lower confining layer {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. To ensure administrative approval, the applicant would present each monitoring well program to NRC and the U.S. Environmental Protection Agency (EPA) before proposed wells are installed (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 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 easily 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 EPA 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

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

Site ID	Type/Name
Impoundments (continued)	
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 the constituents listed in Table 7.3-1 along with 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 project area 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 owner 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 project boundary (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 does not specify a plan for continued meteorological monitoring at the proposed site (Powertech, 2009a,b). 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 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
631	Fall River	Upgradient

Table 7.3-3. Monitoring Wells Proposed for Operational Monitoring (continued)

Well ID	Aquifer	Relative Position
709	Alluvium	Downgradient of Wellfield
Proposed	Alluvium	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 Materials License and SDDENR Regular 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 and 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 regulating agencies require

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 submitted to SDDENR (Powertech, 2012). 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, 2012). 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, 2012).

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. 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. Each compliance and interior well will be sampled a minimum of four times within a 6-month period with no two samples taken in the same month. 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, whichever is greater. 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, 2012).

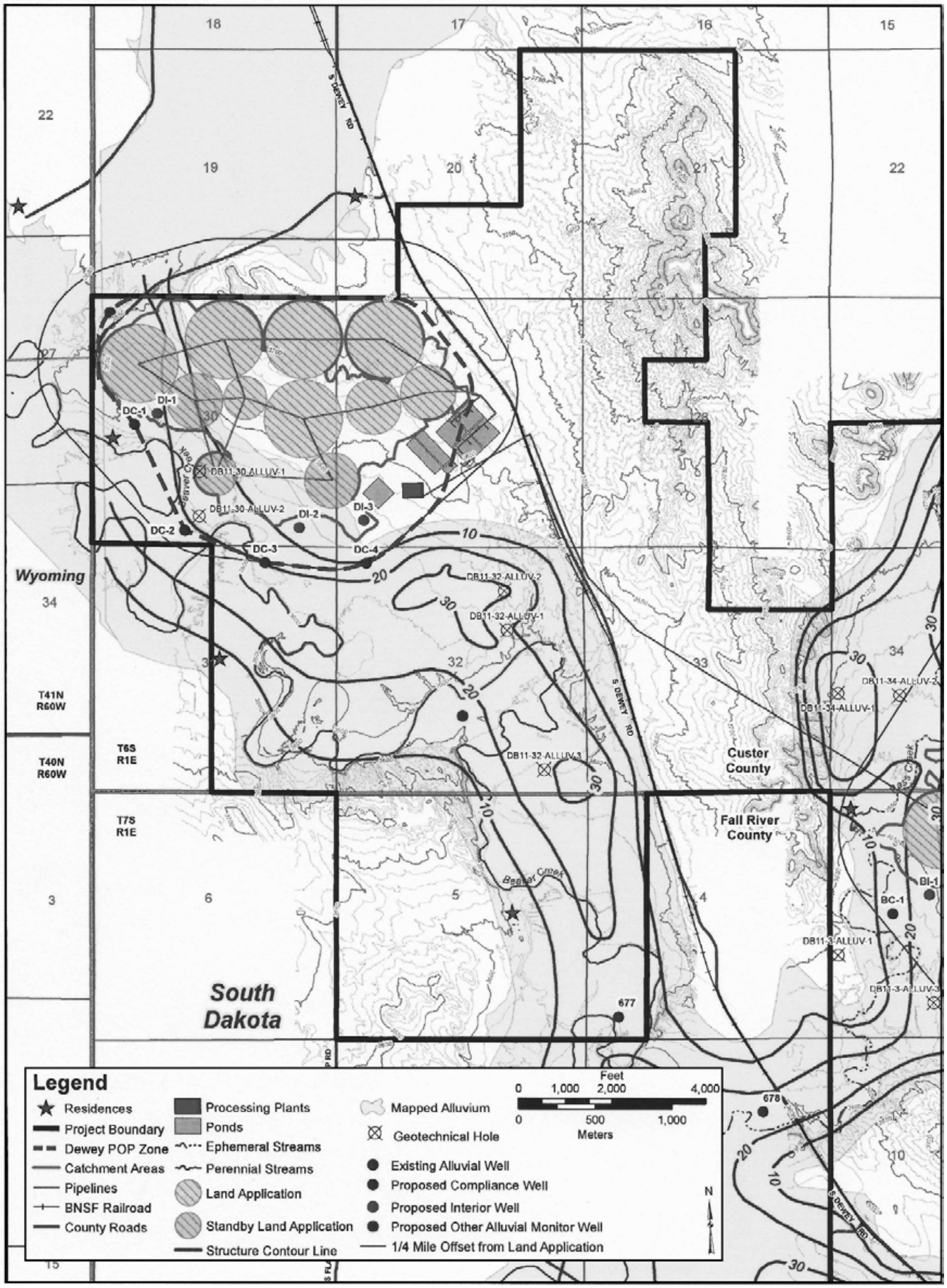

Figure 7.5-1. Map of Dewey Land Application Areas Showing the Perimeter of Operational Pollution (POP) and Proposed Alluvial Monitoring Wells.
Source: Powertech (2012).

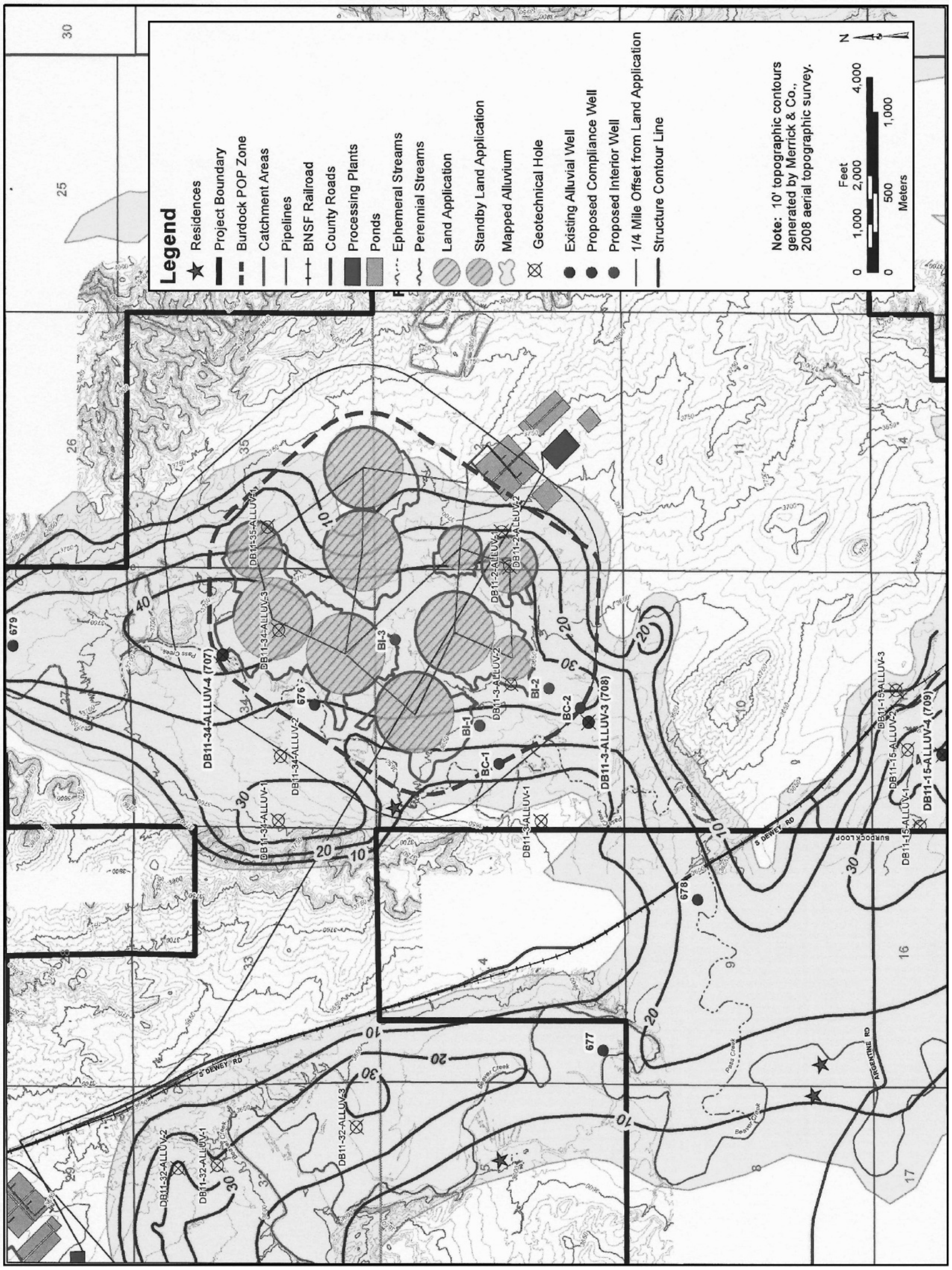

Figure 7.5-2. Map of Burdock Land Application Areas Showing the Perimeter of Operational Pollution (POP) and Proposed Alluvial Monitoring Wells.
Source: Powertech (2012).

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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, 2012		

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
Interior Wells	BI-1	Proposed
	BI-2	Proposed
	BI-3	Proposed
Other Wells	676	Existing
	678	Existing
	679	Existing
	707	Existing
	708	Existing
Source: Powertech, 2012		

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 permit 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 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 constituents listed in Table 7.3-1 along with dissolved and suspended uranium, Ra-226, Th-230, Pb-210, and Po-210.

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 liquid wastewater will be analyzed for compliance with the 10 CFR Part 20, Appendix B radionuclide effluent discharge limits in Table 7.5-3.

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

Table 7.5-3. NRC 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		

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.

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
Vanadium
Nitrate as N, KCl extract
Uranium-natural
Ra-226
Th-230
Pb-210
Po-210
Source: Powertech, 2012

Table 7.5-5. Biomass Sampling Parameters

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

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 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 per well 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 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 will 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, to be injected into an underground source of drinking water, the injectate will need to be treated to meet drinking water standards, or contaminant-specific background concentrations for constituents regulated under the Safe Drinking Water Act, whichever is greater.

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 an 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 permit will require the injectate to be treated to meet drinking water standards. 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

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20. "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

10 CFR Part 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.

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.

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.

10 CFR Part 40, Appendix A. *Code of Federal Regulations*, Title 10, *Energy*, Part 40 Appendix A. "Criteria Relating to the Operation of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily from their Source Material Content." Washington, DC: U.S. Government Printing Office.

40 CFR Part 144. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 144. "Underground Injection Control Program." Washington, DC: U.S. Government Printing Office.

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 146. "Underground Injection Control Program: Criteria and Standards." Washington, DC: U.S. Government Printing Office.

ARSD Section 74:54:01:04. "Standards for Groundwater of 10,000 mg/L TDS Concentration or Less." South Dakota Legislature Administrative Rules.

ARSD Section 74:54:02:28. "Out-of-Compliance Status." South Dakota Legislature Administrative Rules.

Mackin, P.C., D. Daruwalla, J. Winterle, M. Smith, and D.A. Pickett. NUREG/CR–6733, "A Baseline Risk-Informed Performance-Based Approach for *In-Situ* Leach Uranium Extraction Licensees." Washington, DC: NRC. September 2001.

NRC (U.S. Nuclear Regulatory Commission). NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." ML091480244, ML091480188. Washington, DC: NRC. May 2009.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications—Final Report." Washington, DC: NRC. June 2003.

NRC. "Regulatory Guide 4.14, Radiological Effluent and Environmental Monitoring at Uranium Mills, Rev. 1." Washington, DC: NRC. 1980.

Powertech [Powertech (USA) Inc.]. "Dewey-Burdock Project Groundwater Discharge Plan Custer and Fall River Counties, South Dakota." ML12195A039, ML12195A040. Edgemont, South Dakota: Powertech. March 2012.

Powertech. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota, Technical Report RAI Responses, June 2011." ML112071064. Greenwood Village, Colorado: Powertech. 2011.

Powertech. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota ER_RAI Response August 11, 2010." ML102380516. Greenwood Village, Colorado: Powertech. 2010.

Powertech. "Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota—Environmental Report." Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. 2009a.

Powertech. “Dewey-Burdock Project, Application for NRC Uranium Recovery License Fall River and Custer Counties, South Dakota—Technical Report.” Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. 2009b.

Powertech. “Dewey-Burdock Project, Supplement to Application for NRC Uranium Recovery License Dated February 2009.” Docket No. 040-09075. ML092870160. Greenwood Village, Colorado: Powertech. 2009c.