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

4.1 Introduction

The Generic Environmental Impact Statement (GEIS) for *In-Situ* Leach Uranium Milling Facilities (NRC, 2009a) evaluated the potential environmental impacts of implementing *in-situ* recovery (ISR) operations in four distinct geographic regions, including the Nebraska-South Dakota-Wyoming Uranium Milling Region where the proposed Dewey-Burdock ISR Project is located. This chapter evaluates the potential environmental impacts from Alternative 1 (implementing the proposed action, which includes options for liquid waste disposal) and Alternative 2 (the No-Action alternative). In addition, the U.S. Nuclear Regulatory Commission (NRC) staff considered other reasonable alternative actions at the proposed Dewey-Burdock ISR Project. These included alternative sites, alternative lixiviants, alternative well completion methods, conventional mining and milling, and conventional mining and heap leach processing. These alternatives were eliminated from detailed analysis for reasons described in Section 2.2 of the supplemental environmental impact statement (SEIS).

This chapter analyzes the four lifecycle phases of ISR uranium extraction (construction, operations, aquifer restoration, and decommissioning/reclamation) at the proposed site using the analytical approach described in the GEIS (NRC, 2009a). The results of the GEIS impact analyses for the Nebraska-South Dakota-Wyoming Uranium Milling Region, as summarized in Table 1.4-1, were used to focus the site-specific environmental review at the proposed Dewey-Burdock ISR Project. In situations where the GEIS concluded a wide range of impacts on a particular resource area could range from SMALL to LARGE, the NRC staff evaluated the resource area in greater detail for this site-specific SEIS. The site-specific analyses describe new information the NRC staff obtained during its independent site-specific review. The potential impacts of the new information were evaluated to determine whether they changed the expected impacts presented in the GEIS.

This chapter also analyzes the environmental impacts of liquid waste disposal options that the applicant may use at the proposed project site (see SEIS Section 2.1.1.1.2.4). These options include deep well disposal via Class V injection wells, disposal via land application, and disposal via a combination of Class V injection wells and land application. The applicant's use of deep well disposal is contingent on obtaining a permit for Class V injection wells from the U.S. Environmental Protection Agency (EPA). EPA is currently reviewing an application for a Class V injection well permit (see Table 1.6-1). The applicant's use of land application is contingent on obtaining an approved groundwater discharge plan (GDP) from the South Dakota Department of Environment and Natural Resources (SDDENR). SDDENR will permit land application only if the applicant demonstrates insufficient Class V disposal capacity (SDDENR, 2013a). SDDENR is currently reviewing a GDP application for land application (see Table 1.6-1).

SEIS Sections 4.2 through 4.14 evaluate potential impacts from both the proposed action (which includes construction, operations, aquifer restoration, and decommissioning/reclamation using Class V deep injection wells, land application, or a combination of both for management of process-related liquid waste streams) and the No-Action alternative (which means no ISR facility will be built and operated at the proposed Dewey-Burdock ISR Project). The No-Action

alternative provides a baseline against which to compare the potential impacts from the proposed action.

NRC established a standard of significance for assessing environmental impacts in the conduct of environmental reviews based on the Council of Environmental Quality (CEQ) regulations, as described in the NRC guidance in NUREG–1748 (NRC, 2003a) and summarized 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 considered.

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

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

4.2 Land Use Impacts

As described in GEIS Section 4.4.1, potential environmental impacts to land use will occur during all phases of an ISR facility's lifecycle (NRC, 2009a). Impacts to land use will result from (i) land disturbances in conjunction with construction, operations, and decommissioning activities; (ii) access restrictions that will limit grazing and recreational activities; and (iii) competing access for mineral rights (e.g., leasing of land for both uranium and oil and gas exploration and development).

GEIS Construction Phase Summary

NRC staff concluded in the GEIS that land disturbances during the construction phase will be temporary and limited to small areas within permitted boundaries. After construction, disturbed areas around well sites, staging areas, and trenches will be immediately reseeded and restored. In GEIS Section 4.4.1.1, NRC staff also concluded that changes to land use due to grazing restrictions and limits on recreational activities are expected to be limited because restricted areas will be small, the restrictions will be temporary, and other land is available for these activities. Recognizing that the magnitude of land disturbances and access restrictions will vary significantly during construction, the NRC staff assessed the potential impacts on land use during construction in the Nebraska-South Dakota-Wyoming Milling Region as ranging from SMALL to LARGE. (NRC, 2009a)

GEIS Operations Phase Summary

Land use impacts from operational activities will be similar to impacts anticipated during the construction phase, because additional land disturbances and access restrictions are not expected while operational activities are ongoing. Because impacts from access restrictions and land disturbances will be similar to or less than construction impacts, NRC staff concluded in the GEIS that the overall potential impacts on land use from operational activities at an ISR facility will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

Because aquifer restoration will use the same infrastructure that is present during operation phases, land use impacts from aquifer restoration are expected to be similar to or less than operation impacts. As aquifer restoration proceeds and wellfields are closed, operational activities will diminish. Therefore, NRC staff concluded in the GEIS that aquifer restoration impacts to land use will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that decommissioning an ISR facility will temporarily increase land-disturbing activities, such as, dismantling, removing, and disposing of materials equipment, and excavated contaminated soils. Access restrictions will remain in place until decommissioning and reclamation are complete, although a licensee may decommission and reclaim the site in stages. Reclamation of land to preexisting conditions and uses will help to mitigate potential long-term impacts. NRC staff concluded in the GEIS that impacts to land use during decommissioning may range from SMALL to MODERATE and will be SMALL after decommissioning and reclamation activities are complete. (NRC, 2009a)

The potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are detailed in the following sections.

4.2.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.2, the proposed Dewey-Burdock ISR Project site encompasses 4,282 ha [10,580 ac] (Powertech, 2009a). Approximately 97.5 percent of surface rights in the proposed project are held privately, and the U.S. Bureau of Land Management (BLM) holds the remaining 2.5 percent. Land will be converted temporarily from its primary use as rangeland to use as an ISR facility, with facilities constructed and wellfields brought into production over time. Subsurface mineral rights are divided among several private entities and BLM (Powertech, 2009b). The applicant leases both surface and subsurface mineral rights in portions of the proposed project area where it plans to extract uranium. The applicant controls the unpatented mineral claims associated with 1,708 ha [4,220 ac] of federal minerals the U.S. government reserved under the Stock-Raising Homestead Act. The applicant also maintains unpatented mining claims on the 97 ha [240 ac] of BLM-administered surface lands within the project area (see SEIS Section 3.2).

In the GEIS, NRC staff identified potential land use alterations to ecological, historical, and cultural resources that range from SMALL to LARGE. In this SEIS, NRC staff present potential ecological impacts from land use in SEIS Section 4.6 and potential historical and cultural impacts from land use in SEIS Section 4.9. Impacts to soils from surface disturbances are discussed in SEIS Section 4.4. NRC staff assessed potential impacts on mineral extraction, grazing, or recreational activities that may result from the land disturbances and associated access restrictions during the construction, operation, aquifer restoration, and decommissioning phases at the proposed facility.

The applicant described environmental impacts on land use for each of the liquid waste disposal options (which are discussed in following sections) include (i) disposal via Class V injection

wells, (ii) disposal via land application, or (iii) combined disposal via Class V injection wells and land application.

4.2.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid waste is deep well disposal via Class V injection wells. The section discusses potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project.

4.2.1.1.1 Construction Impacts

Construction phase activities, including drilling, trenching, excavating, grading, and surface facility construction, will have the largest direct land use impact at the proposed Dewey-Burdock site. As described in SEIS Section 2.1.1.1.2, initial construction of processing facilities, infrastructure (e.g., pipelines, access roads, power lines, and storage ponds), and wellfields is expected to be completed within 2 years (see Figure 2.1-1), followed by phased construction of additional wellfields during the operational phase.

A breakdown of estimated land disturbance for the facilities and infrastructure associated with the Class V injection well disposal option is provided in Table 4.2-1. For this disposal option, a total of 98.3 ha [243 ac] of land or 2.3 percent of the proposed permit area will be potentially disturbed by activities associated with construction of site buildings, pipelines, wellfields, ponds, and access roads (Powertech, 2010a). The total amount of BLM-managed land expected to be disturbed during construction activities is 4.7 ha [11.63 ac]. Land disturbance on BLM-managed land includes an access road, overhead power lines, wellfields, and underground pipelines. The total land area projected to be disturbed by construction activities for the Class V injection well

Table 4.2-1. Breakdown of Land Disturbance for the Class V Injection Well and Land Application Disposal Options at the Proposed Dewey-Burdock *In-Situ* Recovery Project

Facilities/Infrastructure	Surface Disturbance
Disposal Via Class V Injection Wells	
Site Buildings	9.7 ha [24 ac]
Trunkline Installation	10.1 ha [25 ac]
Access Roads	8.5 ha [21 ac]
Wellfields	56.7 ha [140 ac]
Impoundments (ponds)	13.4 ha [33 ac]
Total	98.3 ha [243 ac]
Disposal Via Land Application	
Site Buildings	9.7 ha [24 ac]
Trunkline Installation	10.1 ha [25 ac]
Access Roads	8.5 ha [21 ac]
Wellfields	56.7 ha [140 ac]
Impoundments (ponds)	55.0 ha [136 ac]
Irrigation Areas	425.7 ha [1,052 ac]
Total	565.7 ha [1,398 ac]
Source: Powertech (2010a)	

disposal option, 98.3 ha [243 ac], is relatively small compared to the 4,282-ha [10,580-ac] permitted area of the proposed project.

To mitigate impacts of surface disturbance during construction, the applicant proposes to reclaim the surface and reestablish vegetation in areas disturbed by drilling, pipeline installation, and facility construction as soon as construction activities are completed (Powertech, 2009a). In addition, the applicant proposes to minimize construction of new access and secondary roads by building only roads essential to operations. Vehicular traffic in the wellfields during construction will also be restricted to designated roads and kept to a minimum to reduce the area of surface disturbance (Powertech, 2009a).

The applicant will enclose the processing facilities, storage ponds, and wellfields to restrict and control access with fences (Powertech, 2009a). As discussed in SEIS Section 2.1.1.1.2.1, the Burdock central processing plant will be located on approximately 2.7 ha [6.7 ac] and surrounded by a controlled access area fence throughout the life of the project. The Dewey satellite facility will be located on 1.2 ha [2.9 ac] and will be surrounded by a controlled access area fence. Radium settling and storage ponds constructed for liquid waste management will be fenced throughout the life of the project to restrict access. As described in Section 2.1.1.1.2.4.1 of this SEIS, 2.7 ha [6.8 ac] of radium-settling and storage ponds in the Dewey area and 3.4 ha [8.3 ac] of radium-settling and storage ponds in the Burdock area will be fenced, if the Class V injection well disposal option is implemented. Fences surrounding the processing facilities and ponds will be inspected daily (Powertech, 2010a).

Fences restricting access to wellfields in the Dewey and Burdock areas will be temporary and will be removed after operations and reclamation of each wellfield are completed (Powertech, 2010a). To minimize the acreage fenced around the wellfields, fencing will enclose only the injection and production wells. Fencing will not surround the perimeter monitor wells (Powertech, 2010a). The applicant will cover each perimeter monitor well with a locking device to limit access. Header houses are to be secured within wellfield fencing (Powertech, 2010a). The applicant will use fencing techniques that preserve habitat and allow the movement of large game (Powertech, 2010a).

Fencing will not be built around the Class V injection wells to be used for deep well liquid waste disposal (Powertech, 2010a). Class V injection well heads and pumping equipment will be located inside locked buildings to restrict access (Powertech, 2010a).

Recreational activities, including hunting and off-road vehicle access, will be limited by fences and restrictions on access to roads and wellfields. As described in SEIS Section 3.2.2, hunting is currently open to the public on 3,521 ha [8,700 ac] within the project area. Hunting within the project area will remain open to the public during the construction phase (Powertech, 2011). Only a small part of the 4,282-ha [10,580-ac] of project area will be enclosed by fencing; 3.9 total ha [9.6 total ac] of processing facilities and 6.6 total ha [15.1 total ac] of radium-settling and storage ponds will be enclosed throughout the life of the project. Fencing around wellfields will be temporary. The public will have access to open, unfenced lands for recreational activities within and surrounding the proposed project area.

The exploration of mineral resources other than uranium (e.g., oil and natural gas) will be intermixed within the permit area or delayed until operations, decommissioning, and restoration activities end. Pending or potential oil and gas mineral leases are not present in the project area. Demand is low for oil and gas leases on available land near the Dewey-Burdock site (see

SEIS Section 3.2.3). In addition, no coal mines or coal bed methane production are located near the site.

Estimates of the amount of land disturbed by ISR facilities, presented in the GEIS, ranged from 49–753 ha [120–1,860 ac] (NRC, 2009a). The NRC staff concluded in the GEIS that the impact of disturbing this area will be SMALL. The land area projected to be disturbed by construction activities for the Class V injection well disposal option is 98.3 ha [243 ac] and is relatively small compared to the 4,282 ha [10,580 ac] of the proposed project area; this falls at the low end of land disturbance estimates in the GEIS. The applicant proposes to use the following concurrent mitigation measures to minimize the impacts of surface disturbance: reclaiming and re-vegetating disturbed areas, limiting construction of new access roads, and restricting vehicular traffic in wellfields.

Fenced areas around processing facilities and storage pond areas will be relatively small in comparison to the permitted area of the proposed project. Furthermore, fences around wellfields are temporary and will be removed after operational and reclamation phases are completed in the wellfields. Prohibiting grazing within fenced areas during construction will have only a SMALL impact on local livestock production. Because there will be abundant open land available around the proposed facilities and surrounding the proposed project area, impacts to recreational activities (primarily big game hunting) will be SMALL. Due to the low demand for oil and gas leasing and absence of coal bed methane production on land within and in the vicinity of the project area, the impact of competing access for mineral rights is expected to be SMALL. Therefore, the NRC staff conclude that overall land use impacts during the construction phase for the Class V injection well disposal option will be SMALL.

4.2.1.1.2 Operations Impacts

The primary changes to land use during the operations phase of the proposed Dewey-Burdock ISR Project will be land disturbance and access restrictions from the expansion of active wellfields and development of new wellfields. Land disturbance and access restrictions will result from drilling new wells and constructing additional header houses and pipelines.

Livestock grazing and recreational activities will be restricted from ISR surface facilities, surface impoundments, and wellfields during the operations phase. During the operational life of the project, fencing around wellfields will remove 56.7 ha [140 ac] of land from grazing and recreational uses (see Table 4.2-1). On BLM-managed land, fencing around wellfields B-WF1 through B-WF4 (see Figure 2.1.6) will remove 3.8 ha [9.4 ac] of land from grazing and recreational uses in the Burdock area over the operational life of the project. The applicant will restore and reclaim wellfields concurrently, as operations are completed and moved to the next wellfield (Powertech, 2009a). As uranium recovery activities cease at a wellfield, the area will be restored and reopened to grazing and recreational uses while a new wellfield is developed. The sequential movement of active operations from one wellfield to the next will minimize potential impacts on grazing and recreational uses throughout the operational life of the project.

If operations are licensed, the applicant has committed to working with BLM, South Dakota Game, Fish, and Parks (SDGFP) and private landowners to limit public access, primarily for hunting (Powertech, 2011). To limit hunting activities in areas of active ISR operations, temporary fencing, advisory signs, and gates will be installed near processing plants and wellfields. Hunting in areas of active ISR operations will also be limited by rules related to the SDGFP walk-in hunting program on private lands, which prohibit the discharge of a firearm

within 98.4 m [300 ft] of a person or a structure (Powertech, 2011). Limits on hunting will continue over the operational life of the project.

In summary, impacts due to land disturbance during the operations phase of the proposed project will be limited to the wellfields and will be similar to impacts expected during the construction phase. Access restrictions during the operations phase will be similar to construction impacts. Processing facilities and storage ponds will remain fenced. The construction of temporary fencing around operational wellfields will restrict livestock grazing and hunting. Once operations are completed in a wellfield, the wellfield will be restored and reopened to grazing and recreational use. Substantial acreage within and surrounding the 4,282-ha [10,580-ac] project site will remain open to grazing and hunting. Therefore, NRC staff conclude that the overall impacts to land use from operations for the Class V injection well disposal option will be SMALL.

4.2.1.1.3 Aquifer Restoration Impacts

The aquifer restoration phase will use the same operational infrastructure and require the same level of infrastructure maintenance as the operations phase. Land use impacts from aquifer restoration will decrease as fewer wells and header houses are used. Additionally, equipment traffic and related impacts will diminish. NRC staff conclude that the potential impacts to land use during the aquifer restoration phase for the Class V injection well disposal option will be comparable to those of the operations phase and will be SMALL.

4.2.1.1.4 Decommissioning Impacts

As described in SEIS Section 2.1.1.1.5, decommissioning of the proposed Dewey-Burdock ISR Project will be based on an NRC-approved decommissioning plan, and all decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal and state regulatory requirements. The applicant will submit a decommissioning plan for NRC review and approval at least 12 months before the planned commencement of final decommissioning (Powertech, 2009b). At the proposed Dewey-Burdock site, the impact from dismantling and decontaminating the central plant, satellite facility, roads, and support facilities will be consistent with NRC staff conclusions reached in the GEIS. The land potentially disturbed as part of the proposed action will be returned to its preoperational condition and will be available for its preoperational use for livestock grazing and wildlife habitat (Powertech, 2009a).

After surface operations are complete and wellfields are restored, the applicant will proceed with the final steps of decommissioning and surface reclamation, and it will return the land to its preoperational conditions (Powertech, 2009b). The areas directly impacted by decommissioning include the central processing plant, satellite facility, wellfields and their infrastructure (i.e., pipelines and header houses), Class V injection wells, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities that are necessary to return the site to its previous land use. These activities include conducting radiological surveys, removing contaminated equipment and materials, cleaning up areas, plugging and abandoning wells, decontaminating and removing buildings and other onsite structures, and restoring disturbed areas (Powertech, 2009b). As disturbed areas are restored, they will be backfilled, contoured, and smoothed to blend with the natural terrain in accordance with the NRC-approved decommissioning plan. All wells are to be sealed and capped, and wellfield pipelines removed. After well plugging and abandonment and wellfield decommissioning are complete, seeded soil

will be returned to the areas from which it was removed and contoured to blend with the natural terrain. As decommissioning and reclamation proceed, the amount of disturbed and fenced land will decrease and the structures that could alter the setting of the project area will be removed. The dismantling of the proposed project facilities, infrastructure, and roads, together with the reseeding and placement of soil will have impacts similar in scale to the construction phase.

At the end of decommissioning, all lands will be returned to their preoperational land use of livestock grazing and wildlife habitat, unless the state and the landowner justify or approve an alternative use (e.g., landowners will be given the option to retain roads or buildings constructed for the ISR project for private use) (Powertech, 2009a). Reclaimed lands will be released for other uses. Livestock grazing and recreational activities will no longer be restricted. The land use impacts for disturbed areas will be MODERATE until vegetation is reestablished in seeded areas. Once vegetation is reestablished in reclaimed areas, the NRC staff conclude the land use impacts for the Class V injection well disposal option will be SMALL.

4.2.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. The potential environmental impacts on land use from construction, operations, aquifer restoration, and decommissioning associated with the land application disposal option are discussed in the following sections.

4.2.1.2.1 Construction Impacts

A breakdown of estimated land disturbance for the facilities and infrastructure associated with the land application option is provided in Table 4.2-1. A total of 565.7 ha [1,398 ac] of land, or 13.2 percent of the proposed permit area, will be disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2010a). This area of land disturbance is larger than anticipated for the Class V injection well disposal option {approximately 98 ha [243 ac]} due to the addition of land irrigation areas {426 ha [1,052 ac]} and the need for increased pond capacity for storage during nonirrigation periods {35 ha [136 ac]} (see Table 4.2-1). The land application option will not impact the total amount of BLM-managed land expected to be disturbed during construction activities at the proposed project site {4.7 ha [11.63 ac]}. As described in SEIS Section 4.2.1.1.1, land disturbance on BLM-managed land includes an access road, overhead power lines, wellfields, and underground pipelines (see SEIS Section 4.2.1.1.1). The total land area projected to be disturbed by construction activities for the land application option {i.e., 565.7 ha [1,398 ac]} is relatively small in comparison to the 4,282-ha [10,580-ac] permitted area of the proposed project.

Mitigation measures, such as performing concurrent reclamation and revegetation of disturbed surface areas, limiting construction of new access and secondary roads, and restricting vehicular traffic in wellfields and land application areas, will reduce the impacts of surface disturbance associated with construction activities for the land application disposal option (Powertech, 2009a).

With the exception of radium settling and storage pond areas, fencing restrictions and their impacts on land use during the construction phase for the land application option will be similar to those of the Class V injection well disposal option. Fenced areas around radium settling and storage ponds to restrict access will increase to approximately 12.5 ha [30.8 ac] in the Dewey area and approximately 13.6 ha [33.5 ac] in the Burdock area (see SEIS Section 2.1.1.1.2.4.2). The increase in fenced areas around ponds for the land application disposal option will remain small in comparison to the 4,282-ha [10,580-ac] permitted area for the proposed project. The applicant does not plan to construct fencing around potential land irrigation areas during the construction phase of the project, and these areas will remain open to hunting (Powertech, 2010a).

As noted in SEIS Section 4.2.1.1.1, the degree of land disturbance at ISR facilities analyzed in the GEIS ranged from 49–753 ha [120–1,860 ac], and NRC staff concluded in the GEIS that impacts from this range of disturbed land area will be SMALL (NRC, 2009a). The land area to be disturbed by construction activities for the land application option {i.e., 565.7 ha [1,398 ac]} is relatively small when compared to the 4,282-ha [10,580-ac] permitted area of the proposed project. The amount of disturbance falls within the estimates evaluated in the GEIS. Impacts of surface land disturbance will be minimized by mitigation measures, including concurrently reclaiming and revegetating surface disturbed areas, limiting construction of new access roads, and restricting vehicular traffic in wellfields and land application areas. Processing facilities, pond areas, and wellfields will be fenced; however, only relatively small areas will be restricted, and fencing around wellfields will be temporary. Therefore, the restriction of livestock grazing within areas fenced off during construction will have a SMALL impact on local livestock production. Land irrigation areas will not be fenced during the construction phase of the project. In addition, open land will be available around the proposed facilities and within the proposed project area. Because of these factors, impacts to recreational activities (primarily big game hunting) will be SMALL. Therefore, the NRC staff conclude that overall land use impacts during the construction phase for the land application disposal option will be SMALL.

4.2.1.2.2 Operations Impacts

The primary change expected to affect land use during the operations phase of the proposed facility is the expansion of active wellfields and development of new wellfields, and the impact will be similar to that of the construction phase. Grazing and recreational activities will be restricted from processing facilities, storage ponds, and wellfields during the operations phase. The need for fencing around wellfields will remove approximately 56.7 ha [140 ac] of land from grazing and recreation activities over the operational life of the project; this is the same acreage as the Class V injection well disposal option requires (see Table 4.2-1). On BLM-managed land, fencing around wellfields B-WF1 through B-WF4 will remove 3.8 ha [9.4 ac] of land from grazing and recreational activities in the Burdock area over the operational life of the project. The applicant will restore and reclaim wellfields concurrently, as operations are completed and moved to the next wellfield (Powertech, 2009a). Therefore, a wellfield where uranium recovery activities have ceased will be restored and reopened for grazing at the same time a new wellfield is being developed. The sequential movement of active operations from one wellfield to the next shifts and minimizes potential impacts to livestock grazing and recreational land over the operational life of the project.

In addition to fencing processing facilities, ponds, and wellfields, the applicant may fence land application areas to control livestock access to these areas (Powertech, 2010a). As described in SEIS Section 2.1.1.1.2.4.2, the maximum estimated area for land application is 426 ha

[1,052 ac], and this acreage includes operating irrigation pivots, standby irrigation pivots, and surface stormwater runoff catchment areas. The land application area is relatively small when compared to the 4,282-ha [10,580-ac] permitted area. Moreover, substantial open land within and surrounding the project site will be available for livestock grazing.

The applicant has committed to work with BLM, SDGFP, and private landowners to limit recreational activities (primarily hunting) within the project area to the extent practicable before operations begin (Powertech, 2011). Temporary fencing, signage, gates, and other means of restricting public access will be used in active ISR areas, such as wellfields and processing plants, and may be used in land application areas. The SDGFP walk-in hunting program on private lands, which prohibits the discharge of a firearm within 98.4 m [300 ft] of a person or a structure, will limit hunting where active ISR operations are ongoing (Powertech, 2011). Limits on hunting will be in effect over the operational life of the project.

Impacts due to land disturbance during the operations phase will be restricted to the wellfields and are expected to be similar to impacts from construction. Access restrictions during the operations phase will be similar to those of the construction phase, except for land irrigation areas. Processing facilities and storage ponds will remain fenced to restrict and control human and wildlife access. Temporary fencing will be constructed around operational wellfields to restrict grazing and hunting. A maximum of 426 ha [1,052 ac] of land irrigation area may be fenced to control livestock grazing and limit access by hunters. The acreage of land application area is relatively small in comparison to the permitted area. In addition, substantial open area within and surrounding the 4,282-ha [10,580-ac] project site will remain open to grazing and hunting. Therefore, NRC staff conclude that the overall impacts to land use from operations for the land application disposal option will be SMALL.

4.2.1.2.3 Aquifer Restoration Impacts

The surface disturbance and access restrictions anticipated in the construction and operational phases will continue during aquifer restoration if the land application disposal option is implemented. Land use impacts from aquifer restoration will decrease over time, as fewer wells and pump houses are used and overall equipment traffic diminishes. Thus, NRC staff conclude that the overall potential impacts to land use during the aquifer restoration phase for the land application disposal option will be comparable to those of the operations phase and will be SMALL.

4.2.1.2.4 Decommissioning Impacts

Decommissioning areas after the land application disposal option will bring about environmental impacts similar to those described in SEIS Section 4.2.1.1.4 for the Class V injection well disposal option. Decommissioning the proposed facility will require an NRC-approved decommissioning plan. All decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal and state regulatory requirements.

After surface operations are complete and wellfields are restored at the proposed facility, the applicant will proceed with the final steps of decommissioning and surface reclamation to return the land to its preoperational conditions (Powertech, 2009b). The areas directly affected by decommissioning will include the central processing plant, satellite facility, wellfields and related pipelines and header houses, irrigation areas, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities required to return the site to its previous land use.

These activities are summarized in SEIS Section 4.2.1.1.4 and include conducting radiological surveys, removing contaminated equipment and materials, cleaning up areas, plugging and abandoning wells, decontaminating and removing buildings and other onsite structures, and restoring disturbed areas (Powertech, 2009b). Land application areas will be included in decommissioning surveys to ensure soil concentration limits are not exceeded. As decommissioning and reclamation proceed, the amount of disturbed and fenced land will decrease and structures that affect the setting of the project area will be removed. The dismantling of the proposed project facilities, infrastructure, and roads and reseeding and placement of soil will have impacts similar in scale to the construction phase.

At the end of decommissioning, all lands will be returned to their preoperational uses of livestock grazing and wildlife habitat, unless the state and the landowner justify or approve an alternative use. For example, landowners will be given the option to retain roads or buildings constructed for the ISR project for private use (Powertech, 2009a). The reclaimed land will be released for other uses. Restrictions on livestock grazing and recreational activities will be terminated. The land use impacts for disturbed areas will be MODERATE until vegetation is reestablished in seeded areas. Once vegetation is reestablished in reclaimed areas, the NRC staff conclude the land use impacts for the land application disposal option will be SMALL.

4.2.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the facility, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis, depending on Class V injection well disposal capacity (Powertech, 2011). The land application option requires the construction and operation of irrigation areas and increased pond capacity for storage of liquid wastes during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the Class V injection well disposal option requires the construction and operation of four to eight Class V injection wells (see SEIS Section 2.1.1.1.2.4.1). Therefore, the environmental impacts of land disturbance and access restrictions associated with the land application option are greater than those for the Class V injection waste disposal option than for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combination disposal option. Thus, the environmental impacts on land uses for the combined disposal option will be less than for the land application option alone and greater than for the Class V injection well disposal option alone. Therefore, NRC staff conclude that the environmental land use impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental land use impacts of the Class V injection well disposal option and the land application disposal option as summarized in Table 4.2-2.

4.2.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC will not license the proposed Dewey-Burdock ISR Project and BLM will not approve the applicant's modified Plan of Operations. Therefore, impacts, such as soil disturbances and access restrictions to current land uses from the proposed action, will not occur. Construction impacts will be avoided because wells will not be drilled and pipelines will not be laid. Operational impacts will also be avoided because no subsurface injection of

Table 4.2-2. Significance of Environmental Land Use Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	MODERATE before vegetation reestablished and then SMALL after vegetation is established	MODERATE before vegetation reestablished and then SMALL after vegetation is established	MODERATE before vegetation reestablished and then SMALL after vegetation is established
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

lixiviant will occur. Without well drilling or the development of wellfields taking place, there will be no impacts from aquifer restoration activities. Impacts to land use from decommissioning activities will not occur, because unbuilt buildings require no decontamination, topsoil will not need reclaiming, and unstripped land surfaces need no revegetation. The current land uses on and near the project area, including grazing lands, natural resource extraction, and recreational activities, remain essentially unchanged under the No-Action alternative.

4.3 Transportation Impacts

As described in GEIS Section 4.4.3, potential environmental impacts from transportation to and from an ISR facility may occur during all phases of the facility lifecycle. Impacts will result from workers commuting to and from the site and from the shipment of construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials. Impacts may also occur from fugitive dust emissions, noise, incidental wildlife or livestock kills, increased traffic on local roads, and from accidents. (NRC, 2009a)

GEIS Construction Phase Summary

NRC staff concluded in GEIS Section 4.4.2.1 that ISR construction activities will generate low levels of additional traffic (relative to local traffic counts) and will not significantly increase traffic or accidents on many of the roads in the region. Roads that have low traffic counts could be moderately impacted by the additional workers commuting during periods of peak employment. Additionally, NRC staff in the GEIS concluded that, depending on site-specific conditions, there could be a moderate impact from fugitive dust, noise, and incidental wildlife or livestock kills on, or near, site access roads. For these reasons, NRC staff concluded in the GEIS that the construction phase of ISR projects may result in transportation impacts that ranged from SMALL to MODERATE. (NRC, 2009a)

GEIS Operations Phase Summary

As described in GEIS Section 4.4.2.2, the low level of facility-related traffic during operations activities will not noticeably increase traffic or the occurrence of accidents on most roads, although local, less traveled roads could be moderately impacted during periods of peak employment. During the construction phase of ISR facilities there could be impacts from fugitive dust emissions, noise, and possible incidental wildlife or livestock kills either on or near site access roads as described in GEIS Section 4.4.1.1. (NRC, 2009a)

GEIS Section 4.4.2.2 also assessed the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. NRC staff in the GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area. The probability of such accidents occurring was determined to be low because of the small number of shipments, comprehensive regulatory controls, and the applicant's use of best management practices (BMP). For radioactive material shipments [yellowcake product, ion-exchange resins, byproduct material], compliance with transportation regulations was expected to limit radiological risk for normal operations. The NRC staff concluded in GEIS Section 4.4.2.2 there will be a low radiological risk from transportation accidents. The use of emergency response protocols will help to mitigate the consequences of severe accidents that involved the release of uranium. NRC staff concluded in the GEIS that the potential environmental impact from transportation during operations may range from SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

NRC staff concluded in GEIS Section 4.4.2.3 that the magnitude of transportation activities during aquifer restoration will be lower than for the construction and operations phases. Aquifer-restoration-related transportation activities will be primarily limited to supply shipments, waste shipments, onsite transportation, and employee commuting. NRC staff concluded in the GEIS that transportation impacts from aquifer restoration will range from SMALL to MODERATE for the same reasons discussed previously for the operations phase. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in GEIS Section 4.4.2.4 that transportation activities during decommissioning at ISR facilities and the potential impacts will be similar to the construction and operation phases, except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning will be lower than for the operations phase. NRC staff concluded in the GEIS that the potential accident radiological risks from transportation during decommissioning will be bounded by the estimates of yellowcake transportation risk during operations based on the concentrated nature of the shipped yellowcake, the greater distance yellowcake is shipped compared to the byproduct material destined for a licensed disposal facility, and the number of shipments of yellowcake relative to byproduct material. NRC staff concluded in the GEIS the potential transportation impacts during decommissioning will be SMALL because of the reduced transportation activities. (NRC, 2009a)

Estimated transportation environmental impacts during the construction, operations, aquifer restoration, and decommissioning phases of the proposed ISR project are discussed next. Fugitive dust impacts are evaluated as air quality impacts in SEIS Section 4.7, noise impacts

are described in SEIS Section 4.8, visual impacts are provided in SEIS Section 4.10, and potential impacts to livestock and wildlife are discussed in SEIS Section 4.6.1.1.2.

4.3.1 Proposed Action (Alternative 1)

The transportation activities for the proposed Dewey-Burdock ISR facility are described in SEIS Section 2.1.1.1.7. Under the proposed action, these activities include workers commuting to and from the site, and road transportation of construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials. The applicant's preferred method for disposal of liquid byproduct material is by Class V injection well. If a permit is not obtained for Class V injection, the applicant will 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. The transportation impacts from the Class V injection well option are described in Section 4.3.1.1. The transportation impacts from the land application option and combined Class V injection and land application are described in Sections 4.3.1.2 and 4.3.1.3.

4.3.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid byproduct material is deep well disposal via Class V injection wells. The potential transportation environmental impacts from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.3.1.1.1 Construction Impacts

As described in SEIS Section 3.3, the site is accessed by Dewey Road (also known as Fall River County Road 6463 and Custer County Road 769) and State Highways 18, 79, and 89. The applicant estimated traffic generated by proposed construction activities, including transportation of equipment, supplies, and workers (Powertech, 2009a, 2010a), and its analysis is described in SEIS Section 2.1.1.1.7. The NRC staff's impact analysis first compared the proposed traffic estimates and data with the information evaluated in GEIS Section 2.8 and then evaluated the estimated percentage increase in existing traffic that could result from the proposed Dewey-Burdock ISR Project.

The NRC impact analysis found the overall magnitude of the proposed daily construction traffic is less than the construction traffic evaluated in GEIS Section 2.8. Commuting workers constitute the majority of road traffic the applicant described for the construction phase. The applicant estimated 38 worker trips to the site daily for the proposed project, which is well below the upper range of 200 commuting worker trips to a site considered in the GEIS. The applicant has estimated the initial facility construction requiring these workers will take approximately 1 year (Powertech, 2010a). The applicant's proposed equipment and supply shipments, however, were higher than those assumed in GEIS Section 2.8 (9 one-way trips per day for the proposed project compared to 0.24 one-way trips per day considered in GEIS Section 2.8).

Table 4.3-1 compares the magnitude of the NRC staff's estimated local traffic counts from proposed construction activities with existing traffic counts on regional/local roads. Considering Table 4.3-1, the proposed traffic, if allocated completely to the individual road segments, will noticeably increase the existing traffic on low-traffic roads, such as unpaved Dewey Road

Table 4.3-1. Estimated Daily Traffic on Regional Roads for the Construction Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	301	18	34	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,437	439	6	4
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,801	368	2	5
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	680	73	12	33
State Highway 79 (at U.S. Highway 18)	3,172	2,569	603	2,645	621	3	3

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed construction phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes then this analysis overestimates impacts to each road segment.

(Fall River County Road 6463 and Custer County Road 769) and State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling from Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. The projected daily traffic on Dewey Road, the road nearest the proposed site, represents a 42 percent increase over existing traffic considering both autos and trucks. State Highway 89 auto traffic was projected to increase by 13 percent if all workers commuted on that route and truck traffic was projected to increase 33 percent. Similarly, based on the traffic count information in Table 4.3-1, State Highway 89 is not a commonly used route for trucks; therefore, the projected increase in truck traffic from the proposed action is considered less likely to be concentrated there relative to other routes. While the projected increase in traffic on some road segments is a noticeable change in conditions, the NRC staff further evaluated the projected increases in traffic by considering the ability of the roads to accommodate the increased traffic. When the projected traffic for all the roads in the analysis is evaluated (ranging from 319 to 5,169 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity, and therefore the staff conclude the regional highways could accommodate the additional traffic from the proposed project.

The conclusion that existing road capacity will not be exceeded is based on the staff's consideration of other road capacity estimates in SEIS Section 3.3. Because the traffic projections in Table 4.3-1 are daily values for both directions of travel, the comparable one-way

projected traffic is assumed to be half the tabulated values [e.g., 2,584 vehicles per day for the U.S. Highway 18 total of 5,169 (2,584 vehicles per day is well below the aforementioned range of capacities staff evaluated of 7,237 to 13,900 vehicles per day)]; therefore, the NRC staff conclude the highest projected traffic is below the estimated capacity.

Considering the magnitude of projected traffic from the proposed Dewey-Burdock ISR Project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the Class V injection well disposal option. This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads under the Class V injection well disposal option will be SMALL.

The applicant intends to use existing roads on the site area to the degree possible; however, some new roads will be constructed to facilitate onsite transportation (SEIS Section 2.1.1.2.2). Impacts to land use related to the development of new access roads are addressed in SEIS Section 4.2.1.1. All roads constructed for the proposed action will be reclaimed except those landowners specify to remain for future use (Powertech, 2009a).

4.3.1.1.2 Operations Impacts

The proposed operational transportation activities for the Dewey-Burdock ISR Project are similar to those evaluated in GEIS Section 4.4.2.2 including employee commuting and truck shipments of yellowcake, ion-exchange resins, hazardous chemical supplies, and byproduct material. The types of impacts evaluated are also similar to those evaluated in the GEIS including impacts to traffic and potential hazards associated with shipment of yellowcake, ion-exchange resins, byproduct material, and hazardous materials.

Traffic generated by these proposed operations is described in SEIS Section 2.1.1.1.7. The overall magnitude of proposed operational transportation is less than the operational transportation evaluated in GEIS Section 4.4.2.2. Commuting workers constitute the majority of road traffic the applicant proposed for the operations phase. The applicant estimated a number of commuting workers trips to the site that was within the range considered in the GEIS (27 vehicle trips for the proposed project compared to 20 to 200 trips considered in the GEIS). For trucking activities, remote ion-exchange shipments were comparable to the GEIS Section 2.8 values and processing chemical shipments were less than GEIS values. The proposed operational byproduct shipments are less than the GEIS values, and proposed yellowcake shipments are at the low end of the range considered in the GEIS. (NRC, 2009a)

Table 4.3-2 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed operations activities. The projected traffic for the operations phase for all road segments evaluated is lower than the projected traffic from the construction phase. Considering Table 4.3-2, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769) but will not substantially increase traffic on more heavily traveled road segments, such as State Highway 89, U.S. Highway 18 (from Edgemont and near Hot Springs), or State Highway 79 at the junction with U.S. Highway 18. The projected daily traffic on Dewey Road, the road nearest the proposed site, represents a 24 percent increase over existing traffic. State Highway 89 traffic was projected to increase by nine percent if all workers commuted on

Table 4.3-2. Estimated Daily Traffic on Regional Roads for the Operations Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	279	4	24	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,415	425	4	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,779	354	1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	658	59	9	7
State Highway 79 (at U.S. Highway18)	3,172	2,569	603	2,623	605	2	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011) except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed operations phase two-way traffic is double the round- trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

that route; however, because the road is more distant from the site, the NRC staff conclude it will be less likely to be used by all workforce commuters and therefore actual traffic impacts will be lower than projected. Based on the information in Table 4.3-2, the projected increases in truck traffic are low for all routes evaluated. Additionally, the magnitude of the projected operational traffic for all the roads evaluated (ranging from approximately 283 to 5,133 vehicles per day considering the sum of projected auto and truck traffic) will not exceed the existing road capacity (see additional discussion of capacity in SEIS Section 4.3.1.1), and the staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed Dewey-Burdock ISR Project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the Class V injection well disposal option. This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads will also be SMALL under the Class V injection well disposal option.

The potential radiological accident risk associated with yellowcake product shipments was evaluated in GEIS Section 4.4.2.2. The yellowcake transportation analysis assumed shipment volumes that ranged from 34 to 145 yellowcake shipments per year, which could result in a risk of 0.01 and 0.04 latent cancer fatalities, respectively, considering accident probabilities and

consequences (NRC, 2009a). The proposed yellowcake transportation activities for the proposed Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. These activities are similar in approach to the activities evaluated in the GEIS Section 4.2.2.2, and the quantities of material shipped, the number of shipments, and the shipment distances are within the magnitude of the yellowcake transportation activities evaluated in the GEIS. The applicant has estimated approximately 25 yellowcake shipments per year will be needed for the proposed action or an average of one shipment every 2 weeks. This estimate is based on the proposed 45,250 kg [1 million lb] annual yellowcake production rate and an assumed 18,100 kg [40,000 lb] capacity per yellowcake shipment (Powertech, 2009b). By comparison the GEIS does not differ significantly; it considers yellowcake shipped in drums that hold approximately 430 kg [950 lb] and shipments carrying 40 drums per load for a total shipment capacity of 17,200 kg [38,000 lb]. Therefore, the radiological accident risk associated with yellowcake shipment at the proposed Dewey-Burdock ISR Project will be bounded by the GEIS risk analysis. The shipment volume will not significantly affect the project-related traffic relative to the expected commuting workforce.

The GEIS Section 4.4.2.2 reported that previous accidents involving yellowcake releases result in up to 30 percent of shipment contents being released (NRC, 2009a). To limit the risk of an accident involving resin or yellowcake transport, the applicant has proposed that all such materials will be transported in accordance with U.S. Department of Transportation (USDOT) and NRC regulations, handled as low specific-activity materials, and shipped using exclusive-use-only vehicles (Powertech, 2009a). The NRC staff conclude the consequences of such accidents will also be limited because the applicant has proposed to develop emergency response procedures (Powertech, 2009a) for yellowcake and other transportation accidents that could occur during shipment to or from the proposed Dewey-Burdock ISR Project. The applicant also proposes to ensure its personnel and the carrier receive training on these emergency response procedures and that information about the procedures is provided to state and local agencies (Powertech, 2009a). Therefore, the NRC staff conclude the impact from a potential accident involving yellowcake transportation during the operations phase of the proposed project will be SMALL under the Class V injection well disposal option.

The potential impacts from ion-exchange shipments were evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. NRC staff concluded in the GEIS that the potential radiological impacts of these shipments will be bound by the risks from yellowcake shipments based on the less concentrated nature of the resins; the uranium being chemically bound to the resins, which will limit dispersion in the event of a spill; and the small shipment distance relative to yellowcake shipments (i.e., the likelihood of an accident increases with the distance traveled). The proposed ion-exchange transportation activities for the Dewey-Burdock ISR Project described in SEIS Section 2.1.1.1.7 are similar to the activities evaluated in the GEIS. The applicant plans to transport one loaded resin truck per day (Powertech, 2009a), which is consistent with the GEIS Section 2.8 assumption of one truck per day. Ion-exchange resin transported onsite between the Dewey site and the Burdock site central processing plant will traverse approximately 8 km [5.0 mi] of road (primarily on Dewey Road). Compliance with the applicable NRC and USDOT regulations for shipping ion-exchange resins, which are enforced by NRC onsite inspections, provides additional confidence that these materials can be safely shipped across the site area. Therefore, applying the GEIS impact analysis to the proposed activities, the NRC staff conclude the aforementioned SMALL potential radiological accident impacts from the proposed Dewey-Burdock facility yellowcake shipments bound the potential radiological accident impacts of the proposed ion-exchange resin shipments. The NRC staff conclude the resulting environmental impact from ion-exchange resin shipments will be SMALL; this is based on the

fact that the risk of ion-exchange resin accidents is low, a resulting spill will be properly removed and disposed of, and the affected area will be reclaimed in accordance with applicable NRC and state regulations.

The potential impacts from operational byproduct material shipments were evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. NRC staff concluded in the GEIS the SMALL risks from transporting yellowcake during operations will bound the risks expected from byproduct material shipments, owing to the concentrated nature of shipped yellowcake, the longer distance yellowcake is shipped relative to byproduct material, and the relative number of shipments of each material. The proposed operational byproduct material transportation activities for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. The applicant proposed to temporarily store operational byproduct material and then ship the material to an offsite disposal facility that is licensed to accept byproduct material. Byproduct material disposal facility options are described in SEIS Section 3.13.2. The applicant's estimated annual generation of 22 m^3 [29 yd^3] of byproduct material (including reverse osmosis reject solids, spent ion-exchange resins, and tank and pond sediments) will comprise approximately one shipment per year (SEIS Section 2.1.1.1.7). This magnitude of operational byproduct material shipping is lower than the range documented in the GEIS of 2.5 to 15 shipments per year (NRC, 2009a, Table 2.8-1). Transportation safety will be maintained by the applicant's proposed adherence to applicable NRC and USDOT transportation requirements, the applicant's proposed use of licensed third-party carriers, and the applicant's proposed emergency response measures (Powertech, 2009b). Based on the preceding analysis, the NRC staff conclude the applicant's proposed operational byproduct material shipment activities are consistent with the impact analysis in GEIS Section 4.4.2.2, and therefore environmental impacts of the proposed shipments under the Class V injection well disposal option will be bounded by impacts from the proposed yellowcake shipments (SMALL).

The potential impacts from transportation of process chemical supplies were also evaluated in GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2. The potential safety hazards associated with process chemicals the applicant intends to use for the proposed action (see SEIS Section 4.13.1.2.3) were also described and evaluated in GEIS Sections 2.11.2 and 4.2.11.2.4 (NRC, 2009a). The proposed operational hazardous chemical shipments for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. The applicant proposes to store, use, and receive shipments of the following chemicals: sodium chloride (NaCl), sodium carbonate ($NaHCO_3$), sodium hydroxide (NaOH), hydrochloric acid (HCl), hydrogen peroxide (H_2O_2), carbon dioxide (CO_2), oxygen (O_2), anhydrous ammonia (NH_3), diesel fuel, gasoline, and bottled gases (Powertech, 2009b). The magnitude of operational chemical supply shipments is less than the value documented in the GEIS (NRC, 2009a, Table 2.8-1), and the types of chemicals shipped align with the materials evaluated in the GEIS (NRC, 2009a).

Transportation risks associated with incoming, onsite, and outgoing shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and they will be transported following applicable USDOT hazardous materials shipping provisions. If an accident occurs, spill response will be handled via emergency response procedures, although a spill of nonradiological materials will be reportable to the appropriate state agency, EPA, and USDOT (NRC, 2009a). Spill material will be recovered or removed and the affected areas reclaimed. The release of anhydrous ammonia, a compound that the applicant may use in the precipitation circuit (Powertech, 2009b), could be hazardous to the public if released near a populated area. However, the proposed project is not situated in a populated area and the likelihood of such an accident

occurring is small, calculated as 3.0×10^{-7} accidents per km [4.8×10^{-7} accidents per mi] based on NUREG–0706 accident data (NRC, 1980). The applicant proposes to maintain transportation safety by following applicable USDOT hazardous materials transportation requirements and the proposed use of licensed third-party carriers (Powertech, 2009a). Based on these considerations, the staff conclude the environmental impacts from operational hazardous chemical shipments under the Class V injection well disposal option will be SMALL.

NRC staff conclude the increase in traffic volumes will result in SMALL impacts to the local and unpaved Dewey Road and SMALL impacts to the remaining regional roads under the Class V injection well disposal option. Based on the low radiological risks from transportation accidents and the implementation of the applicant's additional safety practices as previously discussed, the overall impacts from the proposed transportation activities during the operations phase will be SMALL under the Class V injection well disposal option.

4.3.1.1.3 Aquifer Restoration Impacts

At the proposed Dewey-Burdock ISR Project, commuting workers constitute the majority of road traffic the applicant proposes for the aquifer restoration phase. The applicant estimated the number of worker trips per day to the site will be five (compared to 20 to 200 worker trips per day considered in GEIS Section 2.8). To evaluate the potential traffic impacts, the NRC staff assumed remote ion-exchange and processing chemical shipments will be similar to the operations phase and bounded by the GEIS values (NRC, 2009a).

Table 4.3-3 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed aquifer restoration activities. The projected auto traffic for the aquifer restoration phase for all road segments evaluated is lower than the projected traffic from the construction and operation phases, and the projected truck traffic is similar to the operation phase. Considering Table 4.3-3, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is a 4 percent increase over existing traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the transportation impacts from the proposed aquifer restoration transportation activities will be SMALL under the Class V injection well disposal option.

4.3.1.1.4 Decommissioning Impacts

The proposed decommissioning traffic estimates for the Dewey-Burdock ISR Project are described in SEIS Section 2.1.1.1.7. NRC staff derived these estimates from applicant-provided information. The magnitude of estimated truck transportation for the proposed decommissioning phase is about two times greater than what is reported in the GEIS (NRC, 2009a, Table 2.8-1), due to the larger amount of estimated nonhazardous solid waste (e.g., facility demolition and equipment removal) from the proposed action that will need to be shipped offsite for disposal. Despite this increase, the overall level of transportation is still low at about one truck per day (two trips when both directions are included) based on the information in SEIS Section 2.1.1.1.7.

Table 4.3-4 compares the magnitude of the NRC staff's estimated increase in local traffic counts from proposed decommissioning activities. The projected traffic in Table 4.3-4 is based on the

Table 4.3-3. Estimated Daily Traffic on Regional Roads for the Aquifer Restoration Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	235	4	4	—
U.S. Highway 18 (Edgemont to State Highway 89)	1,782	1,361	421	1,371	425	<1	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,735	354	<1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	622	59	2	7
State Highway 79 (at U.S. Highway 18)	3,172	2,569	603	2,579	607	<1	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed aquifer restoration phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

applicant's proposed Class V injection well disposal option, which the applicant estimated will generate less decommissioning waste than the land application disposal option (and therefore will generate less truck traffic). The projected combined auto and truck traffic for the decommissioning phase for all road segments evaluated is lower than the projected traffic from the construction, operation, and aquifer restoration phases. Considering Table 4.3-4, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected increase in daily traffic on Dewey Road, the road nearest the proposed site, is a six percent increase over existing traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the potential traffic-related impacts from the proposed decommissioning transportation activities will be SMALL under the Class V injection well disposal option.

Another potential transportation impact from proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff consider the potential radiological accident risk associated with byproduct material shipments will be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in SEIS Section 4.3.1.1.2 and in GEIS Section 4.2.2.2. The number of byproduct material shipments NRC staff estimated based on the applicant's proposal is low (Table 2.1-7) (approximately 31 annually for the Class V injection well option compared to

Table 4.3-4. Estimated Daily Traffic on Regional Roads for the Decommissioning Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

Road Segment	2011 Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	225	225	—	239	2	6	—
U.S. Highway18 (Edgemont to State Highway 89)	1,782	1,361	421	1,375	423	1	<1
U.S. Highway 18 (Hot Springs to State Highway 79)	5,075	4,725	350	4,739	352	<1	1
State Highway 89 (U.S. Highway 385 to U.S. Highway 18)	659	604	55	618	57	2	4
State Highway 79 (at U.S. Highway18)	3,172	2,569	603	2,583	605	<1	<1

Sources: Powertech (2013a,b); SDDOT (2011)
*Traffic counts are annual average daily traffic for both directions of travel (Supplemental Environmental Impact Statement Section 3.3). The U.S. Nuclear Regulatory Commission calculated the auto traffic count as the difference between the all vehicle count and reported truck count; for Dewey road, the auto count was assumed equal to the all vehicle count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2012 (Powertech, 2013a).
†Projected traffic is the sum of the proposed action daily two-way traffic and the applicable traffic count. Proposed decommissioning phase two-way traffic is double the round-trips reported in Table 2.1-7.
‡This analysis assumes all projected traffic will travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

145 yellowcake shipments evaluated in the GEIS; annual values for the proposed action are the product of the reported daily values in Table 2.1-7 and 260 days/year shipping frequency). The applicant's annual byproduct material volume estimate in its surety (Powertech, 2009b) (see SEIS Section 2.1.1.6.3) indicates the material will consist primarily of pond leak detection equipment and liners. Relative to powdered yellowcake, this material is in a form that will be less dispersible (i.e., less likely to cause public exposure if released) and easier to clean up if an accident involving release occurred. The byproduct material will be transported and disposed of at a licensed facility. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). The trip distance to this facility from the proposed site of 1,210 km [752 mi] is less than the distance used in the risk analysis described in GEIS Section 4.2.2.2 for transporting yellowcake to the conversion facility in Metropolis, Illinois {approximately 2,414 km [1,500 mi]}. The applicant proposes to implement additional BMPs to reduce the risk of accidents including (i) enforcing safe driving and emergency response procedures and training for personnel and truck drivers, (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders, (iii) and enforcing speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game, livestock, and other vehicles (Powertech, 2009a).
All shipments will be required to comply with applicable USDOT regulations governing the transportation of radioactive material (including quantity limits, packaging requirements, and conveyance dose rate limits). Based on the preceding analysis, the NRC staff conclude the potential radiological risks from the proposed transportation of decommissioning byproduct material will be low and therefore the potential environmental impacts from the proposed

radioactive material transportation will be SMALL under the Class V injection well disposal option.

In conclusion, because of the low estimated traffic for the proposed Dewey-Burdock ISR Project relative to existing road traffic in the region surrounding the site, the NRC staff conclude the potential traffic-related transportation impacts during decommissioning will be SMALL under the Class V injection well disposal option. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal will also be SMALL. Therefore, the NRC staff conclude the overall transportation impacts related to the decommissioning phase will be SMALL under the Class V injection well disposal option.

4.3.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid byproduct material generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The potential transportation environmental impacts from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid disposal option are discussed in the following sections.

4.3.1.2.1 Construction Impacts

The estimated daily traffic volume on regional roads for the construction phase for the land application option will be the same as that described in SEIS Section 4.3.1.1.1 and summarized in Table 4.3-1 for the Class V injection well disposal option. Commuting workers will constitute the majority of road traffic the applicant proposed for the construction phase. Considering Table 4.3-1, the proposed traffic will increase the existing traffic on low-traffic roads, such as Dewey Road, and State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling through Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. As described in SEIS Section 4.3.1.1.1, when the projected traffic for all the roads in the analysis is evaluated (ranging from 319 to 5,169 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity. Therefore, NRC staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the land application disposal option. The projected daily traffic on Dewey Road represents a 42 percent increase over existing traffic considering both autos and trucks (see Table 4.3-1). This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the NRC staff conclude the potential traffic impacts to the remainder of regional roads under the land application disposal option will also be SMALL.

The applicant intends to use existing roads on the site area to the degree possible; however, some new roads will be constructed to facilitate onsite transportation (SEIS Section 2.1.1.2.2). Impacts to land use related to the development of new access roads are addressed in SEIS

Section 4.2.1.1. All roads constructed for the proposed action will be reclaimed except those landowners specify to remain for future use (Powertech, 2009a).

4.3.1.2.2 Operations Impacts

The proposed operational transportation activities for the Dewey-Burdock ISR Project include employee commuting and truck shipments of yellowcake, ion-exchange resins, hazardous chemical supplies, and byproduct material. Traffic generated by these proposed activities for the land application option will be the same as that described in SEIS Section 4.3.1.1.2 and summarized in Table 4.3-2 for the Class V injection well disposal option.

Commuting workers will constitute the majority of road traffic the applicant proposed for the construction phase. Considering Table 4.3-2, the proposed traffic will increase the existing traffic on low-traffic roads, such as Dewey Roadand State Highway 89 but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 traveling through Edgemont or near Hot Springs or State Highway 79 at the junction with U.S. Highway 18. As described in SEIS Section 4.3.1.1.2, when the projected traffic for all the roads in the analysis is evaluated (ranging from approximately 283 to 5,133 vehicles per day based on the sum of projected auto and truck traffic for each road), the magnitude of traffic is not expected to exceed the existing road capacity. Therefore, NRC staff conclude the regional highways could accommodate the additional traffic from the proposed project.

Considering the magnitude of projected traffic from the proposed project, the NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts under the land application disposal option. The projected daily traffic on Dewey Road represents an increase of 24 percent over the existing traffic level (see Table 4.3-2). This increase in traffic will incrementally accelerate degradation of the road surface, increase the generation of dust, and increase the potential for traffic accidents and wildlife or livestock kills. Based on the available capacity on the more distant regional roads, the staff conclude the potential traffic impacts to the remainder of regional roads will also be SMALL under the land application disposal option.

Proposed yellowcake transportation activities for the land application option will be same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. The applicant has estimated approximately 25 yellowcake shipments per year will be needed for the proposed action or an average of one shipment every 2 weeks. This estimate is based on the proposed 45,250 kg [1 million lb] annual yellowcake production rate and an assumed 18,100 kg [40,000 lb] capacity per yellowcake shipment (Powertech, 2009b). This shipment volume will not significantly affect the project-related traffic relative to the expected commuting workforce.

To limit the risk of an accident involving resin or yellowcake transport, the applicant has proposed that all such materials will be transported in accordance with USDOT and NRC regulations, handled as low specific-activity materials, and shipped using exclusive-use-only vehicles (Powertech, 2009a). The NRC staff conclude the consequences of such accidents will also be limited because the applicant has proposed to develop emergency response procedures (Powertech, 2009a) for yellowcake and other transportation accidents that could occur during shipment to or from the proposed Dewey-Burdock ISR Project. The applicant also proposes to ensure its personnel and the carrier receive training on these emergency response procedures and that information about the procedures is provided to state and local agencies (Powertech, 2009a). Therefore, the NRC staff concluded the impact from a potential accident involving

yellowcake transportation during the operations phase of the proposed project will be SMALL under the land application disposal option.

Proposed ion-exchange transportation activities for the land application option will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well option. The applicant plans to transport one loaded resin truck per day (Powertech, 2009a). Ion-exchange resin transported onsite between the Dewey satellite facility and the Burdock central processing plant will traverse approximately 8 km [5.0 mi] of road (primarily Dewey Road). Compliance with the applicable NRC and USDOT regulations for shipping ion-exchange resins, which are enforced by NRC onsite inspections, provides confidence that these materials can be safely shipped across the site area. The NRC staff conclude the aforementioned SMALL potential radiological accident impacts from the proposed Dewey-Burdock facility yellowcake shipments bound the potential radiological accident impacts of the proposed ion-exchange resin shipments. The NRC staff conclude that the resulting environmental impact from ion-exchange resin shipments will be SMALL; this is based on the fact that the risk of ion-exchange resin accidents is low, a resulting spill will be properly removed and disposed of, and the affected area will be reclaimed in accordance with applicable NRC and state regulations.

Proposed operational byproduct material transportation activities for the land application option will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. NRC staff concluded in the GEIS the small risks from transporting yellowcake during operations will bound the risks expected from byproduct material shipments, owing to the concentrated nature of shipped yellowcake, the longer distance yellowcake is shipped relative to byproduct material, and the relative number of shipments of each material. The applicant's estimated annual generation of 22 m^3 [29 yd^3] of byproduct material (including reverse osmosis reject solids, spent ion-exchange resins, and tank and pond sediments) will comprise approximately one shipment per year (SEIS Section 2.1.1.1.7). Transportation safety will be maintained by the applicant's proposed adherence to applicable NRC and USDOT transportation requirements, the applicant's proposed use of licensed third-party carriers, and the applicant's proposed emergency response measures (Powertech, 2009b). NRC staff conclude that the environmental impacts of the proposed byproduct material shipments under the land application disposal option will be bounded by impacts from the proposed yellowcake shipments (SMALL).

Proposed operational hazardous chemical shipments for the land application option will be the same as those described in SEIS Section 4.3.1.1.2 for the Class V injection well disposal option. Transportation risks associated with incoming, onsite, and outgoing hazardous chemical shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and they will be transported following the applicable USDOT hazardous materials shipping provisions. If an accident occurred, spill response will be handled via emergency response procedures, although a spill of nonradiological materials will be reportable to the appropriate state agency, EPA, and USDOT (NRC, 2009a). Spill material will be recovered or removed and the affected areas reclaimed. The release of anhydrous ammonia, a compound that the applicant may use in the precipitation circuit (Powertech, 2009b), could be hazardous to the public if released near a populated area. However, the proposed Dewey-Burdock ISR Project is not situated in a populated area and the likelihood of such an accident occurring is SMALL, calculated as 3.0×10^{-7} accidents per km [4.8×10^{-7} accidents per mi] based on NUREG–0706 accident data (NRC, 1980). The applicant proposes to maintain transportation safety by adherence to applicable USDOT hazardous materials transportation requirements and the proposed use of licensed third-party carriers

(Powertech, 2009a). Based on these considerations, the staff conclude the environmental impacts from operational hazardous chemical shipments under the land application disposal option will be SMALL.

NRC staff conclude the increase in traffic volumes to the local and unpaved Dewey Road will result in SMALL impacts from travel on that road and SMALL impacts to the remaining regional roads under the land application disposal option. Based on the low radiological risks from transportation accidents and the implementation of the applicant's additional safety practices as previously discussed, the overall impacts from the proposed transportation activities during the operations phase will be SMALL under the land application disposal option.

4.3.1.2.3 Aquifer Restoration Impacts

The estimated daily traffic volume on regional roads during the aquifer restoration phase for the land application disposal option will be the same as that described in SEIS Section 4.3.1.1.3 and summarized in Table 4.3-3 for the Class V injection well disposal option. Commuting workers will constitute the majority of road traffic the applicant proposed for the aquifer restoration phase. The projected auto traffic for the aquifer restoration phase for all road segments evaluated is lower than the projected traffic from the construction and operation phases, and the projected truck traffic is similar to the operation phase. Considering Table 4.3-3, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is increased by four percent of the existing low level of traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the transportation impacts from the proposed aquifer restoration transportation activities will be SMALL under the land application disposal option.

4.3.1.2.4 Decommissioning Impacts

The proposed decommissioning transportation activities for the Dewey-Burdock ISR Project include employee commuting and truck shipments of nonhazardous solid waste (e.g., facility demolition and equipment removal) and byproduct material. Traffic generated by these proposed activities for the land application option will be the same as that described in SEIS Section 4.3.1.1.4 and summarized in Table 4.3-4 for the Class V injection well disposal option.

The applicant estimated that the proposed land application disposal option will generate more decommissioning waste than the Class V injection well disposal option (and therefore will generate more truck traffic). The projected combined auto and truck traffic for the decommissioning phase for all road segments evaluated is lower than the projected traffic from the construction, operation, and aquifer restoration phases. Considering Table 4.3-4, the proposed traffic, if allocated completely to the individual road segments, will increase the existing traffic on low-traffic roads, such as the unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), but will not substantially increase traffic on the remaining road segments in the table. The projected daily traffic on Dewey Road, the road nearest the proposed site, is increased by six percent of the existing low level of traffic. Based on the low levels of projected traffic for all vehicle types and road segments, the NRC staff conclude the potential traffic-related impacts from the proposed decommissioning transportation activities will be SMALL under the land application disposal option.

Another potential transportation impact from proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff consider the potential radiological accident risk associated with byproduct material shipments will be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in SEIS Section 4.3.1.2.2. The number of byproduct material shipments NRC staff estimated based on the applicant's proposal is low (Table 2.1-7; approximately 34 annually for the land application option). The applicant's annual byproduct material volume estimate in its surety (Powertech, 2009b) (see SEIS Section 2.1.1.6.3) indicates the material will consist primarily of pond leak detection equipment and liners. Relative to powdered yellowcake, this material is in a form that will be less dispersible (i.e., less likely to cause public exposure if released) and easier to clean up if an accident involving release occurred. The byproduct material will be transported and disposed of at a licensed facility. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). The trip distance to this facility from the proposed site of 1,210 km [752 mi] is less than the distance used in the risk analysis described in GEIS Section 4.2.2.2 for transporting yellowcake to the conversion facility in Metropolis, Illinois {approximately 2,414 km [1,500 mi]}. The applicant proposes to implement additional BMPs to reduce the risk of accidents, including (i) enforcing safe driving and emergency response procedures and training for personnel and truck drivers; (ii) installing communication systems to connect trucks to shipper/receiver/emergency responders; and (iii) and enforcing speed limits on the proposed project site to increase driver safety and to reduce conflicts with big game, livestock, and other vehicles (Powertech, 2009a). All shipments will be required to comply with applicable USDOT regulations governing the transportation of radioactive material (including quantity limits, packaging requirements, and conveyance dose rate limits). Based on the preceding analysis, the NRC staff conclude the potential radiological risks from the proposed transportation of decommissioning byproduct material will be low, and therefore the potential environmental impacts from the proposed radioactive material transportation will be SMALL under the land application disposal option.

In conclusion, because of the low estimated traffic for the proposed project relative to existing road traffic in the region surrounding the site, the NRC staff conclude the potential traffic-related transportation impacts during decommissioning will be SMALL under the land application disposal option. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal will also be SMALL. Therefore, the NRC staff conclude the overall transportation impacts related to the decommissioning phase will be SMALL under the land application disposal option.

4.3.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid byproduct material generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid byproduct material by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep well disposal capacity (Powertech, 2011). The land application option will require the construction and operation of irrigation areas and increased pond capacity for storage of liquid byproduct material during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the Class V injection well

disposal option will require the construction and operation of four to eight deep disposal wells (see SEIS Section 2.1.1.1.2.4.1).

The relative volumes of byproduct material generated by the two disposal options differ during operations, aquifer restoration, and decommissioning phases with the land application option generating the larger amount of material for offsite disposal in each phase. The relative volumes of nonhazardous solid waste generated by the two disposal options differ during the decommissioning phase. The significance of these differences with regard to environmental impacts is low and does not change the impact conclusions for each disposal option. Therefore, the transportation environmental impacts associated with the land application option will be the same for the Class V injection well disposal option for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined Class V injection well disposal and land application option. Therefore, the significance of environmental impacts on waste management resources for the combined disposal option will be less than for the land application option alone. Based on this reasoning, NRC staff conclude that the transportation environmental impacts of the combined Class V injection well disposal and land application option for each phase of the proposed Dewey-Burdock ISR Project will lie between or be bounded by the significance of environmental land use impacts of the Class V deep well injection option and the land application option as summarized in Table 4.3-5.

4.3.2 No Action (Alternative 2)

Under the No-Action alternative, traffic volumes and patterns will remain the same as described in SEIS Section 3.3. There will be no transportation of materials to and from the site to support licensed activities. There will be no transportation of either radionuclide or solid waste attributable to the proposed action because the facility will neither be licensed nor constructed and operated. Existing land use activities, predominantly livestock grazing, will persist.

4.4 Geology and Soils Impacts

Environmental impacts on geology and soils occur during all phases of an ISR facility lifecycle; however, the direct impacts on geology and soils will be concentrated during construction (NRC, 2009a).

Table 4.3-5. Significance of Transportation Environmental Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

GEIS Construction Phase Summary

As described in GEIS Section 4.4.3.1, the principal impacts on geology and soils are caused by earthmoving activities during construction of ISR surface facilities, access roads, wellfields, and pipelines. Earthmoving activities affecting soils include ground clearing, topsoil removal, and preparation of land surfaces before construction of facility structures. Such structures include the processing plant, satellite facilities, header houses, access roads, drilling sites, land application areas, and associated structures. Excavating and backfilling trenches for pipelines and cables will also impact soils. (NRC, 2009a)

NRC staff concluded in the GEIS that the impact on geology and soils from construction activities is dependent on local topography, surface and bedrock geology, and soil characteristics. Earthmoving activities are normally limited to a small portion of the project. Consequently, earthmoving activities will result in SMALL and temporary disturbance of soils, impacts that are commonly mitigated using accepted BMPs. Construction activities will increase the potential for wind and water erosion due to the removal of vegetation and the physical disturbance that will result from vehicle and heavy equipment traffic. These activities, however, will result in SMALL impacts if equipment operators adopt construction BMPs to either prevent or substantially reduce erosion. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.3.2, during ISR operations, a non-uranium-bearing (barren) solution or lixiviant is injected through wells into the mineralized zone. The lixiviant moves through the host rock, dissolving uranium and other metals. Production wells withdraw the resulting “pregnant” lixiviant, which now contains uranium and other dissolved metals, and pump it to a processing facility for further uranium recovery and purification. During ISR operations the removal of uranium and other metals will permanently change the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure, and therefore no significant matrix compression or ground subsidence is expected. Consequently, impacts on geology from ground subsidence at ISR projects will be SMALL. (NRC, 2009a)

In GEIS Section 4.4.3.2, NRC staff discussed the potential soil impacts from ISR operations resulting from the need to transfer barren and pregnant uranium-bearing lixiviant to and from the processing facility in aboveground and underground pipelines. If a pipe ruptures or fails, lixiviant could be released and (i) pond on the surface, (ii) runoff into surface water bodies, (iii) infiltrate and adsorb in overlying soil and rock, or (iv) infiltrate and percolate to groundwater. In the case of spills from pipeline leaks and ruptures, licensees are expected to initiate immediate spill responses using onsite standard operation procedures (e.g., NRC, 2003b, Section 5.7). As part of the monitoring requirements at ISR facilities, licensees must report certain spills to NRC within 24 hours. Regular inspection and monitoring also occurs to minimize the potential for spills and leaks through early detection. (NRC, 2009a)

Additionally, failure of settling and holding pond liners or embankment systems and buildup of certain constituents in land-applied water may negatively impact soils (NRC, 2009a). Licensees will be expected to construct and monitor settling and holding pond liners and embankments in accordance with NRC-approved plans, and licensees will be expected to obtain the appropriate permits from state regulatory agencies for land application and to conduct regular soil monitoring. Such actions will tend to mitigate impacts to soils from these waste

disposal methods. Based on these considerations, NRC staff concluded in GEIS Section 4.4.3.2 that impacts to soils from spills during operations could range from SMALL to LARGE, depending on the volume of soil affected by the spill, but that the immediate response requirement to report spills at ISR facilities, the mandated spill recovery actions, and the required routine monitoring programs will reduce the potential impact from spills to SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

As described in GEIS Section 4.4.3.3, aquifer restoration programs typically use a combination of (i) groundwater transfer; (ii) groundwater sweep; (iii) reverse osmosis, permeate injection and recirculation; (iv) stabilization; and (v) water treatment and surface conveyance (NRC, 2009a). The groundwater sweep and recirculation process does not remove rock matrix or structure, nor will dewatering occur within the aquifer; therefore, no significant matrix compression or ground subsidence is expected. The water pressure in the aquifer decreases during restoration because a negative water balance must be maintained in the wellfield being restored to ensure water flows from the edges of the wellfield inward; this reduces the spread of contaminants outside of the wellfield. The influx of fluid will change the reservoir pressure but will not reactivate any local faults, because the change in reservoir pressure is limited by recirculation of treated groundwater. NRC staff concluded in the GEIS that ISR operations are unlikely to reactivate any local faults and are extremely unlikely to cause earthquakes. After analyzing these conditions the NRC staff concluded in the GEIS the environmental impact of aquifer restoration to the geology of the Nebraska-South Dakota-Wyoming Uranium Milling Region will be SMALL. (NRC, 2009a)

In GEIS Section 4.4.3.3, NRC staff also concluded impacts on soils from spills during aquifer restoration will range from SMALL to LARGE, depending on the volume of soil affected by the spill. Because of the requirements for immediate spill response at ISR facilities, for spill-recovery actions, and for routine monitoring programs, NRC staff concluded in the GEIS that impacts from spills will be temporary and the long-term impact on soils will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

As indicated in GEIS Section 4.4.3.4, the decommissioning of ISR facilities includes the following activities: (i) dismantling process facilities and associated structures; (ii) removing buried piping; and (iii) plugging and abandoning wells using accepted practices. The main impacts to the geology and soils at the project site during decommissioning will result from land reclamation activities and cleaning up contaminated soils. (NRC, 2009a)

The GEIS also states a licensee is required to submit a decommissioning plan to NRC for review and approval before decommissioning and reclamation activities may begin. NRC regulations require an applicant submit a final decommissioning plan to NRC for review and approval at least 12 months prior to the planned decommissioning of a wellfield or any portion of an ISR facility (NRC, 2003a). Any soils that have the potential to be contaminated will be surveyed to identify and clean up areas with elevated radionuclide concentrations, in accordance with NRC regulations at 10 CFR Part 40, Appendix A**,** Criterion 6 (6) (NRC, 2009a). The goal of reclamation is to return the site to preproduction conditions by replacing topsoil and reestablishing vegetation communities. (NRC, 2009a)

NRC staff concluded in the GEIS that the impacts on geology and soils from decommissioning will be detectable but SMALL. Disruption and/or displacement of existing soils will be temporary and relatively small in scale. Changes in the size and location of impervious surfaces will be measureable, but will involve only a few hectares [acres] of compacted soil beneath buildings and parking lots. These changes will not be on a large enough scale to alter existing natural conditions. (NRC, 2009a)

4.4.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.2, the proposed Dewey-Burdock ISR Project site encompasses 4,282 ha [10,580 ac] (Powertech, 2009a). The topsoil in the areas of the Burdock central processing plant and the Dewey satellite facility and wellfield header houses will be removed before construction begins. The applicant has committed to removing topsoil to construct access roads and will adhere to road construction practices stipulated by landowners (Powertech, 2009a). Over the life of the project, the applicant estimates that the area of topsoil to be stripped and removed will be up to 98 ha [243 ac] for the Class V deep well injection option and up to 175 ha [433 ac] for the land application disposal option (Powertech, 2012d). The area of topsoil disturbance will be approximately the same as the total disturbance area in the Class V deep well injection option but smaller than the 566 ha [1,398 ac] of estimated disturbance in the land application option (see Table 2.4-1), since topsoil generally will not be stripped from center pivot irrigation areas.

The following sections discuss the environmental impacts on land use for each of the liquid waste disposal options proposed by the applicant: (i) disposal via Class V injection wells, (ii) disposal via land application, or (iii) combined disposal via Class V injection wells and land application.

4.4.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid waste is deep well disposal via Class V injection wells. The potential environmental impacts on geology and soils from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed project are discussed next.

4.4.1.1.1 Construction Impacts

As described in SEIS Section 2.1.1.1.2, topsoil will be removed from building sites, storage areas, and access roads and stored in designated topsoil stockpiles, in accordance with SDDENR requirements (Powertech, 2009b). The applicant will mitigate soil losses due to stormwater runoff and wind erosion. Mitigation measures will include (i) locating topsoil stockpiles away from drainage channels or other locations that will lead to loss of material, (ii) constructing berms around the base of the stockpiles, and (iii) seeding the stockpiles with an approved seed mix to minimize sediment runoff and wind erosion (Powertech, 2009a).

The applicant will implement additional mitigation measures to limit potential soil erosion impacts during construction at the proposed Dewey-Burdock site (Powertech, 2009a). These measures include (i) reestablishing temporary and permanent native vegetation as soon as possible after disturbance; (ii) decreasing stormwater runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface stormwater runoff; (iii) retaining

sediment within disturbed areas by using silt fencing, retention ponds, and hay bales; (iv) implementing drainage designs to minimize potential erosion and/or providing riprap or other soil stabilization controls; and (v) constructing stream crossings at right angles with adequate embankment and culvert installations to minimize erosion. Construction activities at the proposed Dewey-Burdock site have the potential to compact soils. Compaction of soils could lead to decreased infiltration and increased stormwater runoff. To mitigate the effects of compaction at the proposed site, the applicant proposes to disc and reseed any compacted soils as soon as possible after construction activities are completed (Powertech, 2009a).

During wellfield construction at the proposed Dewey-Burdock site, well construction, exploration drilling, and delineation drilling will also impact soils. The applicant estimated that approximately 646 wells (including delineation, monitor, production, injection, and deep disposal wells) will be drilled in the development of the initial wellfields in the Burdock and Dewey areas (Powertech, 2010b). As discussed in SEIS Section 2.1.1.1.2.3.5, drilling activities include the construction of unlined mud pits. During excavation of mud pits, topsoil will be separated from the subsoil and placed at a separate location (Powertech, 2009a). The subsoil will then be removed and placed next to the mud pit. Once use of the mud pit is complete (usually within 30 days of initial excavation), the applicant will redeposit the subsoil in the mud pit followed by topsoil replacement (Powertech, 2009a). The applicant will follow a similar approach for pipeline ditch construction.

The NRC staff conclude the environmental impacts to geology and soils from construction activities for the Class V injection well option at the Dewey-Burdock site will be SMALL. This finding is based on NRC staff evaluation of the limited area to be disturbed by construction, the applicant commitment to proposed BMPs to limit soil erosion and compaction, the commitment to mitigative methods, the short duration of construction, and the procedures used to construct mud pits and pipeline ditches.

While the NRC staff concludes impacts to soils from construction will be SMALL, the staff recognizes that alternative methods to manage drilling fluids are available that the applicant could choose to implement to further limit the potential impacts from the use of mud pits during well drilling activities. Alternatives or mitigating measures to the use of mud pits during well drilling operations include, for example, lining the mud pits with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids.

4.4.1.1.2 Operations Impacts

As described in SEIS Section 2.1.1.1.3, the applicant's operational activities at the facility are consistent with the operations analyzed in the GEIS. Soil disturbance during the estimated 8-year operations phase of the proposed Dewey-Burdock ISR Project will be limited primarily to earthmoving activities associated with wellfield development (e.g., preparing and constructing drill sites and mud pits, expanding pipelines, and constructing wellfield access roads). Therefore, the amount of soil disturbance resulting from earthmoving activities during the operations phase of the proposed project will be less than that for the construction phase.

As described in SEIS Section 2.1.1.1.3, the applicant's operational activities at the facility are consistent with the operations analyzed in the GEIS. The removal of uranium from the target sandstones in the initial wellfields at the proposed project will occur at depths ranging from approximately 122 to 244 m [400 to 800 ft] below ground surface (bgs) in the Dewey area and

approximately 61 to 122 m [200 to 400 ft] bgs in the Burdock area (Powertech, 2009c). The ISR process and lixiviant chemistry will not remove rock matrix material in the ore-bearing sandstones. Therefore, no significant matrix compression will result from the proposed uranium recovery operations. Dewatering of the source uranium formations (i.e., the Fall River Formation and Chilson member of the Lakota Formation) during ISR operations is not expected. Hydrogeologic characteristics of the uranium source formations (i.e., formation thicknesses and potentiometric surfaces, as described in SEIS Section 3.5.3.2) and results of aquifer pumping tests at estimated production flow rates (see SEIS Section 4.5.2.1.1.2.2) indicate that drawdown in nearby wells will be SMALL. Because rock matrix is not removed during the uranium mobilization and recovery process and dewatering of uranium source formations is not expected, no subsidence is expected from the collapse of overlying rock strata into the ore zone.

In accordance with 40 CFR 144.28(f)(6)(i), for Class III injection wells, the operator must not exceed an injection pressure at the wellhead which will be calculated as to assure that the pressure during injection does not initiate fractures in the injection or confining zone. To ensure that formation fracture pressures are not exceeded, the applicant will estimate maximum allowable wellhead pressures at the proposed project on a well-by-well basis as a function of depth, fracture gradient, and injected fluid pressure gradient (Powertech, 2012g). The applicant will implement operational controls to prevent exceedance of estimated pressures. Based on the depths of target mineralization zones {approximately 61 to 244 m [200 to 800 ft]}, an expected fracture gradient of 15.8 kPa/m [0.7 psi/ft], and an expected fluid pressure gradient of 9.8 kPa/m [0.433 psi/ft] for the injected fluid, the applicant estimates that maximum allowable wellhead pressures at the proposed project will range from approximately 365 to 1,475 kPa [53 to 214 psi] (Powertech, 2012g). The applicant will also specify the maximum injection pressure for each header house (Powertech, 2012g). Maximum estimated injection pressures will be calculated as the lowest value of the following: (i) the lowest value of maximum allowable wellhead pressure for all injection wells connected to the header house based on fracture pressure calculations; (ii) the manufacturer-specified maximum operating pressure for the well casing; or (iii) the manufacturer-specified operating pressure of the injection piping and fittings. The anticipated range of injection pressures at each header house is 239 to 1135 kPa [20 to 150 psig] (Powertech, 2012g). At each header house, the designated maximum injection pressure will be posted and monitored to ensure the formation fracture pressure is not exceeded.

The applicant will implement an NRC-required wellfield and pipeline flow and pressure monitoring program to detect unexpected losses of pressure due to equipment failure, a leak, or a problem with well integrity (Powertech, 2009a). This program, described in SEIS Section 7.3.2, ensures timely detection of any releases from leaks due to pipeline breaks or ruptures and minimizes the volume of such releases. The design of all radium settling and holding ponds at the Dewey-Burdock ISR Project includes a leak detection system (Powertech, 2009b). Detection of a pond leak will initiate measures to take the pond out of use, transfer its contents to another pond, investigate the cause, and repair the condition causing the leak. The applicant will also collect and monitor soils for yellowcake and ion-exchange resin contamination along transportation routes and in wellfield areas where spills and leaks are possible (Powertech, 2009a). If soil is contaminated by a pipeline spill, pond leak, or vehicle accident, the applicant will remove the contaminated soil and dispose of it at a licensed disposal facility to ensure all impacts are temporary (Powertech, 2009a). After decontamination is complete, the applicant is required by regulation to conduct radiation surveys to confirm that soils have been cleaned to the NRC standards for unrestricted use in 10 CFR Part 20 (Powertech, 2009a).

As described in SEIS Section 2.1.1.1.2.4, for the applicant to use deep well disposal, an EPA Class V underground injection control (UIC) permit is required. EPA evaluates the suitability of formations proposed for deep well injection and only allows Class V injection where an applicant demonstrates liquid waste can be safely isolated in a deep aquifer. EPA reviews the application to confirm the well is properly sited, such that confining zones and proper well construction minimize the potential for migration of fluids outside the injection zone.

The NRC will require liquid wastes injected into potential Class V injection wells at the proposed project to be treated to meet release standards at 10 CFR Part 20, Subparts D and K, as wells as Appendix B, Table 2, Column 2. Before injection of fluids into the Class V deep injection wells, the permittee must demonstrate (i) the injection zones are not underground sources of drinking water by providing analytical results for total dissolved solids above 10,000 mg/L [10,000 ppm] and (ii) there are adequate confining zones above and below the proposed injection zones. If the proposed injection zones are underground sources of drinking water (have total dissolved solids concentrations below 10,000 mg/L [10,000 ppm], the applicant will be required to obtain an aquifer exemption from EPA, or the EPA UIC permit will require liquid wastes to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the Safe Drinking Water Act (SDWA). The permit will also place an injection pressure limit prohibiting injection pressures at or above the injection zone formation fracture pressure. The applicant estimates that the average injection pressure during active operations will range from approximately 2,068 to 5,515 kPa [300 to 800 psi] (Powertech, 2011; Appendix 2.7–L).

In summary, based on analysis of the depth of the ore production zones and because the operations phase does not involve the removal of rock matrix, the staff find that the impacts to geology from subsidence at the proposed project will be SMALL. Systems and procedures will be in place to monitor and clean up soil contamination resulting from pipeline and wellfield spills, pond leaks, and vehicle accidents. NRC and the EPA Class V permit conditions will require liquid wastes to be treated prior to deep well injection to meet NRC release standards in 10 CFR Part 20, Subparts D and K, and Appendix B, Table 2, Column 2. Unless the applicant applies for and is granted an aquifer exemption, the EPA UIC permit will require liquid wastes to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the SDWA. Therefore, NRC staff conclude that site-specific impacts to geology and soils during the operational phase for the Class V injection well disposal option will be SMALL.

4.4.1.1.3 Aquifer Restoration Impacts

For the Class V injection well disposal option, the primary method of aquifer restoration will be reverse osmosis (RO) treatment with permeate injection (see SEIS Section 2.1.1.1.4.1.1). About 70 percent of the water withdrawn from the wellfields and passed through high pressure RO membranes will be recovered as permeates. Before reinjection into the wellfields, the permeate will be supplemented with makeup water from wells in the Madison Formation and injected into the wellfields at an amount slightly less than the amount withdrawn to maintain a slight restoration bleed. Although a 1 percent restoration bleed will typically be used to maintain hydraulic control of wellfields, higher bleed rates may be implemented to recover flare (i.e., outward spreading) of lixiviant from the wellfield pattern areas during aquifer restoration. If necessary, the applicant has proposed to increase the restoration bleed by withdrawing up to one pore volume of water through groundwater sweep over the course of aquifer restoration.

During the aquifer restoration phase, liquid wastes injected into the Class V deep injection wells will consist of bleed fluids from operating wellfields and the brine for the RO treatment system. The applicant estimates the maximum volume of liquid wastes injected into the Class V injection wells during aquifer restoration will be 567.75 Lpm [150 gpm] (see SEIS Section 2.1.1.1.4.1.1). The EPA UIC Class V permit will not place an upper limit on the injection rate; only the injection pressure will have an upper limit in the permit.

ISR activities during aquifer restoration at the proposed Dewey-Burdock facility will not remove rock matrix (NRC, 2009a). The source uranium formations lie 122 to 244 m [400 to 800 ft] bgs in the Dewey area and 61 to 122 m [200 to 400 ft] bgs in the Burdock area (Powertech, 2009a). Rock matrix is not removed by groundwater transfer and groundwater sweep during aquifer restoration. In addition, no significant matrix compression or ground subsidence is expected during aquifer restoration activities. For these reasons, the subsidence and collapse of overlying rock strata into the ore zone during the restoration phase is not expected. Therefore, the NRC staff conclude the environmental impact on geology during aquifer restoration will be SMALL.

The spill and leak detection program described for the operations phase in SEIS Section 4.4.1.1.2 will also be maintained during aquifer restoration because the plant and wellfield infrastructure will be used and monitored during aquifer restoration. The potential for spills and pipeline leaks to impact soils are SMALL and similar to impacts described for the operations phase. The NRC staff conclude that the potential for spills to impact the geology and soils is SMALL because of the regulatory requirements for immediate spill response, for implementing spill recovery actions, and for ongoing monitoring programs.

4.4.1.1.4 Decommissioning Impacts

The applicant will restore disturbed lands to their prior uses as livestock grassland and wildlife habitat (see SEIS Section 2.1.1.1.5). The Burdock central processing plant and Dewey satellite facilities will be decontaminated according to regulatory standards and the applicant's NRC-approved decommissioning plan (see SEIS Section 3.13.2). These structures will be demolished and trucked to a licensed disposal facility (see SEIS Section 2.1.1.1.5) or will be turned over to the landowner. Baseline readings of soils, vegetation, and radiological data will guide and provide a basis to evaluate final reclamation efforts. Any soils that have the potential to be contaminated will be surveyed to identify and clean up areas with elevated radionuclide concentrations, in accordance with NRC regulations at 10 CFR Part 40, Appendix A**,** Criterion 6 (6). Any contaminated soils will be disposed of in licensed disposal facilities. As discussed in SEIS Section 2.1.1.1.5.3, stockpiled topsoil will be redistributed over disturbed surfaces, which will be recontoured to match existing topography. Final revegetation will consist of seeding the area with a seed mixture approved by SDDENR, the local conservation district, BLM, and landowners (Powertech, 2009b).

Short-term impacts to geology and soils are expected as reclamation progresses; however, the result will be to return the land to uses that existed before proposed ISR activities began. The NRC staff conclude the environmental impacts of the decommissioning phase on geology and soils at the facility will be SMALL for several reasons. The temporary nature of the impacts on the land, the applicant's goal of decommissioning and reclaiming the site to preproduction conditions, and the fact that the magnitude of expected soil disturbance is within the range evaluated in the GEIS all support a finding of SMALL impacts.

4.4.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Environmental impacts on geology and soils from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.4.1.2.1 Construction Impacts

As described under SEIS Section 4.4.1.1.1, the applicant will implement mitigation measures to minimize soil losses from stormwater runoff and wind erosion of soil stockpiles. These measures include (i) locating topsoil stockpiles away from drainage channels or other locations that will lead to loss of material, (ii) constructing berms around the base of the stockpiles, and (iii) seeding the stockpiles with an approved seed mix to minimize sediment runoff and wind erosion. (Powertech, 2009a)

The mitigation measures to limit soil erosion impacts during construction of the land application disposal system will be the same as the Class V deep injection well disposal method described in SEIS Section 4.4.1.1.1 (Powertech, 2009a). These measures include (i) reestablishing temporary and permanent native vegetation as soon as possible after disturbance; (ii) decreasing stormwater runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface runoff; (iii) retaining sediment within disturbed areas by using silt fencing, retention ponds, and hay bales; (iv) implementing drainage designs to minimize erosion and/or provide riprap or other soil stabilization controls; and (v) constructing stream crossings at right angles with adequate embankment and culvert installations to minimize erosion. Compaction of soils at the site could lead to decreased infiltration and increased stormwater runoff. The applicant plans to disc and reseed any compacted soils as soon as possible after construction activities are completed to mitigate compaction at the site (Powertech, 2009a).

Well construction, exploration drilling, and delineation drilling in the wellfield areas will also impact soils. The applicant estimates 642 delineation, monitor, production, injection, and deep disposal wells will be drilled as the initial wellfields in the Burdock and Dewey areas are developed (Powertech, 2010b). To prevent adverse impacts to groundwater quality, all production, injection, and monitoring wells, as well as all delineation drill holes, will be abandoned according to SDDENR regulations established in Administrative Rules of South Dakota (ARSD) 74:02:04:67 and 74:11:08 (Powertech, 2009a, 2012c). As discussed in SEIS Section 2.1.1.1.2.3.3, drilling activities will include the construction of unlined mud pits. Excavation of mud pits requires separating the topsoil from the subsoil and storing the topsoil at a separate location (Powertech, 2009a). The subsoil will be removed and placed next to the mud pit. Once use of the mud pit is complete (usually within 30 days of initial excavation), the applicant will redeposit the subsoil in the mud pit, followed by topsoil replacement (Powertech, 2009a). The applicant will follow a similar approach for pipeline trench construction.

The NRC staff evaluated the small area to be disturbed by construction, the applicant's plan to use BMPs to limit soil erosion and compaction, the short duration for construction, and use of mud pits and pipeline trenches and other construction methods that will limit environmental impacts. The NRC staff conclude that the environmental impacts to the geology and soils for the land application disposal option at the proposed project will be SMALL.

4.4.1.2.2 Operations Impacts

If land application is used to dispose of process-related liquid wastes, soils may be adversely impacted. The salinity of the treated wastewater could increase the salinity of soils (soil salinization) (NRC, 2009a), which will make the soil less permeable. In addition, land application of liquid wastes could cause radiological and/or other constituents (e.g., selenium and other metals) to accumulate in the soils and vegetation. Licensees of NRC-regulated ISR facilities are required to monitor and control irrigation areas (NRC, 2009a). The applicant proposes to collect and monitor soils and sediments for potential contamination in areas used for land irrigation (Powertech, 2009a). The applicant's land application monitoring program is described in SEIS Section 7.5. In addition, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). NRC will require the applicant to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radionuclides, as referenced in 10 CFR Part 20, Appendix B. NRC will also require by license condition that the applicant conduct pre-operational and operational sampling of land application areas and the surrounding environment and report operational results to NRC semi-annually so NRC staff can evaluate existing conditions and trends. As stated in SEIS Section 2.1.1.1.6.2, land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state standards for the protection of the environment including groundwater, soils, vegetation, biota, and wildlife. Both NRC and SDDENR have authority to request corrective actions or issue enforcement actions if standards or permit conditions are violated after operations begin. Because the monitoring and associated regulatory oversight by both NRC and SDDENR would be conducted for the duration of the proposed project, these activities would help to limit potential short-term and long-term impacts to soils. Finally, as described in SEIS Section 2.1.1.1.5, eventual decommissioning and reclamation activities after operations cease will further mitigate potential impacts to soils and restore vegetation prior to release of the site for other uses. Therefore, the NRC staff conclude that the environmental impacts to geology and soils while operating the land application disposal system for liquid wastes will be SMALL.

4.4.1.2.3 Aquifer Restoration Impacts

As described in SEIS Section 2.1.1.1.4.1.2, the primary method of aquifer restoration for the land application disposal option will be groundwater sweep with Madison Formation water injection (Powertech, 2011). The applicant estimates that typical liquid waste flow rates for the land application option during aquifer restoration will be approximately 1,892 Lpm [500 gpm]. None of the water recovered from the wellfields will be reinjected back into the wellfields. Makeup water for the Madison Formation will be injected into the wellfields at a flow rate sufficient to maintain the restoration bleed, which is typically 1 percent of the restoration flow rate (Powertech, 2011).

If land application is used to dispose of liquid wastes, soils at the proposed Dewey-Burdock Project will be impacted during aquifer restoration activities as the liquid evaporates. During aquifer restoration, the applicant continues routine soil monitoring for contamination of land application areas and must ensure that radionuclide contaminant levels do not exceed the release standards in 10 CFR Part 20, Appendix B and applicable state discharge requirements for land application of treated wastes. Routine monitoring and the inclusion of land application areas in decommissioning surveys provide environmental protections. Therefore, NRC staff conclude that impacts to soils from land application during aquifer restoration will be SMALL.

4.4.1.2.4 Decommissioning Impacts

If the land application disposal option is used, the environmental impacts of decommissioning the site will be similar to impacts described in SEIS Section 4.2.1.1.4 for the Class V injection well disposal option. Decommissioning of the site will follow an NRC-approved decommissioning plan, and all decommissioning activities must be carried out in accordance with 10 CFR Part 40 and other applicable federal regulatory requirements.

If the land application liquid waste disposal option is implemented at the Dewey-Burdock facility, the areas directly impacted by decommissioning will include the central processing plant, satellite facility, wellfields and their infrastructure (i.e., pipelines and header houses), irrigation areas, ponds, and access roads. SEIS Section 2.1.1.1.5 describes the decommissioning activities that will be undertaken to return the site to its previous land use. These include conducting radiological surveys; removing contaminated equipment and materials; cleaning up disturbed areas; plugging and abandoning wells; decontaminating, dismantling, and removing buildings and other onsite structures; and restoring disturbed areas (Powertech, 2009b). Land application areas will also be included in decommissioning surveys to ensure that soil concentration limits are not exceeded.

When decommissioning is complete, the land surfaces will be returned to their preextraction geologic condition. The NRC staff conclude the environmental impacts of the land application disposal option on the geology and soils for the land application option will be SMALL.

4.4.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA, but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the ISR facility, the applicant will dispose of liquid waste by a combination of disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). Under the combined disposal option land application, facilities and infrastructure will be constructed, operated, restored, and decommissioned, as needed, depending on the Class V injection well disposal capacity (Powertech, 2011).

The potential environmental impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V well injection because of the increased land disturbance, thereby increasing potential for soil disturbance and soil erosion. However, implementing the combined disposal option will result in only a portion of land application facilities and infrastructure being constructed, operated, and decommissioned. Therefore, the environmental impacts of the combined disposal option will be less than for the land application option alone, but greater than the Class V injection well disposal option alone. NRC staff conclude that the environmental impacts of the combined Class V injection well and land application disposal option for each phase of the project will be bounded by the effects of the individual disposal methods and therefore will be SMALL as summarized in Table 4.4-1.

4.4.2 No-Action (Alternative 2)

Under the No-Action alternative, a license authorizing operation of an ISR facility will not be issued; therefore, construction and operation of the facility will not occur and aquifer restoration and decommissioning will not be needed. Buildings will not be constructed, wells will not be drilled, wellfields will not be developed, and pipelines connecting the wellfields to the central and satellite plants will not be constructed. The soils will not be disturbed, because earthmoving

Table 4.4-1. Significance of Geology and Soils Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

activities will not disturb or compact soils; therefore, existing topography will be unchanged. The geology of the area will be unaffected by the proposed action because no fluids will be injected into the subsurface through Class V injection well disposal or by the uranium extraction process.

The current land uses on and near the project area, which include grazing land for livestock, natural resource extraction, and recreational activities will continue, but there will be no impacts from the proposed action.

4.5 Water Resources Impacts

4.5.1 Surface Water and Wetlands Impacts

As discussed in GEIS Section 4.4.4.1, potential environmental impacts to surface waters and wetlands may occur during all phases of the ISR facility lifecycle (NRC, 2009a). Impacts to surface waters and wetlands may result from (i) road construction and crossings; (ii) erosion runoff; (iii) spills or leaks of fuels, lubricants, and process-related fluids; (iv) stormwater discharges; and (v) discharge of wellfield fluids as a result of pipeline or well head leaks. Potential impacts to surface waters and wetlands may be greater in areas containing jurisdictional waters and wetlands.

<u>GEIS Construction Phase Summary</u>

NRC staff noted in the GEIS that impacts to surface waters and wetlands during the construction phase of ISR facilities may result from construction of road crossings, filling channels, surface erosion, and surface water runoff. Temporary changes to spring and stream flows due to grading and changes in topography and natural drainage patterns are other potential impacts. U.S. Army Corps of Engineers (USACE) permits under Section 404 of the Clean Water Act are required for placing fill, excavating, or using earthmoving equipment to clear land in jurisdictional wetlands or waters of the United States (WUS). As a result of the USACE permitting process, impacts are expected to be mitigated through various mitigation options, such as banking and riparian/wetland enhancement. Potential impacts to surface waters and wetlands also include accidental spills or leaks of fuels and lubricants from construction equipment and stormwater runoff from limited impervious areas including buildings, roads, and parking areas that infiltrates and recharges shallow aquifers. NRC staff determined in the GEIS that these potential impacts will be temporary and mitigated through proper

planning and design, the use of proper construction methods, and the implementation of BMPs, or restoration after the construction phase. Thus, NRC staff concluded in the GEIS that compliance with applicable federal and state regulations and permit conditions and the implementation of BMPs and other mitigation measures will result in potential impacts to surface water and wetlands during construction that will be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

The expansion of facilities or pipelines during the operations phase may result in impacts comparable to those described for the construction phase. The impacts to surface water and wetlands during operation activities may also involve accidental spills or leaks of process-related water and the discharge of stormwater runoff and process-related water. The impact from spills on surface waters and wetlands will be comparable to those described for the construction phase and will be dependent on the size of the spill, the success of remediation, the use of the surface water, proximity of the spill to surface water, and the volume of discharge to the surface waters. NRC staff noted in the GEIS that during operational activities, federal and state agencies regulate the discharge of stormwater runoff and process-related water through the permitting process, and hence, the impacts from permitted discharges will be mitigated through permit conditions. For these reasons, NRC staff concluded in the GEIS that impacts to surface waters and wetlands during operations will be SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

NRC staff noted in the GEIS impacts to surface waters and wetlands during the aquifer restoration phase may result from (i) produced water, (ii) stormwater runoff and accidental spills, and (iii) brine reject from the reverse osmosis system. NRC staff concluded in the GEIS the impacts from these activities will be similar to the impacts from operations, because the infrastructure will be in place and similar activities will be conducted (e.g., wellfield operation, transfer of fluids, water treatment, stormwater runoff). For these reasons, NRC staff concluded in the GEIS that aquifer restoration impacts on surface waters and wetlands will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that surface water and wetland impacts from decommissioning will be similar to the impacts from construction. The activities to clean up, recontour, and reclaim disturbed lands during decommissioning will mitigate long-term impacts to surface waters and wetlands. NRC staff concluded in the GEIS that the potential impacts to surface waters and wetlands from decommissioning will be SMALL. (NRC, 2009a)

Potential environmental impacts to surface water and wetlands from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR project are discussed in the following sections.

4.5.1.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.5.1, the proposed Dewey-Burdock ISR Project lies within the Beaver Creek watershed, which includes Beaver Creek, Pass Creek, and their tributaries. Beaver Creek is a perennial stream, and its tributaries have ephemeral flow depending on the amount of precipitation. Pass Creek and its tributaries are dry for most of the year, except for

short periods of high runoff following major storms (Powertech, 2009a). Beaver and Pass Creeks are not used for domestic water supply within the proposed project area, but water from Beaver Creek is used for local irrigation.

There are a number of abandoned open pit mines stretching from the eastern to the northern boundaries of the site in the Burdock area (see Figure 3.2-3). With the exception of Darrow Pit #2 and the Triangle Pit, the abandoned pits are usually dry. The Triangle Pit has permanent water storage at a depth greater than 30 m [100 ft]. The Triangle Pit is below the potentiometric surface of the Fall River Formation and is, therefore, hydraulically connected to the Fall River Formation. Water in the Triangle Pit has elevated dissolved uranium and gross alpha concentrations exceeding EPA-regulated maximum contaminant levels (MCLs) and is not used as a livestock or domestic water supply (see SEIS Section 3.12.1).

USACE identified 20 wetlands within the proposed project area (see SEIS Section 3.5.2), of which only 4 were considered jurisdictional: Beaver Creek, Pass Creek, and an ephemeral tributary to each. The jurisdictional ephemeral tributary to Beaver Creek has wetlands present near its confluence with Beaver Creek located in Section 32, Township 6 South, Range 1 East (Figure 4.5-1). The drainage area for this tributary includes surface facilities, infrastructure, and wellfields constructed in the Dewey area. The jurisdictional ephemeral tributary to Pass Creek has wetlands present near its confluence with Pass Creek located in Section 3, Township 7 South, Range 1 East (Figure 4.5-1). The drainage area for this tributary includes surface facilities, infrastructure, and proposed wellfields in the Burdock area.

The environmental impacts on surface waters and wetlands for each of the applicant-proposed liquid waste disposal options (i.e., disposal via Class V injection wells, disposal via land application, or disposal via combination of Class V injection wells and land application) are discussed in the following sections.

4.5.1.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. The Class V injection wells, if permitted by EPA, will be near the satellite plant in the Dewey area and near the central processing plant in the Burdock area (see Figure 2.1-10). Potential environmental impacts to surface waters and wetlands from construction, operation, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed project are discussed in the following sections.

4.5.1.1.1.1 Construction Impacts

The NRC staff evaluated the occurrence of surface water and wetlands and found it to be limited in area and quantity; Pass Creek and the tributaries to both Pass Creek and Beaver Creek are ephemeral and often dry. As described in SEIS Section 4.2.1.1, the deep well liquid waste disposal option is estimated to disturb 98.3 ha [243 ac] of land or 2.3 percent of the permit area (Powertech, 2010a). Land disturbance will result from construction of facilities, pipelines, initial wellfields, radium settling and holding ponds, Class V injection wells, and access roads (see Figure 4.2-1). The applicant is required to obtain construction and industrial stormwater National Pollutant Discharge Elimination System (NPDES) permits in accordance with SDDENR regulations in ARSD Chapter 74:52. The NPDES permit requirements for discharges to surface water, as established in ARSD 74:52, will control the amount of pollutants

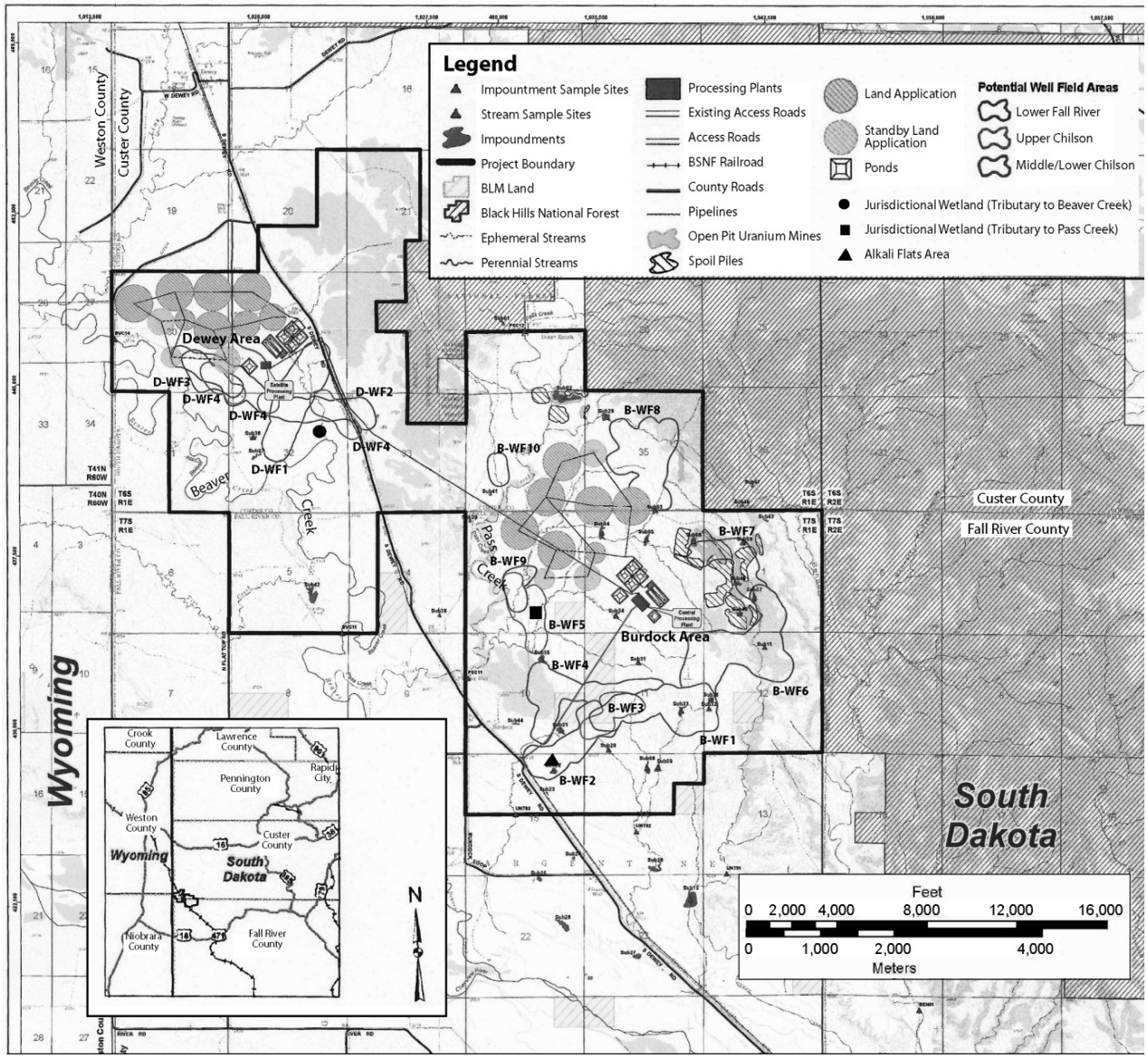

Figure 4.5-1. Map Showing Locations Identified as Jurisdictional Wetlands on Ephemeral Tributaries to Beaver Creek (Black Circle) and Pass Creek (Black Square) and Their Relation to Proposed Site Facilities in the Proposed Dewey-Burdock *In-Situ* Recovery Project Area Source: Modified From Powertech (2011)

that can enter surface water bodies, such as streams, wetlands, and lakes. The applicant has not yet submitted an NPDES permit application (see Table 1.6-1).

The Burdock central plant and Dewey satellite facility and supporting buildings will be constructed outside the 100-year floodplain of Pass and Beaver Creeks and away from other small ephemeral drainages (see SEIS Section 3.5.1). These buildings will be located on relatively flat terrain, which will require minimum soil movement to create level pads for

construction. Surface water runoff from precipitation (rain and snowmelt) will flow from the Burdock central plant area and the Dewey satellite facility area to natural drainages (Figure 4.5-1). Facility buildings will be located away from these intermittent drainage channels

and outside of floodplains so facilities will not flood. If an accidental spill occurs during the construction phase, the applicant will promptly mitigate it by following surface water monitoring and spill response procedures, which will be established as part of the NPDES permit (Powertech, 2009a).

Although facility buildings at the proposed project site will be outside the 100-year floodplain of Pass and Beaver Creeks and small ephemeral drainages, other facilities (e.g., storage ponds), infrastructure (e.g., access roads and the plant-to-plant pipeline), and wellfields will be within the 100-year floodplain of Pass and Beaver Creeks and small ephemeral drainages (see SEIS Section 3.5.1). To protect facilities and infrastructure from flood damage and avoid discharges from storage ponds that are located within the 100-year inundation boundary, the applicant proposes a system of structures, such as straw bales, collector ditches, and engineered diversion structures or berms (Powertech, 2011).

Applicant-proposed measures to protect against flooding in the wellfields include (i) locating above-grade wellfield infrastructure outside the 100-year flood inundation boundary, (ii) constructing diversion or erosion control structures to divert flow and protect any well heads placed within the 100-year inundation boundary, and (iii) sealing all well heads to withstand brief periods of submergence. All pipelines, including the proposed plant-to-plant pipeline, will be buried below the frost line and, therefore, will not be impacted by flooding (Powertech, 2011).

The applicant will use a phased approach to wellfield development. The Burdock B-WF1 wellfield and Dewey D-WF1 wellfield will be constructed during the initial construction phase of the project (Figure 4.5-1). Wellfield B-WF1 will be situated at least 1,006 m [3,300 ft] from Pass Creek and the ephemeral tributary to Pass Creek identified as a jurisdictional wetland. Wellfield D-WF1 is located at least 101 m [330 ft] north of Beaver Creek and 305 m [1,000 ft] northwest of the ephemeral tributary to Beaver Creek, which is a jurisdictional wetland (see Figure 4.5-1). However, wellfield D-WF1 crosses over ephemeral tributaries upstream of the tributary to Beaver Creek identified as a jurisdictional wetland.

Additional wellfields will be built and developed in phases as operations in preceding wellfields become uneconomical. Figure 4.5-1 shows that Dewey wellfield D-WF2 and a portion of Dewey wellfield D-WF4 are located 101 m [330 ft] north of the ephemeral tributary to Beaver Creek identified as a jurisdictional wetland. However, like wellfield D-WF1, wellfields D-WF2 and D-WF4 cross over ephemeral tributaries upstream of the tributary to Beaver Creek identified as a jurisdictional wetland. Figure 4.5-1 also shows that Burdock wellfields B-WF9 and B-WF10 cross nearby ephemeral tributaries upstream of Pass Creek. In addition, Figure 4.5-1 shows that the ephemeral tributary to Pass Creek identified as a jurisdictional wetland bisects wellfield B-WF5.

USACE permits under Section 404 of the Clean Water Act are required for placing fill material, excavating, or using earthmoving equipment to clear land in wetlands or WUS. The presence of wellfields within jurisdictional wetlands and crossing tributaries upstream of jurisdictional wetlands may require the applicant to obtain USACE permits before construction activities (e.g., drilling wells, laying pipeline, and constructing access roads). In addition, the applicant's plant-to-plant pipeline crosses Pass Creek between wellfields B-WF9 and B-WF10 in the Burdock

area (see Figure 4.5-1) and may also require the applicant to obtain a USACE permit prior to construction. The USACE permitting process ensures that proper filling and dredging techniques are used and proper mitigation measures are defined and implemented to ensure protection of wetland habitat and water quality in affected jurisdictional wetlands. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands identified in the project area (Powertech, 2009a). At this time, the applicant has not applied for a Section 404 permit. Therefore, USACE has not conducted additional Section 404 permitting activities at the proposed project site, such as determining specific acreages of jurisdictional wetlands that could be impacted or identifying mitigation measures to be implemented to minimize wetland impacts.

Construction activities may generate a limited amount of surface water runoff. The applicant indicates surface waters will not be consumed and long-term discharge to surface waters will not occur during construction (Powertech, 2009a). The applicant will implement a stormwater pollution management plan (SWMP) to control stormwater runoff during construction and to ensure that surface water runoff from disturbed areas will not contaminate surface waters and wetlands (Powertech, 2009a). SWMP control measures will (i) minimize disturbance of surface areas, drainage channels, and vegetation; (ii) employ grading to direct stormwater runoff away from water bodies; (iii) use riprap at intersections to make bridges and culverts more effective; (iv) stabilize slopes; (v) avoid unnecessary off-road travel; (vi) provide rapid response cleanup procedures and training for potential spills; (vii) require storage of hazardous materials and chemicals in bermed or curbed areas; (viii) place surface piping outside identified 100-year floodplain levels; and (ix) build curbs around facilities and structures to control process fluid spills.

Proposed sites for radium settling and holding ponds for the deep well liquid waste disposal option are shown in Figure 2.1-10. As described in SEIS Section 2.1.1.1.2.4, radium settling and holding ponds will be constructed with linings that meet the requirements of NRC regulations in 10 CFR Part 40, Appendix A, Criterion 5 (NRC, 2003b, 2008). Approved construction uses liners, underdrains, and a leak detection system to identify and reduce the impact on the environment from any leaks.

Because the applicant has committed to (i) implementing mitigation measures to control erosion, stormwater runoff, and sedimentation; (ii) complying with USACE Section 404 permitting requirements for wetlands; (iii) complying with NPDES permit requirements for discharge to surface waters; and (iv) following NRC regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems), NRC finds impacts to surface waters and wetlands during the construction phase to be SMALL.

4.5.1.1.1.2 Operations Impacts

The NRC staff has considered site-specific hydrological factors in assessing environmental impacts to surface water and wetlands during ISR operations in conjunction with the deep well disposal of liquid wastes option. The staff evaluated the occurrence of surface water and wetlands and found it to be limited in area and quantity. Beaver Creek is a perennial stream and does not bisect any wellfields in the Dewey area. Pass Creek and tributaries of Pass and Beaver Creeks have ephemeral surface water flows.

As described in SEIS Section 3.5.3.3, the Fall River and Chilson aquifers make up the Inyan Kara Group aquifer and contain the uranium mineralization that will be extracted at the

proposed project (Powertech, 2009a). Beaver and Pass Creeks do not have a natural hydraulic connection with the underlying Fall River and Chilson aquifers across the Dewey-Burdock site. However, standing water in the Triangle Pit in the Burdock area is hydraulically connected to the Fall River Formation. In addition, pumping tests in the Burdock area indicated a certain degree of hydraulic communication between the Fall River aquifer and Chilson aquifer through the intervening Fuson Shale (see SEIS Section 3.5.3.2). Because the Triangle Pit is not a source of water for domestic use or livestock watering due to its poor water quality [specifically, elevated uranium and gross alpha concentrations exceeding EPA-regulated MCLs for drinking water (see SEIS Section 3.12.1)], the potential environmental impacts to the standing water at the abandoned Triangle Pit mine during ISR operations in conjunction with the Class V injection well disposal option will be SMALL.

As described in SEIS Section 3.5.1, groundwater from the Fall River and Chilson aquifers is discharging to the ground surface through improperly plugged exploratory boreholes at an area in the southwest corner of the Burdock area known as the “alkali flats” (Powertech, 2011). This area is within the proposed B-WF2 wellfield (see Figure 4.5-1). Although the alkali flats area is located outside the drainage areas of Beaver and Pass Creeks, it is near surface impoundments used for stock watering. As described in SEIS Sections 2.1.1.1.2.3.3 and 2.1.1.1.2.3.4, prior to wellfield development, the applicant proposes to identify and evaluate unplugged and improperly sealed boreholes using delineation drilling and wellfield pump testing. Based on the results of the delineation drilling and pump testing, the applicant will plug or otherwise mitigate the potential effects of any boreholes that will potentially affect surface waters and wetlands during ISR operations (Powertech, 2011).

The Class V injection well disposal option involves injecting process-related effluents into the Deadwood and Minnelusa Formations, which lie below the Morrison Formation (Powertech, 2011, Appendix 2.7L). The depth from the ground surface to the disposal horizon for the first 4 Class V injection wells ranges from 492 to 1,076 m [1,615 to 3,530 ft] (Powertech, 2011; Appendix 2.7L). As described in SEIS Section 2.1.1.1.2.4, an EPA Class V UIC permit is required for the applicant to use deep well disposal. EPA will evaluate the suitability of the formations proposed for Class V well injection. Class V injection disposal will be allowed only if the applicant demonstrates liquid waste can be isolated safely in a deep aquifer. In the Dewey-Burdock area, there is no evidence of any hydraulic connection between surface waters and proposed aquifers for the Class V injection well disposal option. Therefore, the potential environmental impacts to surface waters and wetlands from the Class V injection well disposal option during ISR operations will be SMALL.

In addition to site-specific hydrological information and a Class V deep well injection permit, the NRC staff have considered other permit requirements and mitigation measures to which the applicant has committed in assessing environmental impacts to surface water and wetlands during ISR operations in conjunction with the Class V injection well disposal option. The applicant will construct the central plant and satellite facility on concrete slabs surrounded by protective berms or curbs to contain and control accidental spills. Permitted discharge of processing effluents to surface waters will not be undertaken. Earthmoving activities sufficient to generate surface water runoff will not take place. The applicant will use its delineation drilling and pump testing program to identify and plug improperly sealed boreholes that may impact surface waters. The applicant will implement SWMP as part of the NPDES permit in accordance with SDDENR requirements to detain and treat stormwater runoff for these facilities and to ensure that runoff does not contaminate surface waters and wetlands (Powertech, 2009a). The SWMP will identify and evaluate routes by which spills could leave the facility and

lay out BMPs as preventative measures to minimize stormwater contamination. Stormwater runoff will be diverted away from the facility and absorbed into soils. The applicant has committed to implement mitigation measures to control erosion and sedimentation, as part of the SWMP. The applicant will implement an emergency response plan to identify and clean up accidental spills and leaks (Powertech, 2009a). Pipelines will be buried to avoid freezing, and pipeline pressure will be monitored to detect leaks.

In conclusion, based on the aforementioned hydrological factors and the applicant's commitment to comply with permit requirements, the NRC staff conclude that environmental impacts to surface waters and wetlands from ISR operations in conjunction with the Class V injection well disposal option will be SMALL.

4.5.1.1.1.3 Aquifer Restoration Impacts

As described in SEIS Section 2.1.1.1.4.1.1, the primary method of aquifer restoration for the Class V deep injection well option is RO treatment with permeate injection. The RO reject, or brine, will undergo radium removal in the radium settling ponds and then will be disposed of in deep Class V injection wells. Under the EPA Class V UIC permit, deep well disposal of treated liquid wastes must not lead to concentration levels of hazardous constituents that cause adverse environmental impacts on surface waters and wetlands. For the Class V injection well disposal option, automated sensors will monitor the injection process to detect potential pipeline leaks or well ruptures that could result in a surface discharge. When monitoring detects potential problems, the applicant will take corrective actions, which include inspections for leaks and spills and rapid response cleanup and remediation to minimize impacts to soils and surface water (Powertech, 2009a). Liquid effluents will not be discharged to running or standing surface waters (Powertech, 2009a). The applicant's NPDES permit requirements for discharges to surface water and SWMP will be in place to ensure that stormwater runoff will not degrade surface water quality. The applicant's emergency response plan will be in place to address and clean up accidental spills and leaks (Powertech, 2009a). The applicant will follow NRC and state regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems) used to treat and store restoration fluid prior to injection in the Class V well. The applicant is required to follow groundwater restoration activities in compliance with NRC's regulatory requirements (see SEIS Section 2.1.1.1.4). The goal of aquifer restoration is to return groundwater quality in the wellfields consistent with background water quality conditions or to standards consistent with NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(5). Because the applicant commits to complying with permitting and regulatory requirements, NRC finds impacts to surface waters and wetlands during the aquifer restoration phase in conjunction with the Class V injection well disposal option at the proposed project site will be SMALL.

4.5.1.1.1.4 Decommissioning Impacts

The central plant, satellite facility, storage facilities, and pipelines of the facility will be removed during the decommissioning phase, in accordance with an NRC-approved decommissioning plan. The wells, including Class V injection wells, will need to be plugged and abandoned. The removal of buildings and infrastructure will have impacts similar to those for the construction phase as described in SEIS Section 4.5.1.1.1.1. The applicant will implement the mitigation measures described in SEIS Section 4.5.1.1.1.1 to control erosion, stormwater runoff, and sedimentation during decommissioning activities. The applicant's NPDES permit requirements will ensure that stormwater runoff will not contaminate surface water. The applicant is

committed to implement an emergency response plan to address cleanup of accidental spills and leaks. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas. The applicant will recontour the land surface to restore it to a surface configuration to blend with the natural terrain and will seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner.

Well plugging and abandonment and pipeline removal requires temporary soil disturbance that may affect water quality of identified jurisdictional wetlands in the proposed project area. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands to ensure that wetland habitat and water quality is not impacted (Powertech, 2009a). Because the applicant commits to complying with permitting and regulatory requirements, NRC concludes that impacts to surface waters and wetlands during the decommissioning phase for the Class V injection well disposal option will be SMALL.

4.5.1.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste by land application (see SEIS Section 2.1.1.2.4.2). The environmental impacts to surface waters and wetlands from the construction, operation, aquifer restoration, and decommissioning associated with the land application liquid waste disposal are discussed in the following sections.

4.5.1.1.2.1 Construction Impacts

For the land application option, a total of 565.7 ha [1,398 ac] of land or 13.2 percent of the proposed permit area will be disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2010a). This area of land disturbance is larger than for the Class V injection well disposal option {approximately 98 ha [243 ac]} due to the addition of land irrigation areas {426 ha [1,052 ac]} and the need for increased pond capacity for storage during nonirrigation periods {35 ha [136 ac]} (see Table 4.2-1).

All the surface disturbance and associated impacts to surface waters and wetlands discussed in SEIS Section 4.5.1.1.1.1, except for the ground surface disturbance and the impacts to surface waters and wetlands from construction of Class V deep injection wells, will be applicable during the construction phase for the land application disposal option.

Irrigation areas are situated on flat topography along Pass Creek and its tributaries in the Burdock area and along Beaver Creek and its tributaries in the northwest part of the Dewey area (see Figure 4.5-1). The applicant will apply treated liquid effluents to native vegetation or to existing soil after it has been prepared to grow crops such as alfalfa or salt-tolerant wheatgrass (Powertech, 2012c). Significant earthmoving activities will not be conducted to prepare irrigation areas. Runoff from precipitation events or snowmelt on land application areas will be conveyed to catchment areas downgradient of land application areas and allowed to evaporate or infiltrate (Powertech, 2012c). The soil horizon found throughout most of the project area is clayey (see SEIS Section 3.4.2), which will minimize infiltration and enhance evaporation.

Implementation of mitigation measures associated with the applicant's SWMP will control erosion, stormwater runoff, and sedimentation from disturbed areas, as part of the NPDES permit. The applicant's NPDES permit requirements for discharges to surface water will ensure that surface runoff, if any, will not contaminate surface water and wetlands. Additionally, the applicant will implement an emergency spill response plan to address cleanup of accidental spills and leaks. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands identified in the project area (Powertech, 2009a). The USACE permit ensures that proper filling and dredging techniques are used and proper mitigation measures are defined and implemented and to protect wetland habitat and water quality in affected jurisdictional wetlands.

Because minimal land disturbance will occur during preparation of irrigation fields, and the applicant has committed to implement mitigation measures discussed previously and to comply with permitting and regulatory requirements, the NRC staff conclude that impacts to surface waters and wetlands during the construction phase for the land application option will be SMALL.

4.5.1.1.2.2 Operational Impacts

Stormwater runoff from land irrigation areas and their potential discharge into surface waters will be the primary differences in surface water and wetlands impacts between the land application and Class V injection well disposal options. All hydrological factors (hydrological interactions between ore-bearing aquifers, creeks, and abandoned open pit mines) and the resultant assessment of SMALL impacts to surface waters and wetlands due to ISR operations in conjunction with the Class V injection well disposal option (see SEIS Section 4.5.1.1.1.2) also apply to ISR operations in conjunction with the land application option.

Because irrigation fields are located on flat topography (Figure 2.1-11), runoff of treated liquid wastes applied to land irrigation areas is not expected. Additionally, the SDDENR groundwater discharge plan will require land application activities to be conducted so that no ponding and no runoff of effluent (i.e., wastewater solutions) occur. As described in SEIS Section 3.5.1, proposed land application areas are located outside the applicant-modeled 100-year flood inundation boundaries of Beaver Creek and Pass Creek. Potential runoff produced by snowmelt or precipitation in land application areas will be diverted to adjacent catchment areas and allowed to evaporate or infiltrate (Powertech, 2012c). The applicant will grow crops on irrigation fields, which may require adjustments in water application rates to optimize both evaporation and crop production during the irrigation season (Powertech, 2009a, Section 4.5.2). However, the applicant's NPDES permit requirements will ensure that surface runoff at the ISR facilities and irrigation fields from rain events will not contaminate surface water bodies and wetlands. Implementation of mitigation measures will control erosion, runoff, and sedimentation over the land application areas. In addition, the applicant will implement an emergency spill response plan to address cleanup of accidental spills and leaks.

As described in SEIS Section 4.4.1.2.2, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). The applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B, Table 2, Column 2 (see Table 7.5-3) (Powertech, 2011). SDDENR also regulates land application of treated wastewater, which requires the applicant to obtain an approved GDP and to comply with applicable state discharge requirements for land application of treated

wastewater. Additionally, the GDP will require land application activities to be conducted so that no ponding and no runoff of effluent (i.e., wastewater solutions) occur. Therefore, the NRC staff conclude that treated liquid wastes applied to land application areas will contain contaminant levels below NRC and SDDENR requirements.

Based on the aforementioned hydrological factors and permit requirements, the NRC staff conclude that environmental impacts to surface waters and wetlands from ISR operations in conjunction with the land application option will be SMALL.

4.5.1.1.2.3 Aquifer Restoration Impacts

The aquifer restoration phase of the Dewey-Burdock ISR Project will generate liquid wastes that will be disposed of via land application. As described in the previous section, the applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B (Powertech, 2011). SDDENR also regulates land application of treated wastewater, which requires the applicant to obtain an approved GDP and to comply with applicable state discharge requirements for land application of treated wastewater. Liquid effluents will not be discharged into running or standing surface waters (Powertech, 2009a). The applicant's NPDES permit and SWMP will be in place to ensure that runoff from rain events will not contaminate surface waters and wetlands. The applicant's emergency response plan will be in place to address and clean up accidental spills and leaks (Powertech, 2009a). The applicant will follow NRC and state regulations concerning the construction of settling and holding ponds (e.g., use of liners, underdrains, and leak detection systems).

Because treated water applied onto irrigation fields will comply with NRC and state release limits for radioactive and hazardous constituents and because the applicant commits to complying with NPDES permitting and regulatory requirements, the NRC staff find impacts to surface waters and wetlands during the aquifer restoration phase in conjunction with the land application option to be SMALL.

4.5.1.1.2.4 Decommissioning Impacts

All the ground surface disturbance and the resultant impacts to surface waters discussed in SEIS Section 4.5.1.1.1.4 for the Class V injection well disposal option will be applicable for the land application option, except that the latter will not involve plugging and abandonment of Class V injection wells in the decommissioning phase. Under the land application option, production, injection, and monitoring wells will be plugged and abandoned, and the central plant, satellite facility, storage facilities, and associated pipelines will be removed in accordance with an NRC-approved decommissioning plan. The applicant has committed to seek authorization from USACE and comply with Section 404 permitting requirements before conducting work in jurisdictional wetlands to ensure that wetland habitat and water quality are not impacted (Powertech, 2009a). As part of the NPDES permit, the applicant will implement mitigation measures to control erosion, runoff from rain events, and sedimentation to ensure that surface water and wetlands are not contaminated. Additionally, the applicant is committed to implementing an emergency response plan to address cleanup of accidental spills and leaks.

After removal of surface structures, the applicant will replace topsoil in previously disturbed areas. Disturbed land surfaces, including irrigation fields used for land application of treated process fluid, will be recontoured to restore the surface configuration to blend with the natural

terrain and seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner. Because the applicant commits to complying with permitting and regulatory requirements, NRC concludes that impacts to surface waters and wetlands during the decommissioning phase for the land application disposal option will be SMALL.

4.5.1.1.3 Disposal Via Combination of Class V Injection and Land Application

If the applicant obtains the permit for Class V injection from EPA, but the capacity of the deep disposal wells is insufficient to dispose of all liquid effluents generated at the Dewey-Burdock ISR project, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (SEIS Section 2.1.1.1.2.4.3). In this case, land application facilities and infrastructures will be constructed, operated, and restored, and decommissioned as needed, based on the required capacity of Class V injection wells and produced volume of liquid effluents (Powertech, 2011).

If the capacity of Class V injection wells is sufficient to dispose of all liquid effluents, land application sites, facilities, and infrastructures for irrigation will be avoided. In this case, potential environmental impacts to surface waters and wetlands due to erosion and surface runoff of rainwater over land application sites will be eliminated. Therefore, the resultant environmental impacts to surface water and wetlands for the Class V injection well disposal option will be smaller than for the land application disposal option. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined Class V injection well and land application option. Therefore, potential environmental impacts to surface waters and wetlands for the combined disposal option will be less than for the land application option alone.

Thus, NRC staff conclude that the environmental impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental impacts of the Class V injection well option and the land application option as summarized in Table 4.5-1.

4.5.1.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC will not license the Dewey-Burdock ISR Project and BLM will not approve the applicant's modified Plan of Operations. The central processing plant in the

Table 4.5-1. Significance of Environmental Surface Water and Wetland Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

Burdock area and the satellite facility in the Dewey area with their associated infrastructure (i.e., access roads and piping) will not be constructed. Furthermore, wellfields, surface impoundments, Class V injection wells, and land application sites will not be developed. The current land uses on and near the project area, including grazing lands and recreational activities, will continue. Therefore, there will not be any environmental impact to surface waters and wetlands from construction, operations, aquifer restoration, and decommissioning activities.

4.5.2 Groundwater Impacts

As discussed in GEIS Section 4.4.4.1, potential environmental impacts to groundwater could occur during all phases of an ISR facility's lifecycle, although impacts are more likely to occur during operations and aquifer restoration (NRC, 2009a). At ISR sites, ore-bearing aquifers are typically separated from adjacent aquifers at varying depths by confining layers, also known as aquitards. If the confining layers do not effectively isolate the ore-bearing aquifer from the hydrogeological system, the aquifers above and below the uranium-bearing aquifer can be adversely affected during ISR operations.

NRC staff reported in the GEIS that ISR facility impacts on groundwater resources can result from surface spills, leaks from buried piping, consumptive water use (i.e., water removed from available supplies without return to a water resource system), horizontal and vertical excursions of lixiviant from production aquifers, degradation of water quality from changes in production zone aquifer chemistry, and waste management practices involving land application and/or deep well injection. (NRC, 2009a)

<u>GEIS Construction Phase Summary</u>

NRC staff reported in the GEIS that potential impacts to groundwater during construction of an ISR facility are from the consumptive use of groundwater, injection of drilling fluids and mud during well drilling, and spills of fuels and lubricants from construction equipment. Surface activities that can introduce contaminants into soils are more likely to affect near-surface and shallow aquifers during construction. NRC staff concluded in the GEIS that during construction, groundwater use is limited and groundwater quality is protected by implementing BMPs, which include spill prevention and cleanup programs. In addition, the volume of drilling fluids and mud to be introduced into the environment during well installation is limited compared to the existing aquifer volume. Therefore, NRC staff concluded in the GEIS that construction impacts to groundwater resources are SMALL. (NRC, 2009a)

<u>GEIS Operations Phase Summary</u>

GEIS Section 4.4.4.2.2 discussed potential environmental impacts to shallow (near-surface) aquifers during ISR operations. During this phase, shallow aquifers could potentially be affected by lixiviant leaks from pipelines, wells, or header houses and from waste management practices such as the use of settling and holding ponds and disposal of treated wastewater by land application. Potential environmental impacts to groundwater resources in the production and surrounding aquifers also include consumptive water use and changes to water quality that could result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing wastes by deep well injection during ISR operations could also impact groundwater in deep aquifers. (NRC, 2009a)

Shallow (Near-Surface) Aquifers

In the GEIS, NRC staff discussed the potential environmental impacts to shallow, near-surface aquifers during ISR operations. A network of buried pipelines transports lixiviant between the header house and the satellite or main processing facility. Piping connects injection and extraction wells to manifolds inside the header houses. Failure of pipeline fittings or valves, or failure of well mechanical integrity in shallow aquifers, could result in leaks and spills of pregnant and barren lixiviant, with adverse impacts on water quality in shallow aquifers. The potential environmental impacts of pipeline, valve, or well integrity failure depend on the depth to shallow groundwater; the current and anticipated future uses of shallow groundwater for domestic, agricultural, and livestock water demands; and the degree of hydraulic connection between shallow aquifers, production aquifers, and regionally important aquifers. Shallow aquifers may also be affected by disposal of treated process effluents by land application and hazardous wastewater leaks and spills from settling and holding ponds. NRC staff concluded in the GEIS that environmental impacts will range from MODERATE to LARGE if (i) groundwater in shallow aquifers is close to the ground surface, (ii) shallow aquifers are important sources for local domestic or agricultural water supplies, and (iii) shallow aquifers are hydraulically connected to other locally or regionally important aquifers. NRC staff concluded that environmental impacts will be SMALL if (i) shallow aquifers have poor water quality or noneconomic production yields and (ii) shallow aquifers are hydraulically separated from other locally and regionally important aquifers. Land application of treated process effluents during ISR operations is an accepted waste management practice at ISR facilities. Process-related effluents applied to land application areas undergo treatment to reduce radiological and hazardous constituents to levels that are protective of human health and the environment. Additionally, the GDP will require land application activities to be conducted so that no ponding and runoff of effluent (i.e., wastewater solutions) occurs during these activities. BMPs will also be in place to prevent surface runoff and erosion from rain events. Therefore, NRC staff concluded in the GEIS that the impacts of land disposal application of effluents on groundwater in shallow aquifers during ISR operations will be SMALL. (NRC, 2009a)

Production and Surrounding Aquifers

During ISR operations, potential environmental impacts to groundwater resources in the production and surrounding aquifers include consumptive water use. NRC staff reported in the GEIS that short term impacts of consumptive water use will be localized in the South Dakota region and will be SMALL to MODERATE, depending on aquifer characteristics. The localized effects are expected to be temporary because drawdown near wellfields will dissipate after pumping stops. After consideration of these factors, the NRC staff concluded long term impacts of consumptive water use will be SMALL in most cases. (NRC, 2009a)

NRC staff reported in the GEIS that degradation of groundwater quality in the production aquifer will occur during ISR operations. Groundwater quality in the overlying and underlying aquifers and adjacent aquifers could be degraded if horizontal or vertical lixiviant excursions occur beyond the production zone. The production portion of an ore-bearing aquifer will be exempted from being an underground source of drinking water (USDW) according to the criteria in 40 CFR 146.4 as long as (i) the production portion of the aquifer does not currently serve as a source of drinking water and, (ii) the permit applicant can demonstrate as part of a UIC permit application that the production portion contains minerals that, considering their quantity and location, are expected to be commercially producible. After uranium recovery is complete, the licensee must initiate aquifer restoration activities to restore the production zone to Commission-

approved background water quality, if possible. If the water quality in the production aquifer cannot be restored to background conditions, NRC requires the production aquifer be restored to the MCLs provided in 10 CFR Part 40, Appendix A, Table 5C or to NRC-approved alternate concentrations limits (ACLs). Only after demonstrating that it cannot restore a particular hazardous constituent to the background concentration or MCL could a licensee request a license amendment from NRC for an ACL. To be approved, ACLs must demonstrate that the level will not pose a substantial present or potential hazard to human health or the environment as long as the ACLs are not exceeded (NRC, 2003b). After consideration of these factors, NRC staff concluded in the GEIS that potential impacts of ISR operations on water quality of a uranium-bearing production zone aquifer will be SMALL. (NRC, 2009a)

Deep Aquifers Below the Production Aquifers

In the GEIS, NRC staff found that disposal of processing effluents by deep well injection during ISR operations and restoration could impact groundwater quality in deep aquifers (NRC, 2009a). However, NRC staff concluded that impacts from deep disposal of process effluents in the Nebraska-South Dakota-Wyoming Uranium Milling Region are expected to be SMALL if (i) water production from deep aquifers is not economically feasible (e.g., low water yield); (ii) the groundwater quality in the deep aquifers is not suitable for domestic or agricultural uses; and (iii) the aquifers are confined above by sufficiently thick and continuous low permeability layers (NRC, 2009a).

GEIS Aquifer Restoration Phase Summary

NRC staff reported in the GEIS that the potential environmental impacts on groundwater resources during aquifer restoration are related to groundwater consumptive use and waste management practices, including discharge to waste storage ponds and potential deep disposal of brine resulting from reverse osmosis. In addition, aquifer restoration directly affects groundwater quality in the vicinity of the wellfield being restored. (NRC, 2009a)

The purpose of aquifer restoration is to return the groundwater quality in the production zone to groundwater protection standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards state that the concentration of a hazardous constituent must not exceed (i) the Commission-approved background concentration of that constituent in groundwater, (ii) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed, or (iii) an alternate concentration limit the Commission establishes. Potential environmental impacts are affected by the restoration techniques chosen, the severity and extent of the contamination, and the current and future use of the production and surrounding aquifers in the vicinity of an ISR facility. Consequently, NRC staff concluded in the GEIS that the potential environmental impacts of groundwater consumption during restoration could range from SMALL to MODERATE depending on site conditions. (NRC, 2009a)

GEIS Decommissioning Phase Summary

In the GEIS, NRC staff noted that environmental impacts to groundwater during dismantling and decommissioning of ISR facilities will result primarily from consumptive use of groundwater, potential spills of fuels and lubricants, and well abandonment. Consumptive groundwater use includes using water for dust suppression, revegetation of landscapes, and reclamation of disturbed areas. The environmental impacts expected during the decommissioning phase are

the same impacts identified in the staff's analysis of the construction phase. In the GEIS, NRC staff concluded that consumptive use of groundwater during decommissioning will be less than during operations or aquifer restoration phases. Following BMPs as part of state-enforced NPDES permits and NRC-approved decommissioning plans will reduce the occurrence and effects of spills and facilitate cleanup (NRC, 2003a). Therefore, NRC staff concluded in the GEIS that the impact to groundwater resources in shallow aquifers from decommissioning will be SMALL (NRC, 2009a).

Discussion of the potential environmental impacts to groundwater from the construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project follows.

4.5.2.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.5.3.3, ISR methods will be used to recover uranium from sandstone-hosted uranium orebodies in the Fall River and Chilson aquifers that make up the Inyan Kara Group aquifer. Orebodies in unconfined portions of the Fall River Formation in the Burdock area are not part of the recovery plan (Powertech, 2010a). However, the recovery plan does include partially saturated portions of the Chilson aquifer in the eastern portion of the Burdock area (see Figure 3.5-7). NRC staff determined that a license condition will be necessary for ISR operations in partially saturated portions of the Chilson aquifer, which will require the applicant to demonstrate the ability to detect and remediate excursions in partially saturated zones (NRC, 2013).

Potential impacts to groundwater at the proposed Dewey-Burdock ISR project may result from pumping water to meet required consumptive water demands and from potential water quality degradation. In the construction phase of the proposed project, groundwater in surficial (alluvium) and shallow aquifers could be impacted. In the operations and restoration phases of the proposed project, groundwater in the Fall River and Chilson aquifers could be impacted. If Class V injection well disposal of liquid wastes into the Deadwood and Minnelusa Formations that lie below the Morrison Formation is approved, groundwater in these aquifers could be impacted during the operations and restoration phases. If the land application liquid waste disposal option is used in the operations and restoration phases, the groundwater impacts will likely be localized and limited to near-surface aquifers. Near-surface aquifers include the Fall River aquifer in the northeastern part of the Burdock area.

In South Dakota, a water rights permit from SDDENR is required to withdraw water from an aquifer. The water rights permit ensures that unappropriated water is available in the aquifer for the use and withdrawal amount specified in the permit. In June 2012, the applicant submitted water appropriation permit applications to use Inyan Kara aquifer and Madison aquifer water at the proposed Dewey-Burdock ISR Project (see Table 1.6-1).

The water permit application for the Inyan Kara aquifer proposes to appropriate up to 33.8 ha-m [274.2 ac-ft] of water annually (Powertech, 2012h). This water is to be used primarily for the ISR process during the operations phase of the proposed project. The application proposes a gross withdrawal (pumping) rate of 32,172 Lpm [8,500 gpm] or an estimated annual withdrawal of approximately 1, 691 ha-m [13,710 ac-ft]. The consumptive use of water will be a small portion of the gross withdrawal rate. As described in the application, approximately 2 percent of the water {558 Lpm [170 gpm]} is production bleed, which will be disposed of as liquid waste (Powertech, 2012h). The remaining approximately 98 percent of the water is not lost, it is

recirculated and reinjected back into the aquifer as part of the ISR process. Based on a review of the water permit application, which included an analysis of water availability and existing water rights, SDDENR concluded (i) approval of the application will not result in average annual withdrawals from the Inyan Kara aquifer that exceed the average annual recharge to the aquifer; (ii) there is reasonable probability that there is at least 33.8 ha-m/yr [274.2 ac-ft/yr] of unappropriated water available from the aquifer; (iii) SDDENR Water Rights Program observation well data indicate that unappropriated water is available from the Inyan Kara aquifer; and (iv) there is a reasonable probability that the withdrawals proposed in the application can be made without unlawful impairment of existing water rights or domestic wells (SDDENR, 2012a).

The water permit application for the Madison aquifer proposes to appropriate 109.6 ha-m [888.8 ac-ft] of water annually at a withdrawal rate of 2,085 Lpm [551 gpm] (Powertech, 2012i). This water would be used primarily during the aquifer restoration phase of the project. The amount of water that will be withdrawn from the Madison will depend on the liquid waste disposal method that will be used as part of the ISR process. The use of land application will require a diversion rate of 2,085 Lpm [551 gpm] and using deep Class V injection wells will require a withdrawal rate of 606 Lpm [160 gpm]. Based on a review of the application, which included an analysis of water availability and existing water rights, SDDENR concluded (i) there is reasonable probability that unappropriated water is available in the Madison aquifer to supply the proposed appropriation; (ii) approval of the application will not result in average annual withdrawals from the Madison aquifer that exceed the average annual recharge to the aquifer; and (iii) there is a reasonable probability that withdrawal proposed in the application can be made without impacting existing rights including domestic users (SDDENR, 2012b).

Environmental impacts to groundwater for each of the applicant-proposed liquid waste disposal options (i.e., disposal via Class V injection wells, disposal via land application, or disposal via combination of Class V injection wells and land application) are discussed in the following sections.

4.5.2.1.1 Disposal Via Class V Injection Wells

The applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells (see SEIS Section 2.1.1.1.2.4). The applicant plans to inject process-related effluents into the Deadwood and Minnelusa Formations that lie below the Morrison Formation (Powertech, 2011, Appendix 2.7-L). Powertech estimates the injection zone depths for the Minnelusa Formation to be approximately 492 to 672 m [1,615 to 2,205 ft] below ground surface and for the Deadwood Formation to be approximately 943 to 974 m [3,095 to 3,195 ft] below ground surface in the Burdock area. In the Dewey area, the estimated Minnelusa Formation injection zone depth is approximately 594 to 774 m [1,950 to 2,540 ft] below ground surface and the estimated Deadwood Formation depth is approximately 1,045 to 1,076 m [3,430 to 3,530 ft] below ground surface. The use of deep well disposal requires an EPA Class V UIC permit (SEIS Section 2.1.1.1.6.2). EPA evaluates the suitability of formations for deep well injection and allows Class V injection only after an applicant demonstrates liquid waste can be isolated safely in a deep aquifer. NRC staff review of local and regional stratigraphies and local geologic cross sections shows no evidence of hydraulic connection between surface waters and aquifers targeted for deep well injection. In addition, NRC staff review of applicant calculations of the radius of fluid displacement resulting from Class V injection into the Minnelusa and Deadwood Formations indicates that the Dewey Fault will not act as a conduit for fluid to rise to a USDW via the faulted interface. Applicant calculations based on formation parameters derived from

correlation of type logs and proposed injection rates show that the radius of fluid displacement around the deep injection wells will end more than 2,500 m [1.5 mi] from the Dewey Fault (Powertech, 2011, Appendix 2.7-L). The UIC permit will not allow injection into the Class V deep disposal 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.

Potential environmental impacts to groundwater from construction, operation, aquifer restoration, and decommissioning associated with the Class V injection well disposal option are discussed next.

4.5.2.1.1.1 Construction Impacts

The construction of facilities, pipelines, wellfields, deep disposal injection wells, holding ponds, and access roads in the construction phase for the onsite, deep well, liquid waste disposal option will disturb 98 ha [243 ac] of land (Powertech 2010a). The total land disturbance will be 2.3 percent of the permit area. The deep well disposal facilities, if approved, will be located near the satellite plant in the Dewey area and near the central processing plant in the Burdock area (see Figure 2.1-10).

Consumptive water use during construction will be limited to dust control, cement mixing, pump tests, delineation drilling, and well drilling and completion. The applicant estimates that groundwater consumption during construction at the Dewey and Burdock areas will be 8.25×10^7 L and 1.16×10^8 L [21.8×10^6 gal and 30.6×10^6 gal], respectively (Powertech, 2010a). Initially, water for construction activities will be withdrawn from existing wells in the Inyan Kara Group aquifers. The applicant plans to install wells in the deeper Madison aquifer early in the construction phase (Powertech, 2010a). As described previously, the applicant's water permit application for the Madison aquifer proposes to appropriate 109.6 ha-m [888.8 ac-ft] or 1.09×10^9 L [28.9×10^7 gal] of water annually to provide water for the proposed project (Powertech, 2012i). If permitted, the Madison aquifer will become the primary source of water for the project (Powertech, 2010a).

As described in SEIS Section 2.1.1.1.2.3.5, the applicant plans to use standard mud rotary drilling techniques to construct production, injection, and monitoring wells. Wells will be constructed using a small rotary drilling unit that uses bentonite or polymer drilling mud containing water that is pH-adjusted and mixed to control viscosity (Powertech, 2012g). The volume of drilling fluids and mud used during well installation will be limited. The introduction of drilling fluids to surficial (alluvial) aquifers at the proposed project might occur during well drilling, but the amount will be minor because drilling mud is designed to seal boreholes to set the casing. As part of the applicant's Class III UIC permit, all production, injection, and monitoring wells will be cased and cemented to prevent the migration of fluids into and between USDWs in accordance with EPA regulations in 40 CFR 146.32. In addition, the design and construction of Class V deep injection wells must meet EPA requirements. Prior to entering service, all wells will undergo mechanical integrity tests of the casing to ensure against well leakage.

During well installation, drilling fluids and mud will be stored in temporary mud pits to control the spread of fluids, protect the soil from contamination, and enhance evaporation. The applicant could choose alternative methods to manage drilling fluids to further limit the potential impacts from the use of mud pits during well drilling activities. These could include lining the mud pits

with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids. The soil horizon found throughout most of the project area is clayey (see SEIS Section 3.4.2), which will minimize leakage from the mud pits and degradation of water quality of surficial and shallow aquifers.

The groundwater quality of near-surface aquifers can potentially be affected by stormwater runoff during construction, which in turn will be controlled by the applicant's SWMP that is part of the SDDENR-issued NPDES permit (see SEIS Section 4.5.1.1.1.1). The NPDES permit sets limits on the amount of pollutants entering ephemeral drainages that may be in hydraulic communication with alluvial aquifers at the site. The NPDES permit will also specify mitigation measures and BMPs to prevent and clean up spills. The applicant has not yet submitted an application for an NPDES permit to SDDENR.

Fuels and lubricants may enter surficial and shallow aquifers as spills during facility construction and drilling activities and during the installation of injection, production, and monitoring wells. Impacts to groundwater quality of near-surface aquifers will be minimized by UIC and NPDES permit requirements and implementation of BMPs during construction. The applicant commits to implement spill prevention and cleanup plans to minimize impacts to soils and groundwater, including rapid response cleanup and remediation (Powertech, 2009a). Additionally, only small volumes of fuel and lubricants will be stored at the site. Leaks or spills will be cleaned immediately to avert soil contamination and infiltration to surficial aquifers. Under the terms of the NPDES permit (or regulations), spills of petroleum product or hazardous chemicals that threaten groundwater and related habitats must be reported to SDDENR.

In summary, groundwater use during construction will be limited to routine activities, such as dust suppression, mixing cements, and drilling support. As noted previously, the applicant estimates that groundwater consumption during construction at the Dewey and Burdock areas will be 8.25×10^7 L and 1.16×10^8 L [21.8×10^6 gal and 30.6×10^6 gal], respectively (Powertech, 2010a). If the applicant is granted a water appropriation permit to use Madison aquifer water, NRC staff determine that the applicant will rely less on local water supplies in the permit area, and hence, environmental impacts on local aquifers (e.g., the Inyan Kara aquifer) and domestic and livestock wells from consumptive water use during construction will be SMALL. However, if the water appropriation permit is denied, water use from local shallow aquifers during construction could significantly impact domestic and livestock wells. For example, the applicant estimates consumptive groundwater use during construction to be the same as that currently being withdrawn for domestic and livestock use from the Inyan Kara aquifer within 2 km [1.2 mi] of the Dewey-Burdock site (see SEIS Section 4.5.2.1.1.2.2). However, the applicant has committed to removing all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011). This process will begin during the construction phase and, therefore, the current usage rate from the Inyan Kara within the proposed project area will decline. In addition, results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 556 Lpm [147 gpm] over the 2 year construction phase (Petrotek, 2012). This equates to total groundwater consumption of 5.83×10^8 L [1.54×10^8] gal. Therefore, the NRC staff anticipates that the potential impact to shallow local aquifers and domestic and livestock wells from consumptive water use during the construction phase of the proposed project will be SMALL.

In addition to potential stress on local aquifers due to consumptive water use demands, groundwater quality in shallow aquifers (mostly alluvium and also the Inyan Kara aquifer at its

outcrop areas in the eastern part of the Burdock area) could be threatened by stormwater runoff and spills of fuels and lubricants during construction activities. However, required NPDES permit compliance activities, such as monitoring and BMPs, will protect groundwater quality of shallow aquifers. Specifically, the NPDES permit requirements provide controls on the amount of pollutants entering ephemeral drainages during construction. The permit will also specify mitigation measures and BMPs to prevent and cleanup spills. The applicant has committed to implementation of BMPs, such as a spill prevention and cleanup plan to minimize soil contamination and infiltration (Powertech, 2009a). Therefore, the NRC staff conclude that the impacts to groundwater during the construction phase for the Class V injection well disposal option at the proposed project will be SMALL.

4.5.2.1.1.2 Operations Impacts

Groundwater in near-surface (alluvial) and shallow aquifers, production aquifers, aquifers overlying and underlying the production aquifers, and deep aquifers could be impacted during ISR operations if the deep disposal well option is used at the proposed Dewey-Burdock site. Potential impacts to these aquifers could result from pumping water to meet the required consumptive water demands and from potential water quality degradation during ISR operations. Such potential impacts are discussed in the following sections.

4.5.2.1.1.2.1 Shallow (Near-Surface) Aquifers

Alluvial aquifers with thicknesses up to 12 m [40 ft] are present along Beaver Creek, Pass Creek, and the Cheyenne River (see SEIS Section 3.5.3.2). The alluvial aquifers may be locally confined, and they are separated from the underlying Fall River aquifer by the low permeability Graneros Group, which consists of the combined Skull Creek Shale, Mowry, and Belle Fourche Shales. Within the project area, the Graneros Group ranges in thickness from 61 to 168 m [200 to 550 ft], except in the eastern part of the Burdock area, where it has eroded, leaving the Fall River Formation exposed at the surface (see SEIS Section 3.4.1.2 and Figure 3.4-3). An inventory of private wells within a 2-km [1.2-mi] radius of the site indicates that seven wells are completed in alluvial aquifers (Powertech, 2011). The alluvial wells are used solely for monitoring purposes and do not serve as water supply for domestic purposes or livestock watering (Powertech, 2011).

The Inyan Kara Group aquifer is the first near-surface aquifer encountered within the project area, and it is made up of two subaquifers: the Fall River and Chilson aquifers (see SEIS Section 3.5.3.1). The Fall River aquifer has an average thickness of 46 m [150 ft] within the project area and is exposed at the surface in the eastern part of the Burdock area, where the Graneros Group has been eroded (see Figure 3.4-3). The underlying Chilson aquifer varies in thickness from 37 to 61 m [120 to 200 ft] across the project area and is separated from the Fall River aquifer by the Fuson Shale, which has an average thickness of 15 m [50 ft] across the project area. The Chilson aquifer is underlain by a 30-m [100-ft]-thick section of the impermeable Morrison Formation, which hydrologically isolates the Chilson aquifer from deeper aquifers. Based on an inventory of private wells within a 2-km [1.2-mi] radius of the proposed project site, 33 wells obtain water from the Fall River aquifer, 41 wells obtain water from the Chilson aquifer, and 17 wells obtain water from an unknown component of the Inyan Kara aquifer (Powertech, 2011). These wells serve as water supplies for livestock, domestic purposes (e.g., drinking water), and monitoring.

Over the western and central parts of the proposed project area (i.e., the Dewey area and the western part of the Burdock area), the Fall River Formation is overlain by a 61-m to 168-m [200-ft to 550-ft] thick confining layer composed of the combined Skull Creek Shale, Mowry, and Belle Fourche Shales (Graneros Group). Where the Fall River aquifer is overlain by a thick confining layer, impacts to groundwater in this aquifer due to spills and leaks of pregnant or barren lixiviant on the ground surface resulting from pipeline, valve, and well integrity failure will be SMALL.

As described in SEIS Section 3.5.3.3, the Fall River Formation forms a shallow (near-surface) unconfined aquifer where it is exposed at the surface in the eastern part of the Burdock area. As a result, spills and leaks of pregnant or barren lixiviant on the ground surface resulting from pipeline, valve, and well integrity failure could impact water quality. Uranium orebodies are present in unconfined portions of the Fall River Formation in the eastern part of the Burdock area. However, the applicant stated that ISR operations will not be conducted in unconfined portions of the Fall River aquifer (Powertech, 2010a). The applicant stated that ISR operations in the Fall River Formation will be limited to uranium orebodies in confined aquifers in the Dewey portion of the project area, except for one proposed Burdock wellfield (B-WF10) (Powertech, 2010a; Petrotek, 2012). Wellfield B-WF10 is proposed in a confined and fully saturated portion of the Fall River Formation in the western part of the Burdock area (Petrotek, 2012).

The GEIS reported that NRC-required leak detection and cleanup programs greatly reduce the impact of radiological releases at or near the ground surface in shallow groundwater. The applicant is required to have leak detection, spill response, and cleanup programs as part of the NPDES permit (see SEIS Section 7.3.2). The applicant commits to implementing a spill prevention and cleanup plan that includes rapid response cleanup and remediation programs to minimize impacts on soils and groundwater (Powertech, 2009a). In addition, preventive measures, such as NRC-required mechanical integrity testing (see SEIS Section 2.1.1.1.2.3.5) and UIC permits obtained from EPA, will limit the likelihood of well integrity failure during operations, and hence, will minimize the risk of process fluid leaks from operational wells entering (or contaminating) shallow aquifers.

NRC staff determine that near-surface (alluvium) aquifers in the project area have limited occurrences near creeks and are not being used for domestic, agricultural, or livestock watering. Shallow aquifers occur in the eastern part of the Burdock area, where the Fall River aquifer crops out and/or is present in an unconfined condition. The applicant commits to refrain from extracting uranium in the shallow, unconfined Fall River aquifer in the Burdock area. Near-surface and shallow aquifers are hydrologically isolated from deep aquifers below the Chilson aquifer by the impermeable Morrison Formation. In addition, the NRC staff recognize that during ISR operations groundwater impacts will be mitigated and reduced by (i) implementation of leak detection and cleanup programs, (ii) mechanical integrity testing of wells, and (iii) adherence to UIC permit requirements. Therefore, NRC staff conclude that impacts to shallow (near-surface) groundwater during operations for the Class V injection well disposal option at the proposed project will be SMALL.

4.5.2.1.1.2.2 Operations Impacts to Production and Surrounding Aquifers

The potential environmental impact to groundwater in the production and other surrounding aquifers is related to consumptive water use and groundwater quality.

Water Consumptive Use

GEIS Section 4.4.4.2.2.2 included a discussion of the potential impacts of groundwater withdrawal and reinjection into the production zone during ISR operations (NRC, 2009a). Most of the water withdrawn from the aquifer is returned to the aquifer. The portion not returned to the aquifer is referred to as "consumptive use." Consumptive use for ISR operations is primarily due to production bleed and other small losses. Production bleed is the net withdrawal maintained to ensure groundwater hydraulic gradients draw water in toward the production wells to minimize the potential movement of lixiviant and its associated contaminants out of the wellfield.

Consumptive water use during ISR operations could impact those who use local water from the production aquifer outside the exempted zone. This potential impact will lower water levels in nearby wells and reduce the yield of these wells. In addition, if the production zone is hydraulically connected to other aquifers above and/or below the production zone, consumptive use may impact the water levels in these overlying and underlying aquifers and reduce the yield in any nearby wells withdrawing water from these aquifers. (NRC, 2009a)

The applicant has committed to removing all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011). The applicant will work with well owners to provide an alternative water source, such as a replacement well or alternative water supply for domestic use. Replacement wells will be located an appropriate distance from wellfields and target an aquifer outside the production zone that provides water in a quantity equal to that of the original well and of a quality suitable for the same uses as the original well (Powertech, 2011). In addition, the applicant will remove all stock wells within 0.4 km [0.25 mi] of any wellfield from private use prior to operation of the wellfield. Furthermore, the applicant will remove stock wells from private use that could be adversely impacted by or could adversely impact ISR operations. The applicant will also assume control of all wells used for monitoring within the project area boundary and secure the well heads to prevent unauthorized use. During operations, the applicant will monitor all domestic wells within 2 km [1.2 mi] of the wellfields and all stock wells within the project area (Powertech, 2011). In the event of significant drawdown or degradation of water quality in these wells, the applicant will provide alternative sources of water (e.g., a replacement well) to the well owner as described previously (Powertech, 2009a, 2011).

Based on historical records and field investigations of the proposed project area, 107 water wells were identified within 2 km [1.2 mi] of the proposed project site (Powertech, 2011). In addition, field investigations of 36 wells documented in historical records were conducted. Of the 36 wells, 8 were visually confirmed to be plugged and abandoned, while 28 wells were not identified at the surface during the field investigation (Powertech, 2011). The 107 identified water wells are screened in the following aquifers: Fall River (33 wells; 12 of these wells are flowing artesian wells), Chilson (41 wells; 14 of these wells are flowing artesian wells), unknown aquifer (17 wells), Inyan Kara (either the Fall River or Chilson or both; 3 wells), Unkpapa (5 wells), Sundance (1 well), and alluvial aquifers (7 wells) (Powertech, 2009a, 2011). The total estimated groundwater use from wells placed in the Fall River aquifer is 57 Lpm [15 gpm]. From wells placed in the Chilson aquifer, the total estimated groundwater use is 174 Lpm [46 gpm] (Powertech, 2009a). The total estimated flow from wells placed in the Inyan Kara Group aquifers (Fall River, Chilson, or both) is 265 Lpm [70 gpm].

Ore production zone pumping rates are estimated to be 9,084 Lpm [2,400 gpm] in the Burdock area and 6,056 Lpm [1,600 gpm] in the Dewey area during ISR operations (Powertech, 2011). These pump rates will draw down water levels in nearby wells in the production zones, potentially reducing the yield of these wells for livestock watering and domestic use. The applicant estimates that the maximum drawdown outside the project area resulting from projected ISR operations will be approximately 3.65 m [12 ft] in the Fall River aquifer and 3.05 m [10 ft] in the Chilson aquifer (Petrotek, 2012). The estimates are based on numerical modeling developed from site-specific parameters and calibrated to historical pumping test data (Petrotek, 2012). The numerical simulations were for net extraction rates resulting from a gross production pumping rate of 30,280 Lpm [8,000 gpm] (twice the applicant's estimated proposed pumping rate of 15,140 Lpm [4,000 gpm]), a 1 percent production bleed rate, and the use of groundwater sweep during aquifer restoration. As described previously, the applicant has committed to removing domestic wells within the proposed project area prior to operations. Therefore, the drawdown estimates represent the maximum anticipated drawdown amount for nearby domestic wells. The NRC staff analyzed the hydrogeologic characteristics of the Fall River and Chilson aquifers (i.e., formation thicknesses and potentiometric surfaces) and concluded that these estimated drawdowns will have a SMALL impact on nearby wells located in the Fall River and Chilson aquifers.

The NRC staff recognize that the Chilson aquifer is separated from the Sundance/Unkpapa Formation by a 30-m [100-ft] thick section of the impermeable Morrison Formation, which hydrologically isolates the Chilson aquifer from underlying aquifers (i.e., Sundance/Unkpapa). Therefore, the staff find that, for the Class V injection well disposal option, the impacts on water levels and water yields in wells located in the Sundance/Unkpapa Formation (Powertech identified six wells) due to pumping and drawdown in the Chilson aquifer during ISR production will be SMALL.

During ISR operations, the applicant plans to maintain a typical bleed rate of 0.875 percent of the production flow rate over the life of the proposed project (Powertech, 2011). However, instantaneous bleed rates may vary from 0.5 to 3 percent for short durations, ranging from days to months, to ensure a cone of depression is maintained and that no production fluids are released from the production zone (Powertech, 2009a). Because there is no evidence for fast flow paths, such as fractures, in the ore-bearing aquifers, NRC staff conclude that the cone of depression will be maintained during ISR operations. If the applicant uses a bleed rate of 3 percent during the operations phase, drawdowns in the nearest domestic wells in the Fall River and Chilson aquifers will be greater than those estimated in the previous paragraph for a 1 percent bleed rate. However, as noted previously, the maximum simulated drawdown was performed for a gross production pumping rate of twice that proposed by the applicant and for the optional groundwater sweep during aquifer restoration. Therefore, it represents a conservatively high estimate of the potential drawdown resulting from operation and restoration. In addition, drawdowns resulting from higher bleed rates (i.e., bleed rates greater than 1 percent) will be temporary (days to months). After production and restoration are complete and groundwater withdrawals are terminated at the proposed project, groundwater levels will tend to recover with time. Based on numerical modeling, the applicant estimates that water levels will recover to near pre-operational levels within 1 year after groundwater withdrawals cease (Petrotek, 2012).

Furthermore, the applicant will 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 domestic and livestock wells within and adjacent to the

proposed project area (Powertech, 2009a). Therefore, potential impacts to water yields and pumping costs in nearby wells due to drawdowns associated with higher bleed rates for the Class V injection well option will be short-term and SMALL.

As described in SEIS Section 4.5.2.1, the applicant's water permit application to SDDENR for groundwater use from the Madison aquifer proposes to appropriate 109.6 ha-m [888.8 ac-ft] or 1.09×10^9 L [28.9×10^7 gal] of water annually (Powertech, 2012i). If this permit is granted, the applicant will rely largely on Madison aquifer water during ISR operations. The Madison aquifer is approximately 844 m [2,765 ft] bgs in the Burdock area and approximately 945 m [3,100 ft] bgs in the Dewey area (Powertech, 2011, Appendix 2.7–L). Otherwise, the applicant will pump water from the Inyan Kara Group aquifers to meet operational needs at an estimated sustainable rate of 151 to 246 Lpm [40 to 65 gpm] (Powertech, 2009a, 2010a). Results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 363 Lpm [96 gpm] over the 8-year operations phase (Petrotek, 2012).

To mitigate impacts on the use of shallow groundwater, the applicant commits to (i) removing all existing domestic wells within the project area from private use prior to ISR operations, (ii) removing all stock wells within 0.4 km [0.25 mi] of any wellfield from private use prior to operation of the wellfield, (iii) removing stock wells that could be adversely impacted by or could adversely impact ISR operations from private use, (iv) controlling all monitor wells within the proposed project boundary, and (v) providing alternative sources of water to landowners in the event of significant drawdown or degradation of water quality to domestic wells within 2 km [1.2 mi] of the project boundary and stock wells within the proposed project area (Powertech, 2009a, 2011). After production and restoration are complete and groundwater withdrawals are terminated at the Dewey-Burdock Project, groundwater levels will tend to recover with time. Therefore, NRC staff conclude that the overall environmental impacts on local aquifers, production aquifers, and domestic and livestock wells from consumptive use during operations for the Class V injection well disposal option at the proposed project will be SMALL.

Excursions and Groundwater Quality

As described in the GEIS, groundwater quality in the production zone will be degraded during ISR operations (NRC, 2009a). The production portion of the aquifer will need to be exempted from being a USDW though an EPA-issued aquifer exemption in accordance with the criteria under 40 CFR 146.4. After production is completed, the licensee must initiate aquifer restoration activities to restore the production zone to Commission-approved background water quality, if possible. If the aquifer cannot be returned to background conditions, NRC requires that the production aquifer be returned to the MCLs provided in 10 CFR Part 40, Appendix A, Table 5C or to NRC-approved ACLs. Appendix B explains the process for granting an ACL. For proposed ACLs to be approved, they must be shown to protect human health at the site. For these reasons, NRC staff concluded in the GEIS that the potential impacts to the water quality of the uranium-bearing production zone aquifer as a result of ISR operations will be SMALL (NRC, 2009a).

To prevent horizontal excursions, inward hydraulic gradients need to be maintained in the production aquifer during ISR operations (NRC, 2009a). These inward hydraulic gradients are created by the net groundwater withdrawals (production bleeds) maintained through continued pumping during ISR operations. For the Dewey-Burdock ISR Project, the applicant plans to maintain a 0.5 to 3 percent production bleed rate (see SEIS Section 2.1.1.1.3.1.2). The inward

hydraulic gradients will ensure that groundwater flow is toward the production zone and that horizontal excursions will not occur.

As required by NRC license condition, a licensee must take preventive measures to reduce the likelihood and consequences of potential excursions. An applicant must design and install a monitoring network capable of detecting both horizontal and vertical excursions from the production zone to demonstrate that restoration is feasible. A ring of monitoring wells within and encircling the production zone is required for early detection of horizontal excursions. The applicant's groundwater monitoring program is detailed in SEIS Sections 2.1.1.1.3.1.3 and 7.3.1.2. If excursions are detected in the monitoring well ring, corrective actions to either stop or reverse the fluid movement (i.e., excursions) are required. The applicant will need to modify wellfield operations, as necessary, to correct the excursion. As described in SEIS Section 2.1.1.1.3.1.3, corrective actions to monitor and stop or reverse an excursion may include increasing sampling frequency to weekly, increasing the pumping rates (and thus the net bleed) of production wells in the area of the excursion, and pumping individual wells to enhance recovery of extraction solutions. If these actions do not effectively retrieve the excursion within 60 days, the applicant is required by license condition to suspend injecting lixiviant into the production zone adjacent to the excursion until the excursion is retrieved and the upper control limit parameters are no longer exceeded.

Vertical excursions may also occur in aquifers overlying or underlying the production zone aquifer. An analysis presented in the GEIS indicated the potential for migration of production solutions into an overlying or underlying aquifer is minor if the aquitard (confining layer) separating the production zone from the overlying and underlying aquifer is sufficiently thick and the aquitard has low permeability (NRC, 2009a). The hydraulic gradient between the production zone and overlying or underlying aquifers is also used to determine the potential for vertical excursions. The upper confining layer (Skull Creek, Mowry, and Belle Fourche Shales, which are collectively referred to as the Graneros Group) at the Dewey-Burdock site has a thickness of approximately 61 to 168 m [200 to 550 ft] (see Figure 3.5-5). The applicant stated that it will not likely place any monitoring wells below the Lakota Formation due to the presence of a 30-m [100-ft]-thick underlying confining layer (Morrison Formation) and the upward vertical hydraulic gradient at the proposed Dewey-Burdock site (Powertech, 2009a). The thicknesses of the upper confining layer {approximately 61 to 168 m [200 to 550 ft]} and the lower confining layer {approximately 30 m [100 ft]} will minimize the potential impacts of vertical excursions. To ensure the detection of vertical excursions, NRC requires monitoring in the overlying and underlying aquifers. The applicant's groundwater monitoring program is detailed in SEIS Sections 2.1.1.1.3.1.3 and 7.3.1.2.

Vertical excursions can also occur due to improperly sealed boreholes, poorly completed wells, or loss of mechanical integrity of ISR injection and production wells. The applicant will use its delineation drilling and pump testing program to identify and plug improperly sealed boreholes that could result in vertical excursions (Powertech, 2011). The applicant will use its mechanical integrity testing program to mitigate the impacts of potential vertical excursions resulting from borehole failure of injection, production, and monitoring wells (see SEIS Section 2.1.1.1.2.3.5). The applicant must also conduct periodic mechanical integrity testing of each well to check for leaks or cracks in the casing, as required by 40 CFR 146.8. Because mechanical integrity testing reduces the likelihood of poor well integrity, the impacts from excursions involving failure or damage to a well casing will be SMALL.

In GEIS Section 2.11.4, NRC staff discussed excursions that occurred at operating ISR facilities (NRC, 2009a). Separately, NRC staff analyzed the environmental impacts from both horizontal and vertical excursions that occurred at three NRC-licensed ISR facilities (NRC, 2009b). In that analysis, which considered 60 events at 3 facilities, NRC staff found that, for most of the events, the licensees were able to control and reverse the excursions through pumping and extraction at nearby wells. Most excursions were short-lived, although a few continued for several years. In all cases, however, no impacts occurred to nonexempted portions of the aquifer (NRC, 2009b).

Many of the hydrogeologic conditions at the proposed Dewey-Burdock ISR Project are similar to those at other ISR facilities. Groundwater in the production zone aquifers displays sufficient hydraulic conductivity to minimize excursions during ISR activities. However, the Dewey-Burdock site has several distinctive man-made and hydrogeological features that could contribute to potential vertical or horizontal excursions.

First, Tennessee Valley Authority (TVA) drilled several thousand exploratory boreholes within the proposed Dewey-Burdock ISR Project area, which penetrate the Inyan Kara Group aquifers to the Morrison Formation (Powertech, 2010a). These boreholes may provide pathways to aquifers above and below production zone confining units, such as alluvial aquifers above the Graneros Group and deep aquifers below the Morrison Formation, although few explorations holes penetrated the entire thickness of the Morrison Formation (Powertech, 2011). Before developing wellfields, the applicant commits to properly plugging and abandoning or mitigating any historical wells and exploration holes that may potentially impact the control and containment of wellfield solutions within the proposed wellfield (Powertech, 2011). The applicant will use available information and best professional practices—including historical records, color infrared imagery, field investigations, and potentiometric surface evaluation—to locate or detect improperly plugged boreholes or wells in the vicinity of potential wellfield areas. In addition, the applicant will use pumping test results conducted as part of routine wellfield hydrogeologic package development to identify improperly plugged wells and exploration boreholes (Powertech, 2011).

Second, hydraulic communication (i.e., leakage) between the Fall River and Chilson aquifers through the intervening Fuson Shale (see Figure 3.5-5) in the Burdock area has been identified based on aquifer pumping tests [see safety evaluation report (SER) Section 2.4.3.4] and potentiometric surface differences (see SEIS Section 3.5.3.2). Leakage through the Fuson Shale has implications when evaluating the capability of reversing potential vertical excursions by drawing water back into producing wells. Using exploratory drilling data the applicant provided (Powertech, 2010b), NRC staff independently constructed isopach maps (i.e., maps showing the thickness of a bed or formation throughout a geographic area) for the Fuson Shale underlying the Burdock area using different statistical methods (e.g., kriging, inverse distance). The resultant isopach maps for the Fuson Shale were in good agreement with the isopach map for the Fuson Shale the applicant presented (see Figure 3.5-6). However, the thickness of the Fuson Shale at the proposed Dewey-Burdock site may be different from other areas, and the applicant has committed to collecting more detailed lithologic data in each wellfield prior to ISR operations to ensure hydraulic control of the production zone (Powertech, 2010a). The applicant also developed a numerical groundwater model using site-specific geologic and hydrologic information (Petrotek, 2012). Based on results of the numerical model, the applicant concluded that vertical leakage through the Fuson Shale is caused by improperly installed wells or improperly abandoned boreholes. NRC staff reviewed the applicant's numerical groundwater model and calibration, and it determined that the model was appropriately developed and

sufficiently calibrated. As noted previously, the applicant has committed to locating unknown boreholes and wells, and committed to plugging and abandoning historical wells and exploration holes, holes drilled by the applicant, and any wells that fail mechanical integrity tests (Powertech, 2011).

Finally, the applicant plans to conduct ISR operations in partially saturated portions of the Chilson aquifer in the Burdock area (Powertech, 2011). ISR operations in partially saturated aquifers present special challenges with regard to controlling production fluids and detecting and remediating excursions. As described in SEIS Section 2.1.1.1.2.3, the applicant has committed to collect more detailed lithologic data through delineation drilling and conduct additional hydrogeologic investigations (including pump tests) in each proposed wellfield to ensure that hydraulic control of the production zone can be maintained (Powertech, 2010a, 2011). The applicant will be required to submit detailed operational plans, including monitoring well layouts, for NRC and EPA approval before conducting ISR operations in partially saturated aquifers at the proposed Dewey-Burdock site (Powertech, 2010a, 2011). NRC staff have also included a license condition for ISR operations in partially saturated portions of the Chilson aquifer. This license condition will require the applicant to demonstrate the ability to detect and remediate excursions in partially saturated zones (NRC, 2013).

In summary, NRC staff conclude that the impact from excursions at the proposed Dewey-Burdock ISR Project will be SMALL because (i) EPA will exempt uranium-bearing production aquifers from USDW classification according to the criteria under 40 CFR 146.4,(ii) the applicant will be required to submit wellfield operational plans for NRC and EPA approval, (iii) inward hydraulic gradients will be maintained to ensure groundwater flow is toward the production zone, and (iv) the applicant's NRC-mandated groundwater monitoring plan will ensure that excursions are detected and corrected. Impacts from vertical excursions will be SMALL because (i) uranium-bearing production zones in the Fall River and Chilson aquifers are hydrologically isolated from adjacent aquifers by thick, low permeability shale layers (i.e., the overlying Graneros Group and underlying Morrison Formation); (ii) a prevailing upward hydraulic gradient occurs across the major aquifers; (iii) the applicant's required mechanical integrity testing program will mitigate the impacts of potential vertical excursions resulting from borehole failure; and (iv) the applicant commits to properly plugging and abandoning or mitigating any previously drilled wells and exploration holes that may potentially impact the control and containment of wellfield solutions within the proposed project area. Moreover, because the applicant must initiate aquifer restoration in the production aquifers (i.e., Fall River and Chilson aquifers) to return groundwater to Commission-approved background levels or to NRC-approved alternative water quality levels at the end of ISR operations, NRC staff conclude that groundwater quality impacts to the production and surrounding aquifers as a result of ISR operations for the Class V injection well disposal option will be SMALL.

4.5.2.1.1.2.3 Operations Impacts to Deep Aquifers Below the Production Aquifers

Potential environmental impacts to confined, deep aquifers below the production aquifers could occur from deep well injection of process-related liquid effluents. Under the SDWA, EPA has statutory authority to permit and regulate injection well activities that may affect the environment. EPA Region 8 administers the deep well disposal UIC program in South Dakota and is responsible for issuing any permits for deep well disposal at the proposed Dewey-Burdock Project site.

At the proposed Dewey-Burdock ISR Project, the applicant plans to dispose of liquid waste using Class V (nonhazardous) deep injection wells, land application, or a combination of both deep well injection and land application (see SEIS Section 2.1.1.1.2.4). For the Class V injection well disposal option at the proposed project, the applicant will inject process-related liquid waste into the Deadwood and Minnelusa Formations, which both lie below the Morrison Formation (Powertech, 2011, Appendix 2.7-L). However, deep well injection into these formations depends on securing a Class V (nonhazardous) UIC permit through an EPA-permitting process. For disposal through a UIC Class V well, an EPA permit, if granted, will require that the waste stream to be injected will not be classified as hazardous under the Resource Conservation and Recovery Act (RCRA). EPA will also evaluate the suitability of the proposed deep injection wells. EPA will only allow deep well injection if the liquid wastes can be safely isolated in the deep aquifers. If a license is granted, NRC will also require the liquid wastes to be treated and monitored to verify they meet NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B, Table 2, Column 2. If the proposed injection zones are underground sources of drinking water {have a total dissolved solids concentration below 10,000 mg/l [10,000 ppm]}, the EPA UIC permit will require the injectate to be treated to meet drinking water standards or contaminant-specific background concentrations for constituents regulated under the SDWA, unless the applicant applies for and is granted an aquifer exemption. The applicant's Class V injection well monitoring program is detailed in SEIS Section 7.6.

At the Dewey-Burdock site, the Madison aquifer is an important aquifer in the region supplying municipal water for numerous communities, including Rapid City and Edgemont, South Dakota. As noted previously, the proposed injection zones for the deep disposal wells are the Minnelusa Formation and the Deadwood Formation, which respectively lie above and below the Madison Formation (Figure 3.5-5). There are confining layers at the base of the Minnelusa Formation, which separate the Madison Formation from the overlying Minnelusa Formation. Locally, these confining layers may be absent or provide ineffective confinement, which could enhance hydraulic connection between the Minnelusa aquifer and the underlying Madison aquifer (Naus, et al., 2001). However, based on water levels in Minnelusa and Madison observation wells in the area, SDDENR concluded that there is a significant difference in the potentiometric surfaces of the two aquifers suggesting that the aquifers are hydraulically separated in the vicinity of the site (SDDENR, 2012b). The Englewood Formation underlies the Madison Formation and should provide a confining layer between the Madison Formation and the underlying Deadwood Formation. As described in SEIS Section 3.5.3.1, the Whitewood and Winnipeg Formations (see Figure 3.5-5) are not expected to be present in the southern Black Hills (Naus, et al., 2001). As stated previously, the UIC permit will not allow injection into the Class V deep disposal 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. Based on the protective requirements of the EPA UIC Class V permit, NRC staff conclude that the impact of the deep Class V disposal wells on the deep aquifers will be SMALL.

4.5.2.1.1.3 Aquifer Restoration Impacts

Consistent with the GEIS, the primary goal of aquifer restoration at the proposed Dewey-Burdock ISR Project is to return groundwater quality within the production zone of a wellfield to Commission-approved background water quality conditions or to standards consistent with NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(5) (Powertech, 2009b). These standards state the concentration of a hazardous constituent must not exceed

(i) the Commission-approved background concentration of that constituent in groundwater; (ii) the respective value in the table in paragraph 5C (in 10 CFR Part 40, Appendix A) if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an ACL the Commission establishes. Appendix B explains the process for granting an ACL. For proposed ACLs to be approved, they must be shown to protect human health at the site.

In addition to NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(B), groundwater in the production zone aquifer will have to be restored to State of South Dakota standards. In accordance with ARSD 74:54:01:04, groundwater in the production zones will be required to be restored to established ambient concentrations or South Dakota groundwater quality standards.

NRC staff examined available groundwater restoration data from three NRC-licensed ISR facilities (COGEMA's Irigary/Christensen Ranch facility, Power Resources Inc.'s Smith Ranch/Highland Uranium Project facility, and Crow Butte Resources Crow Butte facility) (NRC, 2009b). NRC staff has approved 11 wellfield restorations at the three sites. The restoration data show that pre-operational concentrations are attainable for many parameters (50 to 70 percent of the 35 parameters commonly monitored) but are not attainable for other constituents, in particular, the major and trace cations with solubilities most susceptible to the oxidation state of the aquifer water (i.e., iron, manganese, arsenic, selenium, uranium, vanadium, and radium-226). However, for the approved restorations, the impacts to groundwater in the exempted aquifer met all regulatory standards for the state or EPA UIC program, met the quality designated for its class of use prior to ISR operations, have been shown to decrease in the future due to natural attenuation processes, and have been shown to meet drinking water standards at the perimeter of the exempted aquifer. Therefore, the impacts to the exempted aquifer for each of the approved restorations do not pose a threat to human health and the environment.

Hydraulic control of the ore zone must be maintained during aquifer restoration. This is accomplished by maintaining an inward hydraulic gradient through a restoration bleed. During aquifer restoration at the proposed Dewey-Burdock site, the restoration bleed will typically be 1 percent of the restoration flow (Powertech, 2011). The applicant plans to begin restoration of the first wellfield in both the Burdock and Dewey areas immediately after production activities end in that wellfield (Powertech, 2009a). Subsequently, as additional wellfields are completed, the applicant plans to restore each wellfield as soon as reasonably achievable or practicable following production (Powertech, 2011).

As described in SEIS Section 2.1.1.1.4.1, the applicant's primary method of aquifer restoration for the Class V injection well disposal option is groundwater treatment with RO and permeate injection (Powertech, 2009b, 2011). This method uses a RO system consisting of pressurized, semipermeable membranes that will treat groundwater removed from the wellfields in the Dewey and Burdock areas. The RO system removes more than 90 percent of the total dissolved solids in groundwater being restored. The reverse RO reject, or brine, undergoes radium removal in the radium settling ponds and then disposal in one or more Class V injection wells. The total liquid waste flow rate will be approximately 746 Lpm [197 gpm] during concurrent uranium production and aquifer restoration and approximately 568 Lpm [150 gpm] during aquifer restoration alone (Powertech, 2011). These liquid waste flow rates are lower than the proposed disposal capacity of up to 1,135 Lpm [300 gpm] for the Class V injection well disposal option (see SEIS Section 2.1.1.1.2.4.1).

About 70 percent of the water withdrawn from the wellfields and passed through the RO membranes will be recovered as permeate. Before reinjection into the wellfields, the permeate will be supplemented with makeup water from wells in the Madison Formation and injected into the wellfields at an amount slightly less than the amount withdrawn to maintain a slight restoration bleed. As noted previously, the restoration bleed will maintain hydraulic control of the wellfields during aquifer restoration and will typically be 1 percent of the restoration flow unless groundwater sweep is used in conjunction with RO treatment with permeate injection, in which case the restoration bleed will average approximately 17 percent as described in SEIS Section 2.1.1.1..4.1.3.

As described in SEIS Section 4.5.2.1, the applicant submitted a water appropriation permit to SDDENR in June 2012 for groundwater use from the Madison aquifer. However, if the applicant cannot secure a water appropriation for use of Madison aquifer water, the applicant will have to either identify an alternative source of water to meet aquifer restoration water requirements or reduce pumping rates to meet the estimated sustainable net extraction rate from the Inyan Kara aquifer, which is estimated to be at least 556 Lpm [147 gpm] for 2 years and 363 Lpm [96 gpm] for 8 years (see SEIS Sections 4.5.2.1.1.1 and 4.5.2.1.1.2.2.). Reducing the pumping rate will extend the aquifer restoration phase (Powertech, 2010a). After production and restoration are complete and groundwater withdrawals are terminated, groundwater levels will tend to recover with time (NRC, 2009a). Based on numerical modeling, the applicant estimates that water levels will recover to near pre-operational levels within 1 year after groundwater withdrawals cease (Petrotek, 2012). Thus, the potential long-term environmental impact from consumptive use during the restoration phase at the proposed project for the Class V injection well disposal option will be SMALL.

Aquifer restoration will directly impact groundwater quality in the production zone. At the end of operations in wellfields, the applicant must initiate aquifer restoration to return groundwater to Commission-approved background conditions. If these aquifers cannot be returned to Commission-approved background conditions, NRC will require that the production aquifer be returned to the MCLs provided in 10 CFR 40, Appendix A, Table 5C, or to NRC-approved alternate concentration limits. Restoration to these standards will ensure that groundwater within the exemption boundary will not pose a threat to surrounding groundwater. For these reasons, potential impacts to the water quality of the Fall River and Chilson aquifers and surrounding aquifers as a result of aquifer restoration for the Class V injection well disposal option will be SMALL.

As described previously, leakage between the Fall River and Chilson aquifers through the intervening Fuson Shale in the Burdock area has been identified based on aquifer pumping tests (see SER Section 2.4.3.4) and potentiometric surface differences (see SEIS Section 3.5.3.2). Because leakage may occur through the Fuson Shale, a potential exists for drawdown-induced migration of radiological contaminants from abandoned open pit mines in the Burdock area (e.g., Triangle Pit mine) from the Fall River aquifer into the hydraulically connected Chilson aquifer.

To address uncertainties in the confining properties of the Fuson Shale in the Burdock area, the NRC staff will impose by license condition that the applicant design and implement a monitoring well network (NRC, 2013). Specifically, for wellfields in the Burdock area where the production zone is located in the Chilson aquifer, the NRC will require monitoring wells to be placed in the

Fall River aquifer to identify any lack of confinement. A proposal for the monitoring well network must be submitted to NRC staff for review and written verification at least 60 days prior to construction.

In addition, the applicant committed to conducting hydrogeological characterization and aquifer pumping tests in each wellfield, in order to examine the hydraulic integrity of the Fuson Shale and ensure drawdown-induced migration of potential contaminants will not impact aquifer restoration goals (Powertech, 2010a). By license condition, NRC will also require the applicant to provide the results of the hydrogeological characterization and aquifer pumping tests for review and written verification before any proposed wellfields are developed (NRC, 2013). Further, wellfields in the vicinity of the abandoned mine pits in the Burdock area, specifically wellfields B-WF6, B-WF7, and B-WF8 (see Figure 2.1-6), will be prohibited from operating until NRC staff have reviewed and approved the hydrogeologic data packages for those wellfields (NRC, 2013).

Based on NRC requirements and applicant commitments, the potential for contaminants from abandoned open pit mines in the Burdock area to be drawn through the Fuson Shale into production zones within the Chilson aquifer during aquifer restoration will be SMALL.

As with the operations phase, a network of buried pipelines is used during the restoration phase for transporting fluids between the pump house and the satellite facility, or central processing plant. These pipelines are also used to connect injection and extraction wells to manifolds inside the header houses. However, the fluids transported in these pipes during restoration are generally less concentrated than during production. The failure of pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers, could result in leaks and spills of these fluids that could impact water quality in shallow aquifers. As discussed in SEIS Section 4.5.2.1.1.2.1, the applicant committed to implementing a leak-detection and spill-cleanup program (Powertech, 2009a). The EPA-mandated UIC program will also require preventive measures, such as well mechanical integrity testing. Consequently, implementing these measures will result in potential SMALL impacts to alluvial or shallow (near-surface) aquifers during the aquifer restoration phase at the proposed project.

As previously discussed in SEIS Section 4.5.2.1.1.2.3, it is assumed that the potential environmental impact to deep aquifers below the production aquifers from deep well injection of treated liquid wastes will be SMALL. The applicant will need an EPA UIC Class V permit for deep disposal wells at the proposed project (Powertech, 2009c). EPA will evaluate the suitability of the proposed deep injection wells and will only allow deep well injection if the waste fluids can be suitably isolated in a deep aquifer. Consequently, NRC staff determine that the potential environmental impact from the Class V injection well disposal option on targeted deep aquifers located below the production zone aquifers will be SMALL.

As described in SEIS Section 2.1.1.1.4.2, the applicant will implement a restoration monitoring plan to detect and correct horizontal and vertical excursions during aquifer restoration. After aquifer restoration is complete, groundwater levels will tend to recover with time (NRC, 2009a), and therefore long-term impacts to consumptive water use will be SMALL. Continued implementation of a leak-detection and spill-cleanup program and preventative measures, such as well mechanical integrity testing, will result in SMALL impacts to alluvial or shallow (near-surface) aquifers. The applicant's UIC Class V permits from EPA for deep well disposal will ensure that the impact to deep aquifers during aquifer restoration will be SMALL. Moreover, restoration to Commission-approved background conditions (or NRC-approved water quality

standards) in accordance with NRC license conditions will ensure that groundwater within the exemption boundary will not threaten surrounding groundwater.

Before NRC terminates an ISR source material license, a licensee is required to demonstrate that there will be no long-term impacts to USDWs. NRC review and approval of the wellfield restoration will ensure that the restoration standards are met and that these standards are protective of public health and the environment. Therefore, NRC staff conclude that the impacts from aquifer restoration in the Burdock and Dewey areas for the Class V injection well disposal option will be SMALL.

4.5.2.1.1.4 Decommissioning Impacts

After completion of ISR operations at the Dewey-Burdock ISR Project site, improperly plugged and abandoned wells could potentially impact aquifers above the production zone by providing hydrologic connections between aquifers. As part of the restoration and reclamation activities, all monitor, injection, and recovery wells at the proposed Dewey-Burdock site will be plugged and abandoned in accordance with SDDENR and EPA UIC regulations (see SEIS Section 2.1.1.1.5.2). In addition, the applicant will submit decommissioning plans, including detailed plans for plugging and abandoning wells, to NRC for review and approval.

The applicant has committed to implementing an emergency response plan to address cleanup of accidental spills and leaks that may occur during decommissioning. The applicant will implement the mitigation measures to control erosion and stormwater runoff. The applicant's NPDES permit will ensure that stormwater runoff will not contaminate surface water or shallow groundwater. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas, recontour the land surface to restore it to a surface configuration to blend with the natural terrain, and seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner.

If this process is properly implemented following the NRC-approved decommissioning plan and the abandoned wells are properly isolated from the flow domain, the potential environmental impacts to groundwater from decommissioning for the Class V injection well disposal option will be SMALL.

4.5.2.1.2 Disposal Via Land Application

If the permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.2.4.2). Potential environmental impacts to groundwater from construction, operation, aquifer restoration, and decommissioning for the land application disposal option are discussed in the following sections.

4.5.2.1.2.1 Construction Impacts

The construction of facilities, pipelines, wellfields, holding ponds, irrigation areas, and access roads in the construction phase of the land application disposal option will disturb 566 ha [1,398 ac] of land (Powertech 2010a). The total land disturbance will be 13.2 percent of the permit area. The locations of land application areas are shown in Figure 2.1-12. As described in SEIS Section 4.5.1.1.2.1, significant earthmoving activities will not be conducted to prepare

land irrigation areas. All the ground surface disturbances and the resultant impacts to groundwater discussed in SEIS Section 4.5.2.1.1.1, except for those from construction of deep well disposal facilities, will be applicable during the construction phase of the proposed ISR project for the land application disposal option.

The applicant must obtain a Class III UIC permit, an NPDES permit, and a water appropriation permit before construction activities begin. Consumptive water use during construction will be limited to dust control, cement mixing, pump tests, delineation drilling, and well drilling and completion. The volume of drilling fluids and mud used during well installation will be limited. The introduction of drilling fluids to surficial (alluvial) aquifers at the proposed project might occur during well drilling, but the amount will be minor because drilling mud is designed to seal boreholes to set the casing. As part of the applicant's Class III UIC permit, all production, injection, and monitoring wells will be cased and cemented to prevent the migration of fluids into and between USDWs in accordance with EPA regulations in 40 CFR 146.32. All wells will undergo mechanical integrity tests of the casing to ensure against well leakage prior to entering service.

During well installation, drilling fluids and mud will be stored in temporary mud pits to control the spread of fluids, prevent soil contamination, and enhance evaporation. The applicant could choose alternative methods to manage drilling fluids that will further limit the potential impacts from the use of mud pits during well drilling activities (e.g., lining the mud pits with an impermeable membrane, offsite disposal of potentially contaminated drilling mud and other fluids, and the use of portable tanks or tubs to contain drilling mud and other fluids). The soil horizon found throughout most of the project area is clayey (see SEIS Section 3.4.2), which will minimize leakage from the mud pits and degradation of water quality of surficial and shallow aquifers.

Stormwater runoff during construction will be controlled by the applicant's SWMP, which is part of the SDDENR-issued NPDES permit (see SEIS Section 4.5.1.1.1.1). Runoff from precipitation events or snowmelt on land application areas will be conveyed to catchment areas downgradient of land application areas and allowed to evaporate or infiltrate (Powertech, 2012c). The NPDES permit sets limits on the amount of pollutants entering ephemeral drainages that may be in hydraulic communication with alluvial aquifers at the site. The NPDES permit will also specify mitigation measures and BMPs to prevent and clean up spills. The applicant has not yet submitted an application for an NPDES permit to SDDENR.

Potential environmental impacts to groundwater during construction will be localized and limited to groundwater in near-surface (alluvial) aquifers. As described in SEIS Section 4.5.1.1.2.1 for the Class V injection well disposal option, impacts on local aquifers and domestic and livestock wells from consumptive water use during the construction phase of the project will be SMALL. If the applicant is granted a water appropriation permit to use Madison aquifer water, environmental impacts on local aquifers (e.g., the Inyan Kara aquifer), and domestic and livestock wells from consumptive water use during construction will be minimal. In the event SDDENR denies the applicant's water appropriation permit, the applicant will rely solely on Inyan Kara aquifer water during the construction phase. Results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 556 Lpm [147 gpm] over the 2 year construction phase (Petrotek, 2012). This equates to total groundwater consumption of 5.83×10^8 L [1.54×10^8] gal, which exceeds the project-wide construction phase groundwater consumptive use estimate of 1.98×10^8 L [5.24×10^7 gal] (Powertech, 2010a). In addition, the applicant has committed to removing all domestic wells

within the proposed project area from private use prior to operations (Powertech, 2011). Therefore, NRC staff conclude that the impacts to groundwater during construction for the land application option at the proposed project will be SMALL.

4.5.2.1.2.2 Operations Impacts

Groundwater in near-surface (alluvial) and shallow aquifers, production aquifers, aquifers overlying and underlying the production aquifers, and deep aquifers could be impacted during ISR operations for the land application disposal option at the proposed Dewey-Burdock project. Potential environmental impacts on groundwater could result from consumptive water uses from these aquifers and potential water quality degradations in these aquifers during ISR operations. Such potential impacts are discussed in the following sections.

4.5.2.1.2.2.1 Shallow (Near-Surface) Aquifers

All the ground surface disturbances and the potential resultant impacts to groundwater in shallow (near-surface) aquifers discussed in SEIS Section 4.5.2.1.1.2.1, except for those from construction of Class V injection well disposal facilities, will be applicable during the operations phase of the proposed ISR project for the land application disposal option. Briefly, NRC staff find that near-surface (alluvium) aquifers in the project area occur only near creeks and are not being used for domestic, agricultural, or livestock watering. Near-surface and shallow aquifers are not hydraulically connected to the deep aquifers the applicant proposed for the Class V injection well disposal option. Shallow aquifers occur in the eastern portion of the Burdock area, where the Fall River aquifer crops out and/or is present in an unconfined condition. The applicant commits to refrain from extracting uranium in the shallow unconfined Fall River aquifer in the Burdock area; however, there will be wellfields in this area for extracting uranium from the partially saturated Chilson sandstone. Moreover, the applicant is required to have leak detection, spill response, and cleanup programs as part of the NPDES permit. The applicant commits to implementing a spill prevention and cleanup plan that includes rapid response cleanup and remediation programs to minimize impacts on soils and groundwater. In addition, preventive measures, such as NRC-required mechanical integrity testing and UIC permits obtained from EPA, will limit the likelihood of well integrity failure during operations, and hence, will minimize the risk of process fluid leaks from operational wells into aquifers.

The applicant's proposed land application areas in the Dewey area and in the Burdock area (see Figure 2.1-12) cover approximately 426 ha [1,052 ac] of the permitted land. These areas include all normally operating irrigation pivots, standby irrigation pivots, and areas constructed to contain surface stormwater runoff. In the Dewey area, the proposed land application sites are over confined portions of the Fall River and Chilson aquifers and away from their outcrop areas. In the Burdock area, the easternmost irrigation fields are located downdip of the outcrop area of the Fall River aquifer. The minimum estimated thickness of the Graneros Group in this area is 7.6 m [25 ft] (see Figures 2.1-12 and 3.5-7). Therefore, treated liquid waste applied to the easternmost land application areas is unlikely to recharge the Fall River aquifer due to the presence of the overlying Graneros Group shale. For the rest of the proposed land application sites, the impacts to groundwater will be localized and limited to near-surface (alluvial) aquifers, if they exist underneath the proposed irrigation fields, because alluvial aquifers are separated from the underlying Fall River aquifer by the low permeability, 61-m [200-ft]-thick Skull Creek shale. As discussed in SEIS Section 4.5.2.1.1.2.1, the applicant has proposed to remove all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011).

As described in SEIS Section 4.4.1.2.2, licensees must ensure that radioactive constituents in liquid effluents applied to land application areas are within allowable release limits (NRC, 2009a). The applicant proposes to treat liquid wastes applied to land application areas so they meet NRC release limit criteria for radiological contaminants, as referenced in 10 CFR Part 20, Appendix B (Standards for Protection Against Radiation) (Powertech, 2011). SDDENR also regulates land application of treated wastewater, requiring the applicant to obtain an approved GDP and comply with applicable state discharge requirements for land application of treated wastewater. State regulations also prohibit surface runoff from permitted land application areas and the GDP will require land application activities to be conducted so that no ponding and runoff of effluent (i.e., wastewater solutions) occurs during these activities. Therefore, the NRC staff conclude that applied treated effluents on land application sites will not introduce additional contamination to the soil or surface runoff that is harmful to human health or the environment.

Due to existing hydrological conditions at the site, and the permitting and regulatory requirements the applicant must meet, NRC staff conclude that potential environmental impacts to groundwater in shallow aquifers from operations for the land application disposal option will be SMALL.

4.5.2.1.2.2.2 Operations Impacts to Production and Surrounding Aquifers

The potential environmental impact to groundwater in the production and other surrounding aquifers is related to consumptive water use and groundwater quality.

Water Consumptive Use

The potential impacts to groundwater in the production and surrounding aquifers due to consumptive water uses—impacts the staff discusses in SEIS Section 4.5.2.1.1.2.2—will also apply during ISR operations for the land application liquid waste disposal option. To summarize, in June 2012 the applicant submitted a water appropriation permit for use of the Madison aquifer. If SDDENR approves the permit application, the applicant will rely largely on Madison aquifer water during ISR operations. Otherwise, the applicant will pump water from the Inyan Kara aquifer to meet operational needs at an estimated sustainable rate of 151 to 246 Lpm [40 to 65 gpm] (Powertech, 2009a, 2010a). Results of numerical groundwater simulations indicate the Inyan Kara aquifer can sustain net extraction rates of up to 363 Lpm [96 gpm] over the 8 year operations phase (Petrotek, 2012). Therefore, NRC staff conclude that the impacts on local aquifers and domestic and livestock wells from consumptive water use during ISR operations will be SMALL. In addition, the applicant will monitor and provide alternative sources of water to landowners in the event of significant drawdown to domestic wells within and adjacent to the proposed project area. After production and restoration are complete and groundwater withdrawals are terminated at the Dewey-Burdock ISR Project, groundwater levels will tend to recover with time. Land application of treated liquid wastes will not require additional consumptive water demands. Therefore, NRC staff conclude that the overall environmental impacts on local aquifers, production aquifers, and domestic and livestock wells from consumptive use during operations for the land application option will be SMALL.

Excursions and Groundwater Quality

Potential impacts to groundwater quality from excursions in the production and surrounding aquifers during ISR operations (discussed in SEIS Section 4.5.2.1.1.2.2) will also be applicable during ISR operations for the land application liquid waste disposal option. Impacts from

horizontal excursions will be SMALL because (i) uranium-bearing production aquifers will be exempted as USDWs through the EPA-issued aquifer exemption in accordance with the criteria under 40 CFR 146.4, (ii) the applicant will be required to submit wellfield operational plans for NRC and EPA approval, (iii) inward hydraulic gradients will be maintained to ensure groundwater flow is toward the production zone, and (iv) the applicant's NRC-mandated groundwater monitoring plan will ensure that excursions are detected and corrected. Impacts from vertical excursions will be SMALL because (i) uranium-bearing production zones in the Fall River and Chilson aquifers are hydrologically isolated from adjacent aquifers by thick, low permeability shale layers (i.e., the overlying Graneros Group and underlying Morrison Formation); (ii) a prevailing upward hydraulic gradient occurs across the major aquifers; (iii) the applicant's required mechanical integrity testing program will mitigate the impacts of potential vertical excursions resulting from borehole failure; and (iv) the applicant commits to properly plugging and abandoning or mitigating any previously drilled wells and exploration holes that may potentially impact the control and containment of wellfield solutions within the proposed project area. Moreover, at the end of ISR operations, the applicant must to initiate aquifer restoration in the production aquifers (i.e., Fall River and Chilson aquifers) to return groundwater to Commission-approved background levels or to NRC-approved alternative water quality levels. Therefore, NRC staff conclude the impact to groundwater quality from potential horizontal and vertical excursions will be SMALL.

The applicant proposes land irrigation areas in both the Dewey and Burdock areas of the project (Figure 2.1-12). NRC staff find that no additional contamination will be introduced into the production and surrounding aquifers due to land application of effluents, because (i) the applicant will treat process effluents to meet NRC release limit criteria for radiological contaminants as referenced in 10 CFR Part 20, Appendix B, Table 2, Column 2 and applicable SDDENR release limit requirements before applying them onto irrigation fields and (ii) the irrigation fields are underlain by low permeability shale layers (Graneros Group). Any recharge to the Fall River aquifer from land application of liquid wastes during proposed ISR operations will be remediated as part of restoration activities. As discussed in SEIS Section 4.5.2.1.1.2.1, the applicant has proposed to remove all existing domestic wells within the project area from private use prior to ISR operations (Powertech, 2011). Therefore, NRC staff conclude that the overall environmental impacts to production and surrounding aquifers from potential horizontal and vertical excursions during ISR operations for the land application option will be SMALL.

4.5.2.1.2.2.3 Operations Impacts to Deep Aquifers Below the Production Aquifers

Production zone aquifers at the Dewey-Burdock site are separated from deeper aquifers by a continuous and hydrologically impermeable 30-m [100-ft]-thick section of the Morrison Formation. In addition, there are no known unplugged or improperly abandoned wells or exploratory drills extending from ground surface to aquifers below the Morrison Formation within the project area. Therefore, the NRC staff conclude that, for the land application disposal option, environmental impacts to groundwater in the deep aquifers below the production aquifers from ISR operations will be SMALL.

4.5.2.1.2.3 Aquifer Restoration Impacts

As discussed in the GEIS, the impacts of consumptive groundwater use during aquifer restoration are generally greater than during ISR operations (NRC, 2009a). This is particularly true during the sweep phase, when a larger volume of groundwater is generally withdrawn from the production aquifer. During the sweep phase, groundwater is not reinjected into the

production aquifer and all withdrawals should be considered consumptive. Larger withdrawals will produce larger drawdowns in the production aquifer, resulting in a greater impact on the yields of nearby wells.

As described in SEIS Section 2.1.1.1.4.1.2, the primary method of aquifer restoration for the land application disposal option will be groundwater sweep with Madison Formation water injection (Powertech, 2011). In this method, water from production zones will be pumped to the Burdock central processing plant or Dewey satellite facility for removal of uranium and other dissolved species in ion exchange columns. The partially treated water undergoes radium removal in the radium settling ponds and then disposal in land application areas. The typical liquid waste flow rates for the land application option will be approximately 2,070 Lpm [547 gpm] during concurrent uranium production and aquifer restoration and approximately 1,892 Lpm [500 gpm] during aquifer restoration alone. None of the water recovered from the wellfields will be reinjected back into the wellfields. Instead, makeup water from the Madison Formation will be injected into the wellfields at a flow rate sufficient to maintain the restoration bleed, which will typically be 1 percent of the restoration flow rate (Powertech, 2011).

As described in SEIS Section 4.5.2.1, the applicant submitted a water appropriation permit to SDDENR in June 2012 for groundwater use from the Madison aquifer. However, if the applicant cannot secure a water appropriation for use of Madison aquifer water, the applicant will have to either identify an alternative source of water to meet aquifer restoration water requirements or reduce pumping rates to meet the estimated sustainable net extraction rate from the Inyan Kara Group aquifers, which the applicant estimates is at least 363 to 556 Lpm [96 to 147 gpm] (see SEIS Sections 4.5.2.1.1.1 and 4.5.2.1.1.2.2.). Based on the typical liquid waste flow rates stated in the previous paragraph, reducing the pumping rate to 363 to 556 Lpm [96 to 147 gpm] will extend the aquifer restoration phase. After production and restoration are complete and groundwater withdrawals are terminated, groundwater levels will tend to recover with time. Based on numerical modeling, the applicant estimates that water levels will recover to near pre-operational levels within 1 year after groundwater withdrawals cease (Petrotek, 2012). Thus, the potential long-term environmental impact from consumptive use during the restoration phase for the land application disposal option will be SMALL.

The applicant will implement a restoration monitoring plan to detect and correct horizontal and vertical excursions during aquifer restoration (see SEIS Section 2.1.1.1.4.2). Continued implementation of a leak-detection and spill-cleanup program and preventive measures, such as well mechanical integrity testing, will result in SMALL impacts to alluvial or shallow (near-surface) aquifers. Moreover, restoration to Commission-approved background conditions (or NRC-approved water quality standards) in accordance with NRC license conditions will ensure that groundwater within the exemption boundary will not threaten surrounding groundwater.

Before NRC terminates an ISR source material license, the licensee must demonstrate that there will be no long-term impacts to USDWs. NRC review and approval of the wellfield restoration will ensure that the restoration standards are met and that they are protective of public health and the environment. Although consumptive water use will increase during aquifer restoration, groundwater levels will tend to recover with time after-aquifer restoration activities are complete. As described in SEIS Section 4.5.2.1.1.3, license conditions and applicant commitments will ensure that potential drawdown-induced migration of radiological and hazardous contaminants from abandoned open pit mines (e.g., Triangle pit mine) in the Burdock area through the Fuson Shale into production zones in the Chilson aquifer will not

impact aquifer restoration goals. Therefore, NRC staff conclude that the impacts from aquifer restoration in the Burdock and Dewey areas for the land application disposal option will be SMALL.

4.5.2.1.2.4 Decommissioning Impacts

All impacts to groundwater discussed in SEIS Section 4.5.2.1.1.4 for the Class V injection well disposal option are applicable during the decommissioning phase for the land application liquid waste disposal option. The applicant is committed to implement an emergency response plan to address cleanup of accidental spills and leaks that may occur during decommissioning. The applicant will implement mitigation measures to control erosion and stormwater runoff. The NPDES permit will ensure that stormwater runoff will not contaminate groundwater. After removal of surface structures, the applicant will replace topsoil in previously disturbed areas, recontour the land surface to restore it to a surface configuration to blend with the natural terrain, and seed disturbed areas in wellfields in accordance with the NRC and SDDENR regulations (Powertech, 2009b). Access roads will be reclaimed and restored in a similar manner.

As part of the restoration and reclamation activities, all monitor, injection, and recovery wells at the proposed Dewey-Burdock site will be plugged and abandoned in accordance with SDDENR and EPA UIC regulations (see SEIS Section 2.1.1.1.5.2). The applicant will submit decommissioning plans, including detailed plans for plugging and abandoning wells, to NRC for review and approval. If this process is properly implemented and the abandoned wells are properly isolated from the flow domain, the potential environmental impacts to groundwater from decommissioning for the land application disposal option will be SMALL

4.5.2.1.3 Disposal Via Combination of Class V Injection and Land Application

If the applicant obtains the permit for Class V injection from EPA, but the capacity of the Class V injection wells is insufficient to dispose of all liquid effluents generated at the Dewey-Burdock ISR project, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (SEIS Section 2.1.1.1.2.4.3). In this case, land application facilities and infrastructures will be constructed, operated, restored, and decommissioned as needed, based on the produced volume of liquid effluents exceeding the disposal capacity of the Class V injection wells (Powertech, 2011).

If the capacity of Class V injection wells is sufficient to dispose of all liquid wastes, there will be no need for land application sites, facilities, and infrastructures for irrigation. In this case, environmental impacts will be avoided to shallow aquifers underneath the irrigation fields, if they exist, in the Burdock and Dewey areas and to the Fall River aquifer in the easternmost land application fields in the Burdock area near its outcrop. Therefore, the resultant environmental impacts to near-surface aquifers will be smaller than when partially or fully developed land application sites are needed for disposal of liquid wastes. Similarly, environmental impacts to shallow aquifers during ISR operations and aquifer restoration will be larger for fully developed irrigation sites than partially developed irrigation sites. However, because shallow aquifers are of limited extent and will be removed from domestic use prior to ISR operations, NRC staff determine that impacts to shallow aquifers as a result of ISR operations with the combined Class V injection well and land application option will be SMALL.

Impacts to the production aquifers and groundwater wells within the project area from ISR operations and aquifer restoration with the combined disposal option will be similar to those for the Class V injection well disposal option alone or for the land application option alone, because (i) the production aquifers are overlain and underlain by a thick, hydrologically impermeable shale layer over most of the project site, except for the eastern part of the Burdock area; (ii) the applicant is committed to restricting ISR operations to confined aquifers; and (iii) process effluents will be treated before they are applied on land application areas, and hence, will not introduce additional contamination to the Fall River aquifer at or near its outcrop areas.

Impacts to the deep aquifers from ISR operations and aquifer restoration with the combined Class V injection well and land application option will be similar to those for the Class V injection well disposal option alone, because aquifers proposed for deep well injection do not have hydrogeologic interaction with near-surface or production aquifers.

Therefore, NRC staff conclude that the environmental impacts of the combined Class V injection well and land application option for each phase of the proposed Dewey-Burdock ISR Project will be bounded by the significance of environmental impacts of the Class V injection well option and the land application option, as summarized in Table 4.5-2.

4.5.2.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC will not license the Dewey-Burdock ISR Project and BLM will not approve the applicant's modified Plan and Operations. The Burdock central processing plant and the Dewey satellite facility with their associated infrastructure (i.e., access roads and piping) will not be constructed. Furthermore, wellfields, surface impoundments, Class V injection wells, and land application sites will not be developed or operated. Lixiviant will not be injected into the production aquifer. Consumptive use of groundwater will not occur. Liquid effluent waste will not be generated; therefore, there will be no threat to groundwater quality. Wells that have already been constructed will be plugged and abandoned to prevent potential degradation and contamination. The current land uses on and near the project area, including grazing lands and recreational activities, will continue. Consequently, the No-Action alternative will result in no impacts to groundwater.

4.6 Ecological Resources Impacts

As discussed in GEIS Section 4.4.5, potential environmental impacts to ecological resources, including both flora and fauna, could occur during all phases of the ISR facility lifecycle (NRC,

Table 4.5-2. Significance of Environmental Groundwater Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

2009a). Impacts could include removal of vegetation from the site (with the associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); modification of existing vegetative communities as a result of site activities; loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Impacts to wildlife could include loss, alteration, and/or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species could be affected by disturbance of stream channels, increases in suspended sediments, fuel spills, and habitat reduction.

GEIS Construction Phase Summary

As discussed in GEIS Section 4.4.5.1, during construction, terrestrial vegetation may be affected through (i) the removal of vegetation from the milling site (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (ii) the modification of existing vegetative communities; (iii) the loss of sensitive plants and habitats as a result of clearing and grading; and (iv) the potential spread of invasive species and noxious weed populations. (NRC, 2009a)

The percentage of vegetation removed and land disturbed by construction activities evaluated in the GEIS (from less than 1 percent up to 20 percent) will cause a SMALL impact compared to the total permit area and surrounding plant communities. The GEIS evaluated ISR facilities that ranged in facility size from 1,000 to 7,000 ha [2,471 to 17,297 ac] with disturbed area estimates of 49 to 753 ha [120 to 1,860 ac]. Additionally, NRC staff concluded in the GEIS that clearing of herbaceous vegetation in an open grassland or shrub steppe community was expected to have a short-term SMALL impact, given the rapid colonization of annual and perennial species in the disturbed areas. The clearing of wooded areas could have a long-term impact given the pace of natural succession, and such impacts could range from SMALL to MODERATE, depending on the amount of surrounding woody areas. Noxious weeds will be expected to be controlled with appropriate spraying techniques, and therefore impacts will be SMALL. (NRC, 2009a)

GEIS evaluation of impacts during construction included terrestrial wildlife that may be affected through (i) habitat loss or alteration and incremental habitat fragmentation, (ii) displacement of wildlife from project construction, and (iii) direct and/or indirect mortalities from project construction. NRC staff noted in the GEIS that construction impacts to wildlife habitat will be minimized with the timely reseeding of disturbed areas following construction. In general, wildlife species will be expected to disperse from the proposed license area as construction activities approached, although smaller, less mobile species could perish during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities will be possible; thus, the potential impact on terrestrial wildlife from construction could range from SMALL to MODERATE. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.5.2, wildlife habitats could be altered by operations (fencing, traffic, and noise), and limited wildlife mortalities could occur due to conflicts between species habitat and operations. Fencing could limit access to crucial wintering habitat and water. South Dakota does not specify fencing construction. However, SDGFP field and regional personnel evaluate fencing construction design on a case-by-case basis, which may minimize impediments to big game movement (SDGFP, 2008). NRC staff noted in the GEIS that potential impacts to vegetation may occur as a result of land application of wastewater,

increasing vegetation growth and/or negatively affecting vegetation from the build-up of salts in the soils. Licensee requirements to monitor and control irrigated areas will limit impacts to ensure release limits are met (NRC, 2009a).

As further indicated in GEIS Section 4.4.5.2, temporary contamination or alteration of soils could occur from operational leaks and spills and possibly from transportation or land application of treated wastewater. However, detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soil will limit the magnitude of impacts to terrestrial ecology. The implementation of spill detection and response plans will mitigate impacts to aquatic species from spills around well heads and from pipeline leaks. Mitigation measures, such as SDGFP-recommended fencing and netting for ponds (SEIS Section 1.7.3.7), leak detection and spill response plans, and periodic wildlife surveys, will also limit the potential impact, and the NRC staff concluded in the GEIS that the impact to wildlife and vegetation will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

GEIS Section 4.4.5.3 describes potential impacts to ecological resources during the aquifer restoration phase that are similar to operations. These impacts could include habitat disruption, spills and leaks, and animal mortalities. Because existing (in-place) infrastructure will be used during aquifer restoration, little additional ground disturbance will occur, and therefore potential impacts will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

NRC staff concluded in the GEIS that land use impacts from decommissioning an ISR facility will be comparable to, but overall less than, those described for construction and will further decrease as decommissioning and reclamation proceed. As described in GEIS Section 4.4.5.4, during decommissioning and reclamation, there will be temporary land disturbance from soil excavation, recovery and removal of buried piping, and demolition and removal of structures. Wildlife will be temporarily displaced, but will be expected to return after decommissioning and reclamation are complete and vegetation and habitat are reestablished. Wildlife could come in conflict with heavy equipment or vehicles. Decommissioning and reclamation activities could also result in temporary increases in sediment load in local streams, but aquatic species will recover quickly as sediment load decreases. However, revegetation and recontouring will restore habitat previously altered during construction and operations. Land that is used for irrigation will be included in decommissioning surveys to ensure potentially impacted (contaminated) areas will be appropriately characterized and remediated, as necessary, in accordance with NRC regulations. As a result, the potential impacts to ecological resources during decommissioning are expected to be SMALL. (NRC, 2009a)

Potential environmental impacts to ecological resources from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are provided in the following sections.

4.6.1 Proposed Action (Alternative 1)

The staff's ecological impact analysis for the proposed Dewey-Burdock ISR Project site involves evaluating interactions between the proposed project activities and the local animals and habitat that could be affected by the project. If an applicant or licensee adhered to recommended

standard management practices from appropriate agencies, the potential ecological impacts could be mitigated as discussed in the following sections. NRC staff correspondence is ongoing throughout the SEIS process for the proposed project. BLM's 1986 Resource Management Plan (RMP) for South Dakota is currently being revised. The most recent, working BLM mitigation and reclamation guidelines (BLM, 2012a) were made available to NRC staff and are incorporated into this SEIS.

ISR facility lifecycle phases can have direct and indirect impacts on local habitat and wildlife populations. These impacts are both short-term (lasting until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). However, long-term impacts are not expected to be substantial due to the relatively limited habitat disturbance associated with the ISR extraction method. Because of increased traffic levels and physical disturbance during the construction phase, injury or mortality to wildlife will be more likely than during any of the other waste project phases. Plant and animal community alteration will be greatest under the land application option because of the large amount of land {about 308 ha [760 ac]} that will receive treated liquid waste annually from April through October.

4.6.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on ecology from construction, operations, aquifer restoration, and decommissioning associated with the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.6.1.1.1 Construction Impacts

The construction phase of the proposed Dewey-Burdock ISR Project could potentially impact ecological resources from clearing vegetation; constructing the central processing plant and the satellite facility; developing the holding ponds and wellfields, including drilling wells and laying pipeline; building header houses; and constructing access roads. Construction activities will also result in an increase in vehicular traffic and the potential for animal collisions with vehicles. There will also be a temporary increase in dust from construction, some of which will deposit on vegetation, both on- and offsite, affecting the ability for obligate species to forage. However, vegetation in this naturally dusty, arid region will likely have adapted to moderate, temporary increases of dust coverage. Potential impacts on wildlife from dust adjacent to access roads and disturbed land near the plant site will be limited by applicant dust control measures, such as water application (Powertech, 2009a). However, fugitive dust will still be generated from travel on unpaved roads and disturbed land (see fugitive dust analysis in SEIS Sections 4.7.1.1.1 and 4.7.1.2.1), and therefore localized areas will likely experience short-term and intermittent dust accumulation potentially affecting wildlife.

The applicant's implementation of the road and right-of-way, SDGFP-recommended fencing and netting for ponds (SEIS Section 1.7.3.7), post-construction restoration/reclamation measures, as well as those measures intended to reduce human disturbance and incidental wildlife mortalities, will minimize impacts on wildlife. The standard recommended construction mitigation measures including perimeter fencing, netting, leak detection and spill response plans, erosion controls, and other BMPs described elsewhere in the SEIS will also minimize overall ecological impacts. BLM (2012b–d) has determined wildlife timing stipulations for certain species to protect their populations and habitats (in the table in the Raptors section). The

applicant plans to initiate construction activities outside the recommended time restriction periods (Powertech, 2009a); however, activities will continue year round within the area of approved disturbance (e.g., wellfield patterns, roads, plant areas). BLM South Dakota wildlife timing restrictions are included in the table in the Raptors section.

4.6.1.1.1.1 Construction Impacts on Terrestrial Ecology

The terrestrial ecology of the proposed Dewey-Burdock ISR Project is discussed in the following sections. Potential impacts to vegetation and wildlife from construction for the deep Class V injection well disposal option are described in Sections 4.6.1.1.1.1.1 and 4.6.1.1.1.1.2, respectively.

4.6.1.1.1.1.1 Construction Impacts on Vegetation

For the deep Class V injection well disposal option, the applicant estimates that the land disturbed will be approximately 42 ha [103 ac] excluding wellfields (Powertech, 2010a). Potential wellfields will disturb an additional 57 ha [140 ac]. The wellfields, Burdock central plant, Dewey satellite plant, and deep Class V injection wells at the proposed project will be located primarily within the upland grassland and greasewood shrubland vegetation communities, and smaller disturbed areas within the big sagebrush shrubland, silver sagebrush shrubland, and ponderosa pine woodland communities. Table 4.6-1 provides the land disturbance by vegetation type for the Class V injection well disposal option. Figure 4.6-1 depicts the planned activities in relation to the vegetation communities.

Direct impacts from construction activities at the proposed project for the deep Class V injection well disposal option will include vegetation disturbance (modification of structure, species composition, and areal extent of cover types) of about 98 ha [243 ac]. Indirect impacts will include the short-term and long-term increased potential for noxious species [e.g., Canada thistle (*Cirsium arvense),* houndstongue *(Cynoglossum officinale)*, and field bindweed

Table 4.6-1. Disturbed Land by Vegetation Type for Dewey-Burdock Deep Class V Injection Well Disposal Option

Activity	Vegetation Community (Hectares [acres])							Total Disturbed Area Hectares [acres]
	Big Sage-Brush Shrub-Land	Cotton-wood Gallery	Grease-wood Shrub-land	Mine Pit	Ponderosa Pine Wood-land	Silver Sage-Brush Shrub-land	Upland Grass-land	
Site Facilities	0.8 [2]	0	3.2 [8]	0	0.4 [1]	0	5.7 [14]	9.7 [24]
Trunklines	2.4 [6]	0	2.4 [6]	0	1.2 [3]	0.8 [2]	3.2 [8]	10.1 [25]
Access Roads	2.0 [5]	0	2.0 [5]	0.4 [1]	0.8 [2]	0.4 [1]	2.4 [6]	8.5 [21]
Well Fields	8.5 [21]	0	18.2 [45]	2.0 [5]	8.5 [21]	4.4 [11]	15.0 [37]	56.6 [140]
Impound-ments	0	0	4.1 [10]	0	0	0	9.3 [23]	13.3 [33]
Totals	13.8 [34]	0	29.9 [74]	2.0 [5]	10.9 [27]	5.7 [14]	36.0 [89]	98.3 [243]
Source: Powertech 2012a								

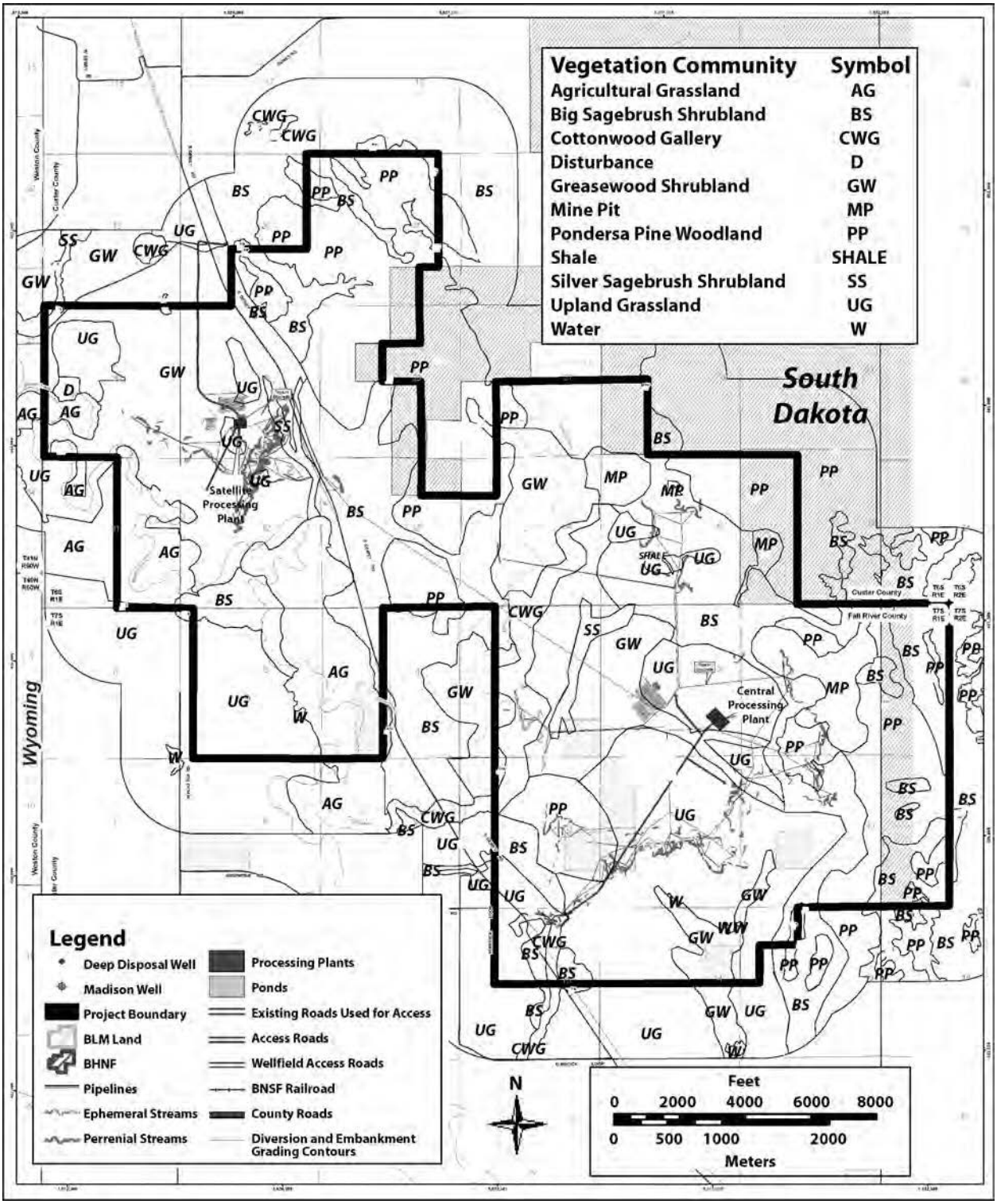

Figure 4.6-1. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Deep Class V Injection Well Disposal Option (Source: Powertech, 2012a)

(*Convolvulus arvensis)*] invasion, establishment, and expansion; potential soil erosion; shifts in species composition or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics.

As previously stated, the construction activities, increased soil disturbance, and increased traffic during construction for the Class V injection well disposal option could stimulate the introduction and spread of undesirable, invasive, nonnative species within the proposed license area. One state- and two county-listed noxious weeds, Canada thistle and field bindweed, respectively, were observed in the proposed project area during the applicant-conducted baseline surveys. These species are perennial and may quickly invade large areas depending on the season of the year. The applicant has proposed mitigation measures, which include conducting weed control as needed to limit the spread of noxious, invasive, and nonnative species on disturbed areas (Powertech, 2009a). If the applicant uses herbicides as a weed control method, the applicant should take precautions to minimize potential impact to the environment. Herbicides can drift to unintended areas due to wind and soil erosion, eliminate desired species from an area, and leave soil susceptible to erosion if not used and managed properly. For example, herbicides formulated with surfactant are toxic to fish and aquatic life and should not be used in or near water (Zollinger, 2012). Plant and wildlife species could be unintentionally impacted during normal application from indirect contact of herbicide residue and consumption of prey affected during application. South Dakota State University published a 2013 weed control guide (Moechnig, et al., 2012) for pastures and range land with recommended techniques, herbicides, and precautions to control regional noxious, invasive, and nonnative vegetative species that the applicant could employ. Applicant use of weed control techniques that incorporate South Dakota State University weed control guidance (Moechnig, et al., 2012) and BLM mitigation and reclamation guidelines (BLM, 2012a) will reduce potential impacts to wildlife and desirable vegetation from use of herbicides.

In areas where vegetation was removed, the applicant has committed to reestablish vegetation concurrently with construction activities according to NRC licensee requirements to conduct reclamation under an approved site reclamation plan (Powertech, 2009a). For the proposed Dewey Conveyor project, BLM concluded that reestablished vegetation in this region often consists of annual forbs and native cool grasses with few shrubs for the first couple of years (BLM, 2009). Reestablishment of herbaceous plant cover can usually be completed within a few years, but reestablishment of shrubland communities may take much longer. SDDNER recommends that the large-scale mine permit include conditions requiring (i) concurrent and interim reclamation in all areas where mining or land disturbance is completed; (ii) that revegetation success be equivalent to vegetative cover in reference areas using SDDENR-approved statistical methods; and (iii) that a post closure bond be held for 30 years after the reclamation bond is released to help ensure revegetation success. However, final permit conditions may change based on the final determination by the hearing board.

If active revegetation measures are used with Natural Resource Conservation Service (NRCS)-, SDDENR-, and BLM-approved seed mixtures, rapid colonization by annual and perennial herbaceous species in the disturbed staging areas and rights-of-way will restore most vegetative cover within the first growing season (NRC, 2009a). On BLM land, BLM reclamation guidelines will be required to provide for stable soils and achieve vegetation cover; however, the exact species is not necessarily required, similar to the predisturbance cover (BLM, 2012a). BLM could require the applicant to reseed areas where initial seeding was not successful. Reclamation and reseeding, as soon as practicable following project completion, in accordance with a reclamation plan will ensure that vegetative communities are restored as

quickly as possible. To stabilize soils and support the ecosystem, the applicant commits to reestablishing, as soon as conditions allow, vegetation in disturbed areas with the BLM-, NRCS-, and SDDENR-approved native seed mixture and rate provided in Table 4.6-2 (Powertech, 2009a, 2012b).

Construction of wellfields will be phased and some vegetation will be affected, but impacts will not generally affect a sizeable segment of any species' population. In general, vegetation development in the region is expected to be sparse due to the limited amount of annual precipitation. To mitigate the potential impact to vegetation, disturbed areas will be both temporarily and permanently revegetated and tilled where soil has been compacted to promote vegetation growth in accordance with SDDENR regulations and the mine permit (Powertech, 2009a). Some encroachment from native populations and/or establishment of early successional species bordering disturbed areas will also be expected, which will facilitate the revegetation process. Additionally, the applicant will take mitigative measures to minimize the spread of noxious weeds (Powertech, 2009a).

No federally listed threatened or endangered plant species are known to occur within the proposed project area (FWS, 2010). Therefore, the NRC staff conclude the impact on federally listed plant species during the construction phase will be SMALL, based on the foregoing analysis that about 98 ha [243 ac] of vegetation will be disturbed primarily in the upland grassland and greasewood shrubland vegetation communities. The applicant commits to mitigation measures that will reduce the overall impacts, but vegetation could still experience long-term impacts especially within the sagebrush shrubland communities. The NRC staff conclude construction impacts on vegetation for the deep Class V injection well disposal option will be SMALL.

4.6.1.1.1.1.2 Construction Impacts on Wildlife

As described in SEIS Section 1.2, the total amount of BLM-managed land expected to be disturbed by the applicant over the life of the proposed project is 4.7 ha [11.63 ac]. The majority of the disturbed BLM land consists of the upland grassland vegetation community southwest of the central processing plant in the Burdock area. A proposed access road will border BLM land in

Table 4.6-2. Reclamation Seed Mixture

Reclamation Seed Mixture Species*	Drill Seeding Rate {kg/ha [lb/ac]}	Broadcast Seeding Rate {kg/ha [lb/ac]}
Western Wheatgrass (*Elymus smithii)*	2.17 [1.94]	5.43 [4.85]
Sideoats Grama (*Bouteloua curtipendula*)	1.62 [1.45]	4.06 [3.62]
Green Needlegrass (*Nassella viridula*)	1.62 [1.45]	4.06 [3.62]
Slender Wheatgrass (*Elymus trachycaulus)*	1.58 [1.41]	3.94 [3.52]
Little Bluestem (*Schizachyrium scoparium*)	1.02 [0.91]	2.54 [2.27]
Totals	8.02 [7.16]	20.06 [17.90]

*Pure live seed
Source: Powertech, 2012b

the greasewood shrubland vegetation community. A proposed "restoration line" will traverse a corner of BLM land in the big sagebrush shrubland vegetation community outside of the ISR project boundary.

Planned land disturbance of about 98 ha [243 ac] during construction will be noncontiguous acres composed of the Burdock central plant, the Dewey satellite plant, and associated storage facilities; deep Class V disposal wells; wellfields and the associated infrastructure (e.g., pipelines and header houses); and new access roads. Most of the habitat disturbance will consist of scattered, confined drill sites for wells in the wellfields, which will not result in large expanses of habitat being dramatically transformed from their original character as in surface mining operations.

Indirect impacts could occur from displacement of wildlife from increased noise, traffic, or other disturbances associated with the development of the proposed project and from small reductions in existing or potential cover and forage due to habitat alteration, fragmentation, or loss. Indirect impacts typically persist longer than direct impacts. However, ISR uranium extraction does not generally involve large-scale habitat alteration.

Certain vegetative communities that exist in the proposed license area could be difficult to reestablish through artificial planting and natural seeding, and recovery could take many years. Consequently, wildlife species associated with specific habitats, such as blue grama (*Bouteloua gracilis)* grasslands and big sagebrush, could be reduced in number or replaced by generalist species with broader habitat requirements until natural reseeding of certain vegetation occurs or reclamation matures to its target mix. The proposed project area is dominated by big sagebrush shrubland followed by greasewood shrubland, ponderosa pine woodland, and upland grassland. The latter three vegetative communities are almost equal in area. The wildlife species using these habitat types are limited in their occurrence in the proposed license area (see SEIS Section 3.6.1.2), and because the actual surface disturbance will be small and noncontiguous, negative impacts to these wildlife species will be SMALL. In addition, the NRC staff conclude that construction impacts resulting from habitat loss or alteration, displacement of wildlife, and mortality due to encounters with vehicles or heavy equipment at the proposed project will be SMALL. The applicant commits to impose and enforce speed limits during all ISR phases to reduce impacts to wildlife throughout the year and particularly during the breeding season (Powertech, 2009a, Section 5.5). To mitigate habitat disturbance, the applicant will use existing roads when possible and limit construction of new primary and secondary roads to provide access to more than one drill site (Powertech, 2009a). In addition, the applicant will restore areas where topsoil has been replaced and construct brush piles and rock piles to enhance wildlife habitat (Powertech, 2009a).

<u>Big Game</u>

Pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), and elk (*Cervus elaphus*) are the four most common big game species that occur within the proposed project area, and bighorn sheep (*Ovis canadensis*) and mountain lions (*Felis concolor)* are predicted to be in the vicinity of the site. As described in Section 3.6.1.2.1, no crucial big game habitat or migration corridors occur on or within at least 1.6 km [1 mi] of the proposed Dewey-Burdock ISR Project (SDGFP, 2010a; BLM, 2011).

Pronghorn antelope, mule deer, white-tailed deer, and elk in the project area could be directly affected by the disturbance of a portion of yearlong range, loss of forage, and vehicular collision

accidents. For the deep Class V injection well disposal option, an estimated maximum of 98 ha [243 ac] will be incrementally disturbed during the life of the proposed project. Pronghorn antelope will be the most impacted big game species because they are the most common within the project area. Pronghorn antelope are sagebrush obligates occupying shrubland habitat year round and eating shrubs. Shrubland vegetation communities cover about 45 percent of the proposed project areas. Mule deer are also found in the project area all year and eat shrubs, but mule deer also enjoy grassland and riparian vegetation habitats and eating grasses and forbs. Elk compete seasonally with horses and cattle in the grassland vegetation community for their preferred food in spring and summer, and are found mostly in the ponderosa pine woodland habitat on the proposed site in fall and winter. Grassland and pine woodland habitats together comprise about 22 percent of the proposed project area. White-tailed deer, the least common big game species in the proposed project area, prefer the treed cottonwood gallery vegetation habitat, which comprises about 2 percent of the proposed project area. (Powertech, 2009a)

Because of these habitat disturbances, the yearlong range-carrying capacity for big game will be reduced over the life of the ISR facility. The SDDENR large scale mine permit will require that reclaimed rangeland is capable of withstanding proper (animal) stocking rates for two consecutive years after the life of the ISR facility prior to bond release. During the construction phase of the proposed project, the projected daily traffic on Dewey Road, the road nearest the proposed site, is estimated to increase by approximately 182 percent (see SEIS Sections 4.3.1.1). This increase in traffic will increase the potential for traffic collisions and wildlife or livestock kills. However, direct impacts to pronghorn antelope, mule deer, white-tailed deer, and elk will be SMALL because the continued existence of the species will not be threatened as a result of vehicle collisions.

Indirect impacts to pronghorn antelope, mule deer, white-tailed deer, and elk could include displacement into surrounding areas from increased human activity, noise, lighting, and the increased potential for poaching and/or harvest from improved access via new roads. Migration of these species toward the Black Hills may also increase predation from other animals. Mountain lions present in the Black Hills prey on white-tailed deer, mule deer, elk, bighorn sheep, and mountain goats (SDGFP, 2010b). The human presence during construction could affect big game use of adjacent areas. Some short-term disturbance (during the lifecycle of the ISR facility) of big game habitat could occur because of the proposed project construction. Adequate big game habitat exists in the surrounding area; these species could return to the areas affected by construction once these activities were completed. The proposed staged reclamation of disturbed areas will provide grass and forage within a few years of habitat disturbance. To the extent practicable, the applicant has proposed implementing speed limits within the proposed project area and fencing to permit big game passage as mitigative actions, and vegetative forage losses from construction will be mitigated by the applicant's plan for staged reclamation of disturbed areas to further reduce big game conflicts associated with the proposed construction activities (Powertech, 2009a). NRC staff conclude that because big game animals are highly mobile species and staff does not expect long-term effects on big game populations from the deep Class V injection well disposal option, the potential impacts to these species during the construction phase will be SMALL.

Upland Game Birds

The only upland game birds observed within the proposed Dewey-Burdock ISR Project area are the wild turkey (*Meleagris gallopavo*) and mourning dove (*Zenaida macroura*), which are

common in the region. Mourning doves are the most abundant game bird in South Dakota and can be found across fields to woodlands and residential areas. Doves are opportunists and eat the seeds of grasses, forbs, and crops as they ripen, changing their feeding habits as different foods become available (SDGFP, 2009a). Essentially all of South Dakota and Wyoming provides habitat that support mourning doves, including the area that surrounds the proposed license area; therefore, the proposed project will not threaten the continued existence of mourning doves.

Within the proposed project area, wild turkeys will most likely use the cottonwood gallery and ponderosa pine vegetative communities, woody draws, and riparian areas along Beaver Creek for roosting, feeding, nesting, and brood rearing (SDGFP, 2009b). Hens will also select the upland grassland community for nesting if tall grasses were present (SDGFP, 2009b). While woody corridors are not abundant in the proposed project area, they also are not unique in the surrounding area. Black Hills National Forest (BHNF) borders the proposed project area to the east and provides ample habitat that could support displaced turkeys during construction activities. Because turkeys wander great distances and require large areas of suitable habitat, NRC staff do not expect the proposed project construction will impact the general population of wild turkeys.

SEIS Section 3.6.1.2.2 explains that sharp-tailed grouse (*Tympanuchus phasianellus*), ruffed grouse (*Bonasa umbellus*), and Greater sage-grouse *(Centrocercus urophasianus)* could potentially occur in the proposed project area. Greater sage-grouse is the most likely grouse species to potentially be impacted by construction of the proposed Dewey Burdock ISR project because of the regional decline and segmentation of sagebrush habitat. As discussed in SEIS Section 3.6.3, Greater sage-grouse are not reported to occur within 6.4 km [4 mi] of the proposed project boundary. Because NRC staff expect that similar habitat is present in the proposed project area that U.S. Fish and Wildlife Service (FWS) evaluated for the nearby Buffalo Gap National Grassland (described in SEIS Section 3.6.3; 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.

In recent years, BLM and state agencies in the region have developed strategies and management measures to preserve, conserve, and restore the sagebrush habitat to prevent further population decline and prevent the listing of the sage-grouse as threatened or endangered species under the Endangered Species Act (ESA). BLM is in the process of revising RPMs and has initiated scoping to prepare an EIS; this will require detailed studies on proposed and alternative policies, and analysis of how implementation of the policies may affect the environment (BLM, 2012d). The BLM Rocky Mountain Region expects several final EISs to be published in 2014, which may identify new issues and best management strategies for sage-grouse that may also benefit other upland game birds. FWS is required to make a decision in 2015 on whether to propose protecting the species under the ESA (FWS, 2012a). In August 2012, FWS issued a draft report to help achieve sage-grouse conservation objectives before the 2015 decision. Recommendations from these studies could be implemented at the proposed Dewey-Burdock ISR Project when they are finalized and become available.

Portions of the proposed Dewey-Burdock ISR Project site will be disturbed during construction activities; therefore, some birds will be displaced and some temporary habitat loss will occur. The applicant commits to (i) minimize disturbance of surface areas and vegetation, where possible; (ii) minimize construction of new access and secondary roads so more than one drill site can be accessed; and (iii) construct new roads, power lines, and pipelines in the same

corridors to the extent possible to reduce overall disturbance and minimize new surface disturbance (Powertech, 2009a). All lands disturbed by project activities will be concurrently revegetated following approved reclamation practices (Powertech, 2009a), which will restore the habitat loss experienced from proposed construction activities. In addition, the applicant has committed in its application to adhere to regulatory timing and spatial restrictions (noise, vehicular traffic, and human proximity) as a mitigative measure that will decrease impacts during breeding season (Powertech, 2009a). Because the site does not support populations of upland game birds that depend on the site for continued existence and because mitigation measures are expected to limit potential impacts to upland game bids, NRC staff conclude potential impacts to upland game birds during the construction phase for the deep Class V injection well disposal option will be SMALL.

Raptors

Twelve species of raptors were recorded within the proposed license area during Powertech's wildlife survey: bald eagle (*Haliaeetus leucocephalus*) (nested), red-tailed hawk (*Buteo jamaicensis*) (nested), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), turkey vulture (*Cathartes aura*), Cooper's hawk (*Accipiter cooperii*), rough-legged hawk (*Buteo lagopus*), merlin (*Falco columbarius*) (nested), great horned owl (*Bubo virginianus*) (nested), and long-eared owl (*Asio otus*) (nested) (Powertech, 2009a). As explained in SEIS Section 3.6.1.2.3, the burrowing owl (*Athene cunicularia*), northern saw-whet owl (*Aegolius acadicus*), and sharp-shinned hawk *(Accipiter striatus)* could be present in the vicinity of the proposed project area (Peterson, 1995). Although some of these raptors (bald eagle, burrowing owl, ferruginous hawk, and golden eagle) are considered BLM sensitive species, the populations of these species are not imperiled with the exception of the bald eagle, which is a state-threatened species (SDGFP, 2012a). The bald eagle, red-tailed hawk, American kestrel, and northern harrier were the most commonly seen raptor species in the proposed project area and will be the primary raptor species impacted by project activities. Raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the ISR construction phase. Five raptor nests (four active and one unknown) were recorded within the proposed project area during surveys conducted in 2007 and 2008, as summarized by species in SEIS Table 3.6-2 (Powertech, 2009a). Two other nest sites, one inactive and one defended but not confirmed active, occurred within 1.6 km [1 mi] of the proposed license area. As described in SEIS Section 3.6.1.2.2, one active bald eagle nest was reported in 2011 within the proposed project area along Beaver Creek, about 1.6 km [1 mi] west of the proposed Dewey satellite processing plant.

Direct impacts to raptor species for the deep Class V injection well disposal option include displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbances, and potential reduction in prey populations within the project site. Avian collision and electrocution with overhead power lines could occur year round. The potential for eagle collisions with electric transmission lines is considered to be low because their foraging behavior is relatively slow compared to falcons and other raptors. Indirect impacts to raptors could include nesting disruption and displacement of prey species, which may reduce food availability within the area. Nesting success by resident raptors could be reduced from disturbances caused by the proposed ISR construction and associated traffic. Birds may continue to use nest sites as they acclimate to the proposed ISR construction activities and could return to inactive nests in the area. The applicant has committed to adhering to timing

and distance restrictions determined by appropriate regulatory agencies to protect raptor nests during breeding season (Powertech, 2009a). In addition, the applicant has committed to mitigation measures to limit noise and vehicular traffic (Powertech, 2009a) during the construction phase of the proposed project, which will reduce overall impacts to raptors. If a disturbance occurs (called a "take") where birds protected under the conventions are pursued, hunted, shot, wounded, killed, trapped, captured or collected in violation of the Bald and Golden Eagle Protection Act (BGEPA) and/or Migratory Bird Treaty Act (MBTA), the applicant will be required to perform a consultation and mitigation of the take with FWS. The applicant has committed to follow an FWS-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur (Powertech, 2009a). However, NRC staff anticipate there will be fewer direct impacts to raptors compared to a higher potential for indirect impacts. Mitigation measures provided in SEIS Chapter 6 will support the continued nesting success of area raptors and minimize potential direct and indirect impacts.

The applicant could mitigate potential impacts to raptor species from power distribution lines by following the Avian Power Line Interaction Committee guidance to avoid activities near active nests, especially prior to the fledging of young (Avian Power Line Interaction Committee, 2006). In addition, the applicant could site all planned facilities outside of the BLM-recommended buffer zone for all raptor nests identified within the proposed project area and adhere to BLM-recommended timing restrictions presented in table located in Table 4.6-3. Figure 4.6-2 shows the 16-ha [40-ac] areas where raptor nests are located near the proposed project area. The potential wellfield areas in Figure 2.1-6 identify where potential drilling/disruptive activity could occur around each orebody, if a particular orebody were mined. Based on the applicant's intent to follow a raptor mitigation plan and implementation of the mitigative measures previously described, the potential impact to raptor species during the construction phase of the proposed Dewey-Burdock ISR Project for the deep Class V injection well disposal option will be SMALL.

Waterfowl and Shorebirds

Eight avian species associated specifically with water and/or wetlands were observed during baseline surveys conducted at the proposed project site: the American white pelican (*Pelecanus erythrorhynchos*), great blue heron (*Ardea herodias*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), American wigeon (*Anas americana*), killdeer (*Charadrius vociferus*), long-billed curlew (*Numenius americanus*), and upland sandpiper (*Bartramia longicauda*) (Powertech, 2009a). In western South Dakota, long-billed curlew and

Table 4.6-3. BLM Recommended Seasonal Wildlife Stipulations

Affected Areas/Species	Activities and/or Timing Restriction	Restricted Area
Sharp-tailed grouse/greater prairie chicken	Surface use prohibited March 1–June 15 except for operations and maintenance	Within a 3.2-km [2-mi] radius of a lek in nesting/brood-rearing habitat*
	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of an occupied lek*

Table 4.6-3. BLM Recommended Seasonal Wildlife Stipulations (Cont'd)

Affected Areas/Species	Activities and/or Timing Restriction	Restricted Area
	Siting structures that are more than 3 m [10 ft] tall or power lines	Within a 3.2-km [2-mi] radius of nesting areas
Peregrine falcon	Prohibit surface disturbance/occupancy or human activity year round	Within 1.6-km [1-mi] radius of a nest including nests recorded during the preceding 7 breeding seasons*
Bald eagle	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.8-km [0.5-mi] radius of a nest including nests recorded during the preceding 5 breeding seasons*
Golden eagle, osprey, burrowing owl, ferruginous hawk, Swainson's hawk, prairie falcon, other raptors	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of occupied nest*
Greater sage-grouse	December 1–March 31	Within crucial winter range for greater sage-grouse. Routine maintenance, production, and emergency response activities are allowed.*
	March 1–July 1	Within a 3.2-km [2-mi] radius of a lek in general habitat areas. Routine maintenance, production, and emergency response activities are allowed.*
	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of an occupied lek*
Piping plover	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of piping plover habitat*
Interior least tern	Prohibit surface disturbance/occupancy or human activity year round	Within a 0.4-km [0.25-mi] radius of wetlands identified as least tern habitat*
Big game winter ranges	December 1–March 31	Surface-disturbing and disruptive activities in winter ranges*

*The authorized officer may grant an exception, modification, or waiver to a stipulation based on certain criteria
Source: BLM, 2012b,c,d

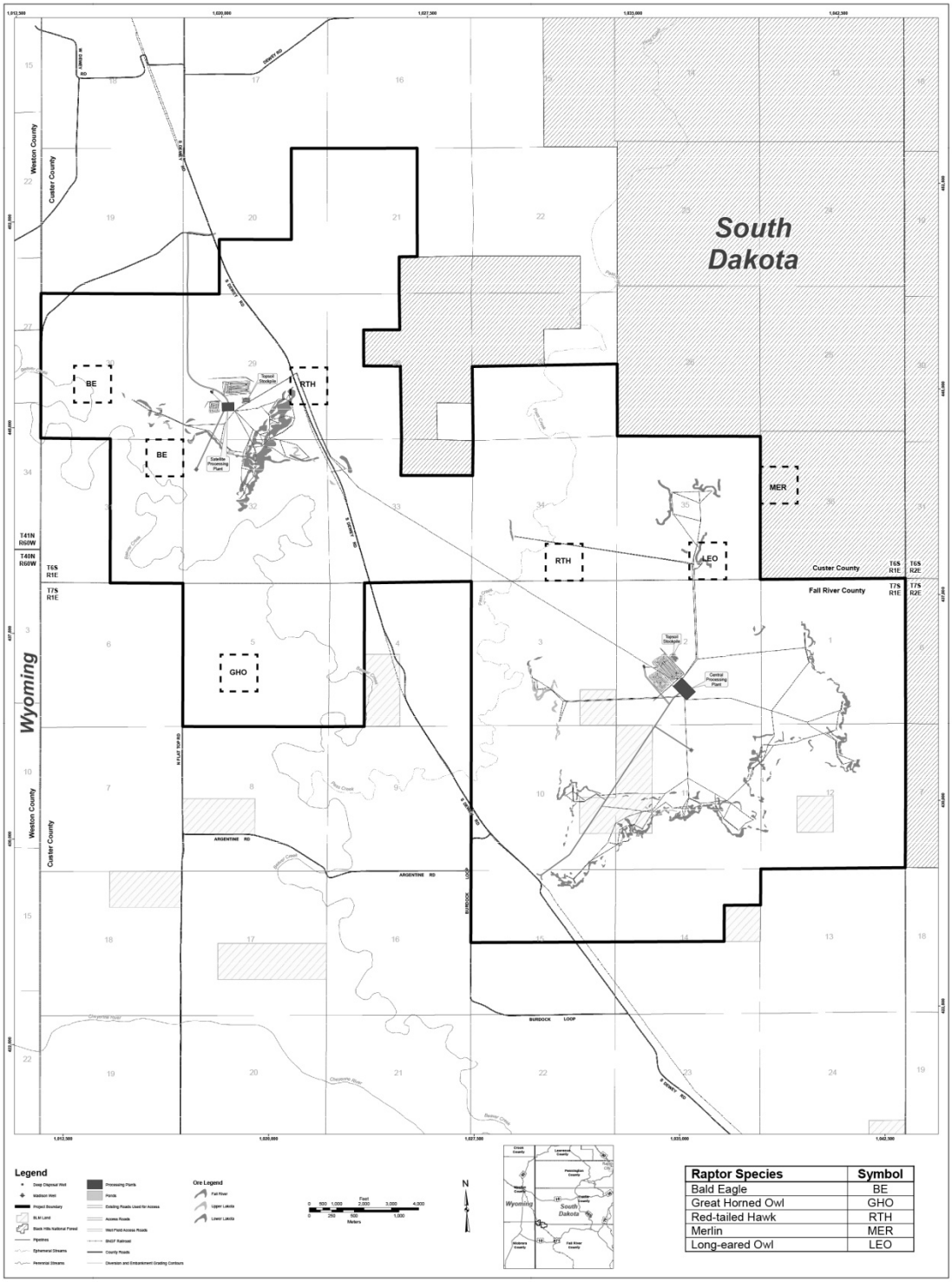

Figure 4.6-2. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Deep Class V Injection Well Disposal Option Sources: BLM, 2012c; SDGFP, 2012c; Powertech, 2012a

upland sandpiper are often found in grasslands, but habitat requirements in this environment are not well known (SDGFP, 2005a). As described in SEIS Section 3.6.1.2.2, the long-billed curlew is a rare species in South Dakota. A large portion of the curlew breeding range occurs in South Dakota, but does not include winter habitat (Fellows, 2009). The continued existence of the species is most threatened by fragmentation, vegetation conversion, and loss of breeding habitat consisting of open, mixed-grass prairie and grazed cattle pastures across its current breeding range (Fellows, 2009). Areas about 0.8 km^2 [0.5 mi^2] or larger of the upland grassland vegetative community {total 885.27 ha [2,187.56 ac]} are found in the Burdock area east of Pass Creek, which is more than in the Dewey area. Construction impacts will affect nesting and breeding curlew the most from early March to mid-July.

At the proposed Dewey-Burdock site, relatively little habitat exists to support large groups or populations of either waterfowl or shorebirds and no breeding waterfowl or shorebirds were observed during wildlife surveys; therefore, NRC does not expect that proposed construction activities for the deep Class V injection well disposal option will destabilize waterfowl or shorebird populations. The applicant has committed to use existing roads when possible and obtain USACE permits when appropriate before construction activities (SEIS Section 4.5.1.1.1.1.). These actions, in addition to reseeding and other mitigation measures explained in SEIS Section 4.6.1.1.1.1, will limit potential long-term impacts to waterfowl and shorebird habitat. Therefore, the potential impact to waterfowl and shorebirds during the construction phase for the deep Class V injection well disposal option will be SMALL.

Construction impacts to nongame and migratory birds for the Class V injection well disposal option are expected to be similar to those discussed for other birds previously described in this section associated with forested, grassland, and shrubland vegetative communities. Some long-term habitat loss {up to about 98 ha [243 ac]} and potential reduction in the carrying capacity for nongame/migratory birds within the proposed project area will occur; however, there is habitat available regionally for displaced animals. Direct impacts will include habitat loss and fragmentation, alteration of plant and animal communities, overhead electric line collisions and electrocution, and increased human activity or noise that could cause collision mortality or the birds to avoid a specific area or reduce breeding efficiency.

Nongame and Migratory Birds

Direct loss of ground nests, eggs, and birds from construction activities could occur; however, these impacts will affect only a few birds and are not expected to have any long-term impacts on the general population of the individual species. NRC expects the proposed project will not influence migratory movement patterns, because most bird species are able to fly over the area without restrictions. Nongame and migratory birds will benefit from mitigation measures described in Chapter 6 because these will limit noise, vehicular traffic, and other human disturbances near these areas. Therefore, the potential impact to nongame and migratory birds during the construction phase will be SMALL.

Other Mammals

A variety of small- and medium-sized mammal species occurs in all the vegetative communities present in the vicinity of the proposed license area, although not all have been observed on the proposed project area itself. These mammals include the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), badger (*Taxidea taxus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), skunk (*Mephitis mephitis)*, porcupine

(*Erethizon dorsatum*), bats (*Myotis* spp.), and weasel (*Mustela* spp.) (Powertech, 2009a). Prey species including rodents (mice, rats, voles, shrews, pocket gophers, ground squirrels, squirrels, chipmunks, prairie dogs), jackrabbits (*Lepus* spp.), and cottontails (hares) (*Sylvilagus* spp.) could also inhabit the proposed project area.

Medium-sized mammals, such as rabbits, coyotes, and foxes, could experience some mortality or be temporarily displaced to other habitats during construction activities. Direct mortality or injury of some ground-dwelling small mammal species (e.g., voles, ground squirrels, mice) could be higher than for other wildlife because of their limited mobility and the likelihood they will retreat into burrows if disturbed. They could potentially be impacted by topsoil scraping or staging activities. However, given the limited, noncontiguous areas that will be affected by topsoil-disturbing construction activities (see Table 4.2-1), NRC expects no major changes or reductions in small- or medium-sized mammalian populations. Indirect impacts from accidental spills will be short term and localized to the impact area. The small- and medium-sized mammal species that occur in the proposed project area have a higher reproductive potential than do more vulnerable wildlife species that require large home ranges and occur in lower densities, such as large mammals (BLM, 2009). Construction disturbance associated with vehicles, equipment, noise, and dust will potentially cause wildlife species associated with all habitat types to avoid the area temporarily during construction activities; however, NRC staff expect that the area will not be uninhabitable after construction ends; therefore, the potential impact to other mammals from construction of the proposed Dewey-Burdock ISR Project will be SMALL. Potential construction impacts to black-tailed prairie dogs (*Cynomys ludovicianus*) and swift fox (*Vulpes velox)*, state endangered and state threatened species, respectively, are detailed in SEIS Section 4.6.1.1.1.1.4.

Reptiles and Amphibians

Three amphibian and one reptile species [boreal chorus frog (*Pseudacris triseriata*), Woodhouse's toad (*Bufo woodhousei*), great plains toad (*B. cognatus*), and western painted turtle (*Chrysemys picta*), respectively], which commonly occur in the region, were observed in the western portion of the project area along Beaver Creek where there are no currently planned activities associated with the proposed deep Class V injection well disposal option (Powertech, 2009a). Several other unidentified lizard species were observed during wildlife surveys conducted at the proposed site in 2007 and 2008 (Powertech, 2009a). The proposed project area provides limited habitat for amphibians and turtles due to the lack of aquatic habitat, which is concentrated along Beaver Creek and in old mine pits that make up about 10 ha [24 ac] of the total 14 ha [35 ac] of wetland habitat within the proposed project area. Within the proposed project area, Beaver Creek is a perennial stream and Pass Creek is an ephemeral stream that supports some intermittent habitat. All Beaver Creek and Pass Creek tributaries are ephemeral. During construction activities, reptile and amphibian species will experience impacts similar to those discussed for small- and medium-sized mammal species, which include loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of vehicular collision.

Because the applicant does not plan to disturb water bodies and perennial streams within the proposed project area (Powertech, 2009a), staff expect that aquatic habitat will not be directly affected by the proposed project activities. In addition, SEIS Sections 4.5.1.1.1.1 and 4.5.1.1.1.2 describe mitigative measures in accordance with NPDES permit requirements; these measures will control the amount of pollutants entering surface water bodies, such as streams, wetlands, and lakes. For these reasons, NRC staff conclude potential impact to amphibian and

regional turtle species and reptiles that require a water body for survival will be SMALL. Other reptiles, such as lizards and snakes that prefer grassland habitat, may be more susceptible to the potential human disturbances previously described. However, due to the small amount of habitat {about 98 ha [243 ac]} that will be disturbed at any given time during the deep Class V injection well disposal option and low likelihood for direct mortalities, staff do not expect construction impacts to measurably affect any reptile species population. Therefore, the potential impact to reptile species during the construction phase will also be SMALL.

4.6.1.1.1.1.3 Aquatic Ecology

GEIS Section 4.4.5.1 discussed impacts to aquatic species that could be temporarily disturbed by in-stream channel activities and concluded the potential impact will be SMALL. Sediment loads in streams are expected to taper off quickly both in time and distance, and long-term impacts will be SMALL. Additionally, SDDENR standard management practices will help to limit impacts to aquatic life. (NRC, 2009a)

Because of the limited and ephemeral nature of surface water at the proposed Dewey-Burdock ISR Project, the occurrence of aquatic species is also limited. Potential impacts to aquatic species at the proposed project site will occur primarily along Beaver Creek, Pass Creek, scattered stock ponds, and drainages. Beaver Creek is a perennial stream that experiences annual low flow conditions (see SEIS Section 3.6) and does not support sensitive species within the proposed project boundary. Further, EPA lists Beaver Creek as an impaired water body partially due to high dissolved and suspended solids (EPA, 2009). 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. The applicant's surface water management plan will limit the loss of aquatic habitat resulting from planned construction activities at the proposed project (Powertech, 2009a).

A baseline level of total uranium was detected in channel catfish during wildlife surveys (SEIS Section 3.6.2). SEIS Section 3.5.1 describes MCL exceedances in surface water samples collected onsite and offsite downstream for gross alpha, uranium, and Ra-226. EPA's national recommended water quality criteria for aquatic life and for human health consumption do not include gross alpha, uranium, or radium (EPA, 2012). No surface water will be diverted, no process water will be discharged into aquatic habitat, and stormwater runoff will be managed through the NPDES permit (as discussed in Section 4.5.1.1). SEIS Section 4.5.2 further describes that EPA requires a Class V UIC permit for deep Class V well injection. EPA will only allow Class V injection if the applicant can demonstrate that liquid waste could be safely isolated in a deep aquifer. In the permitted area, there is no evidence for any hydraulic connection between surface waters and proposed aquifers for the deep Class V injection well disposal option. NRC staff expect planned ISR construction activities, as described in SEIS Section 4.5.1.1, are unlikely to significantly affect surface water quality. Therefore, NRC staff conclude potential impacts to aquatic species and habitats from the construction phase for the deep Class V injection well disposal option will be SMALL.

4.6.1.1.1.1.4 Threatened and Endangered Species

As discussed in GEIS Section 4.4.5.1, if threatened or endangered species are identified on the proposed project site, the potential impact could range from SMALL to LARGE, depending on site conditions. Mitigation plans to avoid and reduce impacts to potentially affected species will be developed. (NRC, 2009a)

The results of wildlife surveys (Powertech, 2009a) have not identified federally listed threatened or endangered species on or within a 1.6-km [1-mi] radius of the proposed Dewey-Burdock ISR Project site; these findings have been confirmed by the FWS (FWS, 2010, 2012b, 2013). NRC staff initially requested information for federally listed species on March 15, 2010 (NRC, 2010c); the FWS provided an initial response on March 29, 2010 (FWS, 2010). NRC staff requested updated information from FWS via e-mail on August 27, 2012; a response was provided the same day (FWS, 2012b). The FWS confirmed the finding made by the applicant that no federal- or state-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats were observed within the proposed project site during baseline wildlife surveys (Powertech, 2009a); therefore, there will be no direct impact to these species (see FWS, 2013). The FWS determination is that the NRC is not required to initiate consultations with FWS under Section 7 of the ESA (FWS, 2013).

SEIS Section 3.6.3 explains that Sprague's pipit (*Anthus spragueii)* could potentially occur in the proposed project area in the upland grassland vegetative community. Based on the information provided in SEIS Section 3.6.3, NRC staff conclude that it is unlikely this species will breed within the proposed project area. In addition, the Sprague's pipit will likely avoid areas near roads, grasslands that have been cultivated, or near the edges of other vegetative community types (FWS, 2011). Because the primary breeding area for this species is north and northeast of the project area and the birds spend winters in the southern half of the United States, NRC staff believe it is reasonable to expect that individual birds may occur in the project vicinity during migration. NRC staff conclude that it is unlikely Sprague's pipit will choose to inhabit the proposed project areas during the proposed ISR facility lifecycle; therefore, direct effects to the species are not expected. NRC staff further conclude that construction activities will not affect the existence of the species' population in the proposed project area.

Whooping cranes *(Grus americana)* currently do not breed in South Dakota; however, the proposed project area is located west of the migration path between Texas and Canada (FWS, 2009). Although construction activities may not directly impact whooping cranes, the potential exists for whooping crane disturbances from proposed mining activities during spring and fall migrations (FWS, 2010). Cranes roost, rest, and forage in relatively shallow wetlands that occur on the proposed project site along Beaver Creek, parts of Pass Creek, mine pits, and depressions, but prefer sites with minimal human disturbance (FWS, 2009). Construction activities at the proposed project may indirectly impact migrating whooping cranes by reducing optimal or preferred resting habitat. NRC staff conclude that migrating whooping cranes will not likely occur at the proposed site based on their traditional migratory pathway (FWS, 2009). If cranes navigate west of the traditional migratory pathway, NRC staff conclude that it is likely cranes will select other appropriate habitat for roosting, resting, and foraging during the proposed ISR facility lifecycle, and that construction activities will not affect the existence of the species' population in the proposed project area.

Bald eagles were observed along Beaver Creek in the western portion of the proposed project area during winter roosting surveys within 1.6 km [1 mi] of the proposed Dewey satellite processing plant (Powertech, 2009a; SDGFP, 2012c). Most recently in 2011, SDGFP confirmed the presence of one active nest along Beaver Creek approximately 1.6 km [1 mi] west of the proposed Dewey satellite plant in a cottonwood tree along Beaver Creek. Active and inactive nests are located within 0.4 km [0.25 mi] of potential Dewey wellfield areas (Powertech, 2009a; SDGFP, 2012a). Although the bald eagle is no longer federally listed as threatened, South Dakota still lists it as a threatened species. As discussed earlier in this chapter, the applicant plans to adhere to regulatory timing and spatial restrictions with regard to construction

activities near raptor nests. In addition, the cottonwood gallery and ponderosa pine woodland vegetative communities where the bald eagles are found will not be physically impacted by the proposed project construction or operations (Powertech, 2009a). Therefore, construction will not directly impact bald eagles. However, eagles nesting nearby or migrating through the area may use the proposed Dewey-Burdock site and surrounding lands for foraging during winter months and may not be able to use these lands during construction until the disturbed areas were reclaimed and prey species returned. The bald eagle is protected under the MBTA and the BGEPA, by which the applicant will have to abide. Although these statutes do not provide for habitat protection, disturbance of eagle habitat that directly takes or kills a bald eagle (such as cutting down a nest tree with chicks present) will constitute a violation of the MBTA, as well as the BGEPA.

Black-footed ferrets (*Mustela nigripes*) are not present in the site vicinity at this time (BLM, 2009a; FWS, 2010; SEIS Section 3.6.3). However, the presence of the black-tailed prairie dog (*Cynomys ludovicianus*) in the northwestern corner of the proposed project area provides potentially suitable habitat for the black-footed ferret. Two other prairie dog towns were observed 1.6 km [1 mi] southwest of the proposed project area. The black-tailed prairie dog is a state endangered and BLM sensitive species (see Tables 3.6-7 and 3.6-8). As discussed in SEIS Section 3.6.3, FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of South Dakota for the purpose of identifying previously unknown ferret populations; therefore, Powertech did not conduct ferret surveys on the proposed Dewey-Burdock ISR Project site. FWS continues to direct federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret. Proposed construction activities may directly impact prairie dogs and habitat for the prairie dog and black-footed ferret within the proposed project boundary that could support populations of these species. Because there have been no occurrences of black-footed ferrets within the proposed project area and the prairie dog colony on the site is likely too small to support and sustain a breeding population of black-footed ferrets (as described in SEIS Section 3.6.3), NRC staff conclude that the proposed project construction will not result in a direct effect on current or future ferret populations.

Potential impacts to sage-grouse, a federal candidate species and BLM sensitive species, were discussed in SEIS Section 4.6.1.1.1.1.2 under Upland Game Birds. Listed threatened or endangered species or candidate animals will not be directly affected by construction activities for the deep Class V injection well option, nor will the habitats of these species' be noticeably altered. Therefore, the NRC staff conclude potential impacts from construction activities on federally listed threatened or endangered species, and candidate or delisted species, will be SMALL.

<u>State and BLM Species of Concern</u>

In addition to the BLM sensitive species listed in Table 3.6-7 that could occur within the proposed project area, the following South Dakota-designated rare animals were observed within the proposed project area during wildlife surveys: long-billed curlew, great blue heron, golden eagle, Cooper's hawk, American white pelican, long-eared owl, merlin, Clark's nutcracker (*Nucifraga Columbiana*), ferruginous hawk, and plains topminnow (*Fundulus sciadicus*) (Powertech, 2009a). State rare and BLM sensitive species are discussed in the following paragraphs.

BLM sensitive species that are found in wetland or grassland/wetland habitats that could occur, but were not observed, during surveys at the proposed site [marbled godwit (*Limosa fedoa*), trumpeter swan (*Plegadis chihi*), willet (*Cataptrophorus semipalmatus*), and Wilson's phalarope (*Phalaropus tricolorl*)] and South Dakota rare animals observed during Dewey-Burdock wildlife surveys (long-billed curlew, great blue heron, and American white pelican in Table 3.6-8) are unlikely to be affected by construction activities because fairly limited suitable habitat exists year round to support large groups or populations of either waterfowl or shorebirds. None of the waterfowl or shorebirds observed during wildlife surveys were breeding; therefore, NRC staff do not expect that proposed construction activities will destabilize sensitive waterfowl or shorebird populations.

Raptors listed as BLM sensitive species that could occur at the proposed site are bald eagle, burrowing owl, ferruginous hawk, golden eagle, peregrine falcon *(Falco peregrines*), and Swainson's hawk (*Buteo swainsoni).* Each of these BLM sensitive species is protected under the MBTA, and the bald and golden eagles are also protected under the BGEPA. Similar to the bald eagle, the peregrine falcon is designated as threatened in South Dakota, but the peregrine falcon was not observed in the proposed project area. The peregrine falcon was once a federally listed species, but it was delisted in 1999. The falcon was presumed to be extirpated from the state by 1980 (USGS, 2006) and is not likely to occur within the proposed project area, although there are recent urban reintroduction efforts to restore the bird to the state (SDGFP, 2012b). Burrowing owls are dependent on large prairie dog towns for food and nesting in western South Dakota (SDGFP, 2005a,b). Several predatory raptor species, such as the ferruginous hawk, feed on prairie dogs and other small vertebrates or burrowing animals found in prairie dog towns. Some raptors, such as the Swainson's hawk, feed primarily on insects. During breeding season, the Swainson's hawk may consume small vertebrates.

State rare raptor species observed in the project area were Cooper's hawk, long-eared owl, and merlin. Each species is also protected under the MBTA. All raptors that occur at the proposed project site will experience potential impacts similar to those described for raptors in SEIS Section 4.6.1.1.1.1.2. Raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the construction period. As described in SEIS Section 4.6.1.1.1.1.2, injury and mortality from encounters with power lines will be minimized by the applicant's proposed use of raptor deterrent products and following regulatory timing and spatial restrictions with respect to construction activities near raptor nests. The applicant has also committed to follow an FWS-approved raptor monitoring and mitigation plan to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur (Powertech, 2009a). Nest abandonment and loss of eggs or fledglings could occur in raptor nests proximate to construction activities, especially during the early nesting period. Because of the presence of raptors within the proposed project area, sensitive and rare raptor species could be disturbed. However, the NRC staff conclude direct impact to raptors is unlikely and the continued existence of the species in the proposed project area will not be threatened due to proposed mitigation measures; these are further detailed in Chapter 6 and include best management practices for monitoring species. The NRC staff conclude the estimated impact on sensitive raptor species during the construction phase for the deep Class V injection well disposal option will be SMALL.

Nongame and migratory birds, such as the Chestnut-collared longspur (*Calcarius ornatus),* dickcissel (*Spiza americana),* and long-billed curlew, may occur within the proposed project area, most likely in the upland grassland vegetative community. The loggerhead shrike (*Lanius ludovicianus)* and blue-grey gnatcatcher (*Polioptila caerulea)* may also occur within the

proposed project area, most likely in the shrubland communities. All of these birds are BLM sensitive species and protected by the MBTA. The gnatcatcher and curlew are also rare state species. Potential impacts from construction on the long-billed curlew and nongame and migratory birds are discussed in SEIS Section 4.6.1.1.1.1.2. NRC staff expect that similar potential impacts described in SEIS Section 4.6.1.1.1.1.2, including injury or mortality from vehicles and electrical lines, fragmentation, vegetation conversion, and loss of breeding habitat, for nongame and migratory birds will also potentially impact chestnut-collared longspur, dickcissel, loggerhead shrike, and blue-grey gnatcatcher. For the proposed Dewey Conveyor Project, which is less than 1.6 km [1 mi] from the proposed Dewey-Burdock ISR Project, BLM staff concluded that while some species reliant on grassland habitat could be displaced, the area contains high density, undisturbed grassland and disturbed grassland species will use similar adjacent habitat (BLM, 2009). The staff also conclude that the grassland habitat in the vicinity of the proposed Dewey Burdock project area will temporarily support grassland species of concern that may be disturbed during construction. Further, NRC staff expect applicant mitigation measures, like those described in SEIS Section 4.6.1.1.1.1.2 and Chapter 6, will prevent destabilization of habitat or populations for these species. Therefore, the NRC staff conclude that potential impacts from construction on chestnut-collared longspur, dickcissel, loggerhead shrike, and blue-grey gnatcatcher will be SMALL.

Clark's nutcracker (*Nucifraga columbiana*), a BLM sensitive species and state rare species, is a nongame bird that was observed flying over the proposed project site during wildlife surveys. Nutcrackers prefer conifer forests (South Dakota Birds and Birding, 2012) and will most likely occur in the ponderosa pine woodland vegetative community in the proposed project site. Black-backed woodpecker (*Picoides arcticus),* veery (*Catharus fuscescens)*, and three-toed woodpecker (*Picoides tridactylus)* are all BLM sensitive species that inhabit forested areas such as the ponderosa pine woodland and cottonwood gallery vegetative communities. The red-headed woodpecker (*Melanerpes erythrocephalus),* a BLM sensitive species and state rare species, inhabits the edge of forested areas near open clearings. All of these birds are protected by the MBTA. NRC staff expect that potential impacts to these nongame and migratory birds associated with forest habitats will be less than those potential impacts described for nongame and migratory birds associated with grassland and shrubland habitats because (i) NRC expects that little to no treed areas will be directly disturbed during construction compared to other habitat types that will experience long-term or permanent impacts; (ii) the applicant has stated that no woody corridors will be disturbed by the proposed activities (Powertech, 2009a); and (iii) potential forest habitat is located in the adjacent BHNF dominated by ponderosa pine and other deciduous trees (Chapman, 2004) that could support displaced birds that depend on forest habitats. Therefore, the staff conclude the potential impact on Clark's nutcracker, black-backed woodpecker, veery, three-toed woodpecker, and red-headed woodpecker during the construction phase will be SMALL.

Two mammals, the black-tailed prairie dog (*Cynomys ludovicianus*), a state endangered species and BLM sensitive species, and the swift fox (*Vulpes velox)*, a state threatened species and BLM sensitive species, could potentially occur within the project area. As described earlier in this section and in SEIS Section 3.6.3, a black-tailed prairie dog colony is located proximate to potential wellfields D-WF3 and D-WF4 in the Dewey area and proposed standby land application sites; therefore potential direct impacts could affect prairie dogs if the wellfields and land application sites are used. A 2008 survey reported that the prairie dog populations more than doubled in Custer and Fall River Counties between 2003 and 2008, and that state prairie dog 2008 conservation population goals were met (Kempema, et al., 2009). Because of management programs to protect the species, prairie dog populations in South Dakota are

stable where the species occurs in most of the western two-thirds of the state (SDGFP, 2012d). According to SDGFP, private landowners and the public are allowed to shoot prairie dogs on private lands to manage the population in prairie dog towns (SDGFP, 2005b). Therefore, NRC expects that management of prairie dogs will be conducted in accordance with applicant and land owner agreements.

The swift fox is typically found in short mixed grass prairies and preys on prairie dogs in addition to other small mammals and their carcasses, birds, insects, reptiles, fruits, and berries (FWS, 2000a). Swift fox are burrowing animals known to dig their own dens or use the burrows of other animals, including those made by prairie dogs. Because of their association with prairie dogs, swift fox that may occur in the proposed project area could be affected by prairie dog control efforts, thereby limiting available food, shelter, and escape cover for swift fox (FWS, 2000a). Other threats include the fact that swift fox are easily trapped or shot and can experience mortality from vehicle collisions (FWS, 2000a). Swift fox have demonstrated the ability to adapt to prairie-agricultural, sagebrush-grassland, and sagebrush-greasewood habitat types and to not be dependent on prairie dog colonies for their food (FWS, 2000a). For the proposed Dewey Conveyor Project, BLM concluded activities may impact individual prairie dogs and swift foxes or their habitat, but will not cause instability in their populations (BLM, 2009). NRC staff also conclude that, based on the reasons previously described in this section, the potential impacts to these species from the proposed Dewey-Burdock ISR Project construction activities will be SMALL.

The banded killifish (*Fundulus diaphanous),* a BLM sensitive species and state endangered species found in the western part of the state, and the northern redbelly dace (*Phoxinus eos*), a BLM sensitive species and state threatened species, were not observed or expected to occur in western South Dakota or Custer or Fall River Counties (SDGFP, 2012c; Table 3.6-7). As discussed in SEIS Section 3.5.1, with the exception of perennial Beaver Creek, the streams within the proposed project area generally only flow during the wet season in response to snow melt or precipitation events. Beaver Creek and Pass Creek do not provide continuous, stable aquatic habitat to support these aquatic species; therefore, NRC staff predict potential impacts to be SMALL.

Table 3.6-7 lists BLM sensitive amphibians, including frogs, and reptile species, including snakes and turtles, that could occur in the proposed project area. The snapping turtle (*Cheldy serpentine)* will be one of the most likely BLM sensitive turtle species to occur in the area (Bandas, 2004), although snapping turtles were not observed during wildlife surveys. This species can be found in any permanent water body in the state and are rarely seen out of the water except for nesting and basking in the sun (Bandas, 2004). The spiny softshell turtle (*Apalone spinifera*) is a state rare species that prefers highly oxygenated, fast flowing rivers, lakes, and streams, but is also found in impoundments and reservoirs (Somma, 2011; Bandas, 2004). As described in SEIS Section 3.6.1.2.3, the applicant reported a spiny softshell subspecies in Beaver Creek during fish surveys downstream of the proposed project area. Turtles usually spend the winter in rivers, lakes, streams, and reservoirs with muddy or sandy bottoms and require soil exposed to sunlight, often near sand or gravel bars, during late spring or summer for a proper nest environment (Somma, 2011). Common toads and frogs were observed during wildlife surveys, but BLM sensitive amphibian species were not reported. For the same reasons explained in SEIS Section 4.6.1.1.1.1.2, NRC concludes potential impact to these sensitive reptiles and amphibians will be SMALL.

Snakes and lizards are generally less dependent than or nondependent on permanent water bodies compared to amphibians. Snakes and lizards could occur within grassland, shrubland, and sometimes woodland habitats depending on the species. The plains or western hognose snake (*Heterodon nasicus*) is a BLM sensitive species that typically burrows into sandy, gravelly, or floodplain areas, but may also occur in agricultural, shrub, and woodland habitats (WGFD, 2010). The Greater short-horned lizard (*Phrynosoma hernandesi*) is also a burrowing BLM sensitive species that prefers grassland and sagebrush habitats (BLM, 2009). Both of these species are known to be distributed within the region, but were not observed during Dewey-Burdock wildlife surveys. As described in SEIS Section 4.6.1.1.1.1.2, potential impacts to reptiles could include loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of equipment encounters and vehicular collision. In addition, snakes can be unnecessarily killed by humans who think snakes are harmful. For example, the hognose snake resembles the rattlesnake and may invoke undue harm (WGFD, 2010), although it is not venomous and does not typically respond to enemies by biting regardless of their dramatic defense display. Construction activities are not planned during the winter months when these species will be hibernating and less responsive to ground-disturbing activities that may result in loss of life. In addition, due to the sequential development and small amount of land that will be disturbed for construction under the deep Class V injection well disposal option {approximately 98 ha [243 ac]}, staff do not expect construction impacts to measurably affect any reptile species population. Therefore, potential impacts to these sensitive reptile species during the construction phase will also be SMALL.

4.6.1.1.2 Operations Impacts

The potential impact to ecological resources during operations under the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project will be consistent with the findings described in the GEIS summarized previously in SEIS Section 4.6. Only minor impacts to vegetative communities will occur because most of the clearing for the ISR facility will have occurred during the construction phase. Invasive and noxious weeds could potentially colonize disturbed areas, but the applicant has committed to monitor and control these. In addition, material spills and failure of settling and holding pond liners or embankment systems could also occur during the operations phase. The applicant has proposed to minimize vehicular access to specific roads and revegetate disturbed areas with an SDDENR- and BLM-approved seed mixture to prevent the establishment of competitive weeds and restore habitat to native species (Powertech, 2009a). There will be less noise and less traffic during the operations phase of the proposed project compared to the construction phase; therefore, the potential to disrupt wildlife populations will be reduced along with a decrease in the probability of vehicular collisions. Wildlife use of areas adjacent to ISR operations will be expected to increase as animals become habituated to site activities. Potential impacts to wildlife, including state and BLM species of concern, during the operations phase will continue to be SMALL because operations will not threaten the continued existence of any particular species in the proposed license area. Leak detection systems, soil monitoring, and spill response plans to remove affected soils and capture released fluids (SEIS Section 4.4.1) will minimize the impact of wildlife exposure to potentially toxic levels of chemicals.

Potential conflicts between active raptor nest sites and operations-related activities, especially the expansion of wellfield areas, will be mitigated by adherence to regulatory timing and spatial restrictions with regard to construction activities near raptor nests.

As described in SEIS Section 2.1.1.1.2.4, the applicant's deep Class V injection well disposal option will require the use of settling and holding ponds. The proposed use of settling and storage ponds presents a potential for wildlife exposure to wastewater solutions. The applicant has proposed predisposal wastewater treatment, including ion-exchange treatment and radium settling, to remove or reduce some of the regulated constituents discharged to the storage ponds (SEIS Sections 2.1.1.1.6.2 and 4.14.1). The proposed wastewater treatment approaches include monitoring the post-treatment water quality to ensure compliance with NRC, EPA, and SDDENR requirements as well as any applicable NRC license conditions (Section 4.14.1). Liquid wastes discharged to settling and holding ponds will be treated to water quality appropriate for discharge injection into permitted Class V (nonhazardous) deep disposal wells (Powertech, 2009a).

To evaluate the potential hazards to wildlife from waste management operations, the NRC staff compared the applicant's estimated concentrations of chemical constituents in the wastewater with aquatic-life and wildlife health effects thresholds. An aquatic life health effects threshold is a concentration of a chemical constituent in water that has been shown to cause health effects in aquatic life based on scientific studies. Selenium, in particular, was identified by the FWS as a constituent of concern in ISR wastewater because of low wildlife health effects thresholds in some sensitive species when compared with concentrations of selenium measured in ISR wastewater (FWS, 2007). The wildlife health effects thresholds described here establish the concentration of a chemical in water that is known to cause health effects in wildlife based on scientific studies.

For this evaluation, the NRC staff compared the applicant's estimated wastewater concentrations with EPA chronic (long-term) exposure-based water quality criteria (guidance) established for the protection of aquatic life (EPA, 2013). The staff found that the estimated concentrations of arsenic and selenium in the injectate the applicant proposes to use exceed the current EPA criteria. Additionally, the applicant's estimated concentrations of selenium exceed levels referenced by FWS (2007) as hazardous to aquatic birds. Based on this comparison, the NRC staff concludes that direct chronic exposure of sensitive species to the applicant's estimated arsenic and selenium concentrations in wastewater (undiluted) could adversely impact exposed individuals. However, NRC staff considers such chronic direct wildlife exposure to undiluted wastewater unlikely because the applicant's proposed wastewater controls (e.g., pond design, leak detection and mitigation, pressure monitoring) and SDDENR permitting requirements will limit direct contact that aquatic life and terrestrial wildlife have with wastewater solutions. The SDDENR controls include limiting access to wastewater with fencing and implementing an avian protection plan for pond operations.

Wastewater storage ponds present an opportunity for wildlife, primarily migratory birds, to have direct contact with wastewater solutions. One detailed wildlife field study of an ISR wastewater irrigation system has been published and observations made in that study identified only limited use of a wastewater storage reservoir by birds (FWS, 2000b). In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant. In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant.

Based on the previous assessment, the potential impact to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds,

nongame/migratory birds, other mammals, aquatic species, and sensitive and protected species) during the operations phase for the deep Class V injection well disposal option will be SMALL and less than that experienced during the construction phase. Therefore, NRC staff predict potential impacts to aquatic species will remain SMALL.

4.6.1.1.3 Aquifer Restoration Impacts

Impacts to ecological resources for the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project during aquifer restoration will be consistent with the impact conclusions described in the GEIS, as summarized in SEIS Section 4.6, and consistent with those potential impacts described previously for the construction phase and the operations phase. Because the existing infrastructure from the operations phase will continue to be used during aquifer restoration and the applicant will continue to apply the mitigation measures described previously, the potential impact to ecological resources will be similar to that described for the operations phase. In addition, the applicant's adherence to the BMPs proposed for seasonal noise, vehicular traffic, and human proximity measures will further reduce potential impacts to ecological resources. Therefore, the potential impact to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, aquatic species, and protected and sensitive species) during aquifer restoration will be SMALL.

4.6.1.1.4 Decommissioning Impacts

The activities resulting in impacts to ecological resources during the proposed Dewey-Burdock ISR Project decommissioning activities under the Class V injection well disposal option are consistent with the activities described in the GEIS as summarized in SEIS Section 4.6. Impacts to ecological resources during the decommissioning phase will be similar to those experienced during the construction phase with respect to noise, traffic flow, and earthmoving activities. However, the decommissioning phase will temporarily disrupt slightly more natural habitat than will have occurred during the construction phase of the ISR process; this is because of an increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Decommissioning and reclamation activities, as described in SEIS Section 4.2 for land use, will primarily be conducted in the previously disturbed areas of the site in accordance with the NRC-approved decommissioning plan and BLM-approved reclamation plan (BLM, 2012a). Affected areas will be revegetated using a final reclamation seed mix developed through discussions with the landowner and approved by the SDDENR and BLM (Powertech, 2009a; BLM, 2012e).

Little loss of vegetative communities beyond those disturbed during construction will be expected during decommissioning. Piping removal will have the greatest impact on vegetation that had reestablished itself since being disturbed during previous ISR phases. The dismantling of the proposed project facilities, infrastructure, and roads, and reseeding and placement/contouring of soil will have impacts similar in scale to the construction phase. SDDNER recommends that the large-scale mine permit require revegetation success be equivalent to vegetative cover in reference areas, using SDDENR-approved statistical methods. In addition, a post closure bond will be held for 30 years after the reclamation bond is released, in order to help ensure revegetation success. However, final permit conditions may change based on the final determination by the SDDENR hearing board. The decommissioning process will be expected to create increased noise, traffic, and sediment runoff as buildings are taken down and hauled away. During this time, wildlife could either come in conflict with heavy equipment

or could move elsewhere due to higher-than-normal noise. As required, the applicant will submit an NRC-approved decommissioning plan and all decommissioning activities will be carried out in accordance with 10 CFR Part 40 and other applicable federal regulatory requirements. Decommissioning of plant facilities at the proposed Dewey-Burdock ISR Project is estimated to take 2 years. Temporarily displaced wildlife could return to the area once decommissioning and reclamation were completed. The applicant's implementation of the previously discussed mitigation measures will further reduce potential impact.

At the proposed Dewey-Burdock ISR Project, the impact from dismantling and decontaminating the central plant, satellite facility, roads, and support facilities will be consistent with the conclusions reached in the GEIS. The potential impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during decommissioning for the deep Class V injection well disposal option will include disturbance of about 98 ha [243 ac] of vegetation, primarily in the upland grassland and greasewood shrubland vegetation communities. Although certain vegetative communities (shrubland) are difficult to reestablish and can take as many as 10 years to achieve full site recovery (WGFD, 2007), the applicant commits to ongoing vegetation reestablishment efforts throughout the ISR facility life cycle. New vegetative growth could be affected by future grazing, droughts, or intense winters, thus reducing the rate of plant productivity and delaying full recovery (WGFD, 2007). For these reasons, NRC staff conclude there will be a MODERATE impact on vegetation from decommissioning and reclamation under the deep Class V injection well disposal option; once vegetation has been reestablished, this impact will be SMALL. Potential impacts to big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species will remain SMALL and comparable to those described for the construction phase. The removal of perimeter fencing will increase big game passage and vegetative forage. As with construction, operations, and aquifer restoration phases, potential impacts to big game during decommissioning will remain SMALL. Potential impact to aquatic species and amphibians will also remain SMALL because of the limited occurrence of surface water, and the applicant's plan to not disturb water bodies located on the proposed project site.

4.6.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Potential environmental impacts on ecology from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.6.1.2.1 Construction Impacts

Planned vegetation disturbance for the land application disposal option is provided in Table 4.6-3. Approximately 566 ha [1,398 ac] of land or 13.2 percent of the proposed permit area will be potentially disturbed by activities associated with construction of facilities, pipelines, wellfields, storage ponds, irrigation areas, and access roads (Powertech, 2012a, 2010a). Disturbance to the vegetative communities will include that described in SEIS Section 4.6.1.1.1.1 for construction under the deep Class V injection well disposal option in addition to disturbance from increased pond capacity totaling approximately 55 ha [136 ac] and irrigation areas for potential land application totaling approximately 425.7 ha [1,052 ac]. The

same area of BLM land will be disturbed during construction for both the deep Class V injection well and land application disposal options.

Figure 4.6-3 shows the planned facilities and vegetation communities for the land application disposal option. The additional ponds in the Dewey and Burdock areas will be located primarily in the greasewood shrubland and upland grassland vegetative communities. Ponds in the Dewey area will also be located in the silver sagebrush shrubland community just west of Dewey Road. Land application areas in the Dewey area will primarily be located in the greasewood shrubland community and a portion within the upland grassland community. The land application areas in the Burdock area will be located in the greasewood shrubland, upland grassland, big sagebrush shrubland, and silver sagebrush shrubland vegetative communities. Table 4.6-4 provides the amount of disturbance in each vegetation community.

During the construction phase, land application piping and pivot installation will create similar impacts described in SEIS Section 4.6.1.1.1.1 including (i) modification of vegetative structure, species composition, and areal extent of cover types (density); (ii) potential invasion, establishment, and expansion of invasive or nonnative species; (iii) potential soil erosion; (iv) reduction of wildlife habitat and livestock forage; and (v) changes in visual aesthetics.

NRC staff expect the center pivot areas to consist of native vegetation or to be converted into agricultural land where alfalfa or salt-tolerant wheatgrass will be planted and grown (Powertech, 2009b); however, application of liquid waste will not begin until the operations phase. NRC expects the applicant or landowners to use earth-moving equipment to clear and till the soil in preparation for planting crops in the land application areas. The applicant will employ similar mitigative measures previously discussed for the deep Class V injection well option to minimize potential construction impacts to vegetation and habitat during construction for the land application option. NRC staff expect potential impacts to vegetation and wildlife from the increased pond capacity totaling approximately 55 ha [136 ac] will not result in measurably higher impacts to wildlife because of the small amount of additional area that will be disturbed. However, combined with the land application areas (including operating and standby center pivot areas and catchment areas) of approximately 426 ha [1,052 ac], greater impacts to wildlife are expected.

As described in SEIS Section 2.1.1.1.2.4.2, the maximum estimated area for land application is 426 ha [1,052 ac] and includes operating irrigation pivots, standby irrigation pivots, and areas constructed to contain surface stormwater runoff. As described in SEIS Section 4.6, the GEIS evaluated ISR facilities that ranged in facility size from 1,000 to 7,000 ha [2,471 to 17,297 ac] with disturbed area estimates of 49 to 753 ha [120 to 1,860 ac] (NRC, 2009a) and land application of treated wastewater. The GEIS concluded that potential impacts from operations during land application will be small, but the GEIS did not evaluate the impacts of planting crops in the irrigation areas prior to land application activities, which could have a greater impact than conducting land application on native vegetation. Because of the long-term direct impacts of approximately 566 ha [1,398 ac] of native vegetation, of which up to 308 ha [760 ac] may be converted into crops, staff conclude impacts to vegetation will be MODERATE.

BLM-managed lands within the project area are not located within proposed irrigation areas and will not experience any additional direct vegetation modification from irrigation activities under the land application disposal option. The applicant may construct fencing around land application areas to control livestock access, which could indirectly increase livestock grazing

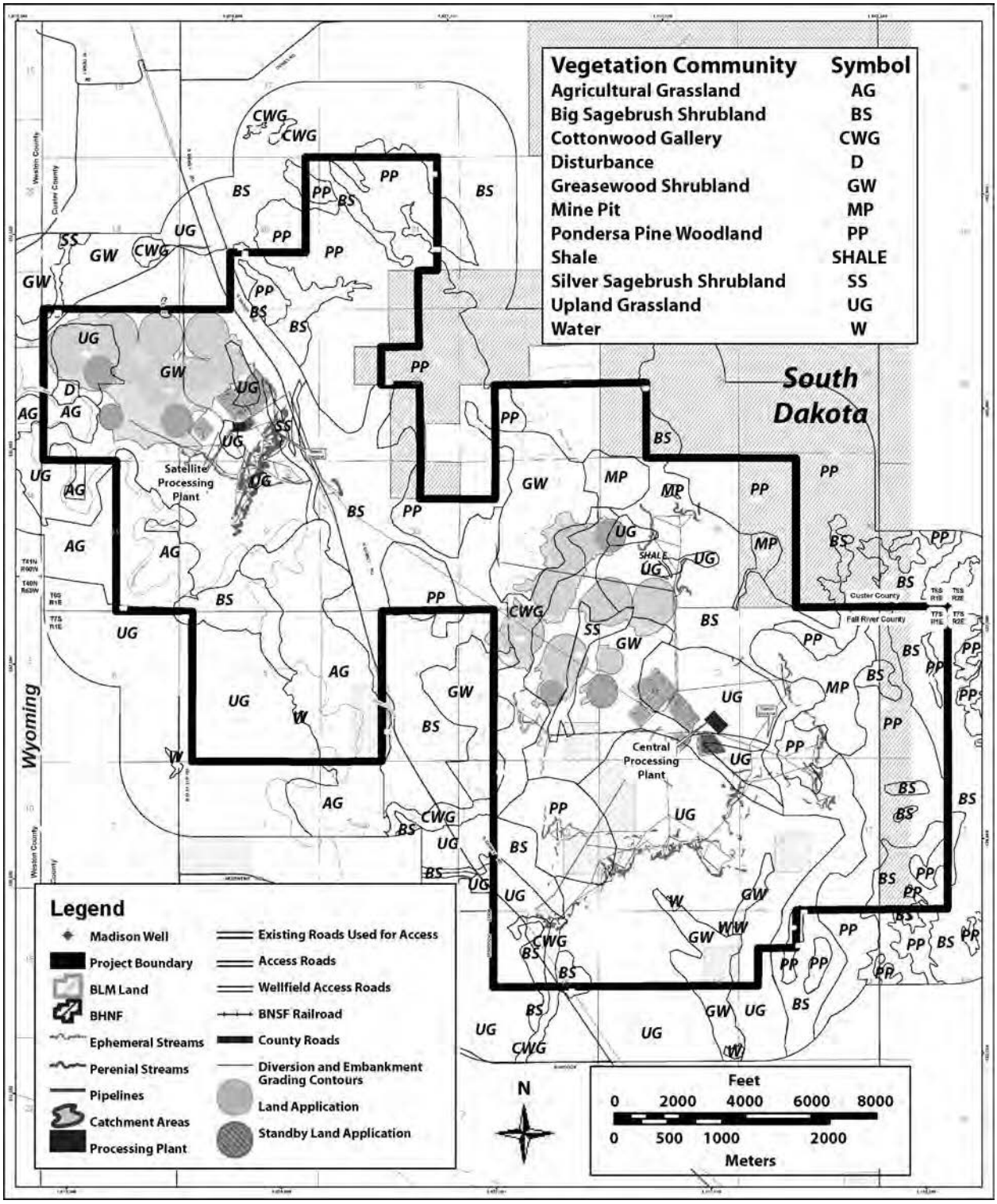

Figure 4.6-3. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Land Application Option
Source: Powertech, 2012a

Table 4.6-4. Disturbed Land by Vegetation Type for Dewey-Burdock Land Application Option

Activity	Vegetation Community {Hectares [acres]}							Total Disturbed Area Hectares [acres]
	Big Sagebrush Shrubland	Cottonwood Gallery	Greasewood Shrubland	Mine Pit	Ponderosa Pine Woodland	Silver Sagebrush Shrubland	Upland Grassland	
Site Facilities	0.8 [2]	0	3.2 [8]	0	0.4 [1]	0	5.7 [14]	9.7 [24]
Trunklines	2.4 [6]	0	2.4 [6]	0	1.2 [3]	0.8 [2]	3.2 [8]	10.1 [25]
Access Roads	2.0 [5]	0	2.0 [5]	0.4 [1]	0.8 [2]	0.4 [1]	2.4 [6]	8.5 [21]
Well Fields	8.5 [21]	0	18.2 [45]	2.0 [5]	8.5 [21]	4.4 [11]	15.0 [37]	56.6 [140]
Impound-ments	1.6 [4]	0	20.2 [50]	0	0.4 [1]	3.2 [8]	29.5 [73]	55.0 [136]
Land Application	75.7 [187]	0	267.9 [662]	0	0	6.9 [17]	72.4 [179]	425.7 [1,052]
Totals	90.6 [224]	0	314.4 [777]	2.0 [5]	11.3 [28]	15.8 [39]	128.3 [317]	565.8 [1,398]

Source: Powertech 2012a

activities on BLM lands, if BLM decides to allow such activities. Because BLM land is considered a public resource and is traditionally used for livestock grazing in this region, NRC staff expect the potential indirect impacts on the vegetation of these BLM lands to be SMALL. Staff also expect that in addition to potential impacts described earlier for the deep Class V injection well option, big game species may experience additional restricted movement due to fencing around land application areas and reduced forage and carrying capacity in the land application areas. However, because the project area is not within big game migration pathways and does not contain critical habitat and because big game species have larger home ranges and are highly mobile, the continued existence of big game species will not be threatened and impacts on big game will be SMALL.

The black-tailed prairie dog colony located within the Dewey area in land application areas could attract black-footed ferrets. The colony supports small- to medium-sized mammals that burrow in the ground, raptors and ground dwelling birds, and reptiles as described in SEIS Sections 4.6.1.1.1.1.2 and 4.6.1.1.1.1.4. Figure 4.6-4 shows the 16-ha [40-ac] areas where raptors nests are located near the proposed project. The potential wellfield areas in SEIS Figure 2.1-6 identify where potential drilling/distruptive activity could occur around each orebody, if a particular orebody were mined. Converting land application areas into cropland during construction under this option will have a greater overall impact on such wildlife than during the construction phase under the deep Class V injection well disposal option due to the additional 481 ha [1,188] of habitat alteration and land disturbance (Table 2.1-8). The removal of sagebrush communities will most impact sagebrush obligate species, such as sage-grouse, sharp-tailed grouse, sage thrasher, and some small mammals. NRC staff expect that prey–predator relationships will be altered within the irrigation areas during construction activities and prey–predator species will leave those areas temporarily during construction activities. Raptors that nest within the proposed project area could abandon their nests. Staff expect some species to return to the area after the irrigation areas are reestablished because the cropland will provide additional nesting sites, cover, and food. Staff also expect that once the crops have been established, some raptors will also return to this area to use the cropland for active hunting.

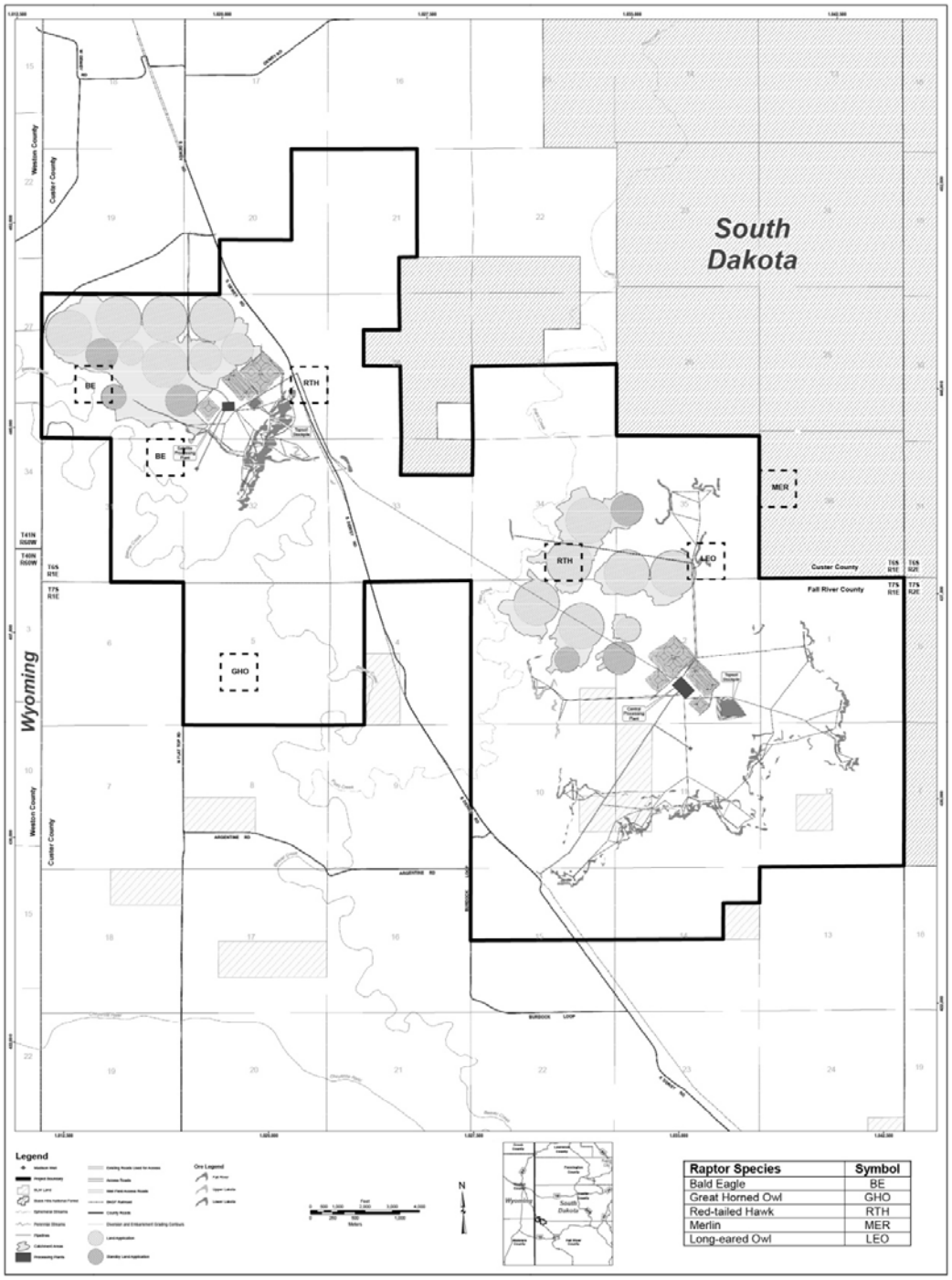

Figure 4.6-4. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Land Application Option
Source: Powertech, 2012a

Because NRC staff expect the applicant or landowners to disturb the surface soil to plant crops in the irrigation areas, staff also expect an increase in potential soil erosion and sedimentation could impact surface water on and downstream from the site. Land application sites are located within 0.4 km [0.25 mi] of Beaver Creek within the Dewey area; however, ISR construction activities are not expected to significantly affect surface water quality unless irrigation activities cross over into jurisdictional waters. In addition, the applicant has committed to implementing mitigation measures to control erosion, stormwater runoff, and sedimentation (SEIS Section 4.5.1.1). Because the applicant does not plan to disturb any additional water bodies and perennial streams within the proposed project area (Powertech, 2009a), NRC staff expect that aquatic species and amphibians will not be directly affected by construction of land application areas and expect impacts to be SMALL.

NRC staff expect the same mitigation measures will be followed for the land application option that were previously explained for the deep Class V injection well option. NRC staff conclude the additional amount of land that will be disturbed for construction under the land application disposal option is expected to noticeably alter, but not destabilize, the vegetation and important wildlife habitat that occur at the site. Therefore, the potential impact to ecological resources, including vegetation, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles, and some protected and sensitive species, will be MODERATE from construction of the land application option. Because no federally threatened or endangered species are expected to occur in the project area, potential impacts to threatened or endangered species will be SMALL. NRC staff expect that construction impacts will not threaten any species' population or current existence.

4.6.1.2.2 Operations Impacts

Surface disturbance, including the application of waste water, will be the primary change to ecology during the operations phase of the proposed Dewey-Burdock ISR Project under the land application option. Wellfield expansion that will disturb approximately 56.7 ha [140 ac] of land during the operations phase will have similar impacts to vegetation wildlife impacts as expected during the operations phase for the deep Class V injection well option. Disturbance of land application areas (including operating and standby center pivot areas and catchment areas) totaling approximately 426 ha [1,052 ac] will have similar impacts on vegetation and wildlife as impacts expected to vegetation and wildlife during the construction phase of the land application option.

Potential exposure of wildlife to holding/settling pond constituents and potential failure of settling and holding pond liners or embankment systems will increase under the land application waste disposal option due the additional pond capacity. In addition, the GEIS identified the following potential land application impacts from operations related to ecology: (i) reduction in growth of vegetation due to soil salination; (ii) accumulation of contaminants, dissolved solids, and radionuclides in the root zone; and (iii) increased vegetation growth due to the increase of available water (NRC, 2009a).

According to SEIS Chapter 2, the irrigation pivots will operate 24 hours a day and irrigated areas will receive approximately 1,124 Lpm [297 gpm] from March 29 to May 10, approximately 2,472 Lpm [653 gpm] from May 11 to September 24, and approximately 1,124 Lpm [297 gpm] from September 25 to October 31. From November to March, land application will not be used and treated liquid waste will be temporarily stored in ponds located near the Burdock central plant and Dewey satellite facility (Powertech, 2011). Land application activities during

operations under this option will have a similar land disturbance impact on wildlife as those expected during the construction phase because of the continuous disturbance from irrigation activities. NRC staff expect that few animals will inhabit the land application areas during continuous irrigation. NRC staff also expect that prey–predator relationships will be altered within the irrigation areas because of seasonal irrigation activities and may not return during the winter season when irrigation activities are not planned. Upland game birds, raptors, waterfowl and shorebirds, nongame and migratory birds, small- and medium-sized mammals, and reptiles will experience direct, long-term habitat loss and reduction in the carrying capacity during the operations phase of the land application option. Staff expect that in general, birds are mobile and able to relocate to other available regional habitat (SEIS Section 4.6.1.1.1.4). Temporary direct impacts to animals and nests could include disturbance from sprayed irrigation water that the wind carries outside of the land application areas.

During the uranium recovery process, the groundwater extracted from the production zone is enriched in uranium and other metals that are typically associated with uranium in nature. In the license application technical report, Tables 4.2-7, 7.3-8 (Powertech, 2009b), and in their state GDP (Powertech, 2012c, Table 5.8-2) the applicant describes the expected radiological constituents and estimated concentrations in wastewater for the proposed land application activities. The radiological constituents include natural uranium, radium-226, thorium-230, and lead-210. At NRC-licensed *in-situ* leach facilities, the licensee is required to monitor and control radiological constituents in effluents to satisfy limits in 10 CFR Part 20, Appendix B, and irrigation areas to maintain levels of radioactive constituents within allowable release standards outlined in 10 CFR Part 40, Appendix A both during and after disposal by land application (NRC, 2009a). As stated in SEIS Section 2.1.1.1.6.2 for radiological emissions, the applicant proposes regular monitoring of air, soil, biomass (i.e., crops and livestock), surface water, and groundwater to identify the presence of NRC- and SDDENR-regulated constituents. The applicant's proposed land application monitoring program is described in SEIS Section 7.5. Monitoring results must be reported to NRC semiannually (see SEIS Chapter 7).

In the license application technical report (Powertech, 2009b, Tables 4.2-7 and 7.3-8) and in its South Dakota GDP (Powertech, 2012c, Table 5.8-2), the applicant described the expected chemical constituents and estimated concentrations in wastewater for the proposed land application activities. The list of chemical constituents includes arsenic, barium, cadmium, chromium, lead, and selenium. The NRC staff evaluated the toxicity of the proposed wastewater solutions and the potential for proposed land application activities to impact wildlife. Selenium, in particular, was identified by the FWS as a constituent of concern in ISR wastewater because of low wildlife health effects thresholds in some sensitive species when compared with concentrations of selenium measured in ISR wastewater (FWS, 2007). The wildlife health effects thresholds described here establish the concentration of a chemical in water that is known to cause health effects in wildlife based on scientific studies.

The NRC staff compared the applicant's estimated wastewater concentrations with EPA chronic (long-term) exposure-based water quality criteria (guidance) established for the protection of aquatic life and found the estimated concentrations of cadmium, chromium, lead, and selenium exceed the EPA criteria. The applicant's estimated concentrations of both cadmium and lead also exceed the acute (short-term) exposure-based EPA water quality aquatic life criteria (EPA, 2013a). Additionally, the applicant's estimated concentrations of selenium exceed levels referenced by FWS (2007) as hazardous to aquatic birds. Based on this comparison, the NRC staff concludes that direct chronic and acute exposure of sensitive species to the applicant's

estimated cadmium, lead, and selenium concentrations in wastewater could adversely impact exposed individuals.

However, the NRC staff considers such chronic direct wildlife exposure to undiluted wastewater unlikely because the applicant's proposed wastewater controls (e.g., pond design, spill and leak detection and mitigation, pressure monitoring, runoff control and mitigation) and SDDENR permitting requirements limit direct contact that aquatic life and terrestrial wildlife will have with wastewater solutions. The SDDENR controls include limiting access to wastewater with fencing, implementing an avian protection plan for pond operations, and requiring no-runoff and no-ponding conditions for land application. These controls would limit direct terrestrial wildlife exposures and migration of wastewater to aquatic life habitat areas such as nearby surface water.

Wastewater storage ponds present an additional opportunity for wildlife, primarily migratory birds, to have direct contact with wastewater solutions. The only detailed wildlife field study of an ISR wastewater irrigation system observed only limited use of a wastewater storage reservoir by birds (FWS, 2000b). In the event that additional treatment to lower wastewater constituent concentrations or additional access controls for ponds are needed to protect wildlife, SDDENR has the authority to require these actions be implemented by the applicant.

While direct wastewater exposures will be limited, as noted in the GEIS and draft SEIS, land application could lead to accumulation of trace metal constituents in soils. The NRC staff evaluated the applicant's estimated steady-state soil concentrations of trace metals from proposed land application with published EPA ecological soil screening guidance levels (Eco SSLs) (EPA, 2010). Eco-SSLs were developed to support screening analyses to identify potential ecological concerns at superfund sites that may need further, more detailed evaluation (e.g., ecological risk assessment). While Eco-SSLs were developed for superfund sites, EPA envisions that any federal, state, tribal, or private environmental assessment can use the values to screen soil contaminants (EPA, 2003). The applicant's estimated steady-state soil concentrations of trace metals (Powertech, 2009b, Table 7.3-8) exceeded EPA Eco-SSLs for cadmium, lead, and selenium. This analysis suggests the land application activities described by the applicant have the potential to accumulate specific trace metal constituents in soils at levels that could impact wildlife. Soil constituents can also be taken up in plants. They may remobilize and transport to nearby surface water and shallow groundwater; even though transport of these constituents will involve dilution. In sum, plants, groundwater, and surface water containing concentrations of trace metals provide additional routes of exposure to wildlife.

The SDDENR mine permit will establish monitoring requirements and action levels for trace metal concentrations in soils, vegetation, surface water, and groundwater that are protective of the environment. The SDDENR will review monitoring data and impose corrective actions if action levels are exceeded. Additionally, SDDENR will evaluate the environmental fate and transport of land-applied wastewater in detail (including environmental concentrations, pathways and food chains, bioaccumulation) prior to operation as part of its permitting and oversight processes. If SDDENR finds the waste management activities could impact wildlife, it will impose additional conditions on the applicant to mitigate impacts and protect the environment.

In summary, some of the chemical constituent concentrations in proposed wastewater solutions and in land application area soils estimated by applicant exceed levels known to cause impacts to wildlife. NRC staff conclude that impacts to individual animals are possible even with the practices proposed by the applicant and the SDDENR regulatory controls that will be imposed

by permit conditions, which include, monitoring, setting action levels, and requiring corrective actions if those controls do not limit all direct exposures to undiluted wastewater solutions. However, the NRC concludes the direct exposure of wildlife to wastewater solutions will be limited and that, under current regulatory controls, environmental concentrations of wastewater constituents are unlikely to reach levels that would lead to destabilization of wildlife populations.

The NRC staff conclude the overall impact on vegetation, small- to medium-sized mammals, upland game birds, raptors, waterfowl and shorebirds, nongame and migratory birds, and reptiles from operations for the land application liquid waste disposal option will be MODERATE because of the potential for some wildlife exposures to harmful constituents and the planned 8-year operation period that will alter approximately 426 ha [1,052 ac] of vegetation, wildlife distribution, and wildlife habitat. Based on the foregoing analysis, the impacts are expected to noticeably alter important attributes of the terrestrial environment; however, staff do not expect these impacts to threaten the continued existence of any species.

Because the land application option will not disturb any additional water bodies and perennial streams within the proposed project area (Powertech, 2009a), and land application treated wastewater will be controlled to avoid runoff, staff expect that aquatic habitat will not be directly affected by land application activities and potential impacts to aquatic species and amphibians will be SMALL. For the same reasons explained for construction impacts on big game from the land application option, staff expect potential operations impacts to big game from operations during the land application option to be SMALL.

4.6.1.2.3 Aquifer Restoration Impacts

During aquifer restoration, potential impacts to ecological resources for the land application liquid waste disposal option at the proposed Dewey-Burdock ISR Project will remain similar to those described previously for the operations phase. Planned activities using existing infrastructure during the aquifer restoration phase are described in SEIS Section 4.2.1.2.3. NRC staff expect land application activities to continue during the aquifer restoration phase. Because construction and drilling equipment are not used during the aquifer restoration phase, NRC staff expect impacts from human presence, noise, and wildlife mortalities from equipment to decrease compared to human presence, noise, and wildlife mortalities expected during the operations phase. The expected liquid waste flow rates for the entire project will be approximately 2,070 Lpm [547 gpm] during concurrent uranium production and aquifer restoration and approximately 1,892 Lpm [500 gpm] during aquifer restoration alone (SEIS Section 2.1.1.1.4.1.2).

As with the operations phase, impacts to potential land application areas during aquifer restoration will be mitigated by implementing a monitoring program and maintaining levels of radiological contaminants in treated waste water to allowable release limits contained in 10 CFR Part 20, Appendix B (Powertech, 2009a, 2011) and chemical constituents in compliance with state requirements and permit conditions. Considering the potential for some wildlife exposures to harmful constituents and the continued alteration of approximately 426 ha [1,052 ac] of vegetation, wildlife distribution, and wildlife habitat, the NRC staff conclude that the overall potential impacts to vegetation, small- to medium-sized mammals, raptors, upland game birds, waterfowl and shorebirds, nongame and migratory birds, and reptiles will remain MODERATE. Based on the projected magnitude of expected liquid waste flow rates during aquifer restoration relative to operations, the potential impacts to big game, aquatic species, and

amphibians during the aquifer restoration phase will not increase beyond those of the operations phase and will therefore be SMALL.

4.6.1.2.4 Decommissioning Impacts

Staff expect the potential ecological impacts of decommissioning for the land application liquid waste disposal option will be similar to those described in SEIS Section 4.6.1.1.4 for the deep Class V injection well disposal option, including increased human presence, noise, and construction and field equipment. In addition to those activities planned for decommissioning under the deep Class V injection well disposal option, irrigation area pipelines, access roads, and larger pond areas will be directly impacted under the land application disposal option as explained in SEIS Section 4.6.1.2.1.

The dismantling of the proposed project facilities, piping, infrastructure, and roads and reseeding and recontouring will have fewer ecological impacts than those experienced during the construction phase due to continuous revegetation efforts during the ISR lifecycle. SDDNER recommends that the large-scale mine permit require (i) the collection of baseline vegetation data within land application areas; (ii) concurrent and interim reclamation in all areas where mining or land disturbance is completed; (iii) that revegetation success be equivalent to vegetative cover in reference areas using SDDENR-approved statistical methods; and (iv) that a post closure bond be held for 30 years after the reclamation bond is released to help ensure revegetation success. However, final permit conditions may change based on the final determination by the South Dakota hearing board. Noise, vehicle and equipment use, and human presence will increase to levels similar to those experienced during the construction phase and for the same expected amount of time (2 years). For these reasons, NRC staff conclude there will be a MODERATE impact on vegetation, small- to medium-sized mammals, raptors, upland game birds, waterfowl and shorebirds, nongame and migratory birds, and reptiles from decommissioning and reclamation under the land application liquid waste disposal option until vegetation has been reestablished and preconstruction wildlife populations return to the area. For the same reasons explained in SEIS Section 4.6.1.1.4, potential impact to big game, aquatic species, and amphibians will remain SMALL from decommissioning under the land application option for the proposed project.

4.6.1.3 Disposal Via Combination of Class V Injection and Land Application

For the combined deep Class V injection well disposal and land application option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). For the reasons explained in SEIS Section 4.2.1.3 for operations impacts to land use under the land application option, the significance of impacts that could impact either vegetation or wildlife populations for the combined disposal option will be less than for the land application option but greater than for the deep Class V injection well disposal option, as reflected in Table 4.6-5. Therefore, NRC staff conclude that the ecological impacts of the combined deep Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will bound the significance of ecological impacts of the deep Class V injection well option and the land application option.

Table 4.6-5. Significance of Ecological Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL for vegetation, terrestrial, and aquatic species	MODERATE for vegetation, small- to medium-sized mammals, raptors, waterfowl and shorebirds, upland game birds, nongame and migratory birds, and reptiles SMALL for big game, aquatic species, amphibians	SMALL to MODERATE for vegetation, terrestrial, and aquatic species
Operations	SMALL for vegetation, terrestrial, and aquatic species	MODERATE for vegetation, small- to medium-sized mammals, raptors, waterfowl and shorebirds, upland game birds, nongame and migratory birds, and reptiles SMALL for big game, aquatic species, amphibians	SMALL to MODERATE for vegetation, terrestrial, and aquatic species
Aquifer Restoration	SMALL for vegetation, terrestrial, and aquatic species	MODERATE for vegetation, small- to medium-sized mammals, raptors, waterfowl and shorebirds, upland game birds, nongame and migratory birds, and reptiles SMALL for big game, aquatic species, amphibians	SMALL for aquatic species and amphibians; SMALL to MODERATE for vegetation and terrestrial species
Decommissioning	MODERATE before vegetation is reestablished SMALL after vegetation is reestablished	MODERATE before vegetation is reestablished SMALL after vegetation is restablished	MODERATE before vegetation is reestablished SMALL after vegetation is reestablished

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well disposal and land application disposal options.

4.6.2 No-Action (Alternative 2)

Under the No-Action alternative, there will be no ISR facility construction, operations, aquifer restoration, or decommissioning associated with this project; therefore, there will be no land disturbance from the proposed action that could impact either vegetation or wildlife populations. The area will continue to sustain vegetation communities and wildlife habitat typical of the region, as characterized in SEIS Section 3.6. Land will continue to be used for livestock grazing. Grazing of existing vegetation, particularly the grassland communities, will continue. Wildlife within the proposed license area could be affected by ongoing grazing if species were displaced by cattle populations due to lack of forage and cover; however, there will be no impacts to ecological resources from the proposed Dewey-Burdock ISR Project under the No-Action alternative.

4.7 Air Quality Impacts

As described in GEIS Section 4.4.6, potential environmental impacts to air quality could occur during all phases of the ISR facility lifecycle (NRC, 2009a). Nonradiological air emission impacts primarily involve fugitive road dust from vehicles traveling on unpaved roads and combustion engine emissions from vehicles and diesel equipment. In general, any nonradiological emissions from pipeline system venting, resin transfer, and elution will be expected to be at such low levels that they will be negligible Such emissions were not considered in the analysis. Radon could also be released from well system relief valves, resin transfer, or elution. Potential radiological air impacts, including radon release impacts, are addressed in the Public and Occupational Health and Safety Impacts analyses in SEIS Section 4.13.

Factors NRC staff used in determining the magnitude of the potential impacts are described in GEIS Section 4.4.6 (NRC, 2009a) and include whether (i) the air quality of the site's region of influence (ROI) is in compliance with the National Ambient Air Quality Standards (NAAQS), (ii) the facility can be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs, and (iii) the presence of Prevention of Significant Deterioration (PSD) Class I areas within the region could be impacted by emissions from the proposed action.

<u>GEIS Construction Phase Summary</u>

As discussed in GEIS Section 4.4.6.1, fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities associated with construction will be expected to be short term and reduced through BMPs (e.g., wetting of roads and cleared land areas to reduce dust emissions). Estimated ISR-construction-phase fugitive dust annual concentrations used in the GEIS are expected to be well below the $PM_{2.5}$ NAAQS. Additionally, particulate, sulfur dioxide, and nitrogen dioxide concentration estimates used in the GEIS are expected to be below PSD Class II allowable increments (1 to 9 percent) and the stricter Class I increments (7 to 84 percent). NRC staff concluded in the GEIS that for NAAQS attainment areas, nonradiological impacts will be SMALL. (NRC, 2009a)

<u>GEIS Operations Phase Summary</u>

GEIS Section 4.4.6.2 stated that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting

program. The GEIS states that the primary nonradiological emissions during operations include fugitive dust and combustion products from equipment, maintenance, transport trucks, and other vehicles. Additionally, NRC staff concluded in the GEIS that any nonradiological emissions from pipeline system venting, resin transfer, and elution will be expected to be at such low levels that they will be negligible and were not considered in the analysis. For NAAQS attainment areas, NRC staff concluded in the GEIS that nonradiological air quality impacts will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

As described in GEIS Section 4.4.6.3, because the same infrastructure will be used during the aquifer restoration as during operations, air quality impacts from aquifer restoration will be similar to, or less than, those during operations. Additionally, fugitive dust and combustion emissions from vehicles and equipment during aquifer restoration will be similar to, or less than, the dust and combustion emissions during operations. For NAAQS attainment areas, NRC staff concluded in the GEIS that nonradiological air quality impacts will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

As discussed in GEIS Section 4.4.6.4, fugitive dust, vehicle emissions, and diesel emissions during land-disturbing activities from the decommissioning phase will come from many of the same sources as the construction phase. In the short term, emission levels are expected to increase given the activity (i.e., demolishing of process and administrative buildings, excavating and removing contaminated soils, and grading of disturbed areas). However, such emissions will be expected to decrease as decommissioning proceeds, and therefore, overall, impacts will be similar to, or less than, those associated with construction; will be short term; and will be reduced through BMPs (e.g., dust suppression). NRC staff concluded in the GEIS that for NAAQS attainment areas, nonradiological impacts will be SMALL. (NRC, 2009a)

Potential environmental impacts on air quality during construction, operations, aquifer restoration, and decommissioning phases of the proposed Dewey-Burdock ISR Project are discussed in the following sections. The discussion also addresses the impacts on air quality during the peak year. The peak year accounts for the time when all four phases occur simultaneously and represents the highest amount of emissions the proposed action will generate in any 1 year. The applicant identifies 2 years when all four phases will occur simultaneously and 7 years when construction and operation phases will occur simultaneously (Powertech, 2012d). Appendix C describes nonradiological air emissions information for the proposed project including emission inventories and air dispersion modeling.

4.7.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.7.2, the air quality of the Black Hills-Rapid City Intrastate Air Quality Control Region, where the proposed Dewey-Burdock ISR Project is located, is designated as an attainment area for all NAAQS pollutants and is located in a Class II area for PSD designation. The nearest PSD Class I area, Wind Cave National Park, located about 47 km [29 mi] northeast of the proposed Dewey-Burdock ISR Project, is also located in this same air quality control region and is also classified as an attainment area. The attainment status of the air quality surrounding the proposed license area provides a measure of current air quality conditions and affects considerations for allowing new emission sources.

While NRC is responsible for assessing the potential environmental impacts from the proposed action pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, NRC does not have the authority to develop or enforce regulations to control nonradiological air emissions from equipment licensees use. For the proposed Dewey-Burdock ISR Project, this authority rests with SDDENR. To ensure the air quality of South Dakota is adequately protected, in addition to addressing all NRC regulatory requirements for radiological emissions, NRC applicants and licensees must comply with all applicable state and federal air quality regulatory compliance and permitting requirements.

The applicant submitted an air quality application to SDDENR in November, 2012 (see Table 1.6-1). Based on the information in the application, SDDENR determined that an air permit will not be required and the proposed project will not be subject to PSD requirements (SDDENR, 2013b). SDDENR's review of the applicant's air quality application included an assessment of potential greenhouse gas emissions relative to the 90,718 metric tons [100,000 short tons] standard identified in SEIS Section 3.7.2. This regulatory determination conducted by the SDDENR did not include mobile and fugitive sources as categorized in this SEIS (see Table 2.1-5). Since mobile and fugitive sources compose the majority of the project emissions, NRC staff determined that the SEIS analysis would include mobile and fugitive emission sources, as well as stationary sources. NRC staff will characterize the magnitude of air effluents from the proposed project throughout SEIS Section 4.7.1, in part, by comparing (i) the emission levels to PSD and Title V thresholds and (ii) the modeled concentrations to regulatory standards such as NAAQS. This characterization is meant to provide a context for understanding the magnitude of the proposed project's air effluents, which are mostly from mobile and fugitive sources rather than stationary sources. The NRC analysis in this SEIS is for disclosure purposes and does not document or represent the formal SDDENR determination. This is an important distinction to remember when considering the analysis in this SEIS.

The air impact analysis includes two types of modeling: AERMOD and CALPUFF. The AERMOD dispersion model was used to predict NAAQS and PSD pollutant concentrations and the CALPUFF model was used to generate Air Quality Related Values for Wind Cave National Park. The two types of modeling results and associated analyses will be discussed separately. Additional information concerning the Dewey-Burdock emission inventory, the modeling protocol, and the results for both the AERMOD and CALPUFF analyses is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

The model options and approach for the air quality impact assessment selected by NRC staff in this EIS do not completely align with EPA's guidelines on air quality models (40 CFR Part 51, Appendix W). Specifically, deviations from the regulatory default options are utilized. For example, the dry depletion option is used in the AERMOD analysis. The dry depletion option accounts for the partial settling and deposition of PM_{10} particles as the dust plume disperses away from the source. Similarly, the PM_{10} emission is not included in the CALPUFF analysis. NRC determined that it is appropriate to use dry depletion in the AERMOD analysis and exclude PM_{10} from the CALPUFF analysis for three main reasons. First, the nature of the project specific emission supports this decision (i.e., over 99 percent of the fugitive dust emissions are from ground-level emission sources where rapid deposition is expected). Second, modelingusing the regulatory default options can overestimate short-term PM_{10} impacts because the rapid deposition phenomenon is not adequately addressed. Third, EISs for coaland gas development in the western United States address PM_{10} emission in this same manner (TRC Environmental Corporation, 2006; Marquez Environmental Services, Inc., 2010).

SEIS Appendix C Section C.2.3 and Sections 3.2 and 3.9 of the Ambient Air Quality Final Modeling Protocol and Impact Analysis discuss these rationales in greater detail.

The guideline in 40 CFR Part 51, Appendix W is used by EPA, States, and industry to prepare and review new source permits and State Implementation Plan revisions. This guideline recognizes the need to accommodate deviations from default conditions on a case-by-case basis to ensure accuracy. However, the guideline states that such deviations should be fully supported. Staff from EPA, SDDENR, and the Bureau of Land Management participated in the development of the protocol for this SEIS analysis. During the protocol development, EPA in particular expressed a strong preference for the SEIS impact analysis to rely on modeling that did not deviate from regulatory default options. For informational purposes only, at the end of impact assessment for each phase, NRC staff will present the impact analysis using the PM_{10} modeling results that do not implement the AERMOD dry depletion option as well as include the PM_{10} emission in the CALPUFF visibility analysis. However, The NRC staff based its impact analyses (i.e., SMALL, MODERATE, or LARGE) in the SEIS on modeling that deviates from regulatory default options noting the reasons why the staff chose this option.

Expressing the proposed project's emissions in concentrations can help in characterizing the magnitude of the emission levels because thresholds, such as NAAQS and PSD increments, are also expressed in concentrations. The AERMOD dispersion model was used to predict pollutant concentrations at a total of 4,220 receptors that extend in all directions from the project site and fully encompass Wind Cave National Park, the nearest Class I area. Figures 4.7-1 and 4.7-2 display the AERMOD receptor placement (i.e., locations where pollutant concentrations were estimated). The spacing between the receptors is not uniform across the model domain. In general, the receptor spacing is larger as the distance from proposed Dewey-Burdock site increases. The model domain includes fenceline, hot spot grid, intermediate grid, and coarse grid receptors. Fenceline receptors at the proposed Dewey-Burdock site boundary were placed at least every 100 m [109.4 yd] with a receptor placed at each boundary corner. For the hot spot grid, receptors were placed at 100-m [109.4-yd] spacing within a 500-m [546.8-yd] wide corridor along the western and southern portions of the project boundary and along the public road accessing the proposed site. The inclusion of the hot spot grid receptors is based on the initial modeling that predicts that high 24-hour PM_{10} values will be limited to this corridor. The modeling domain consists of two intermediate grids. For the first intermediate grid, receptors were placed at 500-meter [546.8-yard] spacing from the project fenceline outward to a distance of 5 km [3.11 mi] in all directions from the project center. For the second intermediate grid, receptors were placed at 1-km [0.62-mi] spacing from the outer edge of the first intermediate grid in all directions to a distance of 15 km [9.32 mi] from the project center. Figure 4.7-2 displays the receptor placement of project fenceline, hot spot grid, and intermediate grids. The modeling domain consists of two coarse grids. For the first coarse grid, receptors were placed at 5-km spacing [3.11-mi] from the outer edge of the second intermediate grid outward in all directions to a distance of 35 km [21.7 mi] from the project center. For the second coarse grid, receptors were placed at 10-km [6.21-mi] spacing from the outer edge of the first coarse grid in all directions to a distance of 55 km [34.2 mi] from the project center. Figure 4.7-1 displays the receptor placement of the coarse grids as well as the second intermediate grid. In addition, 44 fenceline receptors were placed at roughly uniform spacing around the Wind Cave National Park boundary.

The modeling was conducted for the peak year emission inventory (see Table 2.1-5) and included stationary (see Table 2.1-1), mobile (see Table 2.1-2), and fugitive dust (see Table 2.1-3) sources. Although the modeling was conducted using one year of emission data

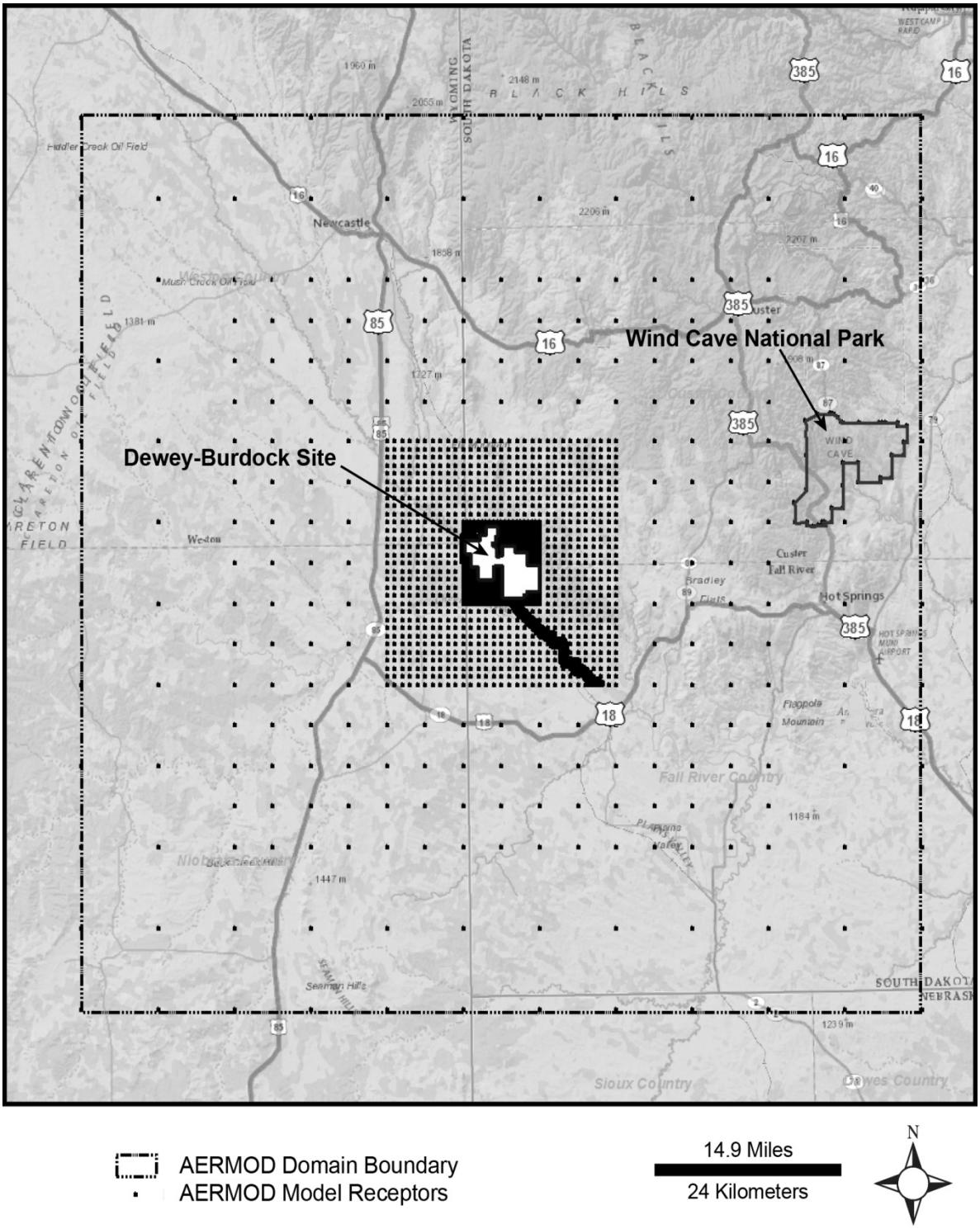

Figure 4.7-1. Macroscale View of Locations Where National Ambient Air Quality Standards and Prevention of Significant Deterioration Air Pollutant Estimates (Concentrations) Were Calculated Using the AERMOD Dispersion Model
Source: Modified From IML (2013a)

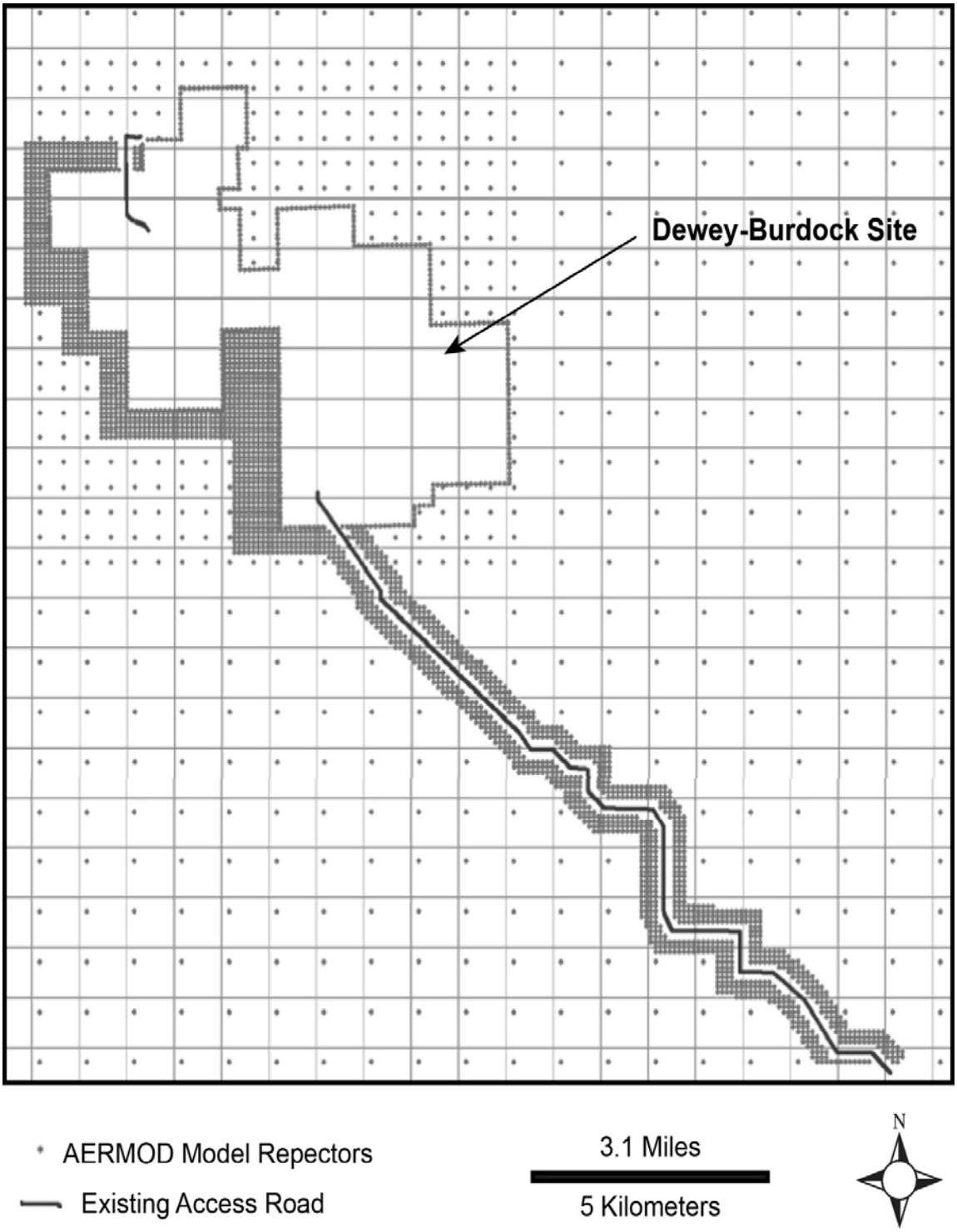

Figure 4.7-2. Microscale View of Locations Where National Ambient Air Quality Standards and Prevention of Significant Deterioration Pollutant Estimates (Concentrations) Were Calculated Using the AERMOD Dispersion Model Source: Modified From IML (2013a)

(i.e., the peak year), the model uses three years of hourly meteorological data. EPA recommends that AERMOD be run with a minimum of three years of meteorological data (IML, 2013a). Table 4.7-1 presents the AERMOD modeling results with respect to the NAAQS and Table 4.7-2 presents the results with respect to the PSD increments. The NAAQS and PSD thresholds are described in SEIS Section 3.7.2. As described in the notes for Table 4.7-1, the model results form for the NO_2 annual and SO_2 3 hour values are not the same as the NAAQS form. The form expresses both the statistic (e.g., maximum, average, 98th percentile, etc.) and the time period (e.g., once per year, over one year, over 3 years, etc.) associated with a value. As described in the notes for Table 4.7-2, none of the model results forms are the same as the PSD increments forms. The lack of continuity between the model results form and the NAAQS and PSD increment forms, as well as the values used to represent project level concentrations, is addressed in SEIS Appendix C, Section C2.3.1. Additional information concerning the emission inventory, AERMOD modeling protocol, and results is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

Protection of Class I air quality is not limited to consideration of PSD Class I increments. As described in SEIS Section 3.7.2, the Air Quality Related Values of visibility and acid deposition are also used to characterize the air quality at Class I areas. Evaluation of the impacts on the Air Quality Related Values at Wind Cave National Park was conducted using the CALPUFF model. Figure 4.7-3 identifies the CALPUFF modeling domain. In order to adequately characterize the Air Quality Related Values impacts to Wind Cave National Park, the modeling domain extended 100 km [62 mi] in all directions from the proposed project area, which includes a 50-km [31-mi] buffer around the Class I area to provide meteorological model continuity. Although the modeling domain is large, the 192 model receptors are located only within the Wind Cave National Park itself as shown in Figure 4.7-4. The CALPUFF modeling was conducted for the peak year emission inventory (see Table 2.1-5) and included stationary (see Table 2.1-1), mobile (see Table 2.1-2), and fugitive dust (see Table 2.1-3) sources.

Although the modeling was conducted using one year of emission data (i.e., the peak year), the model uses three years of hourly meteorological data. Modeled emission sources and emission rates are identical to those used in the AERMOD modeling. The visibility impacts are modeled

Table 4.7-1. Nonradiological Concentration Estimates (i.e., AERMOD Modeling Results) From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Time	Modeling Results Form†	Modeling Results (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NAAQS Limit (ug/m^3)	% of NAAQS Limit
Carbon Monoxide	1 hour	Not to be exceeded more than once per year	2101.1	1097.3	3198.4	40000	8.0
	8 hour	Not to be exceeded more than once per year	262.6	315.5	578.1	10000	5.8
Nitrogen Dioxide	1 hour	98th percentile, averaged over 3 years	156.9	5.6	162.5	187	86.9
	Annual	Annual mean‡	3.3	0.4	3.7	100	3.7
Particulate Matter $PM_{2.5}$	24 hour	98th percentile, averaged over 3 years	6.9	10.9	17.8	35	50.9

Table 4.7-1. Nonradiological Concentration Estimates (i.e., AERMOD Modeling Results) From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the National Ambient Air Quality Standards (NAAQS) (Cont'd)

Pollutant	Averaging Time	Modeling Results Form†	Modeling Results (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NAAQS Limit (ug/m^3)	% of NAAQS Limit
	Annual	Annual mean, averaged over 3 years	1.0	4.8	5.8	12§	48.3
Particulate Matter PM_{10} Initial Run‖	24 hour	Not to be exceeded more than once per year on average over 3 years	187.2	41.0	228.2	150	152.1
Particulate Matter PM_{10} Final Run¶	24 hour	Not to be exceeded more than once per year on average over 3 years	83.6	41.0	124.6	150	83.1
Sulfur Dioxide	1 hour	99th percentile of 1-hour daily maximum concentrations	48.3	15.7	63.9	200	31.9
	3 hour	Not to be exceeded more than once per year#	100.1	20.9	121.0	1300	9.3

Source: Modified from IML (2013a) and Powertech (2013c)
*Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emission.
†the form expresses both the statistic (e.g., maximum, average, or 98th percentile) and the time period (e.g., once per year, over one year, or over 3 years) associated with the numerical value. Unless otherwise noted, the modeling results form and the NAAQS form are the same.
‡Initial modeling form (maximum annual average over a three year period) is not the same as the NAAQS form (maximum annual average over a single year). The value in this table has a form that matches the NAAQS form and was calculated from the initial model result as described in Appendix C Section C2.3.
§The table identifies the primary standard limit. The secondary standard limit is larger (i.e., 15 $\mu g/m^3$). Results that meet the primary standard will automatically meet the secondary standard.
‖Initial modeling run without dry depletion for all receptor locations.
¶Final modeling run with dry depletion for the top 50 receptor locations.
#The model result form (the highest value over any single calendar year) is not the same as the prevention of significant deterioration increment form (not to be exceeded more than once per year). The value in this table has a form that matches the NAAQS form and was calculated from the initial model result as described in Appendix C, Section C2.3.

under two scenarios. The first scenario includes the coarse particulate matter (i.e., PM_{10}) when computing the results and the second scenario excludes the PM_{10} from the computation. Project emission of fine particulate matter (i.e., $PM_{2.5}$) is included in both scenarios. The reason for the second scenario is to account for the settling and deposition of heavier particles as the dust plume dissipates from the source. NRC staff will base the impact analyses in this SEIS on the second scenario, which excludes the PM_{10} emissions from the computation. The rationale for the exclusion of the PM_{10} emissions from the computation is presented in Appendix C Section C2.3.1. For information purposes, NRC staff will also present the impact analysis for the first scenario, which includes the PM_{10} emissions in the analysis. The acid deposition impacts are modeled under one scenario using the complete emission inventory. Acid deposition impacts are modeled as the deposition of a variety of compounds containing nitrogen and sulfur. The sulfur dioxide and nitrogen oxides emissions from the proposed project constitute the potential sources of acid deposition.

Table 4.7-2. Nonradiological Concentration Values From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the Prevention of Significant Deterioration (PSD) Increments

Pollutant	Averaging Time	PSD Increment Form†	Class I			Class II		
			Value‡ ($\mu g/m^3$)	Increment ($\mu g/m^3$)	Percentage of PSD Increment	Value‡ ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)	Percentage of PSD Increment
Nitrogen Dioxide	Annual	Not to be exceeded during the year at any one location	0.03	2.5	1.2	3.3	25	13.2
Particulate Matter $PM_{2.5}$	24 hour	Not to be exceeded more than once per year at any one location	0.45	2	22.5	7.9	9	87.8
	Annual	Not to be exceeded during the year at any one location	0.03	1	3.0	3	4	75
Particulate Matter PM_{10} Initial Run§	24 hour	Not to be exceeded more than once per year at any one location	8	8	100	187.2	30	624
	Annual	Not to be exceeded during the year at any one location	0.15	4	3.7	9.22	17	54.1
Particulate Matter PM_{10} Final Run‖	24 hour	Not to be exceeded more than once per year at any one location	3.6	8	45	83.126	30	279
	Annual	Not to be exceeded during the year at any one location	0.15	4	3.7	6.1	17	35.9
Sulfur Dioxide	3 hour	Not to be exceeded more than once per year at any one location	1.64	25	6.6	100.1	512	19.5
	24 hour	Not to be exceeded more than once per year at any one location	0.25	5	5	12.6	91	13.8

Table 4.7-2. Nonradiological Concentration Values From Stationary, Mobile, and Fugitive Sources for the Peak Year* Compared to the Prevention of Significant Deterioration (PSD) Increments (Cont'd)

Pollutant	Averaging Time	PSD Increment Form†	Class I			Class II		
			Value‡ (μg/m^3)	Increment (μg/m^3)	Percentage of PSD Increment	Value‡ (μg/m^3)	PSD Increment (μg/m^3)	Percentage of PSD Increment
	Annual	Not to be exceeded during the year at any one location	0.00	2	0	0.6	20	3

Source: Modified from IML (2013a and b) and Powertech (2013c)
*Year accounts for when all four phases occur simultaneously and represents the highest amount of emission the proposed action would generate in any one project year
†Form expresses both the statistic (e.g., maximum, average, 98th percentile, etc) and the time period (e.g., once per year, over 1 year, over 3 years, etc.) associated with the numerical value.
‡None of the forms for the modeling results (see Table C-10) are the same as the PSD increment forms. Values were generated as described in Appendix C, Section C2.3.1 to create numbers appropriate to comparison to PSD increments.
§Initial run without dry depletion for all receptor locations.
‖Final run with dry depletion for the top 50 receptor locations.

Table 4.7-3 presents the visibility analysis results and Table 4.7-4 presents the acid deposition analysis results. NRC staff considers comparing project emission levels to thresholds useful for characterizing the magnitude of the potential impacts. Both tables compare the project specific results to appropriate thresholds. The visibility analysis in Table 4.7-3 specifies a threshold parameter identified by EPA, U.S. Forest Service (USFS), and FWS. This threshold indicates that a visibility impact on a Class I area is considered significant when the source's contribution to visibility impairment, modeled as the 98th percentile of the daily (i.e., 24-hour), results in changes in deciviews that are equal to or greater than the contribution threshold of 0.5 deciviews (IML, 2013a). Expressed in another way, a source can be reasonably anticipated to cause or contribute to visibility impairment if the 98th percentile change in light extinction (i.e., the scattering of light) is greater than 0.5 deciviews.

Two different thresholds are presented in Table 4.7-4 for comparison to the project acid deposition results. The first threshold is a concern threshold, also called the Deposition Analysis Threshold, established by USFS. Below this threshold, deposition impacts from a source are considered negligible (IML, 2013a). The second threshold is the estimated critical loads for Wind Cave National Park. The term critical load describes the threshold of air pollution deposition below which significant harmful effects on sensitive resources in an ecosystem are not expected to occur. The critical load threshold is an emerging guideline to help in the protection of Class I areas. Table 4.7-4 also presents the measured deposition rates at Wind Cave National Park. Additional information concerning these thresholds is available in the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a).

The NRC staff conclude that the site-specific conditions at the proposed Dewey-Burdock ISR Project are not bounded by those described in the GEIS for air quality. The estimated emission levels and associated pollutant concentrations for the proposed project described in SEIS Section 2.1.1.1.6.1.1 are greater than those cited in GEIS Table 2.7-2 (NRC, 2009a). The pollutant with the highest emission level for the proposed action is particulate matter PM_{10} with most being generated in the construction phase (see Table 2.1-3). The GEIS estimates that the construction phase an ISR facility generates an annual fugitive dust concentration of 0.28 μg/m^3 based on a 10.0 metric ton emission level (NRC, 2009a). This estimate did not categorize the

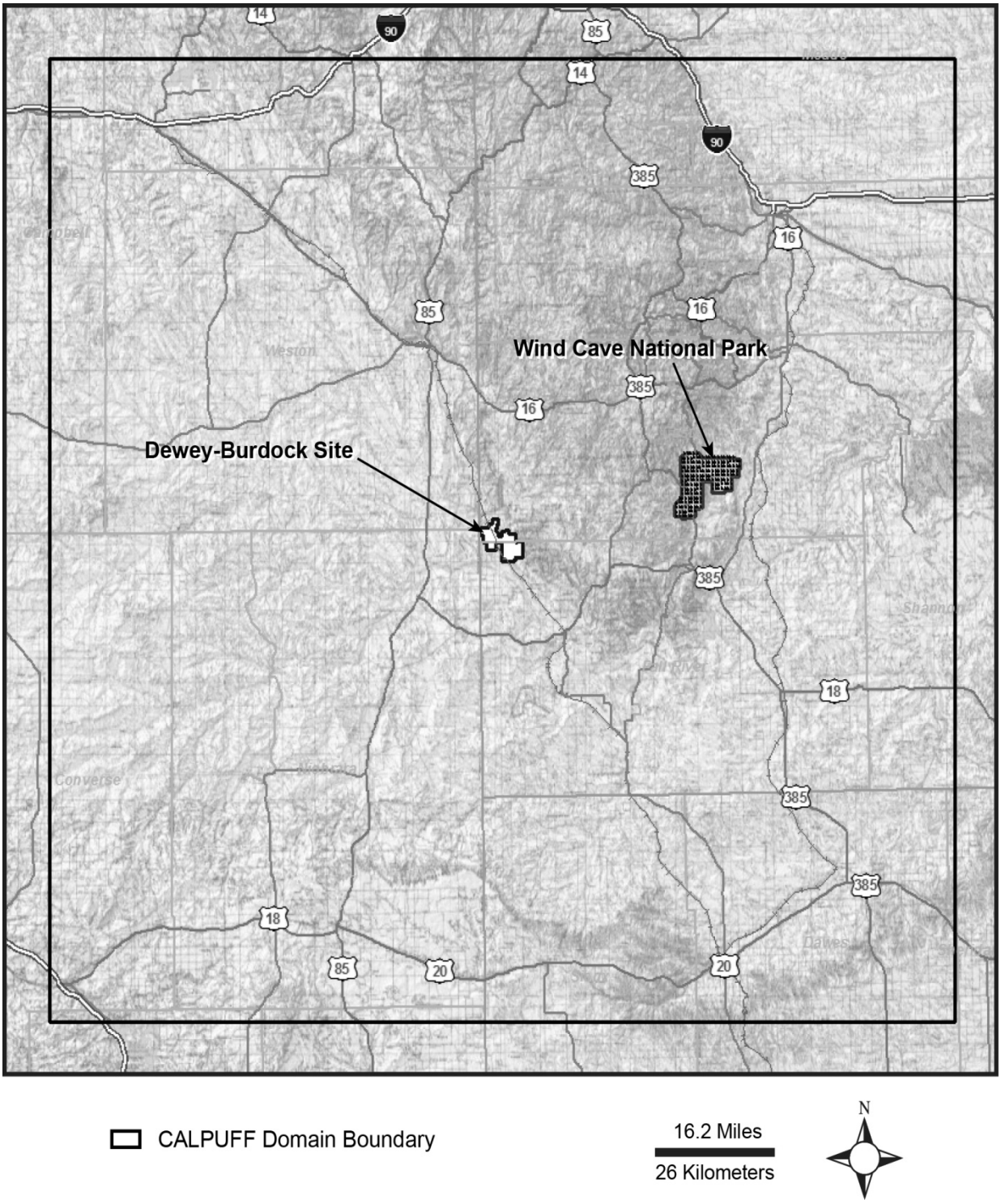

Figure 4.7-3. View of Dewey-Burdock Air Quality Related Values Analysis Domain for the CALPUFF Analysis
Source: Modified From IML (2013a)

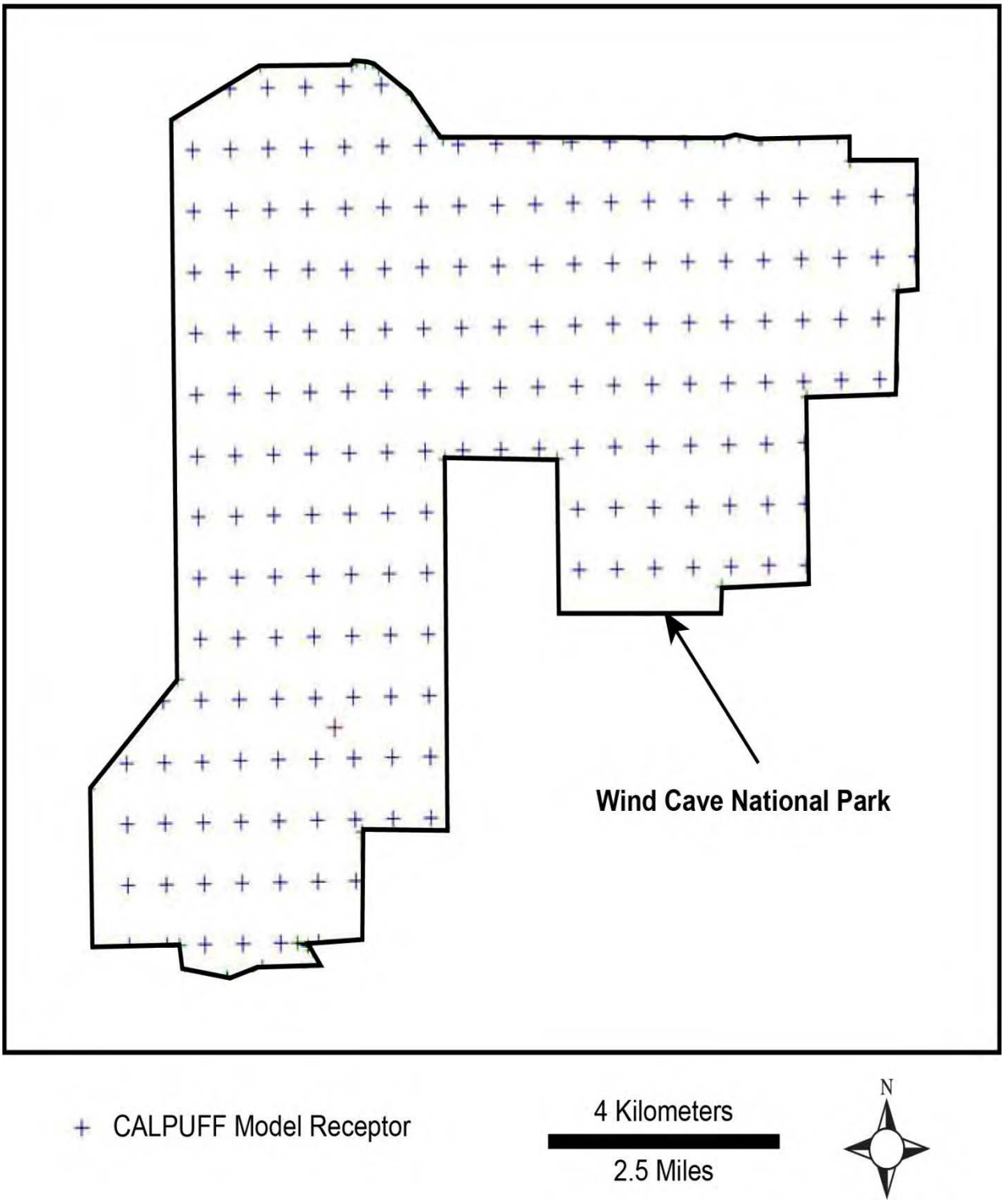

Figure 4.7-4. Locations Where Air Quality Related Values Were Calculated Using the CALPUFF Dispersion Model
Source: Modified From IML (2013a)

Table 4.7-3. Visibility Modeling Results for the Peak Year* at Wind Cave National Park

Scenario	Statistic	Modeled 3-Year Result	Contribution Threshold	Modeled Results		
				2009	2010	2011
Modeled with Particulate Matter PM_{10}	98th percentile Δdv†	0.35	0.50	0.33	0.31	0.40
	Number of days > 0.5 Δdv	11	NA‡	3	4	4
	Number of days > 1 Δdv	0	NA	0	0	0
	Maximum Δdv	0.83	NA	0.55	0.83	0.58
Modeled without Particulate Matter PM_{10}	98th percentile Δdv note1	0.11	0.50	0.10	0.11	0.12
	Number of days > 0.5 Δdv	0	NA	0	0	0
	Number of days > 1 Δdv	0	NA	0	0	0
	Maximum Δdv	0.20	NA	0.15	0.20	0.15

Source: IML (2013a)
*Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emission the proposed action will generate in any one project year.
†Δdv = change in deciviews
‡NA = not applicable

Table 4.7-4. Total (Wet and Dry) Acid Deposition Modeling Results for the Peak Year* at Wind Cave National Park

Parameter		Sulfur (kg/ha/yr)†	Nitrogen (kg/ha/yr)	Sulfur and Nitrogen (kg/ha/yr)
Modeled Results (3-Year Average)		0.0010	0.0016	0.0026
Concern Threshold (annual)		0.005	0.005	0.010
Wind Cave Nation Park Measurements	2009	1.00	2.72	3.72
	2010	1.16	3.56	4.72
	2011	0.90	2.87	3.77
	3-year average	1.02	3.05	4.07
Estimated Critical Load (Annual)		12	5	17

Source: IML (2013a).
*Peak year accounts for when all four phases occur simultaneously and represents the highest amount of emission the proposed action will generate in any one project year.
†Units only expressed in metric form.

particulates as PM_{10} or $PM_{2.5}$. This SEIS estimates that the construction phase of the proposed Dewey-Burdock project generates an annual PM_{10} concentration of 2.4 µg/m^3 based on a 172 metric ton [190 short ton] emission level and an annual $PM_{2.5}$ concentration of 0.41 µg/m^3 based on a 18.8 metric ton [20.7 short ton] emission level (see Tables 2.1-5, C–9, and C–10). The environmental impacts on air quality for each of the liquid waste disposal options the

applicant proposed (i.e., deep well disposal via Class V injection wells, land application, or combined deep well disposal and land application) are discussed in the following sections.

4.7.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on air quality from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.7.1.1.1 Construction Impacts

To help characterize the magnitude of the proposed project's air effluents, the emission levels are compared to regulatory thresholds, such as the New Source Review program threshold for classification as a major source. The estimated emission levels of NAAQS pollutants for stationary sources for the proposed Dewey-Burdock ISR Project listed in Table 2.1-1 are well below the New Source Review program threshold of 227 metric tons [250 short tons] for classification as a major source as described in SEIS Section 2.1.1.1.6.1.1. The pollutant with the highest stationary source emission level is NO_x at 1.54 metric tons [1.70 short tons]. For the construction phase, all of the estimated annual emission levels of nonradiological pollutants from all sources (i.e., stationary, mobile, and fugitive) were lower than the New Source Review threshold (see Table C–11). The pollutant with the highest emission level is PM_{10} at 172.2 metric tons [189.8 short tons] (see Table 2.1-3). However, for the peak year, the one pollutant emission level that exceeds the New Source Review threshold is PM_{10} at 419.0 metric tons [461.9 short tons] (see Table 2.1-5).

Air emission during the construction phase of the proposed project will consist primarily of combustion emissions and fugitive road dust. The construction phase generates the highest levels of fugitive dust relative to the other phases (see Table 2.1-3). Travel on unpaved roads generates about 84 percent of the PM_{10} emission levels with wind erosion accounting for the remaining 16 percent (see Table 2.1-3). For the mobile combustion emissions, the construction phase generates the highest levels of sulfur dioxide, nitrogen oxides, and carbon monoxide when compared with the other three phases (see Table 2.1-2). For the construction phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2).

The total pollutant concentrations (i.e., the modeling results for the project emissions when added to the background concentration levels) for the initial modeling run reveal that the peak year pollutant concentrations are below the NAAQS, except for the PM_{10} 24-hour estimate (see Table 4.7-1). These concentrations include the stationary sources from Table 2.1-1, the mobile sources from Table 2.1-2, and the fugitive sources from Table 2.1-3. All 50 receptor locations where the PM_{10} 24-hour total pollutant concentration exceeded the NAAQS occur within 500 meters [546.8 yards] of the Dewey-Burdock project boundary and the public road over which commuter traffic accesses the site (IML, 2013a). In fact the receptors with the ten highest PM_{10} 24-hour concentrations occur along the public road rather than the project boundary (IML, 2013a). Fugitive dust sources account for 99.1 percent of the peak year PM_{10} emissions for all sources (see Table C–8). For the construction phase, travel on unpaved roads accounts for 84 percent of the PM_{10} emissions (see Table 2.1-3). This indicates that travel on the unpaved roads is a key source for the fugitive dust estimates. The fact that the exceedences occur for

the 24-hour standard and not the annual standard indicates that potential impacts are associated with the short-term time frame.

The initial modeling run for PM_{10} was conducted without implementing the dry depletion option. The AERMOD dry depletion option accounts for the partial settling and deposition of PM_{10} particles as the dust plume disperses away from the source. In simple terms, heavier particles tend to fall out of the air sooner than lighter particles. A more detailed explanation of dry depletion and the rationale for its use in this SEIS is presented in Appendix C Section C2.3.1. NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS on the PM_{10} modeling results that implement the dry depletion option (i.e., the final modeling run). For information purposes, NRC staff will also present the impact analysis for the results that do not implement the dry depletion option (i.e., the initial modeling run). However, the impact assessment in this SEIS will not be based on the PM_{10} estimates generated in the initial modeling run. Implementation of the dry depletion option for the final modeling results only changes the PM_{10} estimates. Put another way, the initial modeling results provide the estimates used in the SEIS for all of the pollutants other than PM_{10}. When the modeling implements the dry depletion option, the peak year total concentration for the PM_{10} 24-hour estimate is below the NAAQS (i.e., 83.1 percent) and the estimated peak year total concentrations for all of the pollutants are below the NAAQS ranging between 3.7 and 86.9 percent of the applicable threshold (see Table 4.7.1). As described in Table C–11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, the total pollutant concentrations for the initial modeling run (i.e. without implementing dry depletion) are below the NAAQS ranging between 2.4 and 78.6 percent of the applicable standard (see Table C–12). This includes the PM_{10} 24-hour estimate which drops from 78.6 percent of the NAAQS to 50.2 percent when dry depletion is implemented (see Table C–12).

While the NAAQS primarily relate to an area's attainment classification (see SEIS Section 3.7.2), the PSD increments relate to pollution levels made by individual projects. The modeling domain for this project included both Class I areas (i.e., Wind Cave National Park) and Class II areas (i.e., all other areas within the domain). Wind Cave National Park is located about 46.7 km [29.0 mi] northeast of the proposed project area, and the predominant wind direction is from the northwest (see Figure 3.7-1). The Class II analysis will be addressed first followed by the Class I analysis.

For the peak year, the estimated PM_{10} 24-hour project level concentration is above the allowable PSD Class II increment for both the initial and final modeling runs (see Table 4.7-2). The estimated project level PM_{10} 24-hour concentration for the final model run is almost three times the PSD Class II increment and the initial modeling result is over six times the PSD Class II increment. The estimated project level concentrations for all of the other pollutants are below the PSD Class II increments ranging between 3 and 87.8 percent of the applicable threshold (see Table 4.7-2). As described in Table C-11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, the estimated PM_{10} 24-hour project level concentrations for the final modeling run (34.4 $\mu g/m^3$) and initial modeling run (76.9 $\mu g/m^3$) are both above the allowable PSD Class II increment of 30 $\mu g/m^3$. For all of the other pollutants, the estimated project level concentrations for the construction phase are below the applicable PSD Class II increments.

For the peak year, none of the estimated project level concentrations exceed the allowable Class I PSD increments (see Table 4.7-2). For the final modeling run, the project level

concentration estimates range between zero and 45 percent of the applicable threshold. If the initial modeling run is considered, this range increases to 100 percent due to the PM_{10} 24-hour project level concentrations. As described in Table C–11, the construction phase contribution to the peak year emissions varies between 40.5 and 70.8 percent depending on the particular pollutant. For the construction phase, all of the estimated project level concentrations are below the applicable PSD Class I thresholds.

NRC staff consideration of the Air Quality Related Values begins with the peak year analysis for the visibility. Table 4.7-3 presents the visibility analysis results both with and without PM_{10} included in the emission inventory. For the modeled results without the PM_{10} included, the 98th percentile of the annual, 24-hour average change in deciviews is less than the contribution threshold for both the 3-year average as well as for each individual year. There are no days during the 3-year model period with a change in light extinction exceeding 0.5 deciviews. For the modeled results with the PM_{10} included, the 98th percentile of the annual, 24-hour average change in deciviews is also less than the contribution threshold for both the three-year average, as well as for each individual year. However, there are eleven days during the 3-year model period with a change in light extinction exceeding 0.5 deciviews. Visibility impacts are not generated for the individual project phases. The analyses with and without PM_{10} both reveal that the annual peak year results are below the threshold. The individual phase results, as a fraction of the peak year results, are also below the threshold. In addition, the visibility result is a value computed from several pollutants with varying contributions rather than just a single pollutant. This complicates any attempt to generate phase specific contribution values.

Table 4.7-4 presents the total (i.e., wet and dry) acid deposition peak year results for the Wind Cave National Park. The modeled results for the 3-year average are below the concern threshold. This will remain true even if all of the modeled emissions occur in a single year. The modeled results when combined with the measured 3-year average at Wind Cave National Park are below the estimated critical load. This will remain true if the modeled results are combined with any of the single year measured averages. Acid deposition impacts are not generated for the individual project phases. The annual peak year results are below the threshold. The individual phase results, as a fraction of the peak year results, will also be below the threshold.

The air emission inventory used in this SEIS incorporates the following mitigation measures the applicant committed to implement (IML, 2013a and Powertech, 2012d):

- Lowering the drill rig engine horsepower from 550 horsepower to 300 horsepower, except for the deep well drill rig.
- Using Tier 1, or higher, drill rig engines and Tier 3, or higher, construction equipment engines.
- Car pooling.
- Water suppression for unpaved roads.

The various tiers refer to a phased program of federal standards that requires newly manufactured engines to generate lower pollutant emission levels. Higher tier numbers correlate with stricter emission standards and lower pollutant levels. Section C2.1 describes how changes in engines used are incorporated into the calculation of the revised emissions inventory. Table C–5 describes the effectiveness (i.e., the percentage of emissions reduction)

of the different tier levels based on the associated emission factors. The applicant committed to implement carpooling. Reducing the number of vehicles commuters use results in fewer emissions and lower pollutant levels. Table C–6 described the effectiveness (i.e., the percent that the emissions are reduced) of the carpooling implemented by the applicant. A 60 percent reduction in the fugitive dust emissions associated with travel on unpaved roads within the proposed project boundary is incorporated into the inventory. The watering frequency of more than twice per hour is the basis for using the 60 percent control efficiency. Appendix D of the Ambient Air Quality Final Modeling Protocol and Impact Analysis (IML, 2013a) provides additional details for the project specific watering control of fugitive dust and the 60 percent control efficiency basis. No reduction in the fugitive dust emission associated with travel on the unpaved road outside of the project boundary is incorporated into the emission inventory. The applicant identified other mitigation measures it will implement (see Table 6.2-1); however, these other measures are not incorporated in the calculation of the revised emissions inventory. In addition, the applicant has proposed the following mitigation measures to further reduce and control air emissions (IML, 2013a and Powertech, 2009a):

- Implement standard dust control measures such as speed limits.
- Coordinate dust-producing activities to reduce maximum dust levels.
- Maintain vehicles to meet applicable EPA emission standards.
- Restore and reseed disturbed areas.
- Assist Fall River County in the maintenance and application of dust suppressant on the unpaved road beyond the project boundary.

All phases of the proposed Dewey-Burdock ISR Project will produce greenhouse gas emissions. Table 2.1-6 presents the carbon dioxide emission estimates for the proposed action for each of the four phases and for the various source categories. The only greenhouse gas included in the emission estimates is carbon dioxide. NRC staff consider the exclusion of other greenhouse gases from the inventory acceptable because carbon dioxide is the primary greenhouse gas emitted by the proposed action (IML, 2013a) and the analysis in this SEIS is for disclosure purposes rather than a formal regulatory determination. SEIS Appendix C Section C3 contains additional information on the greenhouse gas emission estimates presented in Table 2.1-6. The estimated carbon dioxide emission level for the stationary sources is lower than the current EPA permitting threshold, as described in SEIS Section 3.7.2. In fact, both the peak year and construction phase emissions levels for all of the sources (i.e., facility, mobile, and electric consumption) are below this threshold. For comparison, the annual estimated greenhouse gas emissions for the peak year from all sources is 38,621 metric tons [42,572 short tons], which is a small fraction of those produced annually in South Dakota {36.5 million metric tons [40.2 million short tons] of gross CO_2e emissions} (Center for Climate Strategies, 2007). NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and exclude the PM_{10} emissions from the CALPUFF visibility analysis. The proposed action's dispersion modeling results that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the

stationary and mobile sources indicate that pollution concentration levels within the modeling domain are generally low. Pollutant concentrations for both the peak year and construction phase only pollutant concentrations are below the NAAQS. All the estimated project level concentrations for both the peak year and construction phase are below the PSD Class II increments, except for the 24-hour PM_{10} values. As described in SEIS Section 4.7.1, the SDDENR formally determined that the project will not be subject to PSD requirements. Therefore, for this analysis, NRC staff consider comparison of project level pollutant concentrations to PSD increments for disclosure purposes (e.g., indicating the type of project level emission the analysis should focus on for potential environmental impacts) rather than a regulatory concern. For both the peak year and construction phase only, all of the estimated project level concentrations are below the PSD Class I increments. Due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for only the peak year and construction phase. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emissions will result in a MODERATE impact on air quality for the peak year and construction phase. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. In fact, there are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that that the peak year and construction phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the construction phase for the Class V injection well disposal option will range from SMALL to MODERATE. The NRC staff reiterate that the peak year represents the greatest project impacts and conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion.

There is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the NAAQS. For the peak year, the total pollutant concentrations for the initial modeling run reveal that the concentrations for each of the NAAQS pollutants are below the NAAQS except for the PM_{10} 24-hour estimate (see Table 4.7-1). Implementation of the dry depletion option for the peak year total concentrations results in this value being below the standard. The NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact, if mitigating measures are not incorporated by the applicant. One factor or measure that could reduce concentrations is the incorporation of mitigation into the emission inventory calculation such as water suppression for travel on unpaved roads beyond the boundary of the proposed project. Other factors that can be

considered are the implementation of particulate monitoring and an associated contingency plan that identifies steps that will be undertaken, if the monitoring shows that fugitive dust is an issue. In the Ambient Air Quality Final Modeling Protocol and Impact Analysis, the applicant expressed willingness to perform air monitoring. During interactions with the NRC, EPA staff recommended the development of a contingency plan associated with such monitoring. However, NRC staff will not require additional measures be undertaken by the applicant because the impact analyses based on the modeling results implementing the deviations from the default conditions correctly estimate the impact magnitude. NRC suggests that the applicant coordinate with appropriate entities, such as Fall River County, for mitigation to the unpaved public road outside the proposed project boundary, or the SDDENR and EPA for fugitive dust monitoring and associated contingency plans.

Although there is a distinction between the initial and final AERMOD modeling runs for the peak year analysis, this is not an issue for the construction phase analysis because both the initial and final modeling PM_{10} 24-hour results are below the NAAQS. NRC staff acknowledge that, for the visibility analysis that includes PM_{10}, there are eleven days during the three-year modeling period where the change in light extinction exceeds 0.5 deciviews. NRC staff further acknowledge that some may consider a statistic other than the 98th percentile (e.g., the maximum change in deciviews or the number of day greater than a 0.5 change in deciviews) the appropriate value to determine the impact magnitude. However, NRC staff considers the 98th percentile statistic as an appropriate basis for determining the impact magnitude. As a result, there is no difference in impact magnitude between the analyses with and without PM_{10}.

4.7.1.1.2 Operations Impacts

The estimated emission levels of NAAQS pollutants for stationary sources for the proposed action listed in Table 2.1-1 are well below the Title V or operating permit threshold of 90.7 metric tons [100 short tons] for classification as a major source in an attainment area as described in SEIS Section 2.1.1.1.6.1.1. The pollutant with the highest stationary source emission level is NO_x at 1.54 meteric tons [1.70 short tons]. For the operation phase, all of the estimated annual emission levels of nonradiological pollutants from all sources were lower than the operating permit threshold, except for PM_{10} at 138.3 metric tons [152.4 short tons] (see Table 2.1-3 and Table C–11). For the peak year, the only pollutant emission level that exceeds the operating permit threshold is PM_{10} at 419.0 metric tons [461.9 short tons] (see Table 2.1-5).

Air emissions during the operation phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. Travel on unpaved roads generates about 81 percent of the PM_{10} emission levels with wind erosion accounting for the remaining 19 percent (see Table 2.1-3). For the operations phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_X and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the operation phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table6.2-1).

The discussion of the peak year project level emissions compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. As described in Table C–11, the operation phase contribution to the peak year emissions varies between 15.8 and 33.0 percent depending on the

particular pollutant. For the operation phase, the total pollutant concentrations for the initial modeling run are below the NAAQS ranging between 1.1 and 68.5 percent of the applicable standard (see Table C–13). This includes the PM_{10} 24-hour estimate, which drops from 68.5 percent of the NAAQS to 45.7 percent when dry depletion is implemented (see Table C–13). The estimated operation phase PM_{10} 24-hour project level concentration for the final modeling run (27.6 µg/m^3) is below the allowable PSD Class II increment, while the initial modeling run value (61.8 µg/m^3) remains above this threshold. For all of the other pollutants, the estimated project level concentrations for the operations phase are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceed the applicable Class I PSD increment (see Table 4.7-2). The estimated projected level concentrations for the operation phase, as a fraction of the peak year results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction that exceeds 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The operation phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

The operations phase generates the most overall carbon dioxide emissions relative to the other three phases. Table 2.1-6 presents the carbon dioxide emission estimates for the proposed action for each of the phases and for the various source categories. The annual estimated carbon dioxide emission for the operation phase from all sources (i.e., facility, mobile, and electrical consumption) were 25,466 metric tons [28,072 short tons]. Stationary sources accounted for less than 6 percent of the overall carbon dioxide emissions (Table 2.1-6). These estimated levels of carbon dioxide gas emissions are lower than the current EPA permitting threshold as described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and excluding the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the operation phase impact magnitude. The proposed action's dispersion modeling results, that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the operation phase, indicate that pollution concentration levels within the modeling domain are generally low. For the final modeling run, the operation phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the operation phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled

results when combined with the measured results at the Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that that operation phase project emissions will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the operation phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact.

When considering the operation phase, there is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the Class II PSD increments. The estimated PM_{10} 24-hour project level concentrations for the final modeling run is below the allowable PSD Class II increment, while the estimated PM_{10} 24-hour project level concentration for the initial modeling run value is above this threshold. For the initial modeling run, due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for both the peak year and operation phase only. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emission will result in a MODERATE impact on air quality. This conclusion differs from the final modeling run results analysis, which classifies the PM_{10} 24-hour Class II impacts as SMALL.

4.7.1.1.3 Aquifer Restoration Impacts

Air emissions during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. For the proposed project, the aquifer restoration phase generates by far the lowest levels of air emission relative to the other three phases. For the aquifer restoration phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the aquifer restoration phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table 6.2-1).

The discussion of the peak year project level emission compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS

Section 4.7.1.1.1 remains the same. As described in Table C–11, the aquifer restoration phase contribution to the peak year emissions varies between 0.5 and 5.5 percent depending on the particular pollutant. For the aquifer restoration phase, the total pollutant concentrations for the initial modeling run are below the NAAQS ranging between 0.5 and 40.5 percent of the applicable standard (see Table C–14). This includes the PM_{10} 24-hour estimate, which drops from 33.3 percent of the NAAQS to 30.0 percent when dry depletion is implemented (see Table C–14). All of the estimated aquifer restoration phase project level pollutant concentrations, including the PM_{10} 24-hour final modeling run (4.0 µg/m^3) and initial modeling run (9.0 µg/m^3) estimates, are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceed the applicable Class I PSD increment (see Table 4.7-2). The estimated projected level concentrations for the aquifer restoration phase, as a fraction of the peak results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction exceeding 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The aquifer restoration phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

Overall, the total carbon dioxide emissions from the aquifer restoration phase are about three times lower than the operations phase (see Table 2.1-6). Most of the aquifer restoration phase carbon dioxide gas emissions are attributed to indirect electrical consumption (Table 2.1-6). The estimated aquifer restoration phase levels of carbon dioxide emission from all sources is lower than the current EPA permitting threshold as described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS using the PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and excluding the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the aquifer restoration phase impact magnitude. The proposed action's dispersion modeling results that address fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the aquifer restoration phase indicate that pollution concentration levels within the modeling domain are low. For the final modeling run, the aquifer restoration phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the aquifer restoration phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year period modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at the Wind Cave National Park are below the

estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff concludes that the aquifer restoration phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the aquifer restoration phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact. When considering the aquifer restoration phase, there are no distinctions between the two analyses that will result in a difference in impact magnitude conclusions.

4.7.1.1.4 Decommissioning Impacts

Air emissions during the decommissioning phase of the proposed Dewey-Burdock ISR Project will consist primarily of combustion emissions and fugitive road dust. For the decommissioning phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). The construction phase analysis in SEIS Section 4.7.1.1.1 discusses the inclusion of mitigation in the calculation of the emissions inventory and the effectiveness of this mitigation. This information also applies to the aquifer restoration phase impact analysis. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table 6.2-1).

The discussion of the peak year project level emission compared to the NAAQS, Class II PSD increments, and Class I PSD increments presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. As described in Table C–11, the decommissioning phase contribution to the peak year emissions varies between 12.1 and 21.2 percent depending on the particular pollutant. For the decommissioning phase, the total pollutant concentrations for the initial modeling run are below the NAAQS, ranging between 1.0 and 53.7 percent of the applicable standard (see Table C–15). This includes the PM_{10} 24-hour estimate, which drops from 53.7 percent of the NAAQS to 39.1 percent when dry depletion is implemented (see Table C–15). The estimated decommissioning phase PM_{10} 24-hour project level concentrations for the final modeling run (17.6 $\mu g/m^3$) are below the allowable PSD Class II increment, while the initial modeling run value (39.5 $\mu g/m^3$) remains above this threshold. For all of the other pollutants, the estimated project level concentrations for this phase are below the applicable PSD Class II increments. For the peak year, none of the estimated projected level concentrations for both the initial and final modeling run exceeds the applicable Class I

PSD increment (see Table 4.7-2). The estimated projected level concentrations for the decommissioning phase, as a fraction of the peak year results, are also below the PSD Class I increments.

As described in SEIS Section 4.7.1.1.1, Air Quality Related Value impacts are not generated for the individual project phases. Instead, the impacts are based on the peak year values. The analysis presented here is a summary of the analysis presented in SEIS Section 4.7.1.1.1. For the visibility analysis, the modeled peak year results with and without the PM_{10} included are both below the contribution threshold. With the PM_{10} emissions included there are eleven days over the three-year period with a change in light extinction exceeding 0.5 deciviews. The acid deposition peak year results were below the applicable thresholds. The decommissioning phase results, as a fraction of the peak year results, will also be below the applicable visibility and acid deposition thresholds.

All phases of the proposed Dewey-Burdock ISR Project generate carbon dioxide, with the operations phase producing the most. Overall, the total carbon dioxide emissions from the decommissioning phase are about 8 times lower than the operations phase (see Table 2.1-6). The estimated decommissioning phase level of carbon dioxide emissions from all sources is lower than the current EPA permitting threshold described in SEIS Section 3.7.2. NRC staff conclusions concerning potential greenhouse gas impacts are addressed in SEIS Section 5.7 on air quality cumulative effects.

As described in SEIS Section 4.7.1.1, NRC staff will base the impact analyses (i.e. SMALL, MODERATE, or LARGE) in this SEIS on PM_{10} modeling results that implement the AERMOD dry depletion option (i.e., the final modeling run) and exclude the PM_{10} emissions from the CALPUFF analysis. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. The discussion here will focus on the decommissioning phase impact magnitude. The proposed action dispersion modeling results addressing fugitive dust emissions as well as emissions from the burning of fossil fuels for the stationary and mobile sources associated with the decommissioning phase indicate that pollution concentration levels within the modeling domain are generally low. For the final modeling run, the decommissioning phase pollutant concentrations are below the applicable NAAQS, Class II PSD increments, and Class I PSD increments. Due to the level of the decommissioning phase pollutant concentrations, NRC staff conclude that the pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. For the visibility analyses, the annual modeled peak year results are below the contribution threshold. There are no individual days over the three year modeling period with a change in light extinction exceeding 0.5 deciviews. For the acid deposition results, the peak year results are below the contribution threshold. The modeled results when combined with the measured results at Wind Cave National Park are below the estimated critical load. The individual phase results, as a fraction of the peak year results, will be below the visibility and acid deposition thresholds. Due to the level of the visibility and acid deposition results relative to the applicable thresholds, NRC staff conclude that the decommissioning phase project emission will result in a SMALL impact on air quality.

The NRC staff conclude that the overall impact to air quality during the decommissioning phase for the Class V injection well disposal option will be SMALL. The NRC staff reiterate that the peak year represents the greatest project impacts and, as described in SEIS Section 4.7.1.1.1, conclude that the peak year impact will range from SMALL to MODERATE.

For information purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The tables and discussion in the SEIS text already include the information for the initial AERMOD modeling results and inclusion of the PM_{10} emission in the CALPUFF visibility analysis. This discussion will focus on distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for this SEIS and the analysis the NRC is presenting for informational purposes only) that could result in a different impact magnitude conclusion. The discussion of the peak year project level impact magnitude presented in the construction phase analysis in SEIS Section 4.7.1.1.1 remains the same. Without additional consideration (e.g., incorporation of additional mitigation into the emission inventory), NRC will characterize the initial modeling run results for the peak year concentrations as a LARGE impact.

When considering the decommissioning phase, there is an important distinction between the initial and final AERMOD modeling runs in terms of the results relative to the Class II PSD increments. The estimated PM_{10} 24-hour project level concentrations for the final modeling run is below the allowable PSD Class II increment, while the estimated PM_{10} 24-hour project level concentration for the initial modeling run value is above this threshold. For the initial modeling run, due to the level (i.e., above PSD Class II increments) and nature of these fugitive PM_{10} emissions, there is a potential for noticeable localized dust emissions for the decommissioning phase. Short-term, intermittent impacts are possible to the area in and around the site, particularly when vehicles travel on unpaved roads. At times, the fugitive emission will result in a MODERATE impact on air quality. This conclusion is different from the final modeling run results analysis, which classifies the PM_{10} 24-hour Class II impacts as SMALL.

4.7.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). Potential environmental impacts on air quality from construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections. The discussion also addresses the impacts on air quality during the peak year when all four phases occur simultaneously.

4.7.1.2.1 Construction Impacts

When examining combustion emissions, the land application liquid waste disposal option will not require the drilling of up to eight Class V deep disposal wells. The percentage of combustion emission from drill rigs (excluding the deep well rig) ranges from 45 to 70 percent depending on the pollutant (see Table C–2). However, the drilling of eight Class V deep disposal wells constitutes no more than one half of 1 percent of the construction phase emissions for any single NAAQS pollutant. NRC staff conclude that the elimination of drilling the Class V deep disposal wells will result in a very small reduction in the NAAQS pollutant emissions generated.

The source that generates the majority of remaining combustion emissions is the construction and drilling field equipment (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of

irrigation areas, will not be expected to generate many air emissions from the use of construction or field equipment. The amount of land disturbed for wellfields, access roads, trunkline installation, and site buildings is identical for the deep well disposal and land application options. These types of land disturbances will be associated with the generation of air emissions from construction and field equipment use. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources other than the drilling rigs.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for both the construction phase and the peak year (i.e., all phases combined).

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, 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 for the construction phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the construction phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When considered in conjunction with the fugitive emissions from unpaved roads, the peak year land application option will generate about 5 percent more PM_{10} emissions and about 7 percent more $PM_{2.5}$ than the deep well disposal option. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the construction phase land application option will generate about 10 percent more PM_{10} emissions and about 14 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for both the construction phase and the peak year

(i.e., all phases combined). The low level of combustion emissions will result in a SMALL impact on air quality. At times, fugitive emissions will result in a MODERATE impact on air quality from localized dust emissions that are short term and intermittent in nature. The NRC staff conclude that the overall impact on air quality during the construction phase for the land application disposal option will range from SMALL to MODERATE.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the peak year and construction phase only impact assessment is that NRC staff will characterize the initial modeling run results for the peak year concentrations as a LARGE impact based on the PM_{10} 24-hour emission levels. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.2 Operation Impacts

For the operations phase, combustion emissions for NAAQS pollutants are basically evenly divided between the light duty vehicles and the construction and drilling field equipment (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate many air emissions from the use of construction or field equipment. The amount of land disturbed for wellfields, access roads, trunkline installation, and site buildings is identical for the deep well disposal and land application options. These types of land disturbances will be more associated with the generation of air emissions from construction and field equipment use. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the operation phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, 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 for the operation phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the operation phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land

disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the operation phase land application option will generate about 12 percent more PM_{10} emissions and about 17 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the operation phase. The NRC staff conclude that the operation phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the operation phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the operation phase impact assessment is that NRC staff will characterize the initial modeling run results as MODERATE at times because of the PM_{10} 24-hour concentrations relative to the PSD Class II increment. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.3 Aquifer Restoration Impacts

For the aquifer restoration phase, combustion emissions are limited to light duty vehicles (see Table C–2). As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. These types of land disturbances, particularly the addition of irrigation areas, will not be expected to generate much change in air emissions from light duty vehicles. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the aquifer restoration phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analysis because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, 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 for the aquifer restoration phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the aquifer restoration phase, wind erosion generates more fugitive emissions than travel on unpaved roads. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the deep well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the aquifer restoration phase land application option will generate about 46 percent more PM_{10} emissions and about 51 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the land disposal option and the deep well disposal option, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for the aquifer restoration phase. The NRC staff conclude that the aquifer restoration phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The NRC staff conclude that the overall impact on air quality during the aquifer restoration phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF visibility analysis. When considering the aquifer restoration phase, there are no distinctions between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) that will result in a difference in impact magnitude conclusions. NRC staff conclude that the aquifer restoration phase pollutant concentrations when compared to applicable NAAQS, PSD increments, visibility thresholds, and acid deposition thresholds will result in a SMALL impact on air quality. The magnitude of the difference in the emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.2.4 Decommissioning Impacts

For the decommissioning phase, the majority of the combustion emissions are from the construction and drilling field equipment. As detailed in Table 4.2-1, the land application option will result in more land being disturbed than in the deep well disposal option. Specifically, the land application will require 425.7 ha [1,052 ac] of irrigation area and an additional 41.6 ha [103 ac] for impoundments. Reclaiming the additional disturbed land, particularly the impoundments, could result in a slight increase in the emissions from construction and drilling field equipment. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small increase in the NAAQS pollutants generated from combustion emission sources.

For combustion emissions, NRC staff do not expect to see any appreciable difference in the overall NAAQS emission levels between the land disposal option and the deep well disposal option. Therefore, the magnitude of the air quality impacts will be expected to the same for the two disposal options for the decommissioning phase.

The land application option analysis for greenhouse gases will mirror the NAAQS pollutant analysis because the emission sources for the NAAQS and greenhouse gases are the same. Using the same rationale as the NAAQS pollutant analysis, 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 for the decommissioning phase. The impact analysis for greenhouse gases is addressed in SEIS Section 5.7 on air quality cumulative effects.

Fugitive emissions are generated by both travel on unpaved roads and wind erosion of disturbed land. For the decommissioning phase, travel on unpaved roads is the main source of fugitive emissions. As described in Table 4.2-1, the land application option will not require more access roads to be constructed. Furthermore, the land application option will not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option will result in a very small change in fugitive emissions from travel on unpaved roads.

The amount of fugitive emissions from wind erosion is a function of the amount of disturbed land. The two liquid waste disposal options vary in the amount of land disturbed and, therefore, the amount of fugitive dust generated. As described in Table 2.1-4, the annual mass flow emission rate estimates from wind erosion varied little over the project lifetime with the Class V deep injection well and land application options generating 10.1 metric tons [11.1 short tons] and 29.7 metric ton [32.7 short tons] of PM_{10}, respectively. When wind erosion emissions are considered in conjunction with fugitive emissions from unpaved roads, the decommissioning phase land application option will generate about 18 percent more PM_{10} emissions and about 23 percent more $PM_{2.5}$ than the deep well disposal option.

Although there is some difference in the overall fugitive dust emission levels between the two disposal options, the impact magnitude will be expected to be similar. Therefore, the analyses presented for the deep well disposal option will still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts will be expected to be the same for the two disposal options for decommissioning phase. The NRC staff conclude that the decommissioning phase pollutant concentrations when compared to applicable NAAQS and PSD increments will result in a SMALL impact on air quality. The NRC staff conclude that

the overall impact on air quality during the decommissioning phase for the land application disposal option will be SMALL.

For informational purposes, NRC staff will also present the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and include the PM_{10} emissions in the CALPUFF analysis. The only difference between the two analyses (i.e., the analysis NRC is using to determine the impact magnitude for the SEIS and the analysis the NRC is presenting for informational purposes only) for the decommissioning phase impact assessment is that NRC staff will characterize the initial modeling run results as MODERATE at times because of the PM_{10} 24-hour concentrations relative to the PSD Class II increment. The magnitude of the difference in the PM_{10} emission levels between the two disposal options will not be expected to change this impact assessment.

4.7.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep well disposal capacity (Powertech, 2011).

The potential environmental impacts from fugitive dust emissions for all of the phases will be greater for the land application option because of the increased wind erosion emission levels caused by the increased amount of land disturbed. When considering the combustion emissions, the main difference between the two disposal options is the emissions from the deep well rig used to drill the Class V wells. The land application option eliminates this particular source. This distinction will only affect the construction phase because this is where all of the drill rig emissions occur. For the combustion emissions, the potential environmental impacts for the construction phase will be greater for the Class V injection well option because of the additional drill rig emissions. For the remaining three phases, the combustion emissions will be basically the same for both disposal options.

For the combined option, the air emissions associated with the development of all the Class V injection disposal wells will be supplemented with the emissions associated with the development, at some level, of the irrigation areas and increased pond capacity. Fugitive dust emissions for all four phases will include the additional contribution of the wind erosion from the increased land disturbance from the land application option. The construction phase will include the combustion emissions from the deep well drill rig. Therefore, NRC staff conclude that the environmental impacts of the combined option for the construction, operation, aquifer restoration, and decommissioning phases of the proposed Dewey-Burdock ISR Project will be greater than either the Class V deep injection well option or the land application option. However, for each phase of the proposed project, the changes in air emissions levels will be subtle and not result in any distinctions concerning the magnitude of the environmental impacts (Table 4.7-5). NRC staff concludes this will also be the case when the impact analysis uses the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and includes the PM_{10} emissions in the CALPUFF visibility analysis.

Table 4.7-5. Significance of the Air Quality Environmental Impacts for the Proposed Liquid Waste Disposal Options for Each Phase* of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application
Construction	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*The peak year (i.e., when all four phases occur simultaneously) impacts will range between SMALL to MODERATE.			

4.7.2 No Action (Alternative 2)

Under this alternative, there will be no change in the air quality at this site or at any surrounding receptors. The Black Hills-Rapid City Intrastate Air Quality Control Region currently meets the NAAQS, and it is expected that this area will continue to meet the NAAQS based on the current land use.

4.8 Noise Impacts

NRC staff concluded in GEIS Section 4.4.7 that the noise impact at an ISR facility may range from SMALL to MODERATE during all four phases of an ISR project, depending on the distance between the nearest resident and the activities occurring at the ISR facility (NRC, 2009a). Noise may also impact wildlife in the vicinity of the ISR facility. These impacts will be from the operation of equipment such as trucks, bulldozers, and compressors; from either commuting worker traffic or material and waste shipments; and from operation of the wellfields, central processing plant, satellite plant, and associated equipment. For workers at an ISR facility, administrative and engineering controls will be used to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits (29 CFR 1910.95) and will be further mitigated by use of personal hearing protection.

<u>GEIS Construction Phase Summary</u>

Potential noise impacts will be greatest during construction of an ISR facility. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate wellfields, drill wells, construct access roads, and build the processing facilities will generate noise exceeding undisturbed background levels. Noise levels are expected be higher during daylight hours when construction is more likely to occur and more noticeable in proximity to the operating equipment. For individuals living in the vicinity of the site, ambient noise levels will return to background at distances more than 305 m [1,000 ft] from the construction activities. Wildlife will be expected to avoid areas where noise-generating activities occur, although continuous elevated noise levels may reduce the breeding success of certain wildlife (e.g., sage-grouse). Overall, these types of noise impacts will be SMALL, given the use of hearing controls for workers and the expected distance of nearest residents to the site. Traffic noise during construction (e.g., commuting workers; truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, and compressors) is expected to be

localized and limited to highways in the vicinity of the site, access roads within the site, and roads in the wellfields. The relative short-term increase in noise levels from passing traffic will be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through smaller communities. (NRC, 2009a)

GEIS Operations Phase Summary

During ISR operations, noise-generating activities will occur mainly indoors within the central uranium processing facilities; therefore, offsite sound levels will be reduced during the operations phase. Wellfield equipment (e.g., pumps, compressors) will be contained within structures (e.g., header houses, satellite facilities), thus limiting the propagation of noise to offsite individuals. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment will be localized and limited to highways in the vicinity of the site, access roads within the proposed license area, and wellfield roads. Relative short-term increases in noise levels from traffic will be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through smaller communities. Thus, NRC staff concluded in the GEIS that potential impacts from noise during the operations phase may range from SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

General noise levels during aquifer restoration will be expected to be similar to, or less than, noise levels during operations. The noise from pumps and other wellfield equipment contained within buildings will reduce sound levels to offsite receptors. The existing operational infrastructure will be used, and traffic volume will be less than during the construction and operations phases. NRC staff concluded in the GEIS the potential impact from noise during aquifer restoration will range from SMALL to MODERATE, depending on the location of the nearest resident. (NRC, 2009a)

GEIS Decommissioning Phase Summary

General noise levels generated during decommissioning and reclamation will be similar to the noise generated during construction. Equipment used to dismantle buildings and milling equipment, remove potentially contaminated soils, or grade the surface as part of reclamation activities will generate audible noise at above-background levels. This noise will be temporary, and when decommissioning and reclamation activities are completed, noise levels will return to baseline, with occasional noise from longer term monitoring activities. Like the construction phase, the noise level will be greater during daylight hours when decommissioning and reclamation are more likely to occur and most noticeable in proximity to the operating equipment. Given the likely distance to nearby residents {i.e., greater than 305 m [1,000 ft]}, NRC staff concluded in the GEIS that noise will not be discernible to offsite residents or communities. Therefore, NRC staff concluded in the GEIS that the impact from noise generated during decommissioning may range from SMALL to MODERATE. (NRC, 2009a)

The potential site-specific environmental impacts from noise during construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project are described in the following sections.

4.8.1 Proposed Action (Alternative 1)

As described in SEIS Section 3.8, the majority of existing ambient noise (i.e., background noise) in the vicinity of the proposed Dewey-Burdock ISR Project site will be generated by traffic from U.S. Highway 18 and State Highway 89 (see Figure 3.3-1) and freight/coal trains from the Burlington Northern Santa Fe railroad (see Figure 3.2-1). Dwellings within and in the vicinity of the proposed site that may be impacted by noise generated by ISR activities are listed in Table 3.2-1 and shown in Figure 3.2-1. Edgemont, South Dakota (population 774), is the closest community to the proposed site, approximately 21 km [13 mi] to the south-southeast (see Figure 1.1-1). Other towns within 80 km [50 mi] of the proposed project area include Hot Springs and Custer, South Dakota, and Newcastle, Wyoming. As discussed in SEIS Section 3.6.3, no federally listed threatened or endangered species are known to occur within the proposed project area. However, five raptor nests were observed within the proposed project area and two raptor nests were observed within 1.6 km [1 mi] of the proposed project area during applicant surveys. As described in SEIS Section 3.6.1.2.2, one active bald eagle nest (a state-listed species) was reported in 2011 within the proposed project area along Beaver Creek, about 1.6 km [1 mi] west of the proposed Dewey satellite facility. The nearest recreational areas that may be impacted by noise are parcels of the BHNF bordering the proposed project area to the east and northeast and the Buffalo Gap National Grassland located about 4.8 km [3 mi] south of the project boundary.

As described in SEIS Section 2.1.1.1.2.4, options for liquid waste disposal at the proposed Dewey-Burdock ISR Project are (i) Class V deep injection wells, (ii) land application, or (iii) combined Class V deep injection wells and land application. The environmental impacts from noise for each of the waste disposal options are discussed in the following sections.

4.8.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. EPA is currently reviewing the applicant's UIC permit application for Class V injection wells. The locations of the first four Class V injection wells are shown in Figure 2.1-10.

4.8.1.1.1 Construction Impacts

As noted in SEIS Section 2.1.1.1.2, the construction phase of the proposed Dewey-Burdock ISR Project will involve the use of heavy equipment to create and improve road surfaces, transport supplies, excavate foundations, erect buildings, and install wells and pipelines in the wellfields. Equipment such as bulldozers, graders, tractor trailers, excavators, cranes, and drill rigs will create noise that will be audible above background noise levels. For the Class V injection well disposal option, additional noise will be generated by the installation of the Class V injection wells. Noise will also be generated by heavy equipment used to construct pipelines to transport liquid waste from the processing facilities to the Class V injection wells. Construction of processing facilities, pipelines, access roads, ponds, Class V injection wells, and wellfields is expected to be completed within 2 years (see Figure 2.1-1), followed by phased construction of additional wellfields during the operations phase.

Expected noise levels generated during construction activities at the Dewey-Burdock site will be most noticeable in proximity to operating equipment, such as drill rigs, heavy trucks, and bulldozers. Mitigation measures that the applicant will implement to minimize noise impacts

include avoiding construction activities during the night, using sound abatement controls on operating equipment and facilities, and using personal hearing protection for workers in any high noise areas (Powertech, 2009a). These mitigation measures will ensure that noise levels remain below guidelines for offsite receptors [e.g., 55-decibel daytime guideline to protect against activity interference and annoyance (EPA, 1974)] and below OSHA regulatory limits for workers in 29 CFR 1910.95.

As described in SEIS Section 3.2, two permanently occupied dwellings (Putnam residence and Beaver Creek Ranch Headquarters), one vacant dwelling (Spencer residence), and one seasonally occupied dwelling (Daniel residence) are located within the proposed project area (see Figure 3.2-1). All of these onsite dwellings are located more than 1.6 km [1.0 mi] from proposed processing facilities and Class V injection wells in the Dewey and Burdock areas. The permanently occupied Beaver Creek Ranch Headquarters and Putnam residence are located approximately 0.8 km [0.5 mi] west and 1.3 km [0.8 mi] south of proposed wellfields in the Dewey area (see Figure 3.2-1). These distances are greater than the 305-m [1,000-ft] radius for noise from construction activities to return to background ambient noise levels (NRC, 2009a). However, the seasonally occupied Daniel residence is located within 305 m [1,000 ft] of defined wellfield areas B-WF6 and B-WF7 in the Burdock area (see Figure 2.1-6). Therefore, the Daniel residence is expected to experience short-term (1 to 2 years) noise above background levels during construction activities associated with development of these wellfields.

All offsite residential receptors are located more than 1.6 km [1.0 mi] from proposed processing facilities and deep Class V injection wells in the Dewey and Burdock areas. The nearest offsite residential receptors are located approximately 1.3 km [0.8 mi] south (Kennobie residence) and 1.3 km [0.8 mi] southwest (Peterson residence) of proposed wellfields in the Burdock area (see Figure 3.2-1). This distance also exceeds the 305-m [1,000-ft] radius for noise from construction activities to return to background ambient noise levels (NRC, 2009a). In addition, because of decreasing noise levels with distance, construction activities will have only SMALL and temporary noise impacts for nearby communities (e.g., Edgemont, Hot Springs, Custer, and Newcastle) and recreational areas (e.g., BHNF and Buffalo Gap National Grassland).

Truck transport of construction materials will be the primary noise source that may potentially affect the public. The incremental increase in construction-related noise due to traffic on the heavily traveled public roadways in the area (e.g., U.S. Highway 18 and State Highway 89) will not be expected to be noticeable. Traffic noise along Dewey Road from Edgemont to the Dewey-Burdock site will increase during construction activities due to workers commuting to and from the job site and truck shipments to and from the facilities during daylight hours. As described in SEIS Section 3.8, the maximum sound levels from heavy trucks (70 dBA) traveling along Dewey Road will diminish to approximately 57 dBA at a distance of approximately 480 m [1,575 ft] from the source. At distances beyond 480 m [1,575 ft] from Dewey Road, it is assumed that sound levels generated by heavy trucks will be approximately 40 dBA. Based on typical land uses within and surrounding the project site (e.g., rangeland, wildlife habitat, and recreation), sound levels ranging from 40 to 57 dBA are within Federal Highway Administration (FHWA) noise abatement criteria established in 23 CFR Part 772. These criteria are described in Table 3.8-1. In addition, Dewey Road is a lightly traveled county road with few residences, and increases in noise levels associated with passing heavy truck traffic during the construction phase will be short term (1 to 2 years; see Figure 2.1-1).

Elevated noise levels associated with construction activities may affect wildlife behavior (Federal Highway Administration, 2004; Brattstrom and Bondello, 1983; BLM, 2008). As noted in GEIS Section 4.4.7.1, wildlife is expected to avoid areas where noise-generating activities are ongoing (NRC, 2009a). However, raptors are particularly sensitive to noise and the presence of human activity, which will be heightened during the construction phase. As noted in SEIS Section 4.6.1.1.1.1.2, the bald eagle, red-tailed hawk, American kestrel, and northern harrier were the most commonly seen raptor species in the proposed project area and will be the primary raptor species impacted by project activities. These species are not imperiled with the exception of the bald eagle, which is a state-threatened species (SDGFP, 2010c). Direct impacts to raptor species from noise will include displacement, increased potential for nest abandonment and reproductive failure, and potential reduction in prey populations. To reduce noise impacts to raptors, the applicant has committed to adhering to FWS and SDGFP seasonal noise, vehicular traffic, and human proximity guidelines during the construction phase of the proposed project (see SEIS Section 4.6.1.1.1.1.2). The applicant will adhere to regulatory timing and spatial restrictions with regard to construction activities near raptor nests (Powertech, 2009a). Furthermore, the applicant has committed to follow an FWS-approved raptor monitoring and mitigation plan to reduce conflicts between active nest sites and project-related activities if direct impacts to raptors occurs (Powertech, 2009a).

With the exception of the seasonally occupied Daniel residence in the Burdock area, noise levels associated with project-related construction activities will not impact onsite or offsite residential receptors. Residents at the Daniel residence will experience noise levels above background due to heavy equipment use associated with the development of wellfields B-WF6 and B-WF7. However, these noise levels will be short term (1 to 2 years for each wellfield) and the residence will not be occupied year round. Implementation of mitigation measures, such as using sound abatement controls on operating equipment and facilities and using personal hearing protection for workers in high noise areas, will ensure that noise levels remain within guidelines for offsite receptors and workers. Noise levels associated with project-related transportation activities on Dewey Road leading to and from the site will be within FHWA noise abatement criteria at a distance of 480 m [1,575 ft] or greater and will be temporary (1 to 2 years). Noise impacts to raptors will be mitigated by adhering to FWS and SDGFP seasonal noise guidelines, adhering to regulatory timing and spatial restrictions with regard to construction activities near raptor nests, and following an FWS-approved raptor monitoring and mitigation plan. Therefore, the NRC staff concludes that the overall site-specific impacts from noise during construction for the Class V injection well disposal option will be SMALL.

4.8.1.1.2 Operations Impacts

The potential impact from onsite-generated noise during the operations phase of the proposed Dewey-Burdock ISR Project will be less than during the construction phase because fewer pieces of heavy machinery will be used. However, a variety of mechanical equipment (e.g., generators; pumps; air compressors; and heating, ventilation, and air conditioning systems) at the Burdock central processing plant, at the Dewey satellite facility, and in the wellfields will generate noise during the operations phase. Equipment such as pumps used to recover uranium from the pregnant lixiviant and dryers used to process and package the uranium slurry into yellowcake will be contained within the processing buildings, thus limiting the propagation of noise to onsite and offsite receptors. In the wellfields, pumps and compressors used for injection, recovery, and transfer of lixiviant will be contained within header houses. Likewise, pumps and compressors used to inject liquid wastes into deep disposal wells will be contained within locked buildings constructed around the wells (Powertech, 2010a). Mitigation

measures, such as the use of sound abatement controls on operating equipment in processing facilities and wellfields, will further reduce the propagation of noise to onsite and offsite receptors. Noise impacts to workers during operations will be mitigated by the use of personal hearing protection in areas where noise levels exceed OSHA exposure limits in 29 CFR 1910.95 (Powertech, 2009a).

As noted in the previous section, the seasonally occupied Daniel residence is within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area (see Figure 2.1-6). Therefore, the Daniel residence may experience noise above background levels during activities associated with operations in these wellfields. Because wellfields will be developed and operated sequentially, these potential noise levels will be short term (1 to 2 years for each wellfield; see SEIS Section 2.1.1.1). In addition, the Daniel residence will not be occupied year round.

Heavy truck traffic associated with transporting uranium-loaded resins to and from the central processing plant and shipments of yellowcake will result in temporary noise. Shipments of yellowcake will be infrequent (see SEIS Section 2.1.1.1.7) and will have only a SMALL impact on noise levels on Dewey Road and highways in the vicinity of the site (e.g., U.S. Highway 18 through Edgemont). Traffic noise from commuting workers on highways in the vicinity of the site and on Dewey Road leading to and from the site will increase during operations when facilities are experiencing peak employment. However, because of the remote location of the site and lack of sensitive receptors leading to the site, noise impacts from passing traffic during operations will be SMALL.

As noted previously, there will be less noise from heavy equipment during the operations phase of the proposed project compared to the construction phase; therefore, the potential for noise to disrupt wildlife will be reduced. During operations, wildlife is anticipated to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Potential noise-related impacts to active raptor nests due to operations-related activities 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) (Powertech, 2009a).

In summary, much of the noise generated during the operations phase of the proposed project will be contained within buildings and structures. Because of decreasing noise levels with distance, noise from operation activities will have no impact on residents, communities, or recreational areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). As noted previously, the seasonally occupied Daniel residence is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area and may experience noise above background levels during activities associated with operations in these wellfields. Because wellfields will be developed and operated sequentially (see SEIS Section 2.1.1.1), potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniel residence will not be occupied year round. Noise levels to onsite and offsite receptors will be mitigated by use of sound abatement controls on operating equipment, adherence to OSHA regulatory limits, and use of personal hearing protection. Heavy truck traffic associated with yellowcake shipments will be infrequent and result in only short-term noise on local roads and highways. Noise impacts to raptors will continue to be mitigated by adhering to FWS and SDGFP seasonal noise guidelines, adhering to regulatory timing and spatial restrictions with regard to construction activities near raptor nests, and following an FWS-approved raptor monitoring and mitigation plan (Powertech,

2009a). Therefore, the NRC staff conclude that the overall site-specific impacts from noise during operations for the Class V injection well disposal option will be SMALL.

4.8.1.1.3 Aquifer Restoration Impacts

NRC staff conclude that noise generated during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project will either be similar to, or less than, noise generated during the operations phase. Pumps and compressors used to inject liquid wastes generated by aquifer restoration activities into Class V injection wells will be contained within locked buildings constructed around the wells (Powertech, 2010a). Noise from traffic will be limited to delivery of supplies and workers traveling to and from the site; therefore, there will be fewer vehicular trips than during the operations phase. In the wellfields, compressors and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Although potential noise generation during aquifer restoration is expected to be of short duration, aquifer restoration activities will continue over much of the life of the proposed project as operations are completed in sequentially developed wellfields (see Figure 2.1-1).

Because the amount of equipment used and the volume of traffic will be less than during the operations phase, noise impacts during aquifer restoration will remain SMALL. Furthermore, because of decreasing noise levels with distance, aquifer restoration activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). The seasonally occupied Daniel residence, which is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area may experience noise above background levels during activities associated with aquifer restoration. Because wellfields will be operated and restored sequentially, potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniel residence will not be occupied year round. Noise impacts to workers during aquifer restoration will be mitigated by adherence to OSHA noise regulations, and wildlife is anticipated to avoid areas where noise-generating activities are ongoing (NRC, 2009a). 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) and by following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, NRC staff conclude that the potential impact from noise during aquifer restoration for the Class V injection well disposal option will be SMALL.

4.8.1.1.4 Decommissioning Impacts

The noise generated during decommissioning of the proposed Dewey-Burdock ISR Project will be similar to or less than that generated during the construction phase. The sources of noise will include earthmoving, excavation, and building demolition activities. In the wellfields, the greatest source of noise will be from equipment used during plugging and abandonment of production, injection, and monitoring wells. Cement mixers, compressors, and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Fewer shipments to and from the proposed site will occur as decommissioning progresses, resulting in less noise from traffic. Because of decreasing noise levels with distance, decommissioning activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). The

seasonally occupied Daniel residence, which is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area, may experience noise above background levels during activities associated with decommissioning in these wellfields. However, potential noise levels above background at the Daniel residence during wellfield decommissioning will be temporary and the Daniel residence will not be occupied year round. Noise impacts to workers during decommissioning will be mitigated by adherence to OSHA noise regulations, and wildlife is expected to avoid areas where noise generating activities are ongoing (NRC, 2009a). Potential noise-related impacts between active raptor nest sites and decommissioning activities 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) and by following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, NRC staff conclude that the potential impact from noise during decommissioning for the Class V injection well disposal option will be SMALL.

4.8.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. Potential environmental impacts from noise during construction, operations, aquifer restoration, and decommissioning for the land application option are discussed in the following sections.

4.8.1.2.1 Construction Impacts

For the land application disposal option, noise impacts to onsite and offsite human receptors and wildlife from the use of heavy equipment to create and improve road surfaces, transport supplies, excavate foundations, erect buildings, and install wells and pipelines during the construction phase will be similar to those described in SEIS Section 4.8.1.1.1 for the Class V injection well disposal option. However, additional noise will be generated by heavy equipment used to construct (i) pipelines that transport the liquid waste from the processing facilities to land application areas and (ii) catchment areas adjacent to land application areas to control stormwater runoff. To minimize noise impacts due to construction activities in land application areas, the same mitigation measures described in SEIS Section 4.8.1.1.1 will be implemented. These mitigation measures will include using sound abatement controls on operating equipment and facilities, avoiding construction activities during the night, and using personal hearing protection for workers operating heavy equipment (Powertech, 2009a). The applicant will limit worker exposure to noise in accordance with OSHA regulations in 29 CFR 1910.95.

In addition to the seasonally occupied Daniel residence, which is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area, the permanently occupied Beaver Creek Ranch Headquarters is located within 305 m [1,000 ft] of land application areas in the Dewey area. Because of its proximity to land application areas, residents at the Beaver Creek Ranch Headquarters may be impacted by noise associated with construction of pipelines and catchment areas in proposed land application areas in the Dewey area. Therefore, onsite receptors at both the Daniel residence and the Beaver Creek Ranch Headquarters may experience short-term (1 to 2 years) noise levels above background during construction phase activities if land application is implemented to dispose of liquid wastes.

With the exception of the Stodart residence (see Figure 3.2-1), all offsite residences are located more than 1.6 km [1.0 mi] from proposed land application areas. The Stodart residence is located approximately 0.8 km [0.5 mi] northwest of land application areas in the Dewey area. This distance is greater than the 305-m [1,000-ft] radius for noise from construction activities to return to background noise levels (NRC, 2009a).

With the exception of the seasonally occupied Daniel residence in the Burdock area and the Beaver Creek Ranch Headquarters in the Dewey area, noise levels associated with project-related construction activities will not impact onsite or offsite residential receptors. Residents at the Daniel residence and Beaver Creek Ranch Headquarters will experience noise levels above background due to heavy equipment use associated with the development of wellfields B-WF6 and B-WF7 in the Burdock area and land application areas in the Dewey area. However, these noise levels will be short term (1 to 2 years). Implementation of mitigation measures, such as using sound abatement controls on operating equipment and facilities and using personal hearing protection for workers in high noise areas, will ensure that noise levels remain within guidelines for offsite receptors and workers. Noise levels associated with project-related transportation activities on Dewey Road leading to and from the site will be within FHWA noise abatement criteria at distances of 480 m [1,575 ft] or greater and will be temporary (1 to 2 years). Noise impacts to raptors at the proposed project 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 (Powertech, 2009a). Therefore, the NRC staff conclude that the overall site-specific impacts from noise during construction for the land application disposal option will be SMALL.

4.8.1.2.2 Operations Impacts

For the land application disposal option, noise impacts to onsite and offsite human receptors and wildlife generated by mechanical equipment at the processing facilities and wellfields and by heavy truck and commuter traffic during the operations phase of the project will be similar to those described in SEIS Section 4.8.1.1.2 for the Class V injection well disposal option. Additional noise will be generated by pumps and the motors or engines used to drive irrigation pivots in land application areas. Noise levels generated by irrigation equipment in land application areas may be substantially reduced by installing exhaust and inlet silencers on engines, using electric motor drives instead of internal combustion engines, and erecting acoustic barriers to block the line of hearing from the exhaust engine and inlet toward the receptors (either human or wildlife) to be protected from noise.

As noted in the previous section, the seasonally occupied Daniel residence is located within 305 m [1,000 ft] of proposed wellfields B-WF6 and B-WF7 in the Burdock area and the Beaver Creek Ranch Headquarters is located within 305 m [1,000 ft] of proposed land application areas in the Dewey area (see Figure 2.1-6). Therefore, these residences may experience noise above background levels during activities associated with wellfield and land application operations. Because wellfields will be developed and operated sequentially, potential noise levels above background due to wellfield operations will be short term (1 to 2 years for each wellfield). In addition, land application areas will not be operated year round. As described in SEIS Section 2.1.1.1.6.2, treated wastewater will be applied to the land during the growing season (approximately April through October). Beyond the growing season, land irrigation will be conducted as conditions permit, relying on evaporation to remove water from soils.

Much of the noise generated during the operations phase of the project will be contained within buildings and structures. Because of decreasing noise levels with distance, noise from operation activities will have no impact on residents, communities, or recreational areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). As noted previously, residents at the seasonally occupied Daniel residence and the Beaver Creek Ranch Headquarters may experience noise above background levels during activities associated with operations in wellfields B-WF6 and B-WF7 and land application areas in the Dewey area. Because wellfields will be developed and operated sequentially (see SEIS Section 2.1.1.1), potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniels residence will not be occupied year round. Likewise, residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season (approximately April through October). Noise levels to onsite and offsite receptors will be further mitigated by use of sound abatement controls on operating equipment, adherence to OSHA regulatory limits, and use of personal hearing protection. Heavy truck traffic associated with yellowcake shipments will be infrequent and result in only short-term noise on local roads and highways. During operations, wildlife is expected to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Noise impacts to raptors at the proposed project will continue to be mitigated by adhering to FWS and SDGFP seasonal noise guidelines and by following an FWS-approved raptor monitoring and mitigation plan (Powertech, 2009a). Therefore, the NRC staff conclude that the overall site-specific impacts from noise during operations for the land application disposal option will be SMALL.

4.8.1.2.3 Aquifer Restoration Impacts

For the land application liquid waste disposal option, noise generated during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project will either be similar to, or less than, noise generated during the operations phase. Noise levels generated by irrigation equipment in land application areas may be substantially reduced by installing exhaust and inlet silencers on engines, using electric motor drives instead of internal combustion engines, and erecting acoustic barriers to block the line of hearing from the exhaust engine and inlet toward the receptors (either human or wildlife). Noise from traffic will be limited to delivery of supplies and workers traveling to and from the site; therefore, there will be fewer vehicular trips than during the operations phase. In the wellfields, compressors and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Although potential noise generation during aquifer restoration in each wellfield is expected to be of short duration, aquifer restoration activities will continue over much of the life of the project as operations are completed in sequentially developed wellfields (see Figure 2.1-1).

Because the amount of equipment used and the volume of traffic will be less than during the operations phase, noise impacts during aquifer restoration will remain SMALL. Furthermore, because of decreasing noise levels with distance, aquifer restoration activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). Residents at the seasonally occupied Daniel residence and the Beaver Creek Ranch Headquarters may experience noise above background levels during activities associated with aquifer restoration activities in wellfields B-WF6 and B-WF7 and land application areas in the Dewey area. Because wellfields will be developed and operated sequentially (see SEIS Section 2.1.1.1), potential noise levels above background at the Daniel residence will be short term (1 to 2 years for each wellfield). In addition, the Daniel

residence will not be occupied year round. Likewise, residents at the Beaver Creek Ranch Headquarters will only be exposed to noise from nearby land application areas during the growing season. Noise impacts to workers during aquifer restoration will be mitigated by adherence to OSHA noise regulations, and wildlife is anticipated to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Potential noise-related impacts between active raptor nest sites and aquifer restoration activities 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) (Powertech, 2009a). Therefore, the potential impact from noise during aquifer restoration for the land application disposal option will be SMALL.

4.8.1.2.4 Decommissioning Impacts

The noise generated during decommissioning of the proposed Dewey-Burdock ISR Project will be similar to or less than that generated during the construction phase. The sources of noise will include earthmoving, excavation, and building demolition activities. In the wellfields, the greatest source of noise will be from equipment used during plugging and abandonment of production, injection, and monitoring wells. Cement mixers, compressors, and pumps will be the largest contributors to noise, but will be operated only for a relatively short daytime duration. Fewer shipments to and from the proposed site will occur as decommissioning progressed, resulting in less noise from traffic. Because of decreasing noise levels with distance, decommissioning activities and associated traffic will be expected to have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activities (NRC, 2009a). The seasonally occupied Daniel residence and the Beaver Creek Ranch Headquarters may experience noise above background levels during activities associated with decommissioning activities in wellfields B-WF6 and B-WF7 and land application areas in the Dewey area. However, potential noise levels above background at the Daniel residence and the Beaver Creek Ranch Headquarters during decommissioning will be temporary. In addition, the Daniel residence will not be occupied year round. Noise impacts to workers during decommissioning will be mitigated by adherence to OSHA noise regulations, and wildlife is expected to avoid areas where noise-generating activities are ongoing (NRC, 2009a). Potential noise-related impacts between active raptor nest sites and decommissioning activities 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) (Powertech, 2009a). Therefore, NRC staff conclude that the potential impact from noise during decommissioning for the land application disposal option will be SMALL.

4.8.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant will dispose of liquid waste by a combination of Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined Class V injection well disposal and land application option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). As described in SEIS Sections 4.8.1.1 and 4.8.1.2, many project-related noise impacts to onsite and offsite receptors will be similar for either the Class V injection well or land application disposal options. However, for the land application option, additional noise will be generated by construction of land

application facilities and infrastructure (e.g., irrigation areas, pipelines, and ponds for liquid waste storage during nonirrigation periods) and operation of center pivot irrigation systems. In comparison, for the Class V injection well disposal option, additional noise will be generated by construction of four to eight Class V injection wells (see SEIS Section 2.1.1.1.2.4.1). During operations, pumps and compressors used to inject liquid wastes into Class V injection wells will be contained within buildings constructed around the wells (Powertech, 2010a), which will reduce noise impacts to onsite and offsite residents and workers. Therefore, the environmental noise impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V well injection. Furthermore, because only a portion of land application facilities and infrastructure will be constructed, operated, and decommissioned, the significance of environmental noise impacts for the combined disposal option will be less than for the land application option alone. Therefore, NRC staff conclude that the environmental noise impacts of the combined Class V injection well and land application option for each phase of the proposed project will be bounded by the significance of environmental noise impacts of the Class V injection well option and the land application option as summarized in Table 4.8.1.

4.8.2 No Action (Alternative 2)

Under the No-Action alternative, there will be no change to the sound levels either within the proposed license area or to surrounding receptors. While natural resource exploration activities will continue and could potentially expand in the future, they will typically be of short duration and will involve few vehicles and no permanent, noise-emitting infrastructure. The natural setting of the proposed project area and the continuation of ongoing natural resource exploration activities will result in sound levels remaining at ambient levels.

4.9 Historic and Cultural Resources Impacts

As discussed in GEIS Section 4.4.8, potential environmental impacts on historic and cultural resources may occur during all phases of an ISR facility's lifecycle (NRC, 2009a). Loss of and damage to historic, cultural, and archaeological resources may result from land disturbance as part of construction, operations, aquifer restoration, and decommissioning activities. In addition, the introduction of new visual, auditory, or other sensory elements has the potential to impact the integrity of historic properties.

Table 4.8-1. Significance of Environmental Noise Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V *Injection* Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

GEIS Construction Phase Summary

As discussed in GEIS Section 4.4.8.1, the potential impacts during ISR facility construction may include loss of or damage to historic and cultural resources due to excavation and earthmoving activities. An NRC licensee condition that requires the stoppage of work upon discovery of undocumented historic or cultural resources may be imposed. Such a condition will require notification of the appropriate federal, tribal, and state agencies to implement mitigation measures. NRC staff concluded in the GEIS that potential impacts to historic and cultural resources from construction will be SMALL to LARGE depending on whether historic and cultural resources are present within the project area. Mitigation measures identified in the licensee's management plan or site specific Memorandum of Agreement (MOA) or Programmatic Agreement (PA) could reduce an adverse impact to a historic or cultural resource by reducing the adverse effect on a historic property. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.8.2, it is expected potential impacts to historic and cultural resources from operations will be less than during construction, because less land disturbance occurs during this phase. Additionally, conditions in the NRC license typically require the licensee to stop work upon discovery of previously undocumented historic or cultural resources and to notify the appropriate federal, tribal, and state agencies to implement mitigation measures. For these reasons, NRC staff determined in the GEIS that potential impacts to historic and cultural resources from ISR operations will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

In GEIS Section 4.4.8.3, NRC staff determined that potential impacts to historic and cultural resources from aquifer restoration are expected to be similar to, or less than, potential impacts from operations. Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing plant). Additionally, typical conditions in the NRC license regarding the discovery of previously undocumented historic or cultural resources will remain in effect and could minimize potential adverse impacts. For these reasons, NRC staff concluded in the GEIS that the potential impacts from aquifer restoration on historic and cultural resources will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

GEIS Section 4.4.8.4 discussed potential impacts from decommissioning to historic and cultural resources. Decommissioning and reclamation activities will focus on those areas that have been disturbed; therefore, historic and cultural resources within the potential area of effect will already be known. For these reasons, NRC staff determined in the GEIS the potential impacts to historic, cultural, and archaeological resources during decommissioning and reclamation will be SMALL. (NRC, 2009a)

The potential impacts to historic and cultural resources from construction, operations, aquifer restoration, and decommissioning for the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.9.1 Proposed Action (Alternative 1)

Potential impacts on historic and cultural resources at the proposed Dewey-Burdock ISR Project will be linked to the physical structures and infrastructure associated with the proposed action. As described in SEIS Section 2.1.1.2, a central processing plant in the Burdock area, a satellite facility in the Dewey area, access roads, wellfields, pipelines, surface impoundments, and potential land irrigation areas will be constructed at the proposed project site. As described in SEIS Section 3.9.1.2, the area of potential effects (APE) for the review of historic and cultural resources at the proposed Dewey-Burdock ISR Project is defined as the area that will be directly or indirectly impacted by construction, operation, aquifer restoration, and decommissioning activities. The APE for the proposed project coincides with the extent of potential ground disturbance resulting from proposed facility construction and operations. The introduction of new visual and auditory elements also has the potential to diminish the integrity of historic properties in the project area.

The extent of the APE for facility construction and operations at the proposed project will depend on the disposal option used to dispose of liquid waste. The applicant is proposing options for liquid waste disposal that include deep well disposal via Class V injection wells, land application, or a combination of both methods (see SEIS Section 2.1.1.1.2.4). The APE for facility construction and operations for all the liquid waste disposal options totals 1,067 ha [2,637 ac] (see Figure 3.9-1). This area includes a 969-ha [2.394-ac] buffer zone surrounding 98.3-ha [243-ac] of projected disturbance areas for the plant facilities, wellfields, ponds, roads, and pipelines. If land application is used for liquid waste disposal, the APE for facility construction and operations will include an additional maximum area of approximately 506 ha [1,250 ac] surrounding proposed land application areas (see Figure 3.9-1).

The introduction of new visual effects is expected to have the greatest potential to diminish the integrity of historic properties in the project area. The extent of the APE for visual impacts includes areas within a 4.8-km [3-mi] radius of the central processing plant in the Burdock area and the satellite processing facility in the Dewey area (see Figure 3.9-1). The central processing plant and satellite processing facility will be the tallest buildings constructed at the proposed Dewey-Burdock ISR Project site (Powertech, 2009a). Based on proposed locations of the central processing plant and the satellite processing facility, the APE for visual impacts will extend a maximum of 2.33 km [1.45 mi] from the eastern project boundary in the Burdock area and a maximum of 2.7 km [1.7 mi] from the western project boundary in the Dewey area (see SEIS Figure 3.9-1).

The potential impacts on historic and cultural resources for each of the applicant-proposed liquid waste disposal options (i.e., disposal via Class V injection wells, disposal via land application, or disposal via combination of Class V injection wells and land application) are discussed in the following sections.

4.9.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred disposal option for liquid waste is deep well disposal via Class V injection wells. Potential impacts on historic and cultural resources from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.9.1.1.1 Construction Impacts

As discussed in the SEIS Section 4.2.1.1.1, a total of 98.3 ha [243 ac] or 2.3 percent of the proposed permit area will be potentially disturbed by activities associated with construction of site buildings, pipelines, wellfields, ponds, and access roads for the Class V injection well disposal option (Powertech, 2010a). As described previously, the APE for facility construction and operations for the Class V injection well disposal option totals 1,067 ha [2,673 ac] as illustrated in Figure 3.9-1. This area includes a 969-ha [2,394-ac] buffer zone surrounding the 98.3-ha [243-ac] area of projected land disturbance.

As part of the environmental review of historic and cultural resources, the NRC evaluated the results of historic and cultural resource surveys conducted at the proposed Dewey-Burdock ISR Project site (see SEIS Section 3.9.3). These surveys included: (i) a Level III cultural resource investigation conducted as part of prelicense application activities; (ii) a tribal cultural survey; and (iii) a visual impacts assessment. In addition to the visual impacts assessment, NRC evaluated whether the proposed project has the potential to introduce new auditory changes to the project area that could impact historic properties located within or outside the limits of proposed ground disturbance.

In making recommendations on the eligibility of historic properties for the National Register for Historic Places (NRHP), NRC applies the criteria found in the National Historic Preservation Act (NHPA) implementing regulations at 36 CFR 60.4(a)–(d). The criteria are: (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive characteristics of type, period, or construction; and (D) sites or places that have yielded or are likely to yield important information (ACHP, 2012). The NRC NRHP eligibility determinations and impact assessment for cultural and historic properties identified at the Dewey-Burdock site are discussed in the sections below.

<u>Level III Cultural Resource Investigations</u>

As described in SEIS Section 3.9.3.1, NRC staff reviewed Level III cultural resource investigations and evaluative testing reports prepared by the Archaeology Laboratory, Augustana College (ALAC) on behalf of the applicant for the Dewey-Burdock site (Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012). More than 200 archaeological sites were recorded during archeological field investigations. One-hundred and forty-nine (149) sites were recommended as ineligible for listing in the NRHP. Seventy-nine (79) of these sites consisted of isolated finds lacking physical integrity or context. Approximately 140 ineligible sites were mostly prehistoric sites located on high disturbed and eroded landforms and have little potential to possess intact, significant buried cultural deposits. Sites that are not eligible for listing in the NRHP are not expected to be impacted by activities associated with facility construction and operations. Therefore, NRC staff expects SMALL impacts to these sites during the construction phase for the Class V injection well disposal option.

Based on archaeological field investigations, a total of 18 historic properties within the proposed project area are listed or recommended as eligible for listing in the NRHP. Table 4.9-1 lists these sites, as well as the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, the NRC assessment of the significance of impact, and NRC management recommendations. The South Dakota State Historic Presevation Office (SD SHPO) concurred on the NRC determination of sites eligible to

Table 4.9-1. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Historic Properties Within the Proposed Project Area Listed in NRHP or Recommended as Eligible for Listing in the NRHP (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination	Location with Respect to the Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
Historic District 90000949- Edna and Ernest Young Ranch	This historic district covers 52.6 ha [130 ac] and is located approximately 4.8 km [3 mi] south of Dewey and south of Beaver Creek. The area of significance is exploration/settlement during 1900–1924 and 1925–1949. There are 13 contributing buildings, one contributing structure, and one non-contributing structure.	Eligible, Criteria A and C	Outside APE	SMALL; no impact anticipated	Listed in the NRHP in 1990. National Register Historic District will be avoided.
Bakewell Ranch (Structure CU00000050)	The Bakewell Ranch is located within the Edna and Ernest Young Ranch National Register Historic District.	Eligible, Criteria A and C	Outside APE	SMALL; no impact anticipated	Listed on the NRHP. Historic property will be avoided.
Log Barn (Structure CU02500002)	Log barn at the Richardson Homestead was found eligible for listing on NRHP in April 2012 under Criteria A.	Eligible, Criterion A	Wiithin APE for LA	LARGE potential impact	Site is located approximately 76 m [250 ft] south of land application areas. The site will be fenced off to ensure avoidance.
39CU0271	Native American and Archaic artifact scatter and occupation site on a ridge slope with a cairn feature.	Eligible, Criterion D	Within APE for DDW and LA	LARGE potential impact	Site is located approximately 61 m [200 ft] east of proposed wellfield areas. Site will be avoided.
39CU0577	Native American/ Euroamerican/ Occupation site; artifact scatter.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0578	Euroamerican/Native American Historic dump and occupation site located on a ridge slope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0584	Native American occupation site and burial (affiliation unknown) on a ridge slope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0586	Native American and Late Archaic occupation site on a ridge crest.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.

Table 4.9-1. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Historic Properties Within the Proposed Project Area Listed in NRHP or Recommended as Eligible for Listing in the NRHP (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination	Location with Respect to the Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39CU0588	Native American occupation site on a ridge crest.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0590	Native American artifact scatter on a ridge saddle.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU0593	Native American and Euroamerican occupation and artifact scatter on a hillslope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU2000	Historic Railroad.	Eligible, Criteria A and C	Within APE for DDW and LA	LARGE potential impact	Site crosses proposed wellfield areas. Site will be avoided.
39CU2733	Native American hearth and artifact scatter on a ridge slope.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU2735	Archaic- Prehistoric occupation site.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU2738	Native American occupation site on a ridge crest.	Eligible, Criterion D	Outside APE	SMALL; no impact anticipated	Site will be avoided.
39CU3592	Native American artifact scatter and hearth site.	Eligible, Criterion D	Within APE for DDW and LA	LARGE potential impact	Site is located within a proposed wellfield area south of the Dewey satellite facility. Site will be fenced off to ensure avoidance.
39FA1941	Native American artifact scatter and hearth site.	Eligible, Criterion D	Within APE for DDW and LA	LARGE potential impact	Site is located approximately 91 m [300 ft] east of the proposed Burdock central processing plant and is within a proposed wellfield area. Site will be avoided or mitigated as necessary.
39FA2000	Historic Railroad.	Eligible, Criteria A and C	Within APE for DDW and LA	LARGE potential impact	Site crosses proposed wellfield areas. Site will be avoided.

the NRHP in Table 4.9-1 (SD SHPO, 2012, 2014). Avoidance of historic properties is the goal during development and production phases of the proposed project (Powertech, 2009a). Archaeological and tribal monitors are expected to be present during ground disturbing activities in order to protect known historic properties (Powertech, 2009a). The 18 historic properties currently listed or recommended eligible for listing in the NRHP are discussed next. Sites 39CU0577, 39CU0578, 39CU0586, 39CU0588, 39CU2733, 39CU2738, and 39CU0590 are Native American occupation sites. Site 39CU2735 is an Archaic occupation site. Site 39CU0593 contains both Native American and Euroamerican components, with artifact scatters extending down a hillslope. Site 39CU0584 is a Native American occupation site and burial (affiliation unknown) located on a ridge slope. Each of these sites is recommended as eligible for listing in the NRHP (Kruse, et al., 2008). However, all are located outside the APE for facility construction and operations. Because these properties are not threatened by site activities and will be avoided, no impacts to these sites are anticipated.

The Edna and Ernest Young Ranch Historic District (90000949) and the Bakewell Ranch (CU0000050) within this historic district are listed on the NRHP and were described in detail in SEIS Section 3.9.3.1.2. The properties are located south of Beaver Creek in the northwestern part of the project area, southwest of the proposed wellfield areas in the Dewey area. These properties are located outside the APE for facility construction and operations and will be avoided. Therefore, no potential impacts to these historic properties from ground disturbing activities are anticipated.

Five historic properties (39CU3592, 39CU0271, 39FA1941, 39CU2000, and 39FA2000) may be impacted by proposed construction activities associated with the Class V injection well disposal option. These sites are described next.

Site 39CU3592 is a Native American artifact scatter and hearth site located within a proposed wellfield area south of the Dewey satellite facility. NRC staff has recommended that a buffer zone and protective fencing be erected around 39CU3592 to ensure this historic property is not adversely impacted during project activities. The applicant committed to protect this property by establishing a buffer zone and installing protective fencing around the site (Powertech, 2012e).

Site 39CU0271 is an Archaic occupation site with 238 associated hearth features and a cairn feature. Site 39CU0271 is located to the east of a proposed monitoring well ring in the Dewey area. NRC staff recommend avoidance of site 39CU271 and the applicant committed to avoid this site (Powertech, 2012e). During the tribal cultural survey, site 39CU0271 was visited and recorded but the tribes did not provide an eligibility recommendation for this site. The Tribal Cultural Survey is discussed later in this section.

Site 39FA1941 is an Archaic artifact scatter and hearth site located on a ridgetop, east of the proposed Burdock central processing plant. The southern portion of this site lies within a proposed wellfield area. NRC staff recommend avoidance of site 39FA1941 and the applicant committed to avoid this site and if necessary to mitigate impacts (Powertech, 2012e). If avoidance of this historic property is not possible, NRC staff recommend a treatment plan for mitigation and data recovery measures be developed by the applicant in consultation with the NRC, SD SHPO, BLM, and tribal representatives.

Sites 39CU2000 and 39FA2000 are historic properties containing 1889 portions of the Burlington Northern Railroad, which runs the length of the project area. Site 39CU2000 crosses proposed wellfield areas east of the proposed Dewey satellite facility. Additionally, a portion of

site 39FA2000 crosses a proposed wellfield area located southwest of the Burdock central processing plant. NRC staff recommends avoidance of the railroad segments and the applicant has committed to avoid these historic properties (Powertech, 2012e).

One historic property (CU02500002; a log barn structure) may be impacted by proposed construction activities associated with land application disposal. Site CU02500002 is discussed in SEIS Section 4.9.1.2.1.

As described in SEIS Section 3.9.3.1.1, sixty-eight (68) recorded archaeological sites within the proposed project area have not been evaluated for NRHP eligibility. NRC treats unevaluated archaeological sites as eligible for listing in the NRHP under Criterion D. Assessments of unevaluated archaeological sites containing burial and cairn features, as well as unevaluated archaeological sites that may be impacted by ground disturbance activities are discussed next.

As discussed in SEIS Sections 3.9.3.1.1, historic and ethnographic evidence indicate cairn features served as markers for trails, camps, burials, caches, and ceremonial centers. Sites containing burial or cairn features are protected by law in South Dakota, pursuant to South Dakota Codified Law 34-27. Unevaluated sites with burials or cairn features that were identified and recorded during archaeological field investigations are listed in Table 4.9-2 along with NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, the NRC assessment of the significance of impacts, and NRC management recommendations.

As noted previously, NRC considers unevaluated sites eligible for listing in the NRHP under Criterion D. NRC staff recommend avoidance of unevaluated sites pending further evaluation to determine NRHP eligibility.

Site 39FA1902 is a historic site with a possible Euroamerican burial located approximately 152 m [500 ft] west of the proposed Burdock central processing plant and will not be disturbed by project construction or operational activities. As described in SEIS Section 3.9.3.1.2, this site contains a historic bridge structure (FA00000151). Because the site has not been evaluated for eligibility for listing on the NRHP, the applicant has committed to avoid this site by means of a buffer zone and protective fencing (Powertech, 2012f). During the tribal cultural survey, site 39FA1902 was identified as of no interest to the Northern Cheyenne and Northern Arapaho tribes (see SEIS Section 3.9.3.2.2). Representatives of both tribes examined the possible gravesite and determined it most likely did not have a tribal affiliation because modern materials including broken concrete were among the stones marking the location.

During tribal cultural surveys of the Dewey-Burdock site, five of the unevaluated archaeological sites listed in Table 4.9-2 (39CU3620, 39FA1862, 39FA1881, 39FA1890, and 39FA1927) were visited, recorded, and recommended eligible for listing in the NRHP under one or more criteria of eligibility (see Table 3.9-5). The following section (Tribal Cultural Survey) provides the NRC NRHP-eligibility determination, the significance of impact, and management recommendations for these five sites based on information from the tribal cultural survey. Four unevaluated burial and cairn sites listed in Table 4.9-2 (39CU0530, 39CU3564, 39CU3587, and 39FA1863) are located outside the APE for facility construction and operations for the Class V injection well disposal option and, therefore, potential impacts to these sites are not anticipated. One unevaluated site listed in Table 4.9-2 (39CU3584) is located within the APE for facility construction and operations for the land application disposal option. Site 39CU3584 is discussed in SEIS Section 4.9.1.2.1.

Table 4.9-2. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Unevaluated Sites Containing Burial and Cairn Features Identified During Archaeological Field Investigations. (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination*	Location with Respect to the Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39CU0530	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3564	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3584	Cairn site	Unevaluated	Within APE for LA	LARGE potential impact	Avoidance
39CU3587	Two historic Euroamerican burials	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3620	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1862	Cairn site with stone circles	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1863	Cairn site with stone circles	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1881	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1890	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1902	Historic site with Euroamerican burial	Unevaluated	Outside APE	SMALL; no impact anticipated	Euroamerican burial site is located approximately 152 m [500 ft] west of the proposed Burdock central processing plant. Site will be protected by a buffer zone and fencing.
39FA1927	Cairn site	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance
*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.					

As described in SEIS Section 3.9.3.1.1, several unevaluated archaeological sites are located within or adjacent to the APE for facility construction and operations and, therefore, could be potentially impacted by ISR activities. These unevaluated archaeological sites are listed in Table 4.9-3 along with NRC's NRHP eligibility determination, the location of eligible sites within the APE affected by facility construction and operations, the NRC assessment of the significance of impacts, and NRC management recommendations.

Table 4.9-3. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis on Unevaluated Sites Identified During Archaeological Field Investigations Within the APE for Facility Construction and Operations. (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39CU0554	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU0558	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU0653	Artifact scatter	Unevaluated	Within APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU3603	Artifact scatter, hearth	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU3615	Artifact scatter	Unevaluated	Within APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39CU3624	Artifact scatter	Unevaluated	Adjacent to APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Site will be avoided.
39FA0096	Historic cabin	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed
39FA0274	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0556	Artifact scatter	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0740	Artifact scatter	Unevaluated	Adjacent to APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0777	Artifact scatter	Unevaluated	Adjacent to APE for LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA0778	Historic farmstead	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing and mitigation, as necessary. Avoid until testing is completed.

Table 4.9-3. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis on Unevaluated Sites Identified During Archaeological Field Investigations Within the APE for Facility Construction and Operations (Cont'd). (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

StateSite Number	Description	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation
39FA1880	Artifact scatter	Unevaluated	Adjacent to APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed.
39FA1920	Artifact scatter	Unevaluated	Adjacent to APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Site will be protected by fencing and avoided.
*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.					

Site 39FA0778 is an historic farmstead located near the center of the proposed Burdock central processing plant footprint. NRC staff recommends that construction activities be delayed until evaluative testing is completed and a determination of eligibility for listing on the NRHP is made. The applicant committed to further evaluative testing of site 39FA0778 and implementation of mitigation measures, as necessary (Powertech, 2012e,f).

Site 39FA0096, located at the south-central portion of the proposed project area, is a large occupation site with components that may date from the Paleolithic through the Historic period. As discussed in SEIS Section 3.9.3.1.1, Area 8 is a historic component of this multi-component site. Evaluative testing of the prehistoric component of site 39FA0096 demonstrated the prehistoric component is a deflated surface scatter of artifacts and hearths and therefore not eligible for listing on the NRHP, under Criterion D (Palmer and Kruse, 2012; BLM, 2012f). However, preliminary information gathered through consultation with the tribes indicates Areas 1 and 6 at site 39FA0096 have the potential to be of religious and cultural significance to the tribes because of the large size of these areas and the number of hearth features identified.

During the tribal cultural survey, site 39FA0096 was visited, recorded, and recommended as eligible for listing in the NRHP under Criterion A (see Table 3.9.5). Tribal consultation regarding the nature of the features and cultural deposits located at site 39FA0096 and the cultural importance of the site is ongoing. As described in SEIS Section 3.9.3.1.1, a small portion of site 39FA0096 extends onto BLM surface lands. Therefore, BLM requested that site 39FA0096 be designated as "unevaluated" until further information is obtained to support a Criterion A eligibility determination (BLM, 2014). Therefore, NRC staff considers site 39FA0096 as "unevaluated" pending further evaluation by BLM staff. Until evaluation is completed, BLM will require the site boundaries be avoided by all project-related activities with a standard 61 m [200 ft] buffer surrounding the site boundary.

Sites 39CU0554, 39CU0558, 39CU3624, 39FA0274, 39FA0556, 39FA1880, and 39FA1920 are artifact scatters within or adjacent to proposed wellfield areas. Sites 39CU0554, 39FA0274, and 39FA0556 are located within proposed wellfield areas in the Burdock area and site 39CU0558 is located within proposed wellfied areas in the Dewey area. Site 39CU3624 is located south of

Pass Creek and is less than 30.5 m [100 ft] north of a proposed wellfield area in the Burdock area. The applicant has committed to avoid site 39CU3624 (Powertech, 2012e). Site 39FA1880 is located approximately 30.5 m [100 ft] south of a proposed wellfield area in the Burdock area. Site 39FA1920 is located at the southeast corner of the project area and is approximately 30.5 m [100ft] south of a proposed wellfield area in the Burdock area. The applicant committed to protect this property by installing protective fencing around the site (Powertech, 2012e). NRC staff recommend that these unevaluated sites undergo further evaluative testing. Until testing is completed, avoidance of these sites is recommended.

Site 39CU3603 is an artifact scatter and hearth site located within the right of way of a proposed pipeline connecting the Burdock central processing plant and the Dewey satellite facility. NRC staff recommend that this site undergo further evaluative testing. Until testing is completed, avoidance of site 39CU3603 is recommended.

Sites 39CU0653, 39CU3615, 39FA0740, and 39FA0777 are artifact scatters within or adjacent to land applications areas. Sites 39CU0653 and 39CU3615 are located within land application areas in the Burdock area. Site 39FA0740 is located approximately 3.05 m [10 ft] southwest of land application areas in the Burdock area and site 39FA0777 is located approximately 3.05 [10 ft] southeast of land application areas in the Burdock area. NRC staff recommend that these sites undergo further evaluative testing and that the sites be avoided until testing is completed.

Archaeological investigations did not identify other sites (unevaluated, NRHP-listed, or NRHP-eligible) within or in the vicinity of construction impact areas for the Class V injection well disposal option. Based on its review and evaluation of archaeological field investigations, NRC concludes 15 historic properties may experience LARGE potential impacts because they are located within or adjacent to the APE for facility construction and operations for the deep Class V injection well disposal option. Included are five properties eligible for listing in the NRHP (see Table 4.9-1) and ten unevaluated properties considered eligible for listing in the NRHP, under Criterion D (see Table 4.9-3).

The applicant stated the overall goal during development and production of the proposed project is the avoidance of archaeological sites (Powertech, 2009a, Section 3.8.1). As discussed previously, the applicant has committed to protect historic and unevaluated sites by avoidance or for certain sites by constructing protective fencing (Powertech, 2012e,f). In addition, construction personnel will be notified of the location of historic properties and unevaluated sites prior to any ground-disturbing activities (Powertech, 2009a). By license condition, the applicant is required to stop any work resulting in the discovery of previously unknown cultural artifacts (NRC, 2013; License Condition 9.8). All newly discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. The use of archaeological and tribal monitors to protect known historic properties was proposed during ground disturbing activities (Powertech, 2009a). The NRC staff is currently developing a PA with all consulting parties to develop measures to avoid, minimize, or mitigate sites that could be impacted such as those listed in Table 4.9-1 and 4.9-3). A license condition to ensure successful implementation of any agreement made in the PA will lessen the impacts to historic properties from this undertaking (NRC, 2013; License Condition 9.8). Based on implementation of mitigation measures and management recommendations documented here and within the PA, potential impacts to historic properties and unevaluated sites identified during archaeological field investigations are not anticipated.

Tribal Cultural Survey

SEIS Section 3.9.3.2.2 presents the results of tribal cultural surveys and NRHP-eligibility recommendations for previously recorded archaeological sites, as well as newly discovered tribal sites described by the Tribal Historic Preservation Officers (THPOs) for the Northern Cheyenne Tribe, the Northern Arapaho Tribe, the Cheyenne and Arapaho Tribes of Oklahoma, and the Crow Nation. Sites identified during the tribal cultural survey with management recommendations are detailed in a tribal cultural survey report included as Appendix F of this SEIS.

Previously Recorded Archaeological Sites

Tribal survey teams recorded 81 cultural features within the boundaries of 24 known archaeological sites. Tribal survey teams also provided specific recommendations on four (4) archaeological sites that were investigated without identifying new cultural features. Tribal survey teams collectively recommended that 17 known archaeological sites be considered as eligible for listing in the NRHP under one or more eligibility criteria. A summary of these recommendations is provided in Table 3.9-5. NRHP-eligibility recommendations were not provided by tribes for other known archaeological sites.

The NRC NRHP-eligibility determinations, the NRC assessment of the significance of impacts, and management recommendations for known archaeological sites identified during the tribal cultural surveys are summarized in Table 4.9-4. In assessing the significance of impacts to these sites, NRC considered its NRHP-eligibility determinations and the locations of eligible sites within the APE affected by facility construction and operations. In cases where the tribes did not make recommendations for known archaeological sites, NRC used data from the Level III cultural resources investigations to make NRHP-eligibility determinations, assessments of significance of impacts, and management recommendations.

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39CU0251	TS096	Stone Circle	Not Eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys (Cont'd)
(DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39CU0271	TS019 TS035 TS130	Cairn; Possible Gravesite; Earth Paint	Eligible Criterion D	Within APE for DDW and LA	LARGE potential impact	Tribes recorded site but did not make eligibility recommendations. Site is located approximately 61 m [200 ft] east of proposed wellfield areas. Site will be avoided as possible gravesite.
39CU0459	TS108-111	Cairn; stone circle; fasting/prayer circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance. The boundary for 39CU0459 also includes two smaller artifact scatters: 39CU0461 and 39CU0528. Tribes recommended site eligible under Criteria A and C†
39CU0584	TS043-046, TS053, TS132-140	possible medicine wheel, 4 directions marker, burial, fasting site, cairns, stone circle, hearth	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recommended site eligible under Criteria A and C†
39CU3567	TS031-033, TS141	3 stone circles, scattered hearth	Eligible Criterion A	Within APE for LA	LARGE potential impact	Avoidance with no less than 300 m [984 ft] protective barrier. Tribes recommended site eligible under Criteria A and D†
39CU3572	TS034	Stone circles; possible medicine wheel	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3574	TS021-022	stone circle, scraper	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3576	TS020	tested cobble	Not eligible	Within APE for LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3584	TS025-027, TS-029	cairn alignment, stone circle	Unevaluated	Within APE for LA	LARGE potential impact	Avoidance. Tribes recorded site but did not make eligibility recommendations.

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39CU3593	TS055	Cairn	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3596	TS054	disturbed	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39CU3600	TS114-115	2 fasting/prayer circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†
39CU3602	TS119	scattered hearth	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3604	TS121-122	fasting/prayer circles	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoidance Tribes recommended site eligible under Criteria A and C†
39CU3607	TS116-117	chert core & flake	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39CU3620		Cairn, Prayer/ fasting circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance. Partly located on USFS property. Possibly associated with TS106 and TS107. Tribes recommended site eligible under Criteria A and C†
39FA0096	TS001, TS004, TS013	hearth, earth paints	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site will undergo further evaluative testing. Avoid until testing is completed. Tribes recommended site eligible under Criteria A
39FA1862	TS112-113	stone circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance. Located outside license boundary
39FA1881		cairn	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and D†

Table 4.9-4. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP)-Eligibility and Impact Analysis for Previously Recorded Archaeological Sites Also Identified During Tribal Cultural Surveys (Cont'd)
(DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

State Site Number	Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Area of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
39FA1890	TS012	2 Cairns	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1902		Artifact Scatter; Well/cistern; Burial, Road	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. No interest to tribes.
39FA1922	TS014-017	3 stone circles, possible medicine wheel	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance. Located on BLM property.
39FA1923	TS018, TS142-143	2 cairns	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoidance. Located on BLM property.
39FA1926	TS067-074, TS076-078	6 stone circles	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A, C, and D†
39FA1927		6 cairns	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1952	TS123-124	scattered hearth, flake	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
39FA1962	TS056-060	cairn, stone circles	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
39FA1964	TS099-105	2 hearths, alignment, 4 fasting/prayer circles	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.

*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.
†SD SHPO concurred with NRC's Criterion A NRHP-eligibility determinations for previously recorded archaeological sites listed above (SD SHPO, 2014). However, SD SHPO indicated that submission of additional information will be required to evaluate tribal NRHP-eligibility recommendations under Criteria C and D for previously recorded archaeological sites (SD SHPO, 2014).

As described in SEIS Seciton 3.9.3.2.2, the tribal survey teams recommended sites 39CU3602, 39CU3607, 39FA0096, 39FA1890, 39FA1862 (outside APE), and 39FA1952 as eligible for listing in the NRHP under Criterion A. Sites 39CU0459, 39CU0584, 39CU3600, 39CU3604, and 39CU3620 were recommended eligible under criteria A and C. Sites 39CU3567, 39FA1881, and 39FA1927 were recommended eligible under criteria A and D. Site 39FA1926 was recommended eligible under criteria A, C, and D. The tribes recommended avoidance for all sites recommended eligible for listing in the NRHP (see Appendix F of this SEIS). SD SHPO indicated that submission of additional information will be required to assess tribal

NRHP-eligibility recommendations under Criteria C and D for the previously recorded archaeological sites listed above (SD SHPO, 2014).

As described previously, tribal consultation regarding the nature of the features and cultural deposits located at site 39FA0096 and the cultural importance of the site is ongoing. Because the site is partially located on BLM property, BLM requested that the site be designated as "unevaluated" until its NRHP eligibility is evaluated by BLM staff (BLM, 2014). Therefore, NRC staff considers site 39FA0096 as "unevaluated" pending further evaluation. Until evaluation is completed, BLM will require the site boundaries be avoided by all project-related activities with a standard 61 m [200 ft] buffer surrounding the site boundary.

In addition, tribal survey teams recommended two (2) sites (39FA1922 and 39FA1923) located on BLM property as NRHP-eligible (see SEIS Section 3.9.3.2.2). Site 39FA1922 was recommended as eligible under Criteria A, C, and D and site 39FA1923 was recommended as eligible under Criteria A and C. Because the sites are located on BLM property, BLM requested that these sites be designated as "unevaluated" until their NRHP eligibility is evaluated by BLM staff (BLM, 2014). Therefore, NRC staff considers sites 39FA1922 and 39FA1923 as "unevaluated" pending further evaluation by BLM staff. Until evaluation is completed, BLM will require the site boundaries be avoided by all project-related activities with a standard 61 m [200 ft] buffer surrounding the site boundary.

No NRHP-eligibility recommendations were offered by tribal survey teams for sites 39CU0251, 39CU0271, 39CU3572, 39CU3574, 39CU3576, 39CU3584, 39CU3593, 39CU3596, 39FA1962, and 39FA1964. NRC has determined site 39CU0271 is eligible for listing in the NRHP under Criterion D (see Table 4.9-1). The site is located approximately 61 m [200 ft] east of proposed wellfield areas and will be avoided. Site 39CU3584 is an unevaluated cairn site located within a land application area and is considered eligible for listing in the NRHP under Criterion D (see Table 4.9-2). Site 39CU3584 is discussed in SEIS Section 4.9.1.2.1. NRC considers the remaining sites with no NRHP eligibility recommendations as being "not eligible" for listing in the NRHP.

Site 39FA1902 was specifically identified as being of no interest to the Northern Cheyenne and Northern Arapaho tribes. Site 39FA1902 marks the location of a historic artifact scatter and a possible gravesite; it is likely an historic homestead. Northern Cheyenne and Northern Arapaho representatives examined the possible gravesite and because of the presence of broken concrete among the stones, they determined it was not likely of tribal origin. NRC considers site 39FA1902 unevaluated and, therefore, should be treated as eligible for listing in the NRHP under Criterion D (see Table 4.9-2). The applicant committed to installing protective fencing around the Euroamerican burial site identified on site 39FA1902 before undertaking land disturbing activities in the area (Powertech, 2012f).

Tribal Sites: New Discoveries

A total of 47 new discoveries were recorded as a result of the tribal cultural survey. A summary of tribal NRHP-eligibility recommendations for these sites is provided in Table 3.9.6. The NRC NRHP-eligibility determinations, the NRC assessment of the significance of impacts, and management recommendations for new sites identified during the tribal cultural surveys are summarized in Table 4.9-5 and discussed below. In assessing the significance of impact to these sites, NRC considered its NRHP-eligibility determinations and the location of the site with respect to the APE for facility construction and operations.

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS002	Stone circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
TS003	Buffalo bones	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS005	Flake	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS006	Cairn	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoid as gravesite Tribes recommended site eligible under Criteria A, C, and D†
TS007-011	Stone circle; alignment	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoid with no less than a 300 m [984 ft] protective buffer. Tribes recommended site eligible under Criteria A and D†
TS023	Burial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS024	Stone circle	Unevaluated	Outside APE	SMALL; no impact anticipated	Outside license boundary. Tribes recorded site but did not make eligibility recommendations.
TS028	Stone circles (3); campsite; ceremonial site	Not eligible	Within APE for LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS030	stone circle	Not eligible	Within APE for LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS036	Small cairn or marker	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS037	Small cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS040	Ceremonial site	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†
TS041-042	Ceremonial site	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS047	Ceremonial site	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance Tribes recommended site eligible under Criteria A and C†
TS048	bBial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS049	Burial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS050	Burial	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS051	Fasting site	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS052	Stone circle	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS061	Stone circle	Unevaluated	Outside APE	SMALL; no impact anticipated	Site will be avoided. Located just outside license boundary.
TS062	Effigy	Unevaluated	Outside APE	SMALL; no impact anticipated	Located 600 m [1,968 ft] outside license boundary
TS063	No identification	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS064	Stone circle	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS065	Fasting site	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS066	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS075	Cairn	Unevaluated	Outside APE	SMALL; no impact anticipated	Located 60 m [196 ft] outside license boundary.
TS079	Stone circle	Unevaluated	Outside APE	SMALL; no impact anticipated	Located 230 m [754 ft] outside license boundary.
TS080-089, TS098	Alignment and Arc; ceremonial site; pipe ceremony location	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoidance Tribes recommended site eligible under Criteria A and C†
TS090	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Located outside but near 39CU3622. Tribes recorded site but did not make eligibility recommendations.

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS091	Ceremonial site	Not eligible	Outside APE	SMALL; no impact anticipated	Located outside but near 39CU3621. Tribes recorded site but did not make eligibility recommendations.
TS092	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS093	Possible cairn	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS094	Cairn	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS095	Disturbed cairn (modern survey marker)	Not eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS097	Cairn	Not eligible	Outside APE	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS106	Fasting circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Located on U.S. Forest Service (USFS) property 40 m [131 ft] outside license boundary. Possibly associated with 39CU3620. Tribes recommended site eligible under Criteria A and C†
TS107	Possible gravesite and fasting circle	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Located on USFS property 60 m [196 ft] outside license boundary. Avoid as possible gravesite. Possibly associated with 39CU3620. Tribes recommended site eligible under Criteria A and C†
TS118	Hearth	Eligible Criterion A	Outside APE	SMALL; no impact anticipated	Avoidance
TS120	Hearth	Eligible Criterion A	Within APE for DDW and LA	LARGE potential impact	Avoidance
TS125	Burial	Unevaluated	Outside APE	SMALL; no impact anticipated	Avoid as possible gravestie. Located on U.S. Bureau of Land Management (BLM) property 60 m [196 ft] outside license boundary
TS126	Staff	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property180 m [590 ft] outside license boundary
TS127	Fasting site	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property 200 m [656 ft] outside license boundary

Table 4.9-5. U.S. Nuclear Regulatory Commission (NRC) Determination of NRHP Eligibility and Impact Analysis for New Discoveries Identified and Recorded During Tribal Cultural Surveys (Cont'd) (DDW=Deep Class V Disposal Well Option; LA=Land Application Option)

Tribal Survey Number(s)	Tribal Features	NRC's NRHP Determination*	Location with Respect to Are of Potential Effect (APE) for Facility Construction and Operations	Significance of Impact	Management Recommendation/ Comments
TS128	Fasting site	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property 200 m [656 ft] outside license boundary
TS129	Fasting site/ring	Unevaluated	Outside APE	SMALL; no impact anticipated	Located on BLM property 290 m [951 ft] outside license boundary
TS131	Possible grave	Not eligible	Outside APE	SMALL; no impact anticipated	Avoid as possible gravesite. Tribes recorded site but did not make eligibility recommendations.
TS144	Cairn	Not Eligible	Within APE for DDW and LA	SMALL; no impact anticipated	Tribes recorded site but did not make eligibility recommendations.
TS145	Prayer/ offering location	Unevaluated	Within APE for DDW and LA	LARGE potential impact	Site location was not recorded by GPS but is known to be within an 32.4-ha [80-ac] parcel. Would require relocation to assess potential for site avoidance. Tribes recommended site eligible under Criterion D†

*Unevaluated sites are considered eligible for listing on the NRHP under Criterion D pending further evaluation.
†SD SHPO concurred with NRC's Criterion A NRHP-eligibility determinations for newly discovered tribal sites listed above (SD SHPO, 2014). However, SD SHPO indicated that submission of additional information will be required to evaluate tribal NRHP-eligibility recommendations under Criteria C and D for newly discovered tribal sites (SD SHPO, 2014).

Twelve (12) of the 47 newly discovered cultural features were identified outside the license boundary. These features include five (5) discoveries on private land (TS024, TS061, TS062, TS075, TS079), five (5) discoveries on BLM property (TS125, TS126, TS127, TS128, TS129), and two (2) discoveries on U.S. Forest Service property (TS106, TS107). TS106 and TS107 were recommended as eligible for listing in the NRHP under criteria A and C. No eligibility recommendations were provided for the other 10 cultural features or sites. NRC considers these 10 sites as "unevaluated" and eligible for listing in the NRHP under Criterion D pending further evaluation.

Thirty-five (35) of the 47 new discoveries were identified within the project's license boundary. Ten (10) of these tribal sites were recommended as eligible for listing on NRHP under one or more eligibility criteria. TS002, TS118, TS120 were recommended as eligible under Criterion A. TS145 is recommended as eligible under Criterion D. TS007-011 is recommended as eligible under criteria A and D. TS040, TS041-TS042, TS047, and TS080-T089, TS098 are recommended as eligible under criteria A and C. TS006, a gravesite, is recommended as eligible under criteria A, C, and D. The tribes recommended avoidance for all sites recommended eligible for listing in the NRHP (see Appendix F of this SEIS). SD SHPO indicated that submission of additional information will be required to assess tribal NRHP-eligibility recommendations under Criteria C and D for the newly discovered tribal sites listed above (SD SHPO, 2014).

NRHP recommendations were not provided for 25 of the 44 new discoveries recorded within the project license boundary (TS003, TS005, TS023, TS028, TS030, TS036, TS037, TS048, TS049, TS050, TS051, TS052, TS063, TS064, TS065, TS066, TS090, TS091, TS092, TS093, TS094, TS095, TS097, TS131, and TS144). Where no NHRP eligibility recommendations were offered by the tribes for new discoveries within the project's license boundary, NRC assumed the tribal site to be "not eligible" for listing on NRHP. These sites included locations identified as artifact finds, animal bone concentrations, stone circles, cairns, and possible fasting sites. NRC notes that five specific tribal sites included in this group were identified during the field survey as possible gravesites (TS023, TS048, TS049, TS050, and TS131). NRC recommends avoidance of these sites due to the potential for human remains to be present even though tribes and NRC may not consider these locations eligible for listing in the NRHP.

Based on its review and evaluation of tribal cultural surveys, NRC concludes that two previously recorded archaeological sites (39CU3604 and 39FA0096), two tribal sites represented by single survey numbers (TS120 and TS145), and two tribal sites represented by multiple survey numbers (TS007-011 and TS080-089, TS098) may experience LARGE potential impacts due to their location within the APE for facility construction and operations for the deep Class V injection well disposal option (see Tables 4.9-4 and 4.9-5). Sites 39CU3604, TS210, TS007-011, and TS080-089, TS098 have been recommended eligible for listing in the NRHP under one or more eligibility criteria. As previously described, NRC staff considers sites 39FA0096 as "unevaluated" pending further evaluation. SD SHPO recommended that site TS145 be designated "unevaluated" until further information is obtained to support a Criterion D eligibility determination (SD SHPO, 2014). Therefore, NRC staff considers site TS145 as "unevaluated' pending further evaluation. Avoidance is recommended for all of these sites.

Potential impacts to previously recorded archaeological and tribal sites identified during the tribal cultural surveys will be reduced through mitigation strategies developed during NHPA Section 106 consultations. As discussed in SEIS Section 1.7.3.5, consultation involving NRC, the applicant, SD SHPO, BLM, and interested Indian tribes is being conducted to determine what measures can be used to avoid, minimize, or mitigate adverse impacts to historic properties that may be impacted by site activities. Before beginning construction activities at the proposed project site, an agreement between NRC, SD SHPO, BLM, ACHP, interested Native American tribes (tribal government or designated THPO), the applicant, and other interested parties will be developed in accordance with 36 CFR 800.14(b)(2). The agreement will outline the mitigation process for each affected resource identified at the site pursuant to 36 CFR 800.6. Therefore, potential impacts to previously recorded archaeological sites and newly discovered tribal sites identified during tribal cultural surveys are not anticipated.

Visual Impacts Assessment

As described in SEIS Section 3.9.3.3, the NRC staff completed an assessment of potential visual impacts on historic properties (i.e., properties of any type listed in or considered eligible for listing in the NRHP). NRC's assessment of visual impacts included historic properties situated within a 4.8-km [3-mi] radius of the tallest or most prominent building within each processing facility. The tallest building within each processing facility is the satellite facility (SF) in the Dewey area and the central processing plant (CPP) in the Burdock area.

NRC staff compiled a list of 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting and are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the

CPP in the Burdock area (Table 4.9-6). Historic properties considered eligible for the NRHP solely under Criterion D were not evaluated for potential visual impacts because integrity of setting is not often considered a contributing characteristic for properties considered eligible on the basis of their historic information contents (i.e., Criterion D). The group of 31 historic sites evaluated for visual impacts includes one NRHP-listed historic district, the Edna and Ernest Young Ranch (90000949) also known as the Bakewell Ranch (CU00000050). The Young Ranch historic district includes several contributing ranch buildings including the principal residence. A nearby homestead district, known as the Richardson Homestead (CU00000052), includes one individually eligible log barn (CU02500002). Other NRHP-eligible properties include one historic bridge (Beaver Creek Bridge, FA00000111), and 28 sites that include 19 archaeological sites and 9 tribal sites.

Table 4.9-6. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP) Eligibility and Impact Analysis for Historic Properties Included in the Visual Impacts Assessment. (SF=Dewey Satellite Facility; CPP=Burdock Central Processing Plant)

State Property Number	Tribal Survey Number(s)	NRC's NRHP Determination	Facilities Visible From Property	Distance to Nearest Visible Facility	Mitigating Considerations	Significance of Impact	Recommended Action/ Comments
Bakewell Ranch (CU00000050)/ Edna and Ernest Young Ranch Historic District (90000949)		Eligible, Criterion A	SF only	1.6 km [1.0 mi]	None	MODERATE; no adverse visual impact	Minimize visual effect of building with low profile design and compatible exterior color to avoid potential adverse effect
Building 1 (CU02500002) at the Richardson Homestead (CU00000052)		Eligible, Criterion A	CPP only	2,25 km [1.4 mi]	Diminished integrity of overall homestead	MODERATE; no adverse visual impact	
Beaver Creek Bridge (24020020)		Eligible Criterion C	Neither	4.5 km [2.8 mi]	None	SMALL; no visual impact	
39CU0459	TS108-111	Eligible, Criterion A	Both	2.7 km [1.7 mi] (SF)	Other modern intrusions	MODERATE; no adverse visual impact	
39CU0584	TS043-046, TS053, TS132-140	Eligible, Criteria A, D	SF only	2.25 km [1.4 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39CU2000		Eligible, Criteria A, C	Both	0.8 km [0.5 mi] (SF)	Setting is confined to narrow corridor along railroad	MODERATE; no adverse visual impact	
39CU3567	TS031-033, TS141	Eligible, Criterion A	SF only	0.96 km [0.6 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
39CU3600	TS114-115	Eligible, Criterion A	CPP only	3.1 km [1.9 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
39CU3602	TS119	Eligible, Criterion A	SF only	2.25 km [1.4 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39CU3604	TS121-122	Eligible, Criterion A	Both	2.9 km [1.8 mi]	Other modern intrusions	MODERATE; no adverse visual impact	

Table 4.9-6. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP) Eligibility and Impact Analysis for Historic Properties Included in the Visual Impacts Assessment (Cont'd). (SF=Dewey Satellite Facility; CPP=Burdock Central Processing Plant)

State Property Number	Tribal Survey Number(s)	NRC's NRHP Determination	Facilities Visible From Property	Distance to Nearest Visible Facility	Mitigating Considerations	Significance of Impact	Recommended Action/ Comments
39CU3607	TS116-117	Eligible, Criterion A	SF only	2.6 km [1.6 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39CU3620		Eligible, Criterion A	CPP only	3.4 km [2.1 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
39FA0096	TS001, TS004, TS013	Unevaluated	Both	1.4 km [0.9 mi]	Viewshed obstructed by tree cover; Other modern intrusions	MODERATE; no adverse visual impact	Maintain existing tree cover Included in visual impacts assessment because Tribes considered site eligible under Criterion A
39FA1862	TS112-113	Eligible, Criterion A	SF only	2.9 km [1.8 mi] (SF)	Other modern intrusions	MODERATE; no adverse visual impact	
39FA1881		Eligible, Criterion A	CPP only	1.3 km [0.8 mi]	Partially screened by topography; other modern intrusions	MODERATE; no adverse visual impact	
39FA1890	TS012	Eligible, Criterion A	Neither	-	None	SMALL; no visual impact	
39FA1922	TS014-017	Unevaluated	Neither	-	None	SMALL; no visual impact	Included in visual impacts assessment because Tribes considered site eligible under Criterion A
39FA1923	TS018, TS142-143	Unevaluated	Neither	-	None	SMALL; no visual impact	Included in visual impacts assessment because Tribes considered site eligible under Criterion A
39FA1926	TS067-074, TS076-078	Eligible, Criterion A	Neither	-	None	SMALL; no visual impact	
39FA1927		Eligible, Criterion A	Neither	-	None	SMALL; no visual impact	
39FA1952	TS123-124	Eligible, Criterion A	SF only	2.4 km [1.5 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
39FA2000		Eligible, Criteria A, C	Both	0.8 km [0.5 mi] (SF)	Setting is confined to narrow corridor along railroad	MODERATE; no adverse visual impact	
	TS002	Eligible, Criterion A	CPP only	0.96 km [0.6 mi]	Other modern intrusions	MODERATE; no adverse visual impact	

Table 4.9-6. U.S. Nuclear Regulatory Commission (NRC) Determination of National Register of Historic Places (NRHP) Eligibility and Impact Analysis for Historic Properties Included in the Visual Impacts Assessment (Cont'd). (SF=Dewey Satellite Facility; CPP=Burdock Central Processing Plant)

State Property Number	Tribal Survey Number(s)	NRC's NRHP Determination	Facilities Visible From Property	Distance to Nearest Visible Facility	Mitigating Considerations	Significance of Impact	Recommended Action/ Comments
	TS006	Eligible, Criterion A	CPP only	1.9 km [1.2 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
	TS007-0011	Eligible, Criterion A	CPP only	0.64 km [0.4 mi]	Other modern intrusions	MODERATE; no adverse visual impact	
	TS040	Eligible, Criterion A	Both	2.25 km [1.4 mi]	Partially screened by timber; other modern intrusions	MODERATE; no adverse visual impact	Maintain existing tree cover
	TS041-042	Eligible, Criterion A	Both	2.25 km [1.4 mi]	Partially screened by timber; other modern intrusions	MODERATE; no adverse visual impact	Maintain existing tree cover
	TS047	Eligible, Criterion A	CPP only	5.9 km [3.7 mi]	Distance between site and facility > 4.8 km [3 mi]	SMALL; no visual impact	
	TS080-089, TS098	Eligible, Criterion A	CPP only	0.64 km [0.4 mi]	Mostly screened by topography; other modern intrusions	MODERATE; no adverse visual impact	
	TS118	Eligible, Criterion A	SF only	2.4 km [1.5 mi]	Viewshed obstructed by tree cover	SMALL; no visual impact	Maintain existing tree cover
	TS120	Eligible, Criterion A	SF only	2.0 km [1.25 mi]	Other modern intrusions	MODERATE; no adverse visual impact	

Only one historic property located outside the license boundary was included in this review. The Beaver Creek Bridge (Structure FA00000111) is located southwest of the project boundary but falls within the 4.8-km [3-mi] radius for the central processing plant. Two rock art sites in Fall River County (39FA2530, 39FA2531) fell just outside the 4.8-km [3-mi] range for the central processing plant. No other NRHP-listed or eligible properties were identified outside the license boundary.

NRC staff used a Geographic Information System (GIS)-based Line of Sight (LOS) analysis to determine whether the proposed processing facilities would be visible from the vantage point of each individual historic property. This analytical approach uses GIS software to estimate the viewshed surrounding each historic property. It uses variation in elevation and ground terrain to determine whether a direct line of sight exists between two points, in this case a line-of-sight between the historic property and each of the two processing facilities. The analysis produces a map of the area with visible portions of the landscape shaded to illustrate what portions would be visible. While this approach is useful for showing where elevated terrain will interfere with or block the view of the facilities, it does not account for other types of potential visual obstructions such as trees or buildings. It does however provide a quantitative means to determine if a potential visual effect is present (i.e., if one or both of the processing facilities would be visible from the vantage point of each historic property). NRC's determination of impact and NRC's

assessment of the magnitude of that impact is then based on consideration of the LOS data, the type of historic property involved, and the distance between the historic property and the proposed processing facility.

Based on the LOS analysis, NRC calculates that the proposed project will have a SMALL visual impact on 12 of the 31 historic properties included in this study (Table 4.9.6). Neither of the facilities will be visible from six (6) historic properties (Beaver Creek Bridge-24-020-020; 39FA1890, 39FA1922, 39FA1923, 39FA1926, 39FA1927). One (1) historic property (TS047) is located in area where at least one facility would be visible, but at a distance of 5.9 km [3.7 mi] that is greater than the estimated 4.8-km [3-mi] range considered to have potential effect. Five (5) other historic properties (39CU0584, 39CU3602, 39CU3607, 39CU3620, TS118) are located in areas where the local terrain would permit a view of at least one facility; however, in each instance the viewshed in the direction of the proposed facility is obstructed by existing tree cover. As long as the existing tree cover is not altered by the proposed project, NRC has concluded that the existing conditions warrant a finding of a SMALL visual impact.

A total of 19 historic properties have been assessed as having potential visual impacts based the results of the LOS analysis. The NRC considered the significance of a site, qualities that contribute to the significance of sites, and environmental factors and conditions in assessing sites. The NRC concluded modern intrusions, such as public roads, an active railroad corridor, several modern residences and farms, and former open pit mines diminished the qualities of setting, feeling and association of 15 archaeological and tribal cultural properties with potential visual effects (39CU0459, 39CU3567, 39CU3600, 39CU3604, 39FA0096, 39FA1862, 39FA1881, 39FA1952, TS002, TS006, TS007-011, TS040, TS041-042, TS080-089/098, TS120). NRC concluded the introduction of new visual changes to the viewsheds of the Bakewell Ranch (CU00000050)/Edna and Ernest Young Ranch Historic District (NRIS #90000949) and the Burlington Northern Railroad (39CU2000 and 39FA2000) will have minimal effect based on distances from the properties. NRC also judged that new visual changes to the viewshed of the Richardson Log Barn (CU02500002) will be minimal due to the diminished integrity of the abandoned building and the surrounding homestead property (CU00000052). Based on these assessments, NRC staff has concluded that the proposed project will have MODERATE visual impacts on this group of 19 historic properties.

It is important to note that these assessments of impact are based on current designs for the processing facilities, existing topography, and other environmental conditions including tree cover. Other project activities such as grading for project construction or clearing of vegetation could result in changes to the immediate surroundings of individual historic properties that could increase the potential for adverse impacts. Therefore, unanticipated changes in these conditions may warrant reconsideration of these assessments.

Auditory Impact Assessment

This assessment considers whether the proposed project will have the potential to introduce new auditory changes that could impact historic properties within or outside the limits of proposed ground disturbance. NRC staff concluded in the GEIS that activities associated with construction and operations at ISR facilities will not introduce significant audible elements to the project area (NRC, 2009a). NRC's assessment of auditory impacts included the 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting and are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the CPP in the Burdock area

(Table 4.9-6). As discussed previously, historic properties considered eligible for the NRHP solely under Criterion D were not evaluated for potential visual impacts because integrity of setting is not often considered a contributing characteristic for properties considered eligible on the basis of their historic information contents (i.e., Criterion D).

NRC concluded in the GEIS that impacts from noise will be greatest during the construction and decommissioning phases of an ISR project due to noise generated by earthmoving, excavation, building construction, and demolition activities (NRC, 2009a). Noise levels decrease with distance from the source and NRC determined that noise impacts will be SMALL for residences, communities, and sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activtives (NRC, 2009a). None of the historic properties included in this assessment are located closer than 640 m [2,100 ft] from the nearest processing facility, which exceeds the estimated 305 m [1,000 ft] zone for potential auditory impacts. Therefore, NRC staff conclude that potential auditory impacts on historic properties during the construction phase for the deep Class V injection well disposal option will be SMALL.

Construction Impacts Conclusion

The NRC environmental review of historic and cultural resources is based on analyses of historic and cultural resource investigations (Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012); tribal cultural surveys (SEIS Appendix F); visual and auditory impact assessments conducted by NRC staff; and commitments made by the applicant to implement mitigation measures for potentially impacted sites. Based on results of the environmental review, NRC staff conclude that the potential impacts to historic and cultural resources during the construction phase of the proposed project for the Class V injection well disposal option will range from SMALL to LARGE.

4.9.1.1.2 Operations Impacts

As discussed in the GEIS, it is expected that potential impacts to historic and cultural resources from operations will be less than during construction, because less land disturbance occurs during this phase (NRC, 2009a). In addition, there will be minimal impacts from facility operations or maintenance on identified historic and cultural resources because any potential impacts to these sites will be mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.1.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. For these reasons, the potential impacts to historic and cultural resources during the operations phase for the Class V injection well disposal option will be SMALL to MODERATE.

4.9.1.1.3 Aquifer Restoration Impacts

As discussed in the GEIS, it is expected that aquifer restoration impacts to historic and cultural resources will be similar to, or less than, potential impacts from operations (NRC, 2009a). Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, satellite facility, and central processing plant). Potential

impacts to identified historic and cultural resources will have been mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.1.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. Therefore, the potential impacts to historic and cultural resources during the aquifer restoration phase for the Class V injection well disposal option will be SMALL to MODERATE.

4.9.1.1.4 Decommissioning Impacts

As discussed in the GEIS, decommissioning and reclamation activities will be limited to previously disturbed areas, and historic and cultural resources within the APE will already be known (NRC, 2009a). There will be minimal impacts on historic and cultural resources because potential impacts to identified historic properties will have been mitigated. Identified historic sites will have been avoided from the construction phase through the decommissioning phase. Until processing facilities and infrastructure is dismantled and removed, potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.1.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). Potential visual impacts will be reduced to SMALL after processing facilities are dismantled and removed. If historic and cultural resources are encountered during decommissioning and reclamation activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. Therefore, the overall potential impacts to historic and cultural resources during decommissioning for the Class V injection well disposal option will be SMALL.

4.9.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant proposes to dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The potential impacts on historic and cultural resources during construction, operations, aquifer restoration, and decommissioning associated with the land application liquid waste disposal option are discussed in the following sections.

4.9.1.2.1 Construction Impacts

As noted in SEIS Section 4.9.1, if land application is used for liquid waste disposal, the APE for facility construction and operations will include an additional maximum area of approximately 506 ha [1,250 ac] surrounding proposed land application areas (see Figure 3.9-1). As with the Class V injection well disposal option, mitigation measures, such as limiting construction of new access and secondary roads, will minimize surface disturbance (Powertech, 2009a) during this option and will limit potential impacts to historic and cultural resources.

As discussed in SEIS Section 4.9.1.1.1, as part of the environmental review of historic and cultural resources, the NRC evaluated the results of historic and cultural resource surveys

conducted at the proposed Dewey-Burdock ISR Project site (see SEIS Section 3.9.3). These surveys included (i) a Level III cultural resource investigation conducted as part of prelicense application activities; (ii) a tribal cultural survey; and (iii) a visual impacts assessment. In addition to the visual impacts assessment, NRC evaluated whether the proposed project has the potential to introduce new auditory changes to the project area that may impact historic properties located within or outside the limits of proposed ground disturbance. NRC's NRHP eligibility determinations and assessment for cultural and historic properties identified at the Dewey-Burdock site that may be impacted by the land application disposal option are discussed in the sections below.

Level III Cultural Resource Investigation

As described in SEIS Section 4.9.1.1.1, archaeological field investigations identified a total of 18 historic properties within the proposed project area that are listed or recommended as eligible for listing in the NRHP. These sites are listed in Table 4.9-1 along with the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, NRC assessment of the significance of impact, and NRC management recommendations. With the exception of site CU02500002, the impacts of construction activities and recommended mitigation measures for these sites are expected to be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option.

Site CU02500002 is a log barn structure located approximately 76 m [250 ft] south of proposed land application areas in the Burdock area. Site CU02500002 is part of the Richardson Homestead (CU00000052), which contains three other standing structures (CU02500001, CU02500003, and CU02500004). SD SHPO indicated that all four standing structures at the Richardson Homestead are related and should be considered as a district (SD SHPO, 2014). In this context, SD SHPO recommended that the Richardson Homestead be considered eligible under Criterion A. In addition, SD SHPO recommended that the archaeological component of the Richardson Homestead represented by site 39CU3619 be considered "unevaluated" until additional information is submitted (SD SHPO, 2014). NRC recommends that the NRHP-eligibility of sites CU00000052 (Richardson Homestead) and 39CU3619 be further evaluated during development of a PA associated with ongoing Section 106 consultation activities.

Site CU02500002 (the log barn structure) is located within the APE for facility construction and operations for the land application option. NRC recommended and the applicant committed to creating a buffer zone and erecting protective fencing around the perimeter of the log barn structure to minimize potential impacts during construction (Powertech, 2012e). If avoidance is not possible, NRC recommends that the structure be mitigated through Historic American Buildings Survey (HABS) level documentation.

As noted in SEIS Section 3.9.3.1.1, historic and ethnographic evidence indicate that cairn features may have served as markers for trails, camps, burials, caches, and ceremonial centers for Native American tribes. Unevaluated sites with burials or cairn features are listed in Table 4.9-2 along with the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, NRC assessment of the significance of impact, and NRC management recommendations (see SEIS Section 4.9.1.1.1). NRC considers unevaluated archaeological sites eligible for listing in the NRHP under Criterion D. With the exception of site 39CU3584, impacts of construction activities and recommended mitigation measures for these sites are expected to be identical to those

described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Cairn site 39CU3584 is located within a proposed land application area at the Dewey site. As described in SEIS Section 3.9.3.1.1, site 39CU3584 underwent archaeological testing and was recommended ineligible for listing in the NRHP under Criteria D, based on a lack of diagnostic artifacts and intact cultural deposits (Kruse, et al., 2008; Palmer and Kruse, 2012). SD SHPO recommended that site 39CU3584 be considered unevaluated for listing on the NRHP until all eligibility criteria have been determined (SD SHPO, 2012). Site 39CU3584 was visited and recorded during tribal cultural surveys; however, the tribes offered no NRHP recommendations for this site (see SEIS Section 3.9.3.2.2). NRC recommends avoidance of site 39CU3584 and considers this site eligible for listing in the NRHP under Criterion D pending further evaluation. With the exception of 39CU3584, no other unevaluated cairn sites are located within proposed construction impact areas for the land application disposal option.

As described in SEIS Section 3.9.3.1.1, several unevaluated archaeological sites are located within or adjacent to the APE for facility construction and operations and, therefore, could be potentially impacted by ISR activities. These unevaluated archaeological sites are listed in Table 4.9-3 along with the NRC NRHP-eligibility determinations, the locations of eligible sites within the APE affected by facility construction and operations, NRC assessment of the significance of impact, and NRC management recommendations. NRC considers unevaluated archaeological sites eligible for listing in the NRHP under Criterion D. As discussed in SEIS Section 3.9.3.1.1, unevaluated sites 39CU0653, 39CU3615, 39FA0740, and 39FA0777 are artifact scatters within or adjacent to land applications areas. With the exception of these sites, impacts and recommended mitigation measures to ensure that unevaluated sites are not impacted by construction activities will be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Sites 39CU0653 and 39CU3615 are located within land application areas in the Burdock area. Site 39FA0740 is located approximately 3.05 m [10 ft] southwest of land application areas in the Burdock area and site 39FA0777 is located approximately 3.05 [10 ft] southeast of land application areas in the Burdock area. NRC staff recommend that these sites undergo further evaluative testing to determine their eligibility for listing in the NRHP. Until testing is completed, avoidance of these sites is recommended.

Archaeological investigations have not identified other unevaluated or NRHP-eligible sites within or in the vicinity of construction impact areas for the land application disposal option. Based on its review and evaluation of archaeological field investigations, NRC concludes that six (6) historic properties could experience LARGE potential impacts due solely to their location within or adjacent to the APE for facility construction and operations for the land application disposal option. This includes one (1) property eligible for listing in the NRHP (CU02500002) and five (5) unevaluated properties considered eligible for listing in the NRHP under Criterion D pending further evaluation (39CU3584, 39CU0653, 39CU3615, 39FA0740, and 39FA0777).

The applicant stated the overall goal during development and production of the proposed project is the avoidance of archaeological sites (Powertech, 2009a, Section 3.8.1). As discussed previously, the applicant has committed to protect historic and unevaluated sites by avoidance or in some cases constructing protective fencing to ensure avoidance (Powertech, 2012e, f). In addition, construction personnel will be advised of the location of historic properties and unevaluated sites prior to any ground-disturbing activities (Powertech, 2009a). By license condition, the applicant is required to stop any work resulting in the discovery of previously unknown cultural artifacts (NRC, 2013; License Condition 9.8). All newly discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. The use of archaeological

and tribal monitors to protect known historic properties was proposed during ground disturbing activities (Powertech, 2009a). The NRC staff is currently developing a PA with all consulting parties to develop measures to avoid, minimize, or mitigate sites that could be impacted such as those listed in Tables 4.9-1 and 4.9-3). A license condition to ensure successful implementation of any agreement made in the PA will lessen the impacts to historic properties from this undertaking (NRC, 2013, License Condition 9.8). Based on implementation of mitigation measures and management recommendations documented here and within the PA, potential impacts to historic properties and unevaluated sites identified during archaeological field investigations are not anticipated.

Tribal Cultural Survey

SEIS Section 3.9.3.2.2 presents the results of tribal cultural surveys and eligibility recommendations for recorded archaeological sites and newly discovered tribal sites provided by the THPOs for the Northern Cheyenne Tribe, the Northern Arapaho Tribe, the Cheyenne and Arapaho Tribes of Oklahoma, and the Crow Nation. Sites identified during the tribal cultural survey with management recommendations are included as Appendix F of this SEIS.

The NRC NRHP-eligibility determinations, assessment of significance of impact, and management recommendations for known archaeological sites and newly discovered tribal sites identified during the tribal cultural surveys are presented in Tables 4.9-4 and 4.9-5, respectively. In assessing the significance of impact to these sites, NRC considered its NRHP eligibility determination and the location of the site with respect to the APE for facility construction and operations. With the exception of site 39CU3567, impacts and recommended mitigation measures to ensure that these sites are not impacted by construction activities will be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Site 39CU3567 is a previously recorded archaeological site that could experience LARGE potential impacts due to its location within the APE for facility construction and operations for the land application option (see Table 4.9-4). Tribal survey teams recommended avoidance of this site with no less than a 300 m [964 ft] protective buffer.

Potential impacts to known archaeological and newly discovered tribal sites identified during the tribal cultural surveys will be reduced through mitigation strategies developed during National Historic Preservation Act (NHPA) Section 106 consultations. As discussed in SEIS Section 1.7.3.5, consultation involving NRC, the applicant, SD SHPO, BLM, and interested Indian tribes is being conducted to determine what measures can be used to avoid, minimize, or mitigate adverse impacts to historic properties that may be impacted by site activities. Before beginning construction activities at the proposed project site, an agreement between NRC, SD SHPO, BLM, ACHP, interested Native American tribes (tribal government or designated THPO), the applicant, and other interested parties will be developed in accordance with 36 CFR 800.14(b)(2). The agreement will outline the mitigation process for each affected resource identified at the site pursuant to 36 CFR 800.8(c)(1)(v). Therefore, potential impacts to previously recorded archaeological sites and newly discovered tribal sites identified during tribal cultural surveys are not anticipated.

Visual Impact Assessment

As described in SEIS Section 3.9.3.3, NRC staff completed an assessment of the proposed project's potential to have visual impacts on historic properties (i.e., properties of any type listed in or considered eligible for listing in the NRHP). As discussed in SEIS Section 4.9.1.1.1, NRC's

assessment of visual impacts included 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting. They are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the CPP in the Burdock area (Table 4.9-6). Historic properties eligible for the NRHP solely under Criterion D were not evaluated for potential visual impacts because integrity of setting is not a contributing characteristic for these types of properties eligible for their historic information contents (i.e., Criterion D).

NRC staff used a GIS-based LOS analysis to determine whether the proposed processing facilities would be visible from the vantage point of each individual historic property. The Dewey SF and the Burdock CPP will be situated at identical locations for both the land application and Class V injection well disposal options. Therefore, potential visual and auditory impacts to historic properties for the land application option will be identical to those described in SEIS Section 4.9.1.1.1 for the Class V injection well disposal option. Based on the LOS analysis, NRC calculates that the proposed project will have a SMALL visual impact on 12 of the 31 historic properties included in this study (Table 4.9.6) and a MODERATE visual impact on 19 historic properties included in the visual impact assessment (see SEIS Section 4.9.1.1.1 and Table 4.9-6).

Auditory Impact Assessment

NRC concluded in the GEIS that impacts from noise will be greatest during the construction and decommissioning phases of an ISR project due to noise generated by earthmoving, excavation, building construction, and demolition activities (NRC, 2009a). Noise levels decrease with distance from the source and NRC determined that noise impacts will be SMALL for residences, communities, and sensitive areas that are located more than 305 m [1,000 ft] from specific noise-generating activtives (NRC, 2009a). NRC's assessment of auditory impacts included the 31 historic properties that are either listed on the NRHP or considered eligible for listing on the NRHP under criteria A and/or C due in part to their integrity of setting and are also located within a 4.8-km [3-mi] radius of the SF in the Dewey area and the CPP in the Burdock area (Table 4.9-6). None of the historic properties included in this assessment are located closer than 640 m [2,100 ft] from the nearest processing facility, which exceeds the estimated 305 m [1,000 ft] zone for potential auditory impacts. Therefore, NRC staff conclude that potential auditory impacts on historic properties during the construction phase for the land application disposal option will be SMALL.

Construction Impacts Conclusion

The NRC environmental review of historic and cultural resources is based on analyses of historic and cultural resource investigations ((Kruse, et al., 2008; Palmer and Kruse, 2008; Palmer 2008, 2009, 2012); tribal cultural surveys (SEIS Appendix F); visual and auditory impact assessments conducted by NRC staff; and commitments made by the applicant to implement mitigation measures for potentially impacted sites. Based on results of the environmental review, NRC staff conclude that the potential impacts to historic and cultural resources during the construction phase of the proposed project for the land application disposal option will range from SMALL to LARGE.

4.9.1.2.2 Operations Impacts

As discussed in the GEIS, it is expected that potential impacts to historic and cultural resources from operations will be less than during construction, because less land disturbance occurs during this phase (NRC, 2009a). In addition, there will be minimal impacts from facility operations or maintenance on identified historic and cultural resources because any potential impacts to these sites will be mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.2.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. For these reasons, the potential impacts to historic and cultural resources during the operations phase for the land application disposal option will be SMALL to MODERATE.

4.9.1.2.3 Aquifer Restoration Impacts

As discussed in the GEIS, it is expected that aquifer restoration impacts to historic and cultural resources will be similar to, or less than, potential impacts from operations (NRC, 2009a). Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, satellite facility, and central processing plant). Potential impacts to identified historic and cultural resources will have been mitigated prior to facility construction. Potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.2.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). If there is a discovery of historic and cultural resources during routine maintenance activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed. Therefore, the potential impacts to historic and cultural resources during the aquifer restoration phase for the land application disposal option will be SMALL to MODERATE.

4.9.1.2.4 Decommissioning Impacts

As discussed in the GEIS, decommissioning and reclamation activities will focus on previously disturbed areas, and historic and cultural resources within the APE will already be known (NRC, 2009a). There will be minimal impacts on historic and cultural resources because potential impacts to identified historic properties will have been mitigated. Identified historic sites will have been avoided from the construction phase through the decommissioning phase. Until processing facilities and infrastructure is dismantled and removed, potential visual and auditory impacts on historic properties at the proposed project site will be the same as described in Section 4.9.1.2.1 (potential visual impacts will range from SMALL to MODERATE and potential auditory impacts will be SMALL). Potential visual impacts will be reduced to SMALL after processing facilities are dismantled and removed. If historic and cultural resources are encountered during decommissioning and reclamation activities, the applicant is required by license condition to stop work and notify NRC, SD SHPO, and BLM (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and

BLM to proceed. Therefore, the overall potential impacts to historic and cultural resources during decommissioning for the land application disposal option will be SMALL.

4.9.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of deep well disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). In order to implement the combined option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis, depending on the disposal capacity Class V injection wells (Powertech, 2011). Increased land disturbance and added access restrictions associated with the addition of irrigation areas and increased pond capacity for storage during nonirrigation periods will result in different environmental impacts for the combined option. Specifically, the potential environmental impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V injection wells (see SEIS Table 4.2.1). However, because only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned, the impacts to historic and cultural resources for the combined disposal option will be less than for the land application option, but greater than for the Class V injection well disposal option. Therefore, NRC staff conclude that the potential impacts on historic and cultural resources of the combined Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will be no greater than the impacts of the Class V injection well option and the land application option as summarized in Table 4.9-7.

4.9.2 No-Action (Alternative 2)

Under the No-Action alternative, no ISR facility will be constructed or operated at the proposed Dewey-Burdock ISR Project. Therefore, no historic properties will be affected by the No-Action alternative. The potential impacts associated with current land activities, such as, cattle ranching and recreation will continue.

Table 4.9-7. Significance of Historic and Cultural Resources Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE
Operations	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Aquifer Restoration	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Decommissioning	SMALL	SMALL	SMALL

*Significance of impacts on historic and cultural resources for the combined disposal option is bounded by the significance of impacts on historic and cultural resources for the Class V injection well and land application disposal options.

4.10 Visual and Scenic Resources Impacts

As discussed in GEIS Section 4.4.9, potential visual and scenic impacts from an ISR facility in the Nebraska-South Dakota-Wyoming Uranium Milling Region may occur during all phases of the ISR facility lifecycle. These impacts will come primarily from the use of equipment such as drill rigs; dust and other emissions from such equipment; construction of central and satellite plants and storage structures and site and wellfield access roads; land clearing and grading activities; and lighting for nighttime operations. Such impacts may be mitigated by rolling topography, the use of color considerations for structures, and dust suppression techniques. (NRC, 2009a)

GEIS Construction Phase Summary

Visual impacts during construction can result from the presence of equipment (e.g., drill rig masts, cranes), dust and diesel emissions from construction equipment, and hillside and roadside cuts. Depending on the location of an ISR facility relative to viewpoints, such as highways, facility construction and of drill rigs may be visible. For nighttime operations, the drill rigs will be lighted, thus creating a visual impact on elevated areas. Most impacts will be temporary as equipment is moved and will be mitigated by BMPs (e.g., dust suppression). Additionally, because these sites are located in sparsely populated areas with rolling topography, most visual impacts during construction will not be visible from more than about 1 km [0.6 mi]. Therefore, NRC staff concluded in the GEIS that visual and scenic impacts from operations will be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

Visual impacts during operations will be less than those from construction because the wellfield surface infrastructure will have a low profile, and most piping and cables will be buried. The tallest structures will be expected to include the central processing plant {9 m [30 ft] in height} and power lines {6 m [20 ft] in height}. Because ISR sites are typically located in sparsely

populated areas with generally rolling topography, most visual impacts during operations will be limited to a distance of not more than about 1 km [0.6 mi]. The irregular layout of wellfield surface structures, such as wellhead protection and header houses, will further reduce visual contrast. BMPs, design (e.g., painting buildings), and landscaping techniques will be used to mitigate potential visual impact. Therefore, NRC staff concluded in the GEIS that visual and scenic impacts from operations will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

Aquifer restoration activities will be expected to take place some years after the facility has been in operation, and restoration activities will use in-place infrastructure. As a result, potential visual impacts will be similar to those experienced during operations. Mitigation measures (e.g., dust suppression) may be used to further reduce visual and scenic impacts. Therefore, potential impacts from aquifer restoration will be SMALL. (NRC, 2009a).

GEIS Decommissioning Phase Summary

Because similar equipment will be used and similar activities conducted, potential visual impacts during decommissioning will be similar to those experienced during construction. The greatest

potential visual impacts during decommissioning will be temporary as equipment is moved from place to place and mitigated by BMPs (e.g., dust suppression). Additionally, visual impacts will be low, because these sites are expected to be located in sparsely populated areas of the Nebraska-South Dakota-Wyoming Uranium Milling Region, and the impacts will diminish as decommissioning activities decrease and disturbed surfaces become re-vegetated. NRC licensees are required to conduct final site decommissioning and reclamation under an approved site reclamation plan, with the goal of returning the landscape to preconstruction conditions. While some roadside cuts and hill slope modifications may persist beyond decommissioning and reclamation, NRC staff concluded in the GEIS that visual and scenic impacts from decommissioning will be SMALL. (NRC, 2009a)

Potential environmental impacts on visual and scenic resources from construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.10.1 Proposed Action (Alternative 1)

The BLM Visual Resource Management (VRM) classification of landscapes (BLM, 1984, 1986) was considered in assessing the significance and management objectives of visual impacts. As described in GEIS Section 3.4.9, most of the landscape in the Nebraska-South Dakota-Wyoming Uranium Milling Region is identified as VRM Class III or Class IV (BLM, 2000). These classes are based on a combination of scenic quality, sensitivity levels, and distance zones (BLM, 1984, 1986). This classification allows for an activity to contrast with basic elements of the characteristic landscape to a moderate extent for a Class III designation or to a much greater extent for a Class IV designation.

As described in SEIS Section 3.10, the applicant classified the project area and the 3.2-km [2-mi] area surrounding the project area as VRM Class IV (Powertech, 2009a). The objective of this class is to provide management for activities that might require major modifications of the existing character of the landscape (BLM, 1986). The level of change permitted for this class is the least restrictive and can be high. Some VRM Class II areas have been identified around Devil's Tower National Monument and BHNF along the Wyoming-South Dakota border (BLM, 2000). VRM Class II allows an activity to contrast with basic elements of the characteristic landscape to a limited extent. However, these VRM Class II areas are more than 80 km [50 mi] from the proposed project area. As previously discussed, PSD Class I areas require more stringent air quality standards that can affect visual impacts (see SEIS Section 4.7). The nearest PSD Class I area is located at Wind Cave National Park, approximately 47 km [29 mi] east of the proposed Dewey-Burdock site. Other recreational areas in the broader region include Jewel Cave National Monument and Mount Rushmore National Memorial, managed by the U.S. Department of the Interior. These recreational areas are located approximately 37 km [23 mi] north and 71 km [44 mi] northeast of the proposed project, respectively (see Figure 3.2-2). In addition, the SDGFP-managed George S. Mickelson Trail parallels State Highway 89 between Custer, South Dakota, and U.S. Highway 18 connecting Edgemont to Hot Springs and comes within approximately 27 km [17 mi] of the proposed project area.

4.10.1.1 Disposal Via Class V Injection Wells

The applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells (see SEIS Section 2.1.1.1.2.4). EPA is currently reviewing the applicant's UIC permit application for Class V injection wells. The applicant-proposed locations of the first four

Class V injection wells are shown in Figure 2.1-10. Potential environmental impacts on visual and scenic resources for the Class V injection well disposal option are discussed in the following sections.

4.10.1.1.1 Construction Impacts

Visual impacts related to facilities construction at the proposed Dewey-Burdock ISR Project will include addition of access roads, overhead electrical lines, processing facilities (central processing plant and satellite facility buildings), storage ponds, wellhead covers, header houses, piping, and ancillary buildings (Powertech, 2009a). Additional visual impacts related to facilities construction associated with the Class V injection well disposal option will include the construction of four to eight Class V injection wells. After construction, buildings will be constructed around the Class V injection wells to limit access (see SEIS Section 4.2.1.1.1).

During construction, most impacts to visual resources at the proposed Dewey-Burdock site will result from well development, when drilling rig masts contrast with the general topography. Approximately 646 wells will be installed during initial wellfield development, and approximately 406 wells will be installed annually over the operational life of the proposed project (Powertech, 2010b). Multiple drill rigs will likely be operating during wellfield construction. In addition, four to eight Class V deep injection wells will be drilled and developed for liquid waste disposal. Visual impacts from drilling activities will be temporary. Once a well is completed and conditioned for use, the drill rig will be moved to a new location to drill the next hole. In the wellfields, wellheads will be covered to prevent freezing and protect the wells. These covers will be low structures {1–2 m [3–6 ft] high} and will present only a slight contrast to the existing landscape. Unless the topography is extremely flat and void of vegetation, these structures will not be visible from distances of 1 km [0.6 mi] or more.

Visual and scenic impacts from land disturbance associated with facilities construction at the proposed Dewey-Burdock site will be short term (1 to 2 years; see Figure 2.1-1). The applicant has indicated that temporarily impacted areas will be reclaimed after construction is complete and debris created during construction will be removed as soon as possible (Powertech, 2009a). Roads and structures will be more long lasting, but will be removed and reclaimed after operations cease. The applicant proposes to minimize the potential impacts to visual and scenic resources by selecting building materials and paint that complement the natural environment (Powertech, 2009a). Construction and placement of structures and roads will consider the landscape topography to conceal wellheads, plant facilities, access roads, and areas of disturbance from public vantage points. Standard dust control measures (e.g., water application, speed limits, and coordinating dust-producing activities) will be implemented to reduce visual impacts from fugitive dust (Powertech, 2009a). The applicant is also considering other measures to mitigate the potential visual and scenic resource impacts, including using exterior lighting only where needed to accomplish facility tasks, limiting the height of exterior lighting units, and using shielded or directional lighting to limit lighting only to areas where it is needed (Powertech, 2009a).

As discussed previously, the proposed project site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and other recreational areas in the surrounding region. Therefore, the visual and scenic impacts associated with ISR construction at the proposed project will be consistent with the predominant VRM Class III and IV designations for the Nebraska-South Dakota-Wyoming Milling Region (BLM, 2000; NRC, 2009a). Based on the remote location of the proposed project site, the short-term nature of

construction activities, and the mitigation measures that will be used to reduce potential visual and scenic impacts the NRC staff conclude that visual and scenic impacts from ISR facilities and equipment during construction activities for the Class V injection well disposal option will be SMALL.

4.10.1.1.2 Operations Impacts

Most of the pipes and cables associated with wellfield operations at the Dewey-Burdock ISR Project will be buried at least 1.5 m [5 ft] below grade to protect them from freezing, and they will not be visible during operations (Powertech, 2009a). The applicant will sequentially phase in wellfields as the uranium reserves are defined (Powertech, 2009a); therefore, there will not be a large expanse of land undergoing development at one time. Because wellhead covers will typically be low {1–2 m [3–6 ft]} structures and there is no active drilling in operating wellfields, the overall visual impact of an operating wellfield will be the same as or less than from construction.

The central processing plant, satellite facility, header houses, Class V injection well buildings, access roads, and overhead powerlines at the project will be the main operational facilities and infrastructure affecting the visual landscape. The visibility of aboveground facilities and infrastructure will depend on the location of the observer, intervening topography, and distance. The construction and placement of aboveground structures will consider the topography to conceal plant facilities, infrastructure, and roads from public vantage points (Powertech, 2009a). In addition, building materials and paint will be selected to complement the natural environment. As discussed in SEIS Section 4.7, standard dust control measures (e.g., water application and speed limits) will be implemented, which will reduce visual impacts from fugitive dust during operations activities (Powertech, 2009a).

The proposed project site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and recreational areas in the surrounding region. Therefore, the visual impacts associated with operations will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). Because construction of aboveground structures will consider topography to conceal plant facilities and infrastructure and mitigation measures (e.g., water application to control fugitive dust) will be implemented to reduce impacts to visual and scenic resources, NRC staff conclude that the visual and scenic impacts from operations for the Class V injection well disposal option will be SMALL.

4.10.1.1.3 Aquifer Restoration Impacts

Much of the same equipment and infrastructure used during the operational period of the project will be employed during aquifer restoration, so impacts to the visual landscape will be similar to those during operations. Because there is no active drilling, potential visual impacts during aquifer restoration are expected to be less than those during construction and of short duration. As with construction and operations, the visual impacts associated with aquifer restoration will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). No modifications to either scenery or topography will occur during restoration. Standard dust control measures (e.g., water application and speed limits) will be implemented to further reduce the overall visual and scenic impacts of aquifer restoration (Powertech, 2009a). Therefore, NRC staff conclude that the visual and scenic impacts from aquifer restoration for the Class V injection well disposal option will be SMALL.

4.10.1.1.4 Decommissioning Impacts

When project operations and aquifer restoration are complete at the proposed Dewey-Burdock site, the applicant will return all lands disturbed by the ISR facility to their preoperational land use of livestock grazing and wildlife habitat unless the state justifies and approves an alternative use (e.g., the landowner may request to retain structures and roads for further use) (Powertech, 2009a). Reclamation will return the landscape to baseline contours and will reduce the visual impact by removing buildings and associated infrastructure. After reclamation activities are completed, there will be no restrictions on surface use. Prior to final site decommissioning, the applicant will submit a decommissioning plan to NRC, in accordance with 10 CFR Part 40.

During decommissioning and reclamation activities, temporary impacts to the visual environment will be similar to or less than those during the construction phase. Equipment used to dismantle buildings and milling equipment, remove any contaminated soils, or grade the surface as part of reclamation activities will generate temporary visual contrasts. In the wellfields, the greatest source of visual contrast will be from equipment used when production, injection, and monitor wells are plugged and abandoned. Temporary visual contrasts associated with the Class V injection well disposal option will include the dismantling of buildings housing the Class V injection wells and the plugging and abandonment of the wells. Visual and scenic resources may be affected by fugitive dust emissions from decommissioning activities. The applicant will implement dust suppression measures (e.g., water application and speed limits) to reduce dust emissions (Powertech, 2009a). Once decommissioning and reclamation activities are complete, the visual landscape will be returned to baseline conditions, with the potential exception of equipment related to longer term monitoring activities. Therefore, the NRC staff conclude that the visual and scenic impacts from decommissioning for the Class V injection well disposal option will be SMALL.

4.10.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not obtained from EPA, the applicant will dispose of liquid waste generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. Potential environmental impacts on visual and scenic resources during construction, operations, aquifer restoration, and decommissioning for the land application option are discussed in the following sections.

4.10.1.2.1 Construction Impacts

As with the Class V injection well disposal option, visual impacts related to facilities construction for the land application option at the proposed Dewey-Burdock ISR Project will include addition of access roads, overhead electrical lines, processing facilities (central processing plant and satellite facility buildings), storage ponds, wellhead covers, header houses, piping, and ancillary buildings (Powertech, 2009a). Additional visual impacts related to facilities construction for the land application option will include the addition of center pivot irrigation systems in land application areas. As described in SEIS Section 2.1.1.1.2.4.2, the Dewey area will contain five 20.23-ha [50-ac] pivots, two 10.12-ha [25-ac] pivots, and one 6.1-ha [15-ac] pivot. The Burdock area will contain six 20.23-ha [50-ac] pivots and one 6.1-ha [15-ac] pivot. In addition, each area will contain 26.3 ha [65 ac] of pivots on standby.

Similar to the Class V injection well disposal option, visual and scenic impacts associated with facilities construction for the land application option at the proposed site will be short term (1 to 2 years) and minimized by mitigation measures. Applicant-proposed mitigation measures to reduce visual impacts include (i) reclaiming temporary impacted areas after construction and removing debris; (ii) removing and reclaiming roads and structures after operations cease; (iii) selecting building materials and paint that complement the natural environment; (iv) considering landscape topography to conceal wellheads, plant facilities, access roads, and center pivot irrigation systems; and (v) implementing standard dust suppression techniques to reduce visual impacts of fugitive dust (Powertech, 2009a). The applicant is also considering other measures to mitigate the potential visual and scenic resource impacts, including using exterior lighting only where needed to accomplish facility task, limiting the height of exterior lighting units, and using shielded or directional lighting to limit lighting only to areas where it is needed (Powertech, 2009a).

During construction of facilities and infrastructure for the land application option, most impacts to visual resources at the proposed site will result from development of wellfields (as described in SEIS Section 4.10.1.1.1 for the Class V injection well disposal option) and the placement of center pivot irrigation systems. Visual impacts of center pivot irrigation systems will last over the life of proposed project. Center pivot irrigation systems will not be visible to individuals on heavily traveled public roadways in the area (e.g., U.S. Highway 18 and State Highway 89). However, proposed land application areas in the Dewey area are within 1 km [0.6 mi] of Dewey Road (see Figure 2.1-12), and therefore center pivots in the Dewey area will be visible to travelers along Dewey Road.

As discussed previously, the proposed Dewey-Burdock site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and other recreational areas in the surrounding region. Therefore, the visual and scenic impacts associated with ISR construction at the proposed project will be consistent with the predominant VRM Class III and IV designations for the Nebraska-South Dakota-Wyoming Milling Region (BLM, 2000; NRC, 2009a). 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. In 2009, the estimated average daily traffic count on Dewey Road was 25 vehicles (BLM, 2009). Based on the remote location of the proposed project site, the short-term nature of the construction activities and the mitigation measures that will be used to reduce potential visual and scenic impacts, the NRC staff conclude that visual and scenic impacts from ISR construction activities for the land application disposal option will be SMALL.

4.10.1.2.2 Operations Impacts

For the land application liquid waste disposal option, the central processing plant, satellite facility, header houses, access roads, overhead powerlines, and center pivot irrigation systems will be the main operational facilities and infrastructure affecting the visual landscape at the proposed site. As with the Class V injection well disposal option, most of the pipes and cables associated with wellfield operations at the project will be buried at least 1.5 m [5 ft] below grade to protect them from freezing, and they will not be visible during operations (Powertech, 2009a). The applicant proposes to sequentially phase in wellfields as the uranium reserves are defined (Powertech, 2009a); therefore, there will not be a large expanse of land undergoing development at one time. Because wellhead covers will typically be low {1–2 m [3–6 ft]} structures and there is no active drilling in operating wellfields, the overall visual impact of an

operating wellfield will be the same as or less than from construction. As noted in the previous section, center pivot irrigation systems will not be visible to individuals on heavily traveled public roadways in the area (e.g., U.S. Highway 18 and State Highway 89). However, due to the proximity of proposed land application areas in the Dewey area to Dewey Road, center pivots will be visible to travelers along Dewey Road (see Figure 2.1-12). As noted in the previous section, Dewey Road is a lightly traveled county road with few residences. In 2009, the estimated average daily traffic count on Dewey Road was 25 vehicles (BLM, 2009).

The visibility of aboveground facilities and infrastructure will depend on the location of the observer, intervening topography, and distance. The construction and placement of aboveground structures will consider the topography to conceal plant facilities, infrastructure, center pivots in potential land application areas, and roads from public vantage points (Powertech, 2009a). In addition, building materials and paint will be selected to complement the natural environment. As discussed in SEIS Section 4.7, standard dust control measures (e.g., water application and speed limits) will be implemented, which will reduce visual impacts from fugitive dust during operations activities (Powertech, 2009a).

The proposed Dewey-Burdock site is located more than 16 km [10 mi] from the PSD Class I area at Wind Cave National Park, VRM Class II regions, and recreational areas in the surrounding region. Therefore, the visual impacts associated with operations will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). 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. Based on the remote location of the project site, the use of topography to conceal plant facilities and infrastructure, and mitigation measures (e.g., water application to control fugitive dust) that will be implemented to reduce impacts to visual and scenic resources, NRC staff conclude that the visual and scenic impacts from operations for the land application disposal option will be SMALL.

4.10.1.2.3 Aquifer Restoration Impacts

Much of the same equipment and infrastructure used during the operational period of the project will be employed during aquifer restoration, so impacts to the visual landscape will be similar to those during operations. Because there is no active drilling, potential visual impacts during aquifer restoration are expected to be less than those during construction and of short duration. As with construction and operations, the visual impacts associated with aquifer restoration will be consistent with the predominant VRM Classes III and IV for the region (BLM, 2000; NRC, 2009a). Neither scenery nor topography will be modified during restoration. Standard dust control measures (e.g., water application and speed limits) will be implemented to further reduce the overall visual and scenic impacts of aquifer restoration (Powertech, 2009a). Therefore, NRC staff conclude that the visual and scenic impacts from aquifer restoration for the land application disposal option will be SMALL.

4.10.1.2.4 Decommissioning Impacts

Prior to final site decommissioning, the applicant will submit a decommissioning plan to NRC, in accordance with 10 CFR Part 40. During decommissioning and reclamation, temporary impacts to the visual environment will be similar to or less than those during the construction phase. Equipment used to dismantle buildings and milling equipment, remove any contaminated soils, or grade the surface as part of reclamation activities will generate temporary visual contrasts. In

the wellfields, the greatest source of visual contrast will be from equipment used when production, injection, and monitor wells are plugged and abandoned. Temporary visual contrasts associated with the land application disposal option will include the dismantling and removal of center pivot irrigation systems in land application areas. Visual and scenic resources may be affected by fugitive dust emissions from decommissioning activities. The applicant will implement dust suppression measures (e.g., water application and speed limits) to reduce dust emissions (Powertech, 2009a). Once decommissioning and reclamation activities are complete, the visual landscape will be returned to baseline conditions, with the potential exception of equipment related to longer term monitoring activities. Therefore, the NRC staff conclude that the visual and scenic impacts from decommissioning for the land application disposal option will be SMALL.

4.10.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant will dispose of liquid waste by a combination of Class V deep injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined Class V injection well and land application disposal option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). Because of the placement of center pivot irrigation systems in proposed land application areas, the potential visual impacts of liquid waste disposal by land application for all phases of the ISR process will be greater than for liquid waste disposal by Class V well injection (see SEIS Section 4.10.1.2). Furthermore, because only a portion of the center pivot irrigation systems will be constructed, operated, and decommissioned for the combined disposal option, the significance of visual impacts for the combined disposal option will be less than for the land application option. Therefore, NRC staff conclude that visual and scenic impacts of the combined Class V injection well and land application disposal option for each phase of the proposed will be bounded by the significance of visual and scenic impacts of the Class V injection well option and the land application option as summarized in Table 4.10.1.

4.10.2 No Action (Alternative 2)

Under the No-Action alternative, no ISR facility will be constructed and there will be no change to the existing visual and scenic resources at the proposed Dewey-Burdock Project site. No additional structures or uses associated with the proposed project will be introduced from the

Table 4.10-1. Significance of Visual and Scenic Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL	SMALL	SMALL
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.			

proposed action to affect the existing viewscapes, and the existing scenic quality will remain unchanged (BLM VRM Classes III and IV, as defined in SEIS Section 3.10). Natural resource exploration activities and cattle grazing will continue in the area.

4.11 Socioeconomics Impacts

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by a proposed action could affect regional employment, income, and expenditures. Job creation is characterized by two types: (i) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact on the region and (ii) operation-related jobs in support of facility operations, which have a greater potential for permanent, long-term socioeconomic impacts in a region.

GEIS Section 4.4.10 describes the socioeconomic impacts expected during the ISR facility lifecycle (NRC, 2009a). Potential environmental impacts to socioeconomics could occur during

all phases of the facility's lifecycle. The GEIS socioeconomic analysis for the Nebraska-South Dakota-Wyoming Uranium Milling Region was based on 2000 U.S. Census Bureau (USCB) data. The socioeconomic analysis presented in this SEIS for the proposed Dewey-Burdock Project ROI is based on 2010 USCB data. Though specific numbers will differ between the 2000 and 2010 USCB data, the NRC analysis of socioeconomics presented in GEIS Section 4.4.10 remains valid for the proposed Dewey-Burdock ISR Project as explained in the following sections and expected impacts will be similar in scale to NRC staff conclusions in the GEIS.

4.11.1 Proposed Action (Alternative 1)

As discussed in SEIS Section 3.11, the analysis for the proposed action focuses on the impacts of constructing, operating, restoring the aquifer, and decommissioning the proposed ISR facility in Custer and Fall River Counties in South Dakota and Weston County in Wyoming. The applicant expects to directly employ 86 workers during construction and 84 workers during operations of the proposed project (Powertech, 2009a). A smaller number of workers are expected to be involved in aquifer restoration and decommissioning activities (Powertech, 2010a). The applicant expects nine workers to be directly involved in aquifer restoration activities and nine workers to be directly involved in decommissioning activities. The workforce for each phase of the proposed Dewey-Burdock ISR Project is not expected to change in number or skill level based on the liquid waste disposal option that the applicant will ultimately implement (Powertech, 2009a, 2010a). In other words, the number of skilled and unskilled workers required for construction, operations, aquifer restoration, and decommissioning for the Class V injection well disposal option, the land application disposal option, or the combined Class V injection well and land application disposal option will be the same. Therefore, NRC staff conclude that the demands of the workforce on existing public and social services, housing, and infrastructure (schools, utilities, local finance) will be similar regardless of the liquid waste disposal option the applicant implements. Socioeconomic impacts from construction, operations, aquifer restoration, and decommissioning of the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.11.1.1 Construction Impacts

In GEIS Section 4.4.10.1, NRC staff discussed the potential impacts to socioeconomics from construction of an ISR facility. These impacts will result predominantly from employment at an ISR facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local workforce. In the GEIS, NRC staff estimated total peak construction employment at an ISR facility to be about 200 people, including company employees and local contractors. During surface facility and wellfield construction, local contractors will generally be used (e.g., drillers, construction workers), as available, and local building materials and building supplies will be used to the extent practical. NRC staff also estimated an additional 140 indirect jobs may be created to support the construction of an ISR facility. Indirect jobs represent employees hired by producers of materials, equipment, and services that are used on the project. (NRC, 2009a)

In the GEIS, NRC staff assumed that most construction workers will choose to live in larger communities with access to more services. However, NRC staff expected that some construction workers will commute from outside the county to the construction site and that skilled employees (e.g., engineers, accountants, managers) will come from outside the local workforce. The potential also exists that some of these employees will temporarily relocate to the proposed project area and contribute to the local economy through purchasing goods and services and through paying taxes. Depending on where the workforce and supplies come from, the GEIS determined that potential impacts to towns and communities, in terms of housing and employment structure, may be SMALL to MODERATE. Given the expected short duration of construction activities (12 to 18 months), families are not expected to relocate closer to the site. For this reason, potential impacts to education and use of local services was determined to be SMALL. (NRC, 2009a)

Construction of the proposed Dewey-Burdock ISR Project is expected to last for 2 years (see Figure 2.1-1) and employ 86 people (Powertech, 2009a). In addition, 45 indirect jobs are expected to be created to support construction of the proposed project (Powertech, 2009a). Based on the smaller number of required construction workers for the proposed project (86 workers) when compared to the ISR construction workforce estimated in the GEIS (200 workers), the NRC staff conclude that the site-specific impacts of constructing the proposed project will be smaller than the impacts described in the GEIS.

Because of the small relative size of the ISR construction workforce, the overall potential impacts to socioeconomics from construction of the proposed Dewey-Burdock ISR Project will be SMALL. The following subsections describe the construction impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services for the proposed project.

4.11.1.1.1 Demographics

A workforce of 86 employees engaged directly in construction activities is expected during the construction phase of the Dewey-Burdock ISR Project (Powertech, 2009a). An additional 45 indirect jobs are expected to be created to support construction activities for a total of 131 people (Powertech, 2009a). Construction of the buildings, initial wellfields, and waste disposal systems for the proposed project is anticipated to take 2 years (see Figure 2.1-1). Construction workers are likely to locate in nearby communities such as Edgemont and Hot Springs in Fall River County, Custer in Custer County, and Newcastle in Weston County.

Based on housing data presented in SEIS Section 3.11.3, all of the counties have available housing to manage increases in population. Likewise, based on school enrollment and student-teacher ratio data presented in SEIS Section 3.11.6, schools have available capacities to manage increases in population. Furthermore, as described in SEIS Section 3.11.7, surrounding communities have adequate health and social services to serve increases in population. Due to the short duration of construction, the expected 86 construction workers and 45 supporting personnel will have a short-term impact on public services and community infrastructure in surrounding communities.

Increases in population will have the greatest impact on small communities close to the proposed project site, such as Edgemont (population 774). The construction workforce will be made up predominantly of skilled trades (e.g., carpenters, electricians, welders, plumbers) and unskilled workers sourced from nearby communities and counties. The applicant will preferentially source the labor force for construction from within the surrounding region to mitigate any burden on public services and community infrastructure in the nearby towns (Powertech, 2009a). Further, due to the short duration of construction (2 years estimated), construction workers with families will be less likely to relocate their entire families to the region, thus minimizing impacts from an outside workforce. Therefore, the NRC staff conclude that the impacts to demographics on nearby communities such as Edgemont, Custer, Hot Springs, and Newcastle during the construction phase will be SMALL.

4.11.1.1.2 Income

The applicant has estimated a construction workforce of 86 employees (Powertech, 2009a). Construction of the proposed project will preferentially draw upon the labor force within the region before going outside the region (Powertech, 2009a). Construction workers will likely come from nearby communities such as Edgemont, Hot Springs, and Custer in Custer and Fall River Counties and from Newcastle in Weston County, Wyoming. As noted previously, the construction workforce will be made up predominantly of skilled trades and unskilled workers. It is expected that the construction workforce will be paid at rates typical of the region. Income information including median household income and per capita income for Fall River, Custer, and Weston Counties is presented in SEIS Section 3.11.2. Because the construction workforce will be paid at rates typical of the region, the NRC staff conclude that the overall impacts to income during the construction phase of the proposed project will be SMALL.

4.11.1.1.3 Housing

The number of construction workers will cause a short-term increase in the demand of temporary (rental) housing units in Fall River, Custer, and Weston Counties. Based on 2010 USCB housing information, the vacancy rate is 21.9 percent (919 vacant units) in Fall River County, 21.4 percent (992 vacant units) in Custer County, and 14.5 percent (512 vacant units) in Weston County (see SEIS Section 3.11.3). Hence, any changes in employment will have little to no noticeable effect on the availability of housing in Custer, Fall River, and Weston Counties. Due to the short duration of construction activities (2 years), the number of construction workers (86 workers), and the availability of housing in the region, there will be little or no employment-related housing impacts. Therefore, the impact of the proposed action on housing availability will be SMALL.

4.11.1.1.4 Employment Structure

Construction of the proposed Dewey-Burdock ISR Project will create employment opportunities for 86 construction workers, with the potential of up to 45 jobs being generated to support this activity in the local economy. As described in SEIS Section 3.11.4, total 2012 county labor forces were estimated to be 3,660 for Fall River County, 4,390 for Custer County, and 3,308 for Weston County (SDDOL, 2012; WDWS, 2012). Unemployment rates in 2012 were 4.7, 4.0, and 5.1 percent in Fall River, Custer, and Weston Counties, respectively (SDDOL, 2012; WDWS, 2012). Because of the short duration (2 years) and small size of the construction workforce (86 workers), the effect on employment in the region will be SMALL.

4.11.1.1.5 Local Finance

Construction of the proposed ISR facility at the Dewey-Burdock ISR Project site will generate some tax revenue in the local economy through the purchase of goods and services as well as contribute to increased county and state tax revenues through an increased tax base. As described in SEIS Section 3.11.5, the majority of state revenue in South Dakota is generated from a 4 percent statewide sales and use tax (SDDRR, 2011). Towns in South Dakota may also impose up to a 1 percent sales and use tax on various sales including lodging, restaurant meals, alcoholic beverages, and admissions to places of entertainment and up to a 2 percent sales and use tax on all products and services subject to the state sales or use tax (SDDRR, 2011). Sales and use tax revenues totaled $6.6 million for Custer County and $5.4 million for Fall River County in 2011. The tax revenues are based on the 4 percent state sales and use tax on gross sales of $165 million for Custer County and $134 million for Fall River County (SDDRR, 2012). Weston County has a 5 percent sales and use tax (4 percent state base tax and a 1 percent optional county tax) and a 4 percent lodging tax (Wyoming Department of Revenue, 2010). Sales and use tax revenues totaled $11.2 million for Weston County in 2011. Smaller towns, such as Edgemont, experiencing increased population/public service demand may not receive a proportionate level of tax increase, because sales tax revenue is more likely to increase in larger communities, such as Custer and Hot Springs. Because of the short duration of construction (2 years) and small size of the construction workforce (86 workers) in relation to the total labor forces in Fall River, Custer, and Weston Counties (see previous section), construction of the proposed ISR facility at the Dewey-Burdock site will have a SMALL impact on local finances.

4.11.1.1.6 Education

If the construction workforce for the Dewey-Burdock ISR Project and their families secure local housing, an increased demand for schools will occur. However, construction workers are less likely to relocate their entire families to the region, especially given the relative short duration (2 years) of construction activities. Based on school enrollment and student–teacher ratio data presented in SEIS Section 3.11.6, school districts have available capacities to manage increases in school-aged children relocating to the area. The NRC staff concludes that the overall impacts on educational services during the construction phase of the proposed project will be SMALL**.**

4.11.1.1.7 Health and Social Services

The construction workforce is expected to cause only a small short-term increase in the demand for doctors, hospitals, social services, and police during the construction phase of the proposed

Dewey-Burdock ISR Project. Due to the short duration of construction (2 years maximum), construction workers with families will be less likely to relocate their entire families to the region, thus minimizing impacts on health and social services. As presented in SEIS Section 3.11.7, towns surrounding the proposed project have adequate medical facilities; social services; and police, fire, and emergency medical services to accommodate workers and their families. Local governments are expected to have the capacity to effectively plan for and manage the increased demands on health and social services because population increases will be small (86 construction workers). Therefore, impacts to health and social services during the construction phase of the proposed project will be SMALL.

4.11.1.2 Operations Impacts

GEIS Section 4.4.10.2 describes employment levels during ISR facility operations and assumes 50 to 80 workers will support this phase of the ISR lifecycle. Use of local contract workers and local building materials will diminish, because drilling and facility construction will diminish. Revenues will be generated from federal, state, and local taxes on the facility and the uranium produced. Employment types are expected to be more technical during operations, and as a result, the majority of the operational workforce is expected to be staffed from outside the region, particularly during initial operations. According to the GEIS, effects on community services (e.g., education, health care, utilities, shopping, and recreation) during facility operations will be similar to effects experienced during construction, except fewer people will be employed for a longer duration. Overall, NRC staff determined in the GEIS that potential impacts to socioeconomics from operations will be SMALL to MODERATE. (NRC, 2009a) The operations phase of the proposed Dewey-Burdock ISR Project is expected to last for 8 years and employ 84 workers (Powertech, 2009a). In addition, 36 indirect jobs are expected to be created to support operations of the proposed project (Powertech, 2009a). The operations phase will impact the local economy through creating jobs, purchasing local goods and services, and increasing county and state tax revenues. Severance tax on the uranium extracted will also be collected at the state level and will contribute to the State of South Dakota general fund. Because the anticipated size of the ISR operations workforce (84 payroll employees) is only slightly larger than the 50 to 80 employees analyzed in the GEIS, the NRC staff conclude that the site-specific impacts of operating the proposed project will be comparable to the impacts described in the GEIS. The following subsections describe the operations impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services.

4.11.1.2.1 Demographics

A peak workforce of 84 employees engaged directly in operations activities will be expected during the operations phase of the proposed Dewey-Burdock ISR Project (Powertech, 2009a). Although about equal to the construction workforce (86 employees), the operations workforce is expected to stay in the area longer (approximately 8 years) and so will be more likely to secure permanent or semi-permanent housing in the area than the construction workforce. The operations phase will require a number of specialized workers, such as plant managers, technical professionals, and skilled tradesmen. As described in GEIS Section 4.4.10.2, because of the highly technical nature of ISR operations (requiring professionals in the areas of health physics, chemistry, laboratory analysis, geology and hydrogeology, and engineering), the majority (approximately 70 percent) of the workforce during operations is expected to be staffed from outside the region (NRC, 2009a). Therefore, up to 59 personnel (86 employees × 0.7) for the operations phase of the proposed project could be sourced from outside the local area. The

remaining workforce will most likely come from the local labor pool. The increase in population during the operations phase will spur additional job creation to serve the larger population. The applicant has estimated that an additional 36 indirect jobs are expected during the operations phase of the project (Powertech, 2009a).

Because of the small size of the operations workforce (84 workers) and the potential addition of 36 (indirect) workers in support of facility operations, demographic conditions in Custer, Fall River, and Weston Counties are not likely to change. The combined effect of 84 to 120 new jobs in the region (assuming that all of the direct and indirect workers will relocate to the ROI) constitutes less than 1 percent of the current combined civilian labor force in Custer, Fall River, and Weston Counties (see SEIS Section 3.11.4). Therefore, the impact on demographic conditions will be SMALL.

4.11.1.2.2 Income

Operations at the proposed project will create skilled positions such as project managers, plant operators, lab technicians, and drilling contractors. These skilled workers will command salaries that provide income levels equal to or higher than the average local and statewide income levels. The total annual payroll for the proposed project is estimated at $5,600,000 (Powertech, 2009a). The average annual salary for all full-time employees will be roughly $66,700. This is more than the South Dakota median household income of $46,369 and the Wyoming median household income of $53,802 (see SEIS Section 3.11.2). This is also above the Fall River County median household income of $35,833, the Custer County median household income of $46,743, and the Weston County median household income of $53,853 (see SEIS Section 3.11.2). Therefore, the proposed project will have a positive effect on local average annual incomes during ISR facility operations. However, because the operations workforce (84 workers) is small in comparison to the combined labor force in Custer, Fall River, and Weston Counties (see SEIS Section 3.11.4), overall impacts to local income during ISR facility operations will be SMALL.

4.11.1.2.3 Housing

Housing demand is anticipated to increase during operations. The operations workforce is expected to stay in the area longer, approximately 8 years (see Figure 2.1-1), and so will be more likely to secure permanent or semi-permanent housing in the area than the construction workforce. Most workers moving into the area will relocate to the surrounding towns of Edgemont, Custer, Hot Springs, and Newcastle. Discussions with officials of the Edgemont Chamber of Commerce and Custer County Economic Development Committee indicated that housing in the towns of Edgemont and Custer will be available to accommodate the projected operations workforce (NRC, 2009c). Vacancy rates are currently high (14.5 to 22 percent) in Custer, Fall River, and Weston Counties (see SEIS Section 3.11.3), and the added workforce will have little impact on the housing inventory. Because of the small size of both the operations workforce (84 workers) and the workforce indirectly supporting facility operations (36 workers), impacts to housing during ISR operations at the proposed project will be SMALL.

4.11.1.2.4 Employment Structure

As previously discussed, ISR facility operations at the proposed Dewey-Burdock ISR Project will generate 84 new jobs, such as project managers, plant operators, lab technicians, and drill contractors. Most skilled positions are likely to be filled by people moving into the area rather

than providing employment opportunities for people living in nearby communities. As described in GEIS Section 4.4.10.2, because of the highly technical nature of ISR operations (requiring professionals in the areas of health physics, chemistry, laboratory analysis, geology and hydrogeology, and engineering), the majority (approximately 70 percent) of the workforce during operations is expected to be staffed from outside the region. The proposed project will provide some jobs to the local labor pool to support ISR facility operations. However, because the number of skilled workers drawn from areas outside of the ROI will be relatively small (e.g., 84 workers × 0.7 = 59 workers), ISR facility operations at the proposed project will not noticeably affect employment rates in Custer, Fall River, and Weston Counties. Therefore, the impact on the employment structure will be SMALL.

4.11.1.2.5 Local Finance

Tax revenue will profit Fall River and Custer Counties through the projected 8-year operations phase. Personal property tax will be applied to the value of all equipment the project uses. In addition, a state mineral severance tax will be applied to the milled uranium. The State of South Dakota collects the severance tax and returns 50 percent of the tax to the county where the mineral was produced (see SEIS Section 8.3). A county *ad valorem* tax for production will also contribute to local government revenue. The counties and municipalities will indirectly benefit from increased sales tax revenue from the increased population and resultant demand for goods and services. Because the operations workforce (84 workers) is small in relation to the total labor forces in Fall River and Custer Counties (see SEIS Section 3.11.4), the tax-revenue impact from ISR facility operations on local taxing jurisdictions in Fall River and Custer Counties will be positive and SMALL to MODERATE.

4.11.1.2.6 Education

The added population associated with the additional 86 workers and their families relocating during operations may have an impact on local public schools and education-related services. The average family size in South Dakota is 2.43 (USCB, 2012). Assuming a two-parent family, a conservative upper estimate for the number of school-aged children that may relocate to the ROI will be 40 children of various ages. The potential increase in school-aged children will likely be split between the seven school districts in the ROI (see SEIS Section 3.11.5). The five closest school districts are Edgemont, Custer, Hot Springs, Weston County #1, and Weston County #7. Compared to the South Dakota statewide student–teacher ratio of 13.4:1, the Edgemont and Custer student–teacher ratios are low (10:1 and 12:1, respectively) and will not be significantly affected (SDDOE, 2010). The Hot Springs student–teacher ratio of 14:1 is slightly above the statewide ratio. Compared to the Wyoming statewide student–teacher ratio of 12.4:1, the Weston County #1 and Weston County #7 student–teacher ratios are low (11:1 and 10:1, respectively) and will not be significantly affected (Wyoming Department of Education, 2010). Comprising various ages and spread across schools and classrooms in the 5 closest school districts (kindergarten and grades 1 through 12), the small number of children (40) will not likely have a noticeable effect on student-teacher ratios. In addition, city and county planners indicated that the schools could accommodate an increase in the number of students (NRC, 2009c). The impact on schools and education-related service during the ISR facility operations phase will be SMALL.

4.11.1.2.7 Health and Social Services

A small increase in demand will be expected for health and social services during the operations phase of the proposed Dewey-Burdock ISR Project from workers and their families relocating to the ROI. These operational impacts are not expected to differ significantly from those during the construction phase of the ISR facility. Therefore, the small additional increase in demand that will occur for the operations phase will likely already have been met during the construction phase. Discussions with city and county planners indicated that current and planned upgrades to health care and hospitals in the region could accommodate projected increases in population (NRC, 2009c). Further, by license condition, NRC staff will require the applicant to coordinate emergency response activities with local authorities, fire departments, medical facilities, and other emergency services before operations begin (NRC, 2013). The applicant will be required to document the coordination activities and maintain the documentation onsite. Impacts to health and social services during operations will remain SMALL.

4.11.1.3 Aquifer Restoration Impacts

NRC staff determined in GEIS Section 4.4.10.3 that the socioeconomic impact from aquifer restoration will be similar to impacts experienced during ISR facility operations. This is because the level of employment and demand on services will not change. NRC staff concluded in the GEIS the potential impacts to socioeconomics will be SMALL. (NRC, 2009a)

Socioeconomic impacts from the aquifer restoration process at the proposed Dewey-Burdock site will be similar to those experienced during ISR facility operations. Initial aquifer restoration of wellfields will be conducted in conjunction with the operations phase and will not require additional workers with specialized skills (Powertech, 2009a). An aquifer restoration workforce of nine direct employees has been estimated for the proposed project (Powertech, 2010a). Because aquifer restoration will be short term [i.e., extending 4 to 5 years after operations cease (Powertech, 2009a)], workers performing aquifer restoration activities will likely be sourced from the operations phase workforce and any additional workers will likely be drawn from the local area. Impacts on demographics; income; housing; employment; tax revenue; and health, social, and educational services will remain unchanged because it is likely that workers taken from the operations workforce will have already relocated their families to the area and temporary workers will not relocate their families to the area. Therefore, the overall socioeconomic impact of aquifer restoration will be SMALL.

4.11.1.4 Decommissioning Impacts

GEIS Section 4.4.10.3 discusses the potential socioeconomic impacts of decommissioning. Decommissioning and reclamation activities (e.g., dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming and recontouring the ground surface) will likely draw on a skill set similar to the ISR facility construction workforce. Decommissioning activities will be expected to be short in duration (24 to 30 months), and so employment will be temporary. Impacts to employment structure and housing are expected to be similar to those for construction, due to similar employment levels. NRC staff determined in the GEIS that overall, potential impacts to socioeconomics from decommissioning will be SMALL to MODERATE. (NRC, 2009a)

Final decommissioning of wellfields, the central processing plant, and the satellite facility at the proposed Dewey-Burdock ISR Project is expected to take 2 years (Powertech, 2009a). A

workforce of nine employees engaged directly in these activities has been estimated (Powertech, 2010a). Decommissioning activities for the proposed project could impact the demand for housing and local infrastructure, as well as health, social, and educational services if new workers relocate their families to the local area. However, due to the size of the expected workforce needed for decommissioning (nine direct employees), these impacts will be SMALL and further reduced if a number of the ISR facility operations and aquifer restoration employees remain to assist in the decommissioning activities.

4.11.2 No-Action (Alternative 2)

Under the No-Action alternative, the ISR facility will not be constructed or operated at the proposed Dewey-Burdock site. Socioeconomic conditions in Custer and Fall River Counties in South Dakota and Weston County in Wyoming will not change under the No-Action alternative. Potential benefits from the proposed project, such as job creation and contribution to local, regional, and state revenues, will not occur under the No-Action alternative.

4.12 Environmental Justice Impacts

As required by Title VI of the Civil Rights Act of 1964, federal agencies must consider whether their actions may cause disproportionately negative impacts on minority or low-income populations. Executive Order 12898 (59 FR 7629) (1994), “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires similar analysis.

In response to Executive Order 12898, the Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040). The Policy Statement explains that “The Commission is committed to the general goals set forth in Executive Order 12898, and strives to meet those goals as part of its NEPA review process.”

In 1997, the CEQ provided the following guidance relevant to determining when an agency’s actions may disproportionately affect certain populations:

> Disproportionately High and Adverse Human Health Effects. Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as defined by NEPA) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group. (CEQ, 1997)
>
> Disproportionately High and Adverse Environmental Effects. A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as defined by NEPA). In assessing cultural and aesthetic

> environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered. (CEQ, 1997)

The following environmental justice analysis assesses whether issuing a license for the proposed Dewey-Burdock ISR facility might cause disproportionately high and adverse human health or environmental effects on minority and low-income populations. In assessing the effects, the following CEQ (1997) definitions of minority individuals, minority populations, and low-income populations were used:

> Minority individuals. Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.
>
> Minority populations. Minority populations are identified when (i) the minority population of an affected area exceeds 50 percent or (ii) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
>
> Low-income population. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

4.12.1 Analysis of Impacts

Methodology

NRC addresses environmental justice matters for license reviews through (i) identifying minority and low-income populations that may be affected by the proposed construction and operations of the proposed Dewey-Burdock ISR facility and (ii) examining any potential human health or environmental effects on these populations to determine whether these effects may be disproportionately high and adverse.

In January and February 2010, the NRC staff published an advertisement in six newspapers circulated near the proposed project area (Rapid City Journal, Edgemont Herald Tribune, Custer Chronicle, Hot Springs Star, Lakota Country Times, and the Native Sun) to inform the public and solicit comments on the proposed action. As part of information gathering, the NRC staff also contacted potentially interested Native American tribes, local authorities, and public interest groups in person, by email, and by telephone.

The 2010 Census provides race and poverty characteristics in Custer and Fall River Counties in South Dakota and Weston County in Wyoming, which are the counties potentially affected by the proposed project. For the year 2010, Table 4.12-1 shows the percentage of people living in poverty and minority populations in the United States, South Dakota and Wyoming, and in Custer, Fall River, and Weston Counties. The table also includes the census tracts and block groups in these counties. Note that poverty data from the 2010 Census are not yet available at the block group level.

Table 4.12-1. Percent Living in Poverty and Percent Minority in 2010

Geographic Unit	Percent Living in Poverty	Percent Minority
United States	13.8	36.3
South Dakota	13.7	15.3
Custer County	9.7	7.2
Custer County Census Tract 9651	8.0	6.6
Block Group 1	NA	7.5
Block Group 2	NA	3.9
Block Group 3	NA	3.9
Custer County Census Tract 9652	12.9	8.4
Block Group 1	NA	7.1
Block Group 2	NA	4.2
Block Group 3	NA	12.6
Fall River County	17.4	12.6
Fall River County Census Tract 9641	13.4	8.7
Block Group 1	NA	5.1
Block Group 2	NA	6.1
Block Group 3	NA	13.6
Fall River County Census Tract 9642	20.5	15.2
Block Group 1	NA	10.0
Block Group 2	NA	12.1
Block Group 3	NA	16.0
Wyoming	9.8	14.1
Weston County	7.9	6.2
Weston County Census Tract 9511	7.7	5.7
Block Group 1	NA	5.0
Block Group 2	NA	6.3
Weston County Census Tract 9513	8.1	6.6
Block Group 1	NA	6.5
Block Group 2	NA	3.4
Block Group 3	NA	7.7

Source: USCB (2012)
NA = Not available

Impact Analysis

In 2010, the populations of Custer, Fall River, and Weston Counties were 8,216, 7,094, and 7,208, respectively (USCB, 2012). In 2010, 15.3 percent of the South Dakota population and 14.1 percent of the Wyoming population was classified as minority (Table 4.12-1). The percentage of the population classified as minority in Custer, Fall River, and Weston Counties was 7.2, 12.6, and 6.2 percent, respectively, which is below the state minority population percentages. The minority population in census tracts in Custer and Fall River Counties potentially affected by the proposed Dewey-Burdock ISR Project ranged from 6.6 to 15.2 percent which is at or below the state average of 15.3. The minority population in block groups in Custer and Fall River Counties ranged from 3.9 to 16 percent. In Weston County, the minority population in the census tracts potentially affected by the proposed project ranged from

5.7 to 6.6 percent, which is below the Wyoming state average of 14.1 percent. The minority population in block groups in Weston County ranged from 3.4 to 7.7 percent.

As described in SEIS Section 3.11.1 and summarized in Table 3.11-1, the population in Fall River County fell approximately 5 percent between 2000 and 2010, in comparison to approximately 9 and 13 percent gains in Weston and Custer Counties over the same period, respectively. Weston County's population is expected to grow at a similar rate of approximately 9 percent over the next decade (WDAI, 2011). The populations of Fall River and Custer Counties are expected to remain relatively constant through 2020 (Brooks, 2008).

Demographic information on race and ethnicity in 2000 and 2010 for Custer, Fall River, and Weston Counties is provided in Table 4.12-2. Since 2000, minority populations have increased by 0.6 percent (111 persons) in Custer County, 1.9 percent (98 persons) in Fall River County, and 1.0 percent (100 persons) in Weston County. In Custer and Weston Counties, most of this increase was due to an influx of Hispanic or Latinos (72 persons in Custer County and 79 persons in Weston County). In Fall River County, the increase was due to an influx of Black or African Americans (18 persons), American Indian and Alaska Natives (24 persons), and Hispanic or Latinos (29 persons).

The U.S. population living below the poverty level was identified as 13.8 percent in 2010 (Table 4.12-1). In South Dakota and Wyoming, the populations living below the poverty level were 13.7 and 9.8 percent, respectively. The percentage of people living below the poverty level in Custer, Fall River, and Weston Counties is 9.7, 17.4, and 7.9, respectively. The percentage of people living below the poverty level within the census tracts surrounding the proposed Dewey-Burdock ISR Project ranged from 7.7 to 20.5 percent (Table 4.12-1).

As described in SEIS Section 3.11.2 and summarized in Table 3.11-3, the median household income for South Dakota and Wyoming in 2010 was $46,369 and $53,802, respectively. In

Table 4.12-2. Demographic Profile Comparison of the 2000 and 2010 Population in Custer and Fall River Counties, South Dakota, and Weston County, Wyoming

Population Category	Custer County		Fall River County		Weston County	
	2000	2010	2000	2010	2000	2010
Race (Percent of Total Population, Not Hispanic or Latino)						
White	93.4	92.8	89.3	87.4	94.8	93.8
Black/African American	0.3	0.2	0.3	0.6	0.1	0.2
American Indian, Alaskan Native	3.1	2.8	6.1	6.7	1.3	1.2
Asian	0.2	0.3	0.2	0.4	0.2	0.3
Native Hawaiian, Pacific Islander	0.0	0.0	0.1	0.0	0.0	0.0
Some other race	0.4	0.0	0.3	0.0	0.9	0.0
Two or More Races	1.9	1.7	2.5	2.6	1.5	1.4
Ethnicity						
Hispanic or Latino (number of people)	110	182	130	159	137	216
Percent of total population	1.5	2.2	1.7	2.2	2.1	3.0
Minority Population (Including Hispanic or Latino Ethnicity)						
Total minority population	481	592	797	895	346	446
Percent minority	6.6	7.2	10.7	12.6	5.2	6.2
Source: USCB, 2012						

South Dakota, 8.7 percent of families live below the federal poverty threshold (the 2012 federal poverty threshold is $23,050 for a family of four). In Wyoming, 6.2 percent of families live below the federal poverty threshold. Custer and Weston Counties had similar median household incomes ($46,743 and $53,853, respectively) and a lower percentage of families living below the poverty level (4.3 percent and 5.8 percent, respectively) than the state average (see Table 3.11-3). Fall River County had a lower median household income ($35,833) and a higher percentage of families living below the poverty level (11.4 percent) than the state average (see Table 3.11-3).

If the percentage for either minority or low-income population in block groups significantly exceeds that of the state or county percentage, environmental justice will have to be considered in greater detail (NRC, 2003a). As a general matter, NRC staff consider differences greater than 20 percentage points to be significant (NRC, 2003a, Appendix C). Additionally, if either the minority or low-income population percentage exceeds 50 percent, environmental justice will have to be considered in greater detail. The percentages of minority populations living in the affected block groups do not significantly exceed the percentage of minority populations recorded at the state and county. No significant minority populations were identified as residing near the proposed Dewey-Burdock ISR Project. Therefore, NRC staff conclude that there will be no disproportionately high or adverse impacts to minority populations from the proposed project. As noted previously, low-income data from the 2010 Census at the block group level is not yet available. However, the percentages of the population living in poverty at the census tract level do not significantly exceed the percentage of low-income populations recorded at the state or county level. In addition, the percentage of families living below the poverty level in the affected counties does not significantly exceed the percentage of families living in poverty at the state level. Therefore, NRC staff conclude that it is realistic to expect that low-income percentages for the counties at the block group level will not be an environmental justice concern.

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] to the east in Shannon County, South Dakota. Communities within the Pine Ridge Indian Reservation include the towns of Oglala and Pine Ridge. Based on 2010 USCB data, these towns have both minority [greater than 95 percent Native American (Oglala Sioux Tribe)] and low-income populations (USCB, 2012).

This environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the proposed action. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community.

Disproportionately high effects may include biological, cultural, economic, or social impacts (CEQ, 1997). Some of these potential effects have been identified in the resource areas

discussed in SEIS Chapter 4. For example, ground-disturbing activities during the construction phase of the proposed ISR facility could disproportionately affect cultural and historic resources important to Native American populations. On the other hand, minority and low-income populations, such as Native American tribes, are subsets of the general public residing around the proposed Dewey-Burdock ISR Project site. All populations, regardless of their status, will be exposed to the same health and environmental effects associated with construction, operations, aquifer restoration, and decommissioning activities at the Dewey-Burdock site.

4.12.2 Proposed Action (Alternative 1)

Potential impacts to minority and low-income populations due to the construction, operations, and decommissioning of the proposed ISR facility and aquifer restoration at the Dewey-Burdock site will mostly consist of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, housing, and cultural impacts). Noise and dust impacts will be short term and limited to onsite activities. Minority and low-income populations residing along site access roads could experience increased commuter vehicle traffic during shift changes. As construction and operations employment increases at the proposed project site, employment opportunities for minority and low-income populations may also increase. Increased demand for housing during peak construction could disproportionately affect low-income populations. According to the latest census information, 2,423 vacant housing units in the census tracts in Custer, Fall River, and Weston Counties will be potentially affected by the proposed project (Table 4.12-3). Based on this information and the analysis of human health and environmental impacts presented in this chapter, there will not be disproportionately high and adverse impacts to minority and low-income populations from the construction, operations, and decommissioning of the proposed ISR facility and aquifer restoration at the Dewey-Burdock site.

As described in GEIS Section 6.4, Native American tribes in the Black Hills region believe that preserving and maintaining access to sacred lands is essential to both cultural and spiritual aspects of traditional Native American societies of the northern plains. Protection of the cultural and historic resources as well as the spiritual value of the land (e.g., identification of traditional cultural properties) within the proposed Dewey-Burdock ISR Project area will be addressed through NHPA Section 106 consultation process as described in SEIS Section 4.9.1. Mitigation measures to minimize adverse impacts to cultural and historic resources will be developed in consultation with the applicant, NRC, SD SHPO, Native American tribes (Tribal government or designated THPO), and other government agencies (e.g., BLM, Archaeological Research

Table 4.12-3. Housing in Custer and Fall River Counties, South Dakota, and Weston County, Wyoming, in 2010

Geographic Unit	Total Housing Units	Vacant Units
Custer County	4,628	992
Custer County Census Tract 9651	3,173	715
Custer County Census Tract 9652	1,455	277
Fall River County	4,191	919
Fall River County Census Tract 9641	1,940	649
Fall River County Census Tract 9642	2,251	270
Weston County	3,533	512
Weston County Census Tract 9511	1,584	262
Weston County Census Tract 9513	1,949	250
Source: USCB, 2012		

Center). The Section 106 consultation process provides an avenue for potentially affected Native American tribes to become consulting parties with regard to heritage interests related to the proposed project site. Potential impacts to sites of religious or cultural significance to tribes will be reduced through mitigation strategies developed during Section 106 consultations.

As part of addressing environmental justice associated with license reviews, NRC also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

Subsistence Consumption of Fish and Wildlife

Executive Order 12898 (59 FR 7629) directs federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations that rely principally on fish and wildlife for subsistence and to communicate the risks of these consumption patterns to the public. For this SEIS, NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to traditional lifestyle special pathway receptors. Special pathways that were considered included the potential levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the proposed Dewey-Burdock site. Potential impacts to minority and low-income populations will mostly consist of radiological effects; however, radiation doses from ISR facility operations will be expected to be well below regulatory limits as described in SEIS Section 4.13. As described in GEIS Section 6.4, the land in the area of the Black Hills has historically provided sustenance to many Native American tribes by way of fishing, hunting, and plant food gathering. The results of background radiological monitoring of soils and sediments, surface water, livestock, fish, and vegetation at the proposed Dewey-Burdock Project site are described in SEIS Sections 3.12.1 and 3.6.2. In general, the results of the radiological monitoring indicate that radionuclide concentrations in soils and sediments and surface water were often elevated in abandoned open pit surface mine areas in the eastern and northeastern parts of the Burdock area. In addition, surface water samples from Beaver Creek and the Cheyenne River often exceeded EPA-regulated MCLs for radionuclides (e.g., uranium, gross alpha, Ra-226, and Pb-210) in drinking water as established in 40 CFR Part 141. In general, radionuclide concentrations in vegetation and fish were present at low concentrations and radionuclide concentrations in local livestock were at or below the lower limits of detection.

As described in SEIS Section 4.2, fencing will be installed in areas of active ISR operations such as wellfields, processing plants, and possible land application areas. This will limit hunting within the permitted boundary of the Dewey-Burdock ISR Project area. Limits on hunting will continue over the operational life of the project. However, substantial land surrounding the 4,282-ha [10,580-ac] project site will remain open to big game hunting and therefore the impacts to hunting on Native American tribes will be SMALL. The applicant's SWMP will limit adverse impacts on aquatic habitat and species within the proposed project area resulting from planned construction and operational activities (Powertech, 2009a). As discussed in SEIS Section 4.5.1.1.2, no surface water will be diverted, no process water will be discharged into aquatic habitat, and stormwater runoff will be managed through the applicant's NPDES permit. Therefore, potential impacts to aquatic species and habitats will be SMALL.

To mitigate exposure or health risks associated with contaminants reaching the food chain in potential land application areas, the applicant proposes treating liquid wastes applied to potential land application areas so that they meet NRC release limit criteria for radionuclides in 10 CFR Part 20, Appendix B (Standards for Protection Against Radiation) (Powertech, 2009a, 2011). During decommissioning of the proposed project, seeded soil will be returned to areas from which it was removed and contoured to blend with the natural terrain. At the end of decommissioning all lands will be returned to their preextraction use of livestock grazing and wildlife habitat.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the proposed action will not have disproportionately high and adverse human health and environmental effects on Native American and other traditional lifestyle pathway receptors in the vicinity of the Dewey-Burdock project area. The impacts to Native American tribes will, for the most part, be no different than those other populations experience within the vicinity of the project area. Mitigation strategies will be developed through the ongoing Section 106 consultation for impacts to sites of religious or cultural significance to the tribes (see SEIS Section 4.9.1).

4.12.3 No-Action (Alternative 2)

Under the No-Action alternative, the ISR facility will not be constructed and operated at the proposed Dewey-Burdock ISR Project site. The relative conditions affecting minority and low-income populations in the vicinity of the proposed project site will remain unchanged. Therefore, there will be no disproportionately high or adverse impacts to minority and low-income populations from this alternative.

4.13 Public and Occupational Health and Safety Impacts

As described in GEIS Section 4.4.11, potential radiological and nonradiological impacts from ISR activities may occur during all phases of the ISR facility's lifecycle (NRC, 2009a). These impacts may occur during normal operations where proposed activities are executed as planned or during potential accident conditions when unplanned events can generate additional hazards. Additionally, the potential hazards and associated impacts can be either radiological or nonradiological. Therefore, the impact analysis in this section evaluates the radiological and nonradiological potential public and occupational health and safety impacts for normal and accident conditions in each phase of the ISR facility lifecycle.

<u>GEIS Construction Phase Summary</u>

Standard construction safety practices will address nonradiological worker safety during ISR facility construction. Construction emissions will be primarily from fugitive dust and diesel-powered construction equipment exhausts. Fugitive dust generated from construction activities and vehicle traffic will be of short duration, and because the average natural levels of radioactivity in soils are low, it will not result in a radiological dose to workers and the public. Diesel emissions from construction equipment will also be of short duration and readily dispersed into the atmosphere. For these reasons, NRC staff concluded in the GEIS that potential impacts to public and occupational health and safety from construction will be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

Potential public and occupational radiological impacts from normal operations may result from (i) exposure to radon gas from the wellfields, (ii) ion-exchange resin transfer operations, and (iii) venting during processing activities. Workers may also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation may occur from the same radon releases and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20, which require licensees to implement an NRC-approved radiation protection program. NRC periodically inspects those programs to ensure compliance. Measured and calculated doses for workers and the public are commonly only a fraction of regulatory limits. For these reasons, NRC staff concluded in the GEIS that potential radiological impacts to workers and the public from operations will be SMALL. (NRC, 2009a)

Nonradiological worker safety at ISR facilities will be addressed through occupational health and safety regulations and practices (NRC, 2009a). The potential impact from nonradiological accidents includes high consequence chemical release events (e.g., of ammonia) that may expose workers and nearby populations. However, NRC staff concluded that the likelihood of such a release will be low, based on historical operating experience at NRC-licensed facilities, primarily because operators follow chemical safety and handling protocols. Therefore, NRC staff concluded in the GEIS that radiological and nonradiological impacts from accidents during operations may range from SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

Activities occurring during aquifer restoration will overlap similar activities occurring during operations (e.g., operation of wellfields, wastewater treatment and disposal). Therefore, the potential impact on public and occupational health and safety will be bounded by the operational impacts. In the GEIS, NRC staff also stated that the reduction of some operational activities (e.g., yellowcake production and drying, remote ion-exchange) as aquifer restoration proceeded will be expected to limit the relative magnitude of potential worker and public health and safety hazards. NRC staff concluded in the GEIS that the overall impacts to workers and the public from aquifer restoration will be SMALL. (NRC, 2009a)

GEIS Decommissioning Phase Summary

During decommissioning, the degree of potential impact decreases as hazards are reduced or removed, soils and facility structures are decontaminated, and lands are restored to preoperational conditions. To ensure the safety of workers and the public during decommissioning, NRC requires ISR licensees to submit a decommissioning plan for review and approval. NRC will then periodically inspect the facility to ensure that the decommissioning plan is implemented properly. The plan includes details of the radiation safety program that is implemented during decommissioning activities. The plan is developed to minimize health and safety hazards and to be compliant with worker and public dose limits in 10 CFR Part 20, Subparts C and D limits. An approved plan will also provide “as low as reasonably achievable” (ALARA) provisions under 10 CFR Part 20, Subpart B to further ensure best safety practices are being used to minimize radiation exposures (see SEIS Section 3.12.3). Adequate protection of workers and the public during decommissioning will therefore be ensured through NRC review and approval of the applicant’s decommissioning plan, license conditions, inspection, and

enforcement. Based on the NRC review and approval of the applicant's decommissioning plan, the NRC application of any site-specific license conditions, and NRC inspection and enforcement actions to ensure compliance with NRC radiation safety requirements, NRC staff concluded in the GEIS the potential public and occupational health and safety impacts for decommissioning will be SMALL. (NRC, 2009a)

4.13.1 Proposed Action (Alternative 1)

As described in SEIS Section 2.1.1.1.2.4, the applicant has proposed to dispose of liquid wastes by deep well disposal via Class V injection wells, land application, or combined deep well disposal via Class V injection wells and land application. The environmental impacts on public and occupational health and safety for each of the liquid waste disposal options are discussed in the following sections.

4.13.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts to public and occupational health and safety from construction, operations, aquifer restoration, and decommissioning associated with the Class V injection well disposal option are discussed in the following sections.

4.13.1.1.1 Construction Impacts

As described in SEIS Section 2.1.1.1.2, construction activities at the Dewey-Burdock ISR Project will include clearing and grading for roads, building foundations and surface impoundments, drilling wells, trenching, laying pipelines, and assembling buildings. Construction activities for the Class V injection well disposal option will also involve the installation of four to eight Class V injection wells (see SEIS Section 2.1.1.1.2.4.1). The important radiation exposure pathways during the construction phase will be through direct exposure, inhalation or ingestion of radionuclides during well construction, construction activities that disturbed soils, and fugitive dust from vehicular traffic. These activities are equivalent to the activities analyzed in GEIS Section 4.4.11.

Drilling wells at the proposed project will use a common technique known as mud rotary drilling (see SEIS Section 2.1.1.1.2.3.5). This technique uses fluid moving through a drill stem, out the drill bit, and back to the surface between the drill stem and host rock. When the fluid returns to the surface, it passes through a trough to a mud pit, where the cuttings settle out and the fluid is recycled down the borehole. Residual cuttings and drilling fluids are typically held in the mud pit after drilling and construction activities are completed (NRC, 2009a). Because the cuttings are taken from very near and within the ore deposits, they have the potential to be more contaminated than soil samples at the surface. Depending on state and local regulations, such mud pits are backfilled and graded or are alternatively emptied and cleaned, and residual solids and liquids transported and disposed of offsite (NRC, 2006). After well drilling is completed at the proposed project, the applicant proposes to redeposit the excavated subsoil in the mud pit followed by topsoil application and grading, usually within 30 days of the initial excavation of the mud pit (Powertech, 2009a).

As described in SEIS Section 3.12.1, the average concentration of radionuclides measured in the soil at the proposed Dewey-Burdock site is low. With outliers removed, the mean Ra-226

concentration of surface soils in surface mine areas and the broader permit area was 0.048 Bq/g [1.3 pCi/g]. Fugitive dust generated from construction activities will be of short duration (1 to 2 years; see Figure 2.1-1), and because the average levels of radioactivity in soils are low, inhalation of fugitive dust will not result in a radiological dose to workers and the public. In addition, the applicant has proposed to implement standard dust control measures, such as water application and speed limits, to reduce and control fugitive dust emissions (Powertech, 2009a). Therefore, NRC staff estimate that the direct exposure, inhalation, or ingestion of fugitive dust will not result in a radiological dose to workers and the general public during the construction phase of the proposed project. The applicant calculated the amount of radon released from wellfield development using methods described in NUREG–1748 (NRC, 2003a). Using conservative estimates, the applicant calculated a release rate of 1.35×10^6 disintegrations per second/yr [3.6×10^{-5} Ci/yr] (Powertech, 2009a). This represents a negligible fraction of the amount of radon generated during operations as described in SEIS Section 4.13.1.1.2) and will result in a radiological dose that is well below the 10 CFR Part 20 occupational and public dose limits of 0.05 Sv/yr [5 rem/yr] and 1 mSv/yr [100 mrem/yr], respectively. Based on the low average concentration of radionuclides in soils at the proposed site, the proposed mitigation measures that will be implemented to control fugitive dust, and the negligible amount of radon that will be released during wellfield development, the NRC staff conclude that the radiological impacts to workers and the general public from the construction phase for the Class V injection well disposal option will be SMALL.

The potential nonradiological air quality impacts from fugitive dust and diesel emissions are evaluated in SEIS Section 4.7.1. Construction equipment will be diesel powered and will emit diesel exhaust, which includes small particles (PM_{10}). The impacts and potential human exposures from these emissions will be SMALL because the releases are usually short and are readily dispersed into the atmosphere. The potential impacts to air quality from proposed diesel emissions, including comparisons with health-based standards, are detailed in SEIS Section 4.7.1. In SEIS Section 4.7.1.1, NRC staff concluded that implementation of mitigation measures will result in fugitive dust emission levels that will not destabilize the air quality of the local area nor change the current attainment status of the air quality surrounding the proposed site areas. However, despite the use of controls, short-term and intermediate fugitive dust emissions are possible when vehicles travel on unpaved roads. The NRC staff conclude that short-term and intermediate MODERATE impacts from fugitive dust are possible, but because average air quality is expected to remain in compliance with ambient standards, the overall impacts will be SMALL. The applicant's compliance with federal and state occupational safety regulations will limit the potential nonradiological impacts of fugitive dust and diesel emissions to levels acceptable for workers and the public. Based on the foregoing analysis, NRC staff conclude that overall nonradiological impacts on workers and the general public from the construction phase for the Class V injection well disposal option will be SMALL.

4.13.1.1.2 Operations Impacts

4.13.1.1.2.1 Radiological Impacts From Normal Operations

As discussed in GEIS Section 4.2.11.2.1, some amount of radioactive materials will be released to the environment during normal ISR operations. The potential impact from these releases can be evaluated by the MILDOS-AREA computer code (MILDOS), which Argonne National Laboratory developed for calculating offsite facility radiation doses to individuals and populations. MILDOS uses a multi-pathway analysis for determining external dose; inhalation dose; and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. The primary

radionuclide of interest at an ISR facility is Rn-222. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

GEIS Section 4.2.11.2.1 presented historical data for ISR operations, providing a range of estimated offsite doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure (human receptor) locations range between 0.004 mSv [0.4 mrem] per year for the Crow Butte facility in Nebraska and 0.32 mSv [32 mrem] per year for the Irigaray facility in Johnson County, Wyoming. Each value is well below the 10 CFR Part 20 annual radiation public dose limit of 1 mSv/yr [100 mrem/yr] (NRC, 2009a).

GEIS Section 4.2.11.2.1 also provides a summary of doses to occupationally exposed workers at ISR facilities. As stated, doses will be similar regardless of the facility's location and are well within the 10 CFR Part 20 annual occupational dose limit of 0.05 Sv [5 rem] per year. The largest annual average dose to a worker at a uranium recovery facility over a 10-year period [1994–2006] was 0.007 Sv [0.7 rem]. More recently, the maximum total dose equivalents reported for 2005 and 2006 were 0.00675 and 0.00713 Sv [0.675 and 0.713 rem]. Similarly, the average and maximum worker exposure to radon and radon daughter products ranged from 2.5 to 16 percent of the occupational exposure limit of 4 working-level months. NRC staff concluded in the GEIS that the radiological impacts to workers during normal operations at ISR facilities will be SMALL.

At the proposed Dewey-Burdock site, planned ISR facility design and operations for the Class V injection well disposal option are consistent with the projects analyzed in the GEIS. To mitigate radiological exposure to workers, the applicant will (i) install ventilation designed to limit worker exposure to radon; (ii) install gamma exposure rate monitors, air particulate monitors, and radon daughter product monitors to verify that expected radiation levels are met; and (iii) conduct work area radiation and contamination surveys to help prevent and limit the spread of contamination (Powertech, 2009a). The applicant's airborne radiation monitoring program is further described in SEIS Section 7.2.1.

GEIS Section 4.2.11.1.2 noted that radon gas is emitted from ISR wellfields and processing facilities during operations and is the only radiological airborne effluent during normal operations for facilities using vacuum dryer technology (NRC, 2009a). The applicant plans to dry yellowcake using a rotary vacuum dryer (Powertech, 2009a). Therefore, during normal operations, emissions other than radon are not expected.

In its environmental report, the applicant evaluated the potential consequences of radiological emissions at the proposed Dewey-Burdock ISR Project (Powertech, 2009a, Section 4.14.2). Sources of radon emanation the applicant identified and modeled included land application of treated wastewater, wellfield operations, central processing plant operations, and resin transfers in the satellite facility (Powertech, 2009a). The applicant described its implementation of the computer code MILDOS that was used to model radiological impacts on human and environmental receptors (e.g., air and soil) using site-specific data that included Rn-222 release estimates, meteorological and population data, and other parameters. The estimated radiological impacts from routine site activities were compared to applicable public dose limits in 10 CFR Part 20 {1 mSv/yr [100 mrem/yr]}, as well as to baseline radiological conditions (see SEIS Section 3.12.1).

The NRC review of the applicant's radiological impact modeling (Powertech, 2009a, 2011) independently verified that appropriate exposure pathways were modeled and reasonable input parameters were used. The applicant also listed the origin of the input parameters and provided justification for their use. The applicant described the source terms, and the NRC staff review concluded that the source terms represented operations at full capacity and consisted of ISR operations at two wellfields, releases from the central plant and the satellite plant, and releases from one center pivot land irrigation area in the Dewey area and three center pivot land irrigation areas in the Burdock area. The applicant calculated the total effective dose equivalent (TEDE) at the site boundary in 16 compass directions each from the central plant and the satellite facility, 7 residences, and the town of Edgemont (a total of 40 locations).

Results of the applicant's modeling (Powertech, 2011) indicated that the maximum TEDE of 0.06 mSv/yr [6.0 mrem/yr] is located southeast of the Dewey satellite facility within the proposed project boundary (Figure 4.13-1). The applicant's calculations also demonstrated that land application sources accounted for 80 percent of the TEDE at this location (Powertech, 2009a). Therefore, for the Class V injection well disposal option, the maximum TEDE located southeast of the Dewey satellite facility within the proposed project boundary will be 20 percent of 0.06 mSv/yr [6.0 mrem/yr] or 0.012 mSv/yr [1.2 mrem/yr]. This dose is 1.2 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Thus, the 10 CFR Part 20 public dose limit is not exceeded at any property boundary.

The maximum TEDE at a residence was 0.0448 mSv/yr [4.48 mrem/yr] at Spencer Ranch located approximately 2 km [1.25 mi] northwest of the proposed central processing plant in the Burdock area (see location AMS-02 in Figure 4.13-1). The applicant's calculations also demonstrated that land application sources accounted for 62 percent of the TEDE at the most highly exposed residence (Powertech, 2009a). Therefore, for the Class V injection well disposal option, the maximum TEDE at the Spencer Ranch residence will be 38 percent of 0.0448 mSv/yr [4.48 mrem/yr] or 0.017 mSv/yr [1.7 mrem/yr]. This is 1.7 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Hence, the TEDE at nearby receptor locations will not exceed the public dose limit.

Because Rn-222 is the only radionuclide emitted during normal operations, the public dose requirements in 40 CFR 190.10 and the 0.1 mSv/yr [10 mrem/yr] constraint rule in 10 CFR 20.1101 do not apply. However, even if 100 percent of the Rn-222 contained in production fluids was released to the atmosphere (instead of 10 percent as assumed in the applicant's calculations), the TEDE and Rn-222 air concentrations at residential receptor locations surrounding the facility will be less than the 1 mSv [100 mrem] public dose limit and the Rn-222 effluent concentration limit, respectively. Therefore, radiological dose impacts to the public from normal operations will be SMALL.

In summary, for the Class V injection well disposal option, potential radiation doses to occupationally exposed workers and members of the public during normal operations will be SMALL. Calculated radiation doses from the releases of radioactive materials to the environment are small fractions of the limits in 10 CFR Part 20 that have been established for the protection of public health and safety. In addition, the applicant is required to implement an NRC-approved radiation protection program to protect occupational workers and ensure that radiological doses are 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).

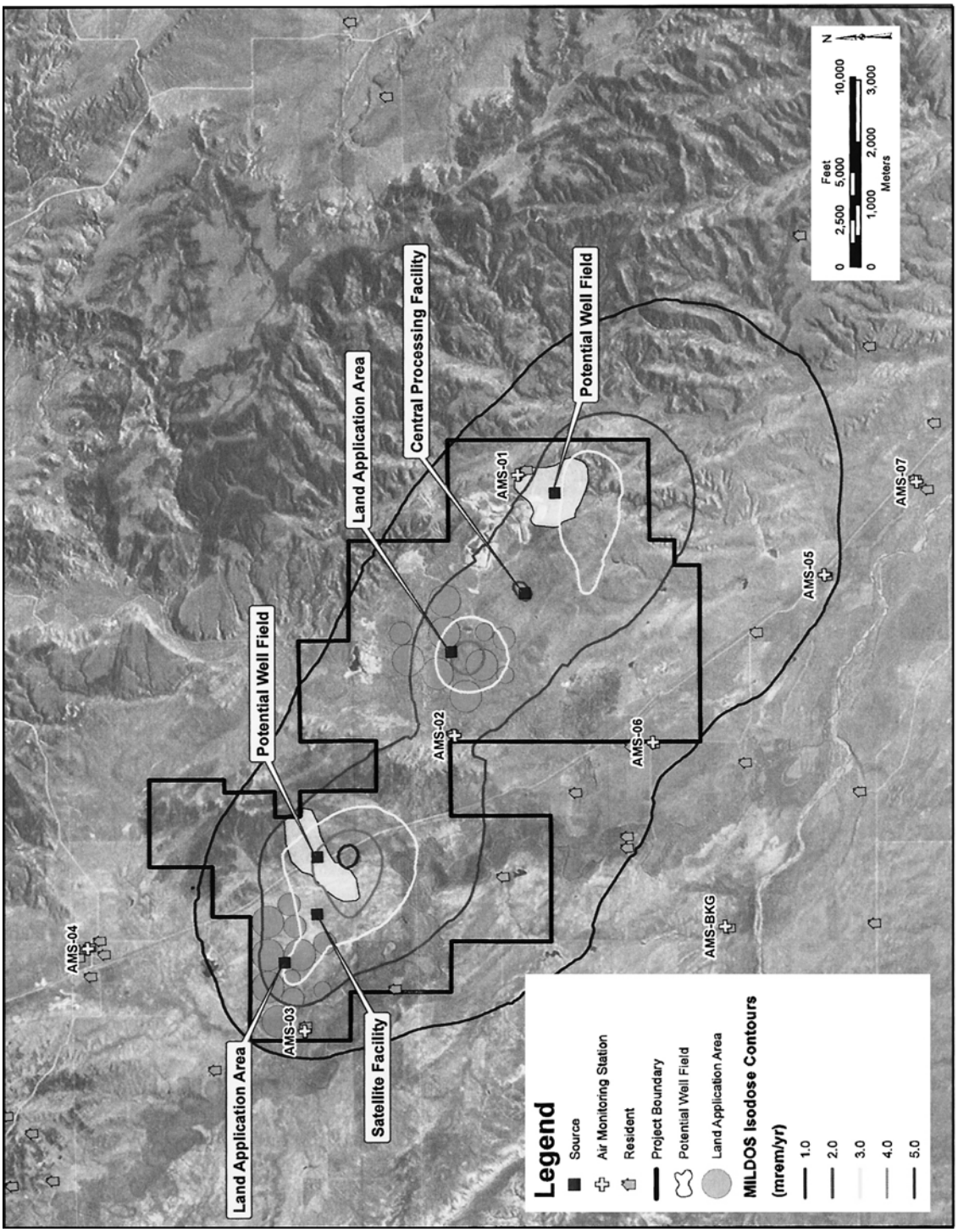

Figure 4.13-1. Map SHowing Isodose Contours Obtained From MILDOS Modeling at the Proposed Dewey-Burdock *In-Situ* Recovery Project Site
Source: Modified From Powertech (2011)

4.13.1.1.2.2 Radiological Impacts from Accidents

GEIS Section 4.2.11.2.2 describes and evaluates numerous accident scenarios that may result in impacts to public health and safety and identifies mitigation measures for each accident scenario. Radiological accident risks may involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. NRC staff state in the GEIS that consequences of these accidents to workers and the public are generally low, with the exception of a dryer explosion, which may result in a worker dose exceeding NRC limits (NRC, 1980). However, the likelihood of such an accident is low, due to design considerations and operational monitoring, and therefore NRC staff considered the risk also to be low.

GEIS Section 4.2.11.2.2 also noted that in addition to accident mitigation measures, other measures will be in place to protect workers and members of the public. Employee personnel dosimetry programs are required. As part of worker protection, respiratory protection programs will be in place, as well as bioassay programs that detect uranium intake in employees. Contamination control programs will be in place, which involve surveying personnel, clothing, and equipment prior to their removal to an unrestricted area.

As described in GEIS Section 4.2.11.2.2, a radiological hazard assessment (Mackin, et al., 2001) considered three types of accidents, representing the sources containing the higher levels of radioactivity for all aspects of operations:

- Thickener failure or spill
- Pregnant lixiviant and loaded resin spills (radon release)
- Yellowcake dryer accident release

In addition, SEIS Section 4.3.1.2 evaluates the impacts of shipping uranium-loaded exchange resins from the Dewey satellite facility to the Burdock central processing plant.

The following discussion presents an overview of the accident scenarios, as evaluated in the GEIS, along with site-specific application to the proposed Dewey-Burdock ISR Project. Table 4.13-1 summarizes the potential dose to workers and the public from the accident scenarios using data adapted from the GEIS.

Thickener Failure and Spill. Thickeners are used to concentrate the yellowcake (U_3O_8) slurry before it is transferred to the dryer or packaged for offsite shipment. Yellowcake may be inadvertently released to the atmosphere through a thickener failure or spill. The accident scenario evaluated in GEIS Section 4.2.11.2.2 assumed a tank or pipe leak that releases 20 percent of the thickener outside of the processing building. The analyses included a variety of wind speeds, stability classes, release durations, and receptor distances. A minimum receptor distance of 500 m [1,640 ft] was selected because it was found to be the shortest distance between a processing facility and an urban development for current operating ISR

Table 4.13-1. Generic Accident Dose Analysis for *In-Situ* Recovery Operations

Accident Scenario	Maximum Dose to Workers	Maximum Dose to Public
Thickener spill	50 mSv [5,000 mrem]	0.25 mSv [25 mrem]
Pregnant lixiviant, resin spill	13 mSv [1,300 mrem]	<0.13 mSv [13 mrem]
Yellowcake dryer release	0.088 Sv [8.8 rem] Generic <0.01 Sv [1 rem]	<1 mSv [100 mrem]
Data adapted from the GEIS (NRC, 2009a)		

facilities. Offsite, unrestricted doses from such a U_3O_8 spill could result in a dose of 0.25 mSv [25 mrem], or 25 percent of the annual public dose limit of 1 mSv [100 mrem] with negligible external doses based on sufficient distance between the facility and receptor (NRC, 2009a). Because the nearest onsite resident is located 1 km [0.6 mi] south of the proposed wellfields in the Dewey area and the nearest offsite resident is located 0.64 km [0.4 mi] south of the proposed permit boundary and 1.45 km [0.9 mi] from proposed wellfields in the Burdock area, the potential dose from a similar accident scenario involving a thickener failure or spill at the proposed project will be even less.

The applicant also discussed the accident analysis of a catastrophic tank failure involving a yellowcake thickener (Mackin, et al., 2001) as a worst-case accident scenario (Powertech, 2010a). The applicant's analysis was based on an accident described in Mackin, et al. (2001) that involved a thickener containing 278 m^3 [73,500 gal] of yellowcake slurry. The applicant's proposed yellowcake thickener is sized to contain 143 m^3 [37,800 gal] of yellowcake slurry. Two yellowcake thickener vessels are planned for the central processing plant for a combined capacity of 286 m^3 [75,600 gal]. The plan for the central processing plant at the proposed project also includes a 15.2-cm [6-in]-high concrete containment curb (Powertech, 2011). The capacity of the curbed area will be 304 m^3 [80,308 gal]; it will contain the entire contents of both thickeners in the event both thickeners failed simultaneously and spilled their entire contents onto the floor of the central processing plant before the contents flowed into floor sumps (Powertech, 2011). The sumps will provide additional temporary containment capacity. The total containment capacity of curbs and sumps at the proposed project will exceed 200 percent of the largest liquid-containing tank or vessel in the central processing plant (Powertech, 2011). Based on the design of the central plant, a catastrophic yellowcake thickener spill at the proposed project will be similar in volume to that evaluated in Mackin, et al. (2001) but will be contained in the central plant structure. Therefore, potential doses to the public will be smaller and well within the annual public dose limit of 1 mSv [100 mrem].

As discussed in GEIS Section 4.2.11.2.2, doses to unprotected workers inside the facility from a thickener failure or spill have the potential to exceed the annual dose limit of 0.05 mSv [5 mrem] if timely corrective measures are not taken. In addition, the applicant is required to implement an NRC-approved radiation protection program to protect occupational workers and ensure that radiological doses are ALARA. The applicant's radiation protection program includes commitments for implementing management controls, radiation safety training, radon monitoring and sampling, and audit programs (Powertech, 2011). These protection measures, along with engineering controls such as concrete curbs and sumps to contain process spills at the central processing plant, will reduce worker exposures and the resulting doses to a small fraction of those evaluated.

<u>Pregnant Lixiviant and Loaded Resin Spills</u>. Process equipment (ion-exchange columns, drying and packing facilities) will be located on curbed concrete pads to prevent any liquids from exiting the building via spills or leaks and contaminating the outside environment (NRC, 2009a). The total containment capacity of curbs and sumps at the proposed project will exceed 200 percent of the largest liquid-containing tank or vessel in the central processing plant (Powertech, 2011). The primary radiation source for liquid releases within the facility will be the resulting airborne radon (Rn-222) released from the liquid or resin tank spill.

The radon accident release scenario assumes a pipe or valve of the ion-exchange system, containing pregnant lixiviant, develops a leak and releases (almost instantaneously) all present Rn-222 at a high activity level {2.96×10^7 Bq/m^3 [8×10^5 pCi/L]}. For a 30-minute exposure, the

dose to a worker located inside the central plant performing light activities without respiratory protection was calculated to be 13 mSv [1,300 mrem], which is below the 10 CFR Part 20 occupational annual dose limit. The analysis did not evaluate public dose; however, because atmospheric transport offsite will reduce the airborne levels by several orders of magnitude, any dose to a member of the public will be less than the 1 mSv [100 mrem] public dose limit of 10 CFR Part 20 (see Table 4.13-1). The applicant's radiation protection program's controls and monitoring measures will be expected to minimize the magnitude of any such release and further reduce the consequences of this type of accident. Typical control and monitoring measures will include radiation and occupational monitoring, respiratory protection, engineering controls, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response (Powertech, 2011).

The applicant also described an accident involving a process tank failure (Powertech, 2009a). The applicant indicated that the central processing plant at the proposed project will be designed to control and confine liquid spills from tanks should they occur. The central plant building structure will be designed with a 15.2-cm [6-in] concrete curb designed to contain liquid spills from the leakage or rupture of a process vessel and will direct any spilled solution to a floor sump (see SEIS Section 2.1.1.1.2.1). The floor sump system will be designed to direct any spilled solutions back into the plant process circuit or to the waste disposal system. As noted previously, the total containment capacity of curbs and sumps at the proposed project will exceed 200 percent of the largest liquid-containing tank or vessel in the central processing plant (Powertech, 2011). Bermed areas, tank containments, and/or double-walled tanks are designed to perform a similar function for any process chemical vessels located outside the central plant building (Powertech, 2009a).

Yellowcake Dryer Accident Release. Dryers used to produce yellowcake powder from yellowcake slurry are another source of accidental release of radionuclides. A multiple-hearth dryer is capable of releasing yellowcake powder inside the processing building as a result of an explosion. This scenario was evaluated in GEIS Section 4.2.11.2.2 to establish a bounding condition for other accident scenarios involving dryers. The analysis in the GEIS assumes that about 4,309 kg [9,500 lb] of uranium yellowcake is released within the building area housing the dryer and that 1 kg [2.2 lb] is subsequently released as an airborne effluent to the outside atmosphere as a 100 percent respirable powder. Due to the nature of the material, most of the yellowcake will rapidly fall out of airborne suspension. For the occupationally exposed worker using respiratory protection, which is the normal mode during dryer access and drum-filling operations, the dose was calculated to be 0.088 Sv [8.8 rem], which exceeds the annual occupational dose limit of 0.05 Sv [5 rem] established in 10 CFR Part 20. The amount assumed to remain airborne and to be transported outside the building for atmospheric dispersion to an offsite location will be 1 kg [2.2 lb] of yellowcake. The rapid fallout within the building and the atmospheric dispersion will significantly reduce the exposure to members of the public to about 6.5×10^{-4} Sv [65 mrem] (NRC, 1980), which is less than the 10 CFR Part 20 public dose limit of 1 mSv [100 mrem].

The applicant proposes to use a rotary vacuum dryer with heat-transfer fluid that circulates through the dryer shell (Powertech, 2009a). This configuration separates the heater combustion source from the dryer itself, thereby mostly eliminating the possibility of an explosion, which is the initiating event for the assumed catastrophic failure and significant release of dryer radioactive content. Additionally, NRC will require the applicant to have emergency response procedures in place to mitigate worker exposures. Emergency training drills, dosimetry, respiratory protection, contamination control, and decontamination will all be required elements

of the applicant's radiation protection program that will further reduce the consequences of a dryer accident.

Accident Analysis Conclusions. In the unlikely event of an unmitigated accident, and depending on the type of accident, potential doses to workers may result in a MODERATE impact to occupational health and safety. However, there will be only a SMALL impact to public health and safety. 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 radiological consequences to workers from accidents. Therefore, NRC staff conclude that the overall radiological impacts from accidents for the Class V injection well disposal option will be SMALL.

4.13.1.1.2.3 Nonradiological Impacts from Normal Operations

GEIS Section 4.2.11.2.4 identifies the various chemicals, hazardous and nonhazardous, that are typically used at ISR facilities. The GEIS also identifies the typical quantities of these chemicals that are used. The use of hazardous chemicals at ISR facilities is controlled under several regulations that are designed to provide adequate protection to workers and the public. The primary regulations applicable to use and storage include the following:

- 40 CFR Part 68, Chemical Accident Prevention Provisions. This regulation lists regulated toxic substances and threshold quantities for accidental release prevention.
- 29 CFR 1910.119, OSHA Standards (which includes Process Safety Management). This regulation lists highly hazardous chemicals, including toxic and reactive materials that have the potential for a catastrophic event at or above the threshold quantity.
- 40 CFR Part 355, Emergency Planning and Notification. This regulation lists extremely hazardous substances and their threshold planning quantities for the development and implementation of emergency response procedures. A list of reportable quantity values is also provided for reporting releases.
- 40 CFR 302.4, Designation, Reportable Quantities, and Notification–Designation of Hazardous Substances. This regulation lists Comprehensive Environmental Response, Compensation, and Liability Act hazardous substances compiled from the Clean Water Act, Clean Air Act, RCRA, and the Toxic Substances and Control Act.

Chemicals will be utilized at the proposed Dewey-Burdock ISR Project during the extraction process and during restoration of groundwater quality (see SEIS Section 2.1.1.1.3). The hazardous chemicals and their associated protective provisions expected to be used at the proposed project are as follows:

- Sodium chloride (NaCl) and sodium bicarbonate ($NaHCO_3$)—Systems utilizing these chemicals will be designed to industry standards. These chemicals will be stored in tanks inside the central processing plant.

- Barium chloride ($BaCl_2$)—Systems utilizing these chemicals will be designed to industry standards. Barium chloride will be stored in tanks inside a metal building adjacent to the radium settling and storage ponds.

- Hydrochloric acid (HCl) and sulfuric acid (H_2SO_4)—Due to the quantities that will be used, reporting will be required under 40 CFR 302.4. The hydrochloric acid and sulfuric acid storage tanks will be located away from other process tanks to prevent accidental mixing with other chemicals.

- Hydrogen peroxide [50 percent (H_2O_2)]—Because the concentration will be <52 percent, no additional regulatory protective measures will be required. Bulk storage tanks for the hydrogen peroxide will be located outside the central processing plant.

- Carbon dioxide (CO_2)—Carbon dioxide will be stored adjacent to the plant facilities. Floor-level ventilation and low-point carbon dioxide monitors will be installed to prevent a buildup of carbon dioxide in occupied areas.

- Oxygen (O_2)—Oxygen will be stored near, but a safe distance from, plant facilities or within wellfield areas. The oxygen storage facility will be designed to meet industry standards contained in National Fire Protection Association 50—(National Fire Protection Association, 2001). Procedures will be developed for releases or fires in the oxygen system.

- Sodium hydroxide (NaOH)—Systems utilizing NaOH will be designed to industry standards and stored in tanks outside the central processing plant.

- Diesel, gasoline, and bottled gases—Systems utilizing these chemicals will be designed to industry standards. All bulk quantities of these chemicals will be stored outside of plant facilities. All gasoline and diesel storage tanks will be above ground and within secondary containment structures that are designed and constructed to meet EPA requirements. In addition, gasoline and diesel storage tanks must comply with SDDENR requirements in ARSD 74:56:01 and 74:56:03.

The typical onsite quantities for some of these chemicals may exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices (NRC, 2009a). Storage of these chemicals must comply with EPA-administered Superfund Amendments and Reauthorization Act (SARA) Title III reporting requirements. Compliance with applicable regulations reduces the likelihood of a release, which may result in injury or illness to an exposed worker. Because chemicals used in the ISR process are stored and used in or near plant facilities and wellfields, offsite impacts of a chemical spill will be SMALL and do not typically pose a significant risk to the public. Workers involved in a response and cleanup to a chemical spill may experience MODERATE impacts if the proper emergency and cleanup procedures and worker training were not available or were inadequate. Risk assessments completed in NUREG/CR–6733 (Mackin, et al., 2001) identified anhydrous ammonia and bulk acid (sulfuric and hydrochloric) storage as the chemicals with the greatest potential for impacts to occupational and public safety.

In general, the handling and storage of chemicals at the proposed project will follow standard industrial safety practices. The applicant has committed to developing and implementing standard operating procedures regarding receiving, storing, handling, and disposing of

chemicals (Powertech, 2009a). The applicant is also required to comply with EPA, SDDENR, and OSHA regulations regarding inspections and the industrial and environmental safety aspects associated with the use of chemicals. South Dakota OSHA regulates the industrial safety aspects associated with the use of hazardous chemicals. At the proposed project site, bulk chemicals will be stored in areas at a distance from the processing facilities, which will minimize the risk to public and worker health and safety (Powertech, 2009a). As described in SEIS Section 2.1.1.1.2.1, bulk storage tanks for process chemicals, such as sulfuric acid, hydrochloric acid, sodium hydroxide, and hydrogen peroxide, will be outside the central processing plant in concrete secondary containment basins designed to contain 110 percent of the tank volume plus withstand a 25-year, 24-hour storm event. The secondary containment basins will be separate from the containment basins for other chemical systems. The types and quantities of chemicals (hazardous and nonhazardous) identified for use at the proposed project are consistent with those evaluated in the GEIS. The information the applicant provided regarding chemicals does not give NRC any reason to question the GEIS conclusions regarding potential impacts to public or occupational health and safety. Therefore, NRC staff conclude that the nonradiological impacts during normal operations for the Class V injection well disposal option will be SMALL.

4.13.1.1.2.4 Nonradiological Impacts from Accidents

The risks from accidents associated with the use of the typical hazardous and nonhazardous chemicals for ISR operations are not different from those for other typical industrial applications. Potential nonradiological accidents impacts include high consequence chemical release events (e.g., of ammonia) involving both workers and nearby populations. In GEIS Section 4.2.11.2.2, NRC staff state that the likelihood of such release events will be low based on historical operating experience at NRC-licensed facilities, primarily due to operators following commonly applied chemical safety and handling protocols. NRC staff concluded in the GEIS that nonradiological impacts due to accidents will be expected to be SMALL offsite and potentially MODERATE for workers involved in accident response and cleanup.

GEIS Appendix E, Hazardous Chemicals, provides an accident analysis for the more hazardous chemicals. This accident analysis indicates that chemicals commonly used at ISR facilities can pose a serious safety hazard if not properly handled. The GEIS does not evaluate potential hazards to workers or the public due to specific types of high consequence, low probability accidents (e.g., a fire or large magnitude sudden release of chemicals from a major tank rupture or piping system rupture). The application of common safety practices for handling and use of chemicals is expected to decrease the likelihood of these high consequence events. The spills of reportable quantities from chemical bulk storage areas must be reported to SDDENR in accordance with ARSD Chapter 74:34 (Regulated Substance Discharges) and to EPA in accordance with 40 CFR Part 302 (Comprehensive Environmental Response, Compensation, and Liability Act). These procedures and reporting requirements will mitigate the impacts of an accident involving hazardous and nonhazardous chemicals.

The types and quantities of chemicals (hazardous and nonhazardous) to be used at the proposed project do not differ from those evaluated in the GEIS. Nor is there any new or significant information that conflicts with the conclusions drawn in the GEIS regarding the potential nonradiological impacts on public and occupational health and safety from chemical accidents. Offsite impacts involving hazardous and nonhazardous chemicals will be SMALL and do not typically pose a significant risk to the public. Workers involved in a response and cleanup could experience MODERATE impacts, but training requirements and adherence to

established procedures will reduce the impact to SMALL. Based on the foregoing analysis and the GEIS conclusions, for the Class V injection well disposal option at the proposed Dewey-Burdock ISR Project, the impacts from potential accidents for both occupationally exposed workers and members of the public will be SMALL.

4.13.1.1.3 Aquifer Restoration Impacts

For the Class V injection well disposal option, the proposed aquifer restoration activities are similar to activities that will take place during operations (e.g., operation of wellfields, wastewater treatment and disposal). Therefore, the potential impact on public and occupational health and safety will be expected to be similar to the operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote ion-exchange) will further limit potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the operations assessment in Section 4.13.1.1.2.1. Similarly, nonradiological hazards during aquifer restoration are assessed in Section 4.13.1.1.2.3. Accident consequences will be expected to be smaller than those evaluated in Sections 4.13.1.1.2.2 and 4.13.1.1.2.4. Therefore, for the Class V injection well disposal option, aquifer restoration will be expected to have a localized SMALL occupational impact on workers (primarily from radon gas) and to the general public.

4.13.1.1.4 Decommissioning Impacts

Prior to decommissioning, the applicant will have to submit a decommissioning plan for NRC review and approval at least 12 months before any decommissioning activities begin. The plan will need to include the types of safety information described in the GEIS. The applicant will also be required to comply with any site-specific, NRC-established license conditions. Additionally, the applicant will be subjected to NRC safety inspections during the course of decommissioning activities.

The applicant's proposal does not contain any new or significant information that questions the conclusions in the GEIS regarding potential impacts to public and occupational health and safety from decommissioning. The majority of safety issues that are addressed during decommissioning involve radiological hazards at the facility (NRC, 2009a). Removal of nonradiological hazardous chemicals will be conducted in accordance with applicable state and federal hazardous waste disposal and occupational health and safety requirements. Following decommissioning, the site could be released for unrestricted use in conformance with NRC license conditions and the dose criteria for site release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A limit the dose from radiological contamination that may exist at the site after decommissioning is completed to levels that are sufficiently low to protect public health and safety.

Assuming NRC review and approval of the applicant's decommissioning plan, the applicant's compliance with any applicable license conditions, and regular NRC inspection and enforcement activities, the anticipated impact from decommissioning for the Class V injection well disposal option will be short term and SMALL.

4.13.1.2 Disposal Via Land Application

If the applicant does not obtain a permit for Class V injection wells from EPA, it proposes to dispose of liquid waste by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of

land application areas are shown in Figure 4.13-1. The following sections discuss how the land application option could potentially affect health and safety during various phases of the ISR lifecycle.

4.13.1.2.1 Construction Impacts

Construction activities and the potential impact on occupational health and safety for the land application liquid waste option will be similar to those for the Class V injection well disposal option. Instead of installing four to eight Class V injection wells, the land application option will require the installation of irrigation areas and equipment (e.g., center pivot irrigation systems) and the placement and construction of additional infrastructure (e.g., storage ponds for non-irrigation periods).

For the land application option, the important radiation exposure pathways during construction will be the same as for the Class V injection well disposal option. These pathways will include direct exposure, inhalation, or ingestion of radionuclides during well construction; construction activities that disturb soils; and fugitive dust from vehicular traffic. As described in SEIS Section 4.13.1.1.1, the average concentrations of radionuclides in soils at the proposed Dewey-Burdock site are low. Standard dust control measures, such as water application and speed limits, will be implemented to control fugitive dust, and well development during the construction phase will release a negligible fraction of the amount of radon generated during operations. Therefore, NRC staff conclude that for the land application option the radiological impacts to worker and the general public during the construction phase will be SMALL.

As described in SEIS Section 4.13.1.1.1, the nonradiological impacts and potential human exposures from diesel equipment emissions during construction will be SMALL because the releases are usually of short duration and are readily dispersed into the atmosphere. Section 4.7.1 details the potential impacts to air quality from diesel emissions, including comparisons to health-based standards. Furthermore, as described in SEIS Section 4.7.1.1, NRC staff concluded that despite use of dust control measures, short-term and intermediate MODERATE impacts from fugitive dust are possible, but average air quality is expected to comply with ambient air standards. The NRC staff therefore conclude that overall, for the land application option, the nonradiological impacts on workers and the general public during the construction phase will be SMALL.

4.13.1.2.2 Operations Impacts

4.13.1.2.2.1 Radiological Impacts From Normal Operations

For the land application liquid waste option, the potential impacts on public and occupational health and safety during operations will be similar to the impacts for the Class V injection well disposal option described in SEIS Section 4.13.1.1.2.1. Radon gas is the only radiological airborne effluent emitted during normal operations at ISR wellfields and at processing facilities that use vacuum dryer technology. Because the applicant plans to dry yellowcake using a rotary vacuum dryer (see SEIS Section 2.1.1.1.6.1.2), emissions other than radon during normal operations are not expected.

The applicant used the MILDOS computer code to model sources of radon emission, including land application of treated wastewater, wellfield operations, central processing plant operations, and resin transfers in the satellite facility (Powertech, 2009a, 2011). As discussed in SEIS

Section 4.13.1.1.2.1, NRC reviewed the applicant's radiological impact modeling and verified that appropriate exposure pathways were modeled and reasonable input parameters were used.

Results of the applicant's modeling (Powertech, 2011) indicated that the maximum TEDE of 0.06 mSv/yr [6.0 mrem/yr] is located southeast of the Dewey satellite facility within the proposed project boundary (Figure 4.13-1). This dose is 6 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Thus, the 10 CFR Part 20 public dose limit is not exceeded at any property boundary. The applicant's calculations also demonstrate that land application sources accounted for 80 percent of the TEDE at this location (Powertech, 2009a).

The maximum TEDE at a residence was 0.0448 mSv/yr [4.48 mrem/yr] at Spencer Ranch, located approximately 2 km [1.25 mi] northwest of the proposed central processing plant in the Burdock area (see location AMS-02 in SEIS Figure 4.13-1). This is 4.48 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr]. Therefore, the TEDE at nearby receptor locations will not exceed the public dose limit. The applicant's calculations also demonstrate that land application sources accounted for 62 percent of the TEDE at the most highly exposed residence (Powertech, 2009a).

Because Rn-222 is the only radionuclide emitted during normal operations, the public dose requirements in 40 CFR 190.10 and the 0.1 mSv/yr [10 mrem/yr] constraint rule in 10 CFR 20.1101 do not apply. However, even if 100 percent of the Rn-222 contained in production fluids was released to the atmosphere (instead of 10 percent as assumed in the applicant's calculations), the TEDE and Rn-222 air concentrations at the calculated receptor locations surrounding the facility will be less than the 1 mSv [100 mrem] public dose limit and the Rn-222 effluent concentration limit, respectively. Therefore, radiological dose impacts to the public from normal operations will be SMALL.

In summary, for the land application option, potential radiation doses to occupationally exposed workers and members of the public during operations will be SMALL. Calculated radiation doses from the releases of radioactive materials to the environment are small fractions of the limits of 10 CFR Part 20 that have been established for the protection of public health and safety.

4.13.1.2.2.2 Radiological Impacts From Accidents

For the land application option, the types of accidents that could occur and their radiological impacts will be identical to those described in SEIS Section 4.13.1.1.2.2 for the Class V injection well disposal option. Therefore, the discussion of accident scenarios and the site-specific analysis in SEIS Section 4.13.1.1.2.2 for the Class V injection well disposal option applies equally to the land application option. Based on the discussion presented in SEIS Section 4.13.1.1.2.2, in the unlikely event of an unmitigated accident and depending on the type of accident, potential doses to workers at the proposed Dewey-Burdock ISR Project may result in a MODERATE impact to occupational health and safety, while doses to the general public will result in only a SMALL impact to public health and safety. However, 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

radiological consequences to workers from accidents. Therefore, NRC staff conclude that for the land application option, the overall radiological impacts from accidents will be SMALL.

4.13.1.2.2.3 Nonradiological Impacts From Normal Operations

For the land application option, the types and quantities of chemicals (hazardous and nonhazardous) and the related impacts during operations will be the same as those described in SEIS Section 4.13.1.1.2.3 for the Class V injection well disposal option. The discussion of the chemicals used in the ISR process, handling and storage of these chemicals, and regulations designed to protect workers and the public in SEIS Section 4.13.1.1.2.3 for the Class V injection well disposal option applies equally to the land application option. The applicant must implement standard operating procedures regarding receiving, storing, handling, and disposing of chemicals and is required to comply with EPA, SDDENR, and OSHA regulations regarding inspections and the industrial and environmental safety aspects associated with the use of chemicals.

The types and quantities of chemicals (hazardous and nonhazardous) identified for use at the proposed Dewey-Burdock ISR Project are consistent with those evaluated in the GEIS. There is no new or significant information that changes the GEIS conclusions regarding potential impacts to public or occupational health and safety. Therefore, for the land application option, the nonradiological impacts during normal operations will be SMALL.

4.13.1.2.2.4 Nonradiological Impacts from Accidents During Operations

For the land application option, the risks from accidents associated with the use of typical hazardous and nonhazardous chemicals are no different than those described in SEIS Section 4.13.1.1.2.4 for the Class V injection well disposal option. As described in SEIS Section 4.13.1.1.2.4, an accident analysis provided in GEIS Appendix E indicates that certain hazardous chemicals used at ISR facilities can pose a serious safety hazard if not properly handled. The applicant has committed to following standards put in place by relevant regulatory agencies and industries for handling and managing hazardous chemicals (Powertech, 2009b).

The types and quantities of chemicals (hazardous and nonhazardous) to be used at the proposed Dewey-Burdock ISR Project do not differ from those evaluated in the GEIS. There is no new or significant information that changes the conclusions in the GEIS regarding potential nonradiological impacts on health and safety from chemical accidents. Offsite impacts involving hazardous and nonhazardous chemicals will be SMALL and do not typically pose a significant risk to the public. Workers involved in a response and cleanup may experience MODERATE impacts, but training requirements and adherence to established procedures will reduce the impact to SMALL. Based on the foregoing analysis and the GEIS conclusions, for the land application option, the impacts from potential accidents for both occupationally exposed workers and members of the public will be SMALL.

4.13.1.2.3 Aquifer Restoration Impacts

For the land application option, the proposed aquifer restoration activities are similar to activities during operations (e.g., operation of wellfields, wastewater treatment and disposal in land application areas). Therefore, the potential impacts on public and occupational health and safety will be expected to be similar to the operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote ion-exchange) will

further limit the relative magnitude of potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the operations assessment in Section 4.13.1.2.2.1. Similarly, nonradiological hazards during aquifer restoration are assessed in Section 4.13.1.2.2.3. Accident consequences will be expected to be smaller than those evaluated in Sections 4.13.1.2.2.2 and 4.13.1.2.2.4. Accordingly, for the land application option, a localized SMALL occupational impact to workers (primarily from radon gas) and to the general public will be expected during the aquifer restoration phase.

4.13.1.2.4 Decommissioning Impacts

For the land application option, decommissioning procedures and activities will be similar to those described in SEIS Section 4.13.1.1.4 for the Class V injection well disposal option. Prior to decommissioning the proposed Dewey-Burdock ISR Project, the applicant will need to submit a decommissioning plan that includes the types of safety information described in the GEIS. The applicant will also need to comply with any site-specific, NRC-established license conditions. Additionally, the applicant will be subjected to NRC safety inspections during the course of decommissioning activities.

Typically, the initial decommissioning steps include removal of hazardous chemicals; this will be conducted in accordance with applicable state and federal hazardous waste disposal and occupational health and safety requirements. Following decommissioning, the site could be released for unrestricted use in conformance with the conditions of the NRC license and the dose criteria for site release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A limit the dose from radiological contamination that may exist at the site after decommissioning is completed to levels that are sufficiently low to protect public health and safety.

The applicant's proposal does not contain any new or significant information that changes the GEIS's conclusions regarding potential impacts to public and occupational health and safety. The applicant will be required to submit a detailed decommissioning plan for NRC approval at least 12 months before decommissioning activities begin. With the combination of NRC review and approval of the plan, and compliance with any applicable license conditions and regular NRC inspection and enforcement activities, the anticipated impact from decommissioning for the land application option at the proposed project will be short-term and SMALL.

4.13.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes, the applicant proposes to use a combination of deep well disposal via Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined disposal option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the Class V injection well disposal capacity (Powertech, 2011). Based on the discussions in SEIS Sections 4.13.1.1 and 4.13.1.2, the potential impacts to occupational and public health and safety will be similar regardless of whether Class V injection well disposal or land application is used, except for radiological impacts from normal operations. As described in SEIS Sections 4.13.1.1.2.1 and 4.13.1.2.2.1, the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr] will not be exceeded at the project boundary or nearby receptor locations under either the Class V injection well disposal option or the land application option during normal operations. Calculated maximum TEDEs were 0.012 mSv [1.2 mrem/yr] for the Class V

injection well disposal option and 0.06 mSv/yr [6 mrem/yr] for the land application option. Calculated maximum TEDEs at a residence were 0.017 mSv/yr [1.7 mrem/yr] for the Class V injection well disposal option and 0.0448 mSv/yr [4.48 mrem/yr] for the land application option. Because only a portion of land irrigation areas will be operated for the combined disposal option, maximum calculated TEDEs are expected to lie between or be bounded by the maximum TEDEs calculated for the Class V injection well disposal option and the land application option. Therefore, the 10 CFR Part 20 public dose limit will not be exceeded at the project boundary or nearby receptor locations for the combined disposal option. Thus, NRC staff conclude that during the operations phase, the radiological impacts to occupational and public health and safety for the combined disposal option will be SMALL. In addition, as noted previously, the potential impacts to occupational and public health and safety for all other phases of the proposed project will be SMALL regardless of whether Class V injection well disposal or land application is used. Therefore, NRC staff conclude that during all other phases the radiological and nonradiological impacts to occupational and public health and safety for the combined disposal option will be SMALL, as summarized in Table 4.13-2.

4.13.2 No-Action (Alternative 2)

Under the No-Action alternative, there will be no occupational exposure. There will be no additional radiological exposures to the general public from project-related effluent releases, and there will be no impact on long-term environmental radiological conditions. Radiation exposure and risk to the general public will continue to be determined by exposure from natural background, medical-related exposures, and exposures from existing residual contamination.

4.14 Waste Management Impacts

As described in GEIS Section 4.4.12, environmental impacts on waste management could occur during all phases of the ISR lifecycle. The proposed project will generate radiological and nonradiological liquid and solid materials that must be handled and disposed of properly. The primary radiological materials that must be disposed are process-related liquids and process-contaminated structures, equipment, and soils, all of which are classified as byproduct material.

Before operations could begin, NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material. NRC will require by license condition that the disposal agreement be in place before the initiation of operations. Lack of a signed disposal agreement will be grounds for a cessation of operations until a signed agreement is obtained.

<u>GEIS Construction Phase Summary</u>

In GEIS Section 4.4.12.1, NRC staff concluded that waste management impacts from the construction phase of an ISR facility will be SMALL. Because construction activities will be on a relatively small scale, a low volume of construction waste will be generated. (NRC, 2009a)

Table 4.13-2. Significance of Occupational and Public Health and Safety Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction			
Radiological	SMALL	SMALL	SMALL
Nonradiological	SMALL	SMALL	SMALL
Operations			
Radiological (Normal Operations)	SMALL	SMALL	SMALL
Radiological (Accidents)	SMALL	SMALL	SMALL
Nonradiological (Normal Operations)	SMALL	SMALL	SMALL
Nonradiological (Accidents)	SMALL	SMALL	SMALL
Aquifer Restoration			
Radiological	SMALL	SMALL	SMALL
Nonradiological	SMALL	SMALL	SMALL
Decommissioning			
Radiological	SMALL	SMALL	SMALL
Nonradiological	SMALL	SMALL	SMALL

*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the Class V injection well and land application disposal options.

GEIS Operations Phase Summary

According to GEIS Section 2.7, byproduct material generated during the operations phase at an ISR facility will primarily be liquid consisting of process bleed (1 to 3 percent of the process flow rate). NRC staff also noted in the GEIS that byproduct material will be generated from flushing of eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. Treatment and disposal methods described in the GEIS for liquid byproduct material at ISR facilities were characterized as effective at reducing the volume of material prior to disposal at an approved facility. Solid byproduct material will be decontaminated and released for other use or disposed of at approved waste disposal facilities.

NRC staff concluded in the GEIS that the waste management impact from disposal of byproduct material will be SMALL given the required preoperational disposal agreements between an applicant and a licensed byproduct material disposal site. The impact from hazardous waste disposal was expected to be SMALL because of the small volume of hazardous waste generated. The impact from disposal of nonhazardous solid waste was expected to be SMALL based on the available disposal capacity of municipal solid waste facilities. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

GEIS Section 4.4.12.3 described waste management activities that will occur during the aquifer restoration phase of an ISR project and noted that the same treatment and disposal options will be implemented as used during operations. Therefore, the waste management impacts will be similar to those during the operations phase of an ISR project. Some increase in wastewater volumes could occur, but the increase in volume will be offset by the decrease in production capacity. NRC staff concluded in the GEIS that the impact on waste management from aquifer restoration will be SMALL. (NRC, 2009a)

GEIS Decommissionig Phase Summary

GEIS Section 2.6 stated that wastes generated from decommissioning an ISR facility will be predominantly byproduct material and nonhazardous solid waste. GEIS Section 4.4.12.4 stated that decommissioning byproduct material (including contaminated facility demolition materials, process and wellfield equipment, excavated soil, and pond bottoms) will be disposed of at a licensed facility. As stated previously, to ensure that sufficient disposal capacity is available for byproduct material (including that generated by decommissioning activities), NRC requires a preoperational agreement with a licensed disposal facility to accept byproduct material for disposal. NRC staff concluded in the GEIS that because the volume of byproduct material, chemical, and solid wastes generated during decommissioning will be small, the impact on waste management will also be SMALL. (NRC, 2009a)

Environmental impacts on waste management resources during the construction, operations, aquifer restoration, and decommissioning phases of the proposed ISR project are discussed next. The environmental impacts of the proposed waste management actions on other resources are evaluated within the applicable subsections of each impact analysis in this chapter.

4.14.1 Proposed Action (Alternative 1)

Under the proposed action, the types of waste streams that could be generated are discussed in SEIS Section 2.1.1.1.6. The primary radiological materials the proposed Dewey-Burdock ISR Project will dispose of are process-related liquid effluent and process-contaminated structures, equipment, and soils, all of which are classified as byproduct material. As described in SEIS Section 2.1.1.1.6.3, the applicant has identified White Mesa for disposal of solid byproduct material. The applicant's preferred method for disposal of liquid byproduct material is by Class V injection well. If a permit cannot be obtained from EPA for Class V injection, the applicant will 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. The impacts on waste management from the Class V injection well option are described in Section 4.14.1.1. The impacts on waste management from the land application option and combined Class V injection and land application are described in SEIS Sections 4.14.1.2 and

4.14.1.3. Alternative wastewater disposal options, including evaporation ponds and surface water discharge, are described in SEIS Section 4.14.1.4.

4.14.1.1 Disposal Via Class V Injection Wells

As described in SEIS Section 2.1.1.1.2.4, the applicant's preferred option for disposal of liquid wastes is deep well disposal via Class V injection wells. Potential environmental impacts on waste management from construction, operations, aquifer restoration, and decommissioning associated with the deep Class V injection well disposal option at the proposed Dewey-Burdock ISR Project are discussed in the following sections.

4.14.1.1.1 Construction Impacts

The primary wastes to be disposed of during this phase of the ISR facility lifecycle will be nonhazardous solid waste, such as building materials and piping. As discussed in SEIS Sections 2.1.1.1.6.3 and 3.13.2, the applicant has proposed to dispose of nonhazardous solid wastes at the Custer-Fall River Waste Management District landfill located at Edgemont, South Dakota, approximately 24 km [15 mi] southeast of the proposed Dewey-Burdock ISR Project site or at the Newcastle, Wyoming, landfill, approximately 64 km [40 mi] north of the proposed project site if additional capacity is needed (Powertech, 2010a). As described in SEIS Section 3.13.2, these landfills are not at or near capacity.

The proposed activities to manage construction waste generated by the proposed project are discussed in SEIS Section 2.1.1.1.6. The proposed action will annually generate a volume of 144 m^3 [188 yd^3] of nonhazardous solid waste during the construction phase (SEIS Section 2.1.1.1.6.3), which is 1 percent or less of the annual volume of waste disposed at either the Custer-Fall River Waste Management District landfill or the Newcastle landfill (SEIS Section 3.13.2). Nonhazardous solid waste generated at the proposed annual rate for the duration of the construction phase (6 years) will account for 1 percent or less of the capacity of either landfill. Because there is available capacity and the ISR construction phase will annually generate a small volume, the NRC staff conclude the impact on waste management from the Class V injection well disposal option at the proposed project will be SMALL.

4.14.1.1.2 Operations Impacts

Liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals (SEIS Section 2.1.1.1.6.2). The applicant estimates the maximum production of liquid byproduct material at any time considering concurrent uranium recovery operations and aquifer restoration activities is 746 L/min [197 gal/min] for the deep Class V disposal well option (Powertech, 2011). The applicant proposes to treat this combined liquid byproduct material stream onsite to remove radium and uranium by radium settling and ion exchange, respectively (SEIS Section 2.1.1.1.6.2). This will reduce radionuclide activities below the established NRC limits under 10 CFR Part 20, Appendix B, Table 2, Column 2 prior to injecting the material into a deep Class V disposal well (Powertech, 2011). 10 CFR Part 20, Appendix B, Table 2, Column 2 includes effluent concentration limits for natural uranium, Ra-226, Pb-210 and Th-230. As stated in Section 2.1.1.1.6.2, the applicant will have to meet applicable EPA and NRC requirements before injection in a deep Class V injection well begins. When evaluating permit applications for Class V wells, EPA considers the characteristics of the operation, the material proposed to be injected, and the surrounding environment and

determines whether the proposed injection will endanger public health or the environment (EPA, 2012). An EPA permit, if granted, will also prohibit hazardous waste (as defined by RCRA) from being injected. NRC will require (i) liquid byproduct material to be treated prior to injection and (ii) treatment systems to be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. The applicant proposes to have 4 to 8 Class V injection wells with a capacity of 1,136 L/min [300 gal/min], sufficient to accommodate the estimated 746 L/min [197 gal/min] of liquid byproduct material generated from the proposed operation. Based on the applicant's proposal to obtain adequate disposal capacity as well as requirements to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via deep Class V injection wells during the ISR operation phase will be SMALL.

Solid byproduct material generated during operations could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 22 m^3 [29 yd^3] of solid byproduct material from radium settling ponds annually from the deep Class V disposal well option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the impacts on waste management from the disposal of solid byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during operations could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a conditionally exempt small quantity generator (CESQG). The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of byproduct material and waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management activities during the ISR operations phase of the proposed Dewey-Burdock Project will have a SMALL impact on waste management resources.

4.14.1.1.3 Aquifer Restoration Impacts

For the proposed Dewey-Burdock Project, the applicant will use the same waste management systems for aquifer restoration as used during ISR operations discussed in SEIS Section 2.1.1.1.6.

Liquid byproduct material generated during aquifer restoration is composed of reverse osmosis brine (SEIS Section 2.1.1.1.6.2). The applicant proposes to manage aquifer restoration wastewater (i.e., liquid byproduct material) by treating the wastewater by reverse osmosis and reinjecting the treated water (i.e., permeate) back into the aquifer production zone undergoing

restoration (see SEIS Section 2.1.1.1.4.1). The applicant will combine the contaminants removed from water with operational wastewater and transfer the combined wastewater to the radium settling ponds for further treatment prior to disposal in the deep Class V wells. As stated in SEIS Section 2.1.1.1.6.2, the applicant will have to meet applicable EPA and NRC requirements before injection in a deep Class V disposal well begins. When evaluating permit applications for Class V wells, EPA considers the characteristics of the operation, the material to be injected, and the surrounding environment and determines whether the proposed injection will endanger public health or the environment (EPA, 2012). NRC will require liquid byproduct material to be treated prior to injection and treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. The applicant proposes to have 4 to 8 Class V injection wells with a capacity of 1,136 L/min [300 gal/min], sufficient to accommodate the estimated 746 L/min [197 gal/min] of liquid byproduct material generated from the proposed operation. Based on the applicant's proposal to obtain adequate disposal capacity as well requirements to comply with EPA Class V disposal permit conditions, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via deep Class V injection wells during the ISR aquifer restoration phase will be SMALL.

Solid byproduct material generated during aquifer restoration could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 22 m^3 [29 yd^3]of solid byproduct material from radium settling ponds annually from the deep Class V disposal well option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the waste management impacts from the generation of byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during aquifer restoration could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management actions during the ISR aquifer restoration phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.1.4 Decommissioning Impacts

The anticipated decommissioning activities occurring at the proposed Dewey-Burdock ISR Project site will be comparable to those described in GEIS Section 2.6. The applicant proposed

to conduct radiological surveys of decommissioned facilities and equipment and classify materials in accordance with the applicable disposition of the materials (Powertech, 2009b, 2011), including decontamination, recycling and reuse, disposal as byproduct material at a licensed facility, or disposal as nonhazardous solid waste at a municipal solid waste landfill (Powertech, 2009b, 2011).

As discussed in SEIS Section 2.1.1.1.6.3, the applicant's estimate for byproduct material generated from decommissioning the plant facilities and all wellfields (over a planned 2-year period) is 1,419 m^3 [1,856 yd^3] for the deep Class V injection well disposal option (Powertech, 2011). As discussed in SEIS Section 2.1.1.1.6.3, the applicant does not have a disposal agreement in place with a licensed site to accept solid byproduct material, and as discussed in SEIS Section 4.14.1.1.2, NRC will require that the applicant enter into a written agreement with a disposal site to ensure adequate capacity for byproduct material disposal. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). Based on the disposal options currently available for byproduct material and the disposal agreement which NRC will require by license condition prior to operations, the NRC staff conclude that the impact on waste management from the generation of byproduct material during decommissioning will be SMALL.

The applicant's estimate of the total volume of nonhazardous solid waste that will be generated from decommissioning is 10,427 m^3 [13,638 yd^3] for the deep Class V injection well disposal option (Powertech, 2011). From this estimate, the NRC staff derived an annual nonhazardous solid waste generation of 5,213 m^3 [6,819 yd^3] from decommissioning by dividing the applicant's total estimate by 2 (the applicant's proposed decommissioning period in years). This estimated solid waste volume is greater than what was analyzed in the GEIS {715 m^3 [935 yd^3]} and thus not bounded by the impact assessment described in the GEIS; therefore, the NRC staff considered additional site-specific information to evaluate impacts.

Although permitted landfill disposal capacities of the Custer-Fall River Waste Management District landfill and the Newcastle landfill are currently available (SEIS Section 3.13.2), considering the proposed project duration and limited future disposal capacity, the NRC staff evaluated the estimated landfill capacities and demand at the time of decommissioning. Based on the current operational life of 12 years (SEIS Section 3.13.2), the Newcastle landfill will not be open to accept waste at the planned time of decommissioning (15 and 16 years after the start of construction; Figure 2.1-1) unless the landfill capacity is expanded. The Custer-Fall River landfill, with an estimated operational life of 17 years after midyear 2012, will still be in operation at the time of decommissioning if project construction started in 2013; therefore, this landfill was evaluated in more detail. NRC staff projections suggest the remaining capacity of the Custer-Fall River landfill at the time of proposed decommissioning will be insufficient to accommodate all decommissioning nonhazardous solid waste and serve the regional annual demand for disposal capacity unless existing landfill capacity and operations are expanded. Furthermore, the NRC staff estimate the additional demand for capacity will consume the remaining landfill capacity at a faster rate with the landfill reaching full capacity approximately 1 year earlier than current projections. The NRC staff's projections supporting these conclusions are detailed in the following paragraphs.

The NRC staff's landfill capacity analysis calculated the total disposal demand from mid-year 2012 through the end of the proposed decommissioning period and compared it with the reported remaining landfill capacity as of mid-year 2012. NRC staff used this comparison of projected demand and capacity to evaluate whether sufficient capacity will be available to

dispose of the additional waste from the proposed project. The total disposal demand of 148,079 t [163,229 T] was based on the sum of the regional disposal demand[1] and the project disposal demand[2] from mid-2012 through the end of the proposed decommissioning period in 2028. The projected demand exceeds the available capacity of 139,619 t [154,000 T][3] by 8,372 t [9,229 T].[4]

The staff also evaluated the difference in the projected time the landfill will reach full capacity with and without disposal of waste from the proposed Dewey-Burdock ISR Project. The purpose of this analysis was to evaluate the impact of the additional disposal demand on the projected operational life of the landfill. The NRC staff calculated when the landfill will reach full capacity with the additional disposal of proposed project waste by first calculating the available landfill capacity at the end of 2027 after 1 year of decommissioning waste disposal and 15.5 years of post mid-2012 regional waste disposal.[5] Next, the NRC staff derived a combined monthly disposal demand[6] for year 2028 from the projected disposal rates for decommissioning waste and regional waste. At the combined monthly disposal demand, the projected year 2028 remaining capacity of 6,473 t [7,136 T] will be depleted within the first half of 2028.[7] For comparison, the projected operational life of the landfill without disposal of waste from the proposed action (SEIS Section 3.13.2) is 17 years beyond mid-2012 or mid-year 2029. Therefore, the analysis suggests disposal of waste from the proposed Dewey Burdock ISR Project will cause the landfill to reach full capacity 1 year earlier than expected if the proposed decommissioning was executed on schedule and regional disposal demand continued at the current rate.

The potential for future expansion of capacity is being considered at both landfills (AET, Inc., 2011; SDDENR, 2010); however, specific long-term actions remain uncertain. If one of these landfills does not expand capacity in the future, the applicant will have to dispose of waste elsewhere. Anothermore distant and higher capacity landfill serving Rapid City is projected to be operational until 2050 (HDR Engineering Inc., 2010). Therefore, the staff consider regional

[1]The regional demand of 134,717 t [148,500T] was calculated based on the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 16.5 (the number of years from mid-2012 to the end of proposed decommissioning in 2028).
[2]The project demand (i.e., total nonhazardous solid waste volume from decommissioning) of 13,354 t [14,729 T] is the volume of this waste from SEIS Section 2.1.1.1.6.3 converted to mass using 1.08T/yd^3 multiplier.
[3]The available landfill capacity reported in SEIS Section 3.13.2 as of the end of June 2012 is 139,619 t [154,000 T].
[4] The available capacity of 139,619 t [154,000 T] was subtracted from the total disposal demand of 148,079 t [163,229 T] (the sum of footnotes 1 and 2) to obtain the result of 8,372 t [9,229 T].
[5]The calculated available capacity at the beginning of year 2028 is 6,473 t [7,136 T]. This is the result of subtracting 133,150 [146,865 T] of the combined disposal demand (from regional and decommissioning wastes) for mid-2012 to year 2027 from the available landfill capacity as of mid-2012 of 139,619 t [154,000 T] (SEIS Section 3.13.2). The combined disposal demand was calculated as the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 15.5 (the number of years from mid 2012 to the end of the first year of proposed decommissioning in 2027) added to the volume of nonhazardous decommissioning solid waste for year 2027 of 6,680 t [7,364 T] {half of the 2 year decommissioning total waste volume of 13,354 t [14,729 T]}.
[6]The combined monthly disposal demand for year 2028 of 1,237 t/month [1,364 T/month] is the sum of derived monthly disposal demands (i.e., waste generation rates) for proposed decommissioning and regional waste. Specifically, the derived monthly proposed decommissioning disposal demand is the total amount of proposed decommissioning waste of 13,354 t [14,729 T] for 2 years converted to a monthly rate of 557 t/month [614 T/month]. Similarly, the derived monthly regional disposal demand is the Custer-Fall River landfill annual average disposal amount of 8,160 t/yr [9000 T/yr] converted to a monthly rate of 680 t [750 T/month].
[7]The time to reach full capacity of 5.2 months was calculated as the ratio of the available year 2028 capacity of 6,473 t [7,136 T] from footnote 4 and the combined monthly disposal demand of 1,237 t/month [1,364 T/month] from footnote 5.

capacity will be available during the period of decommissioning if local capacity is limited or otherwise unavailable.

Based on the preceding capacity analysis, the NRC staff conclude that the potential impacts on waste management resources will vary depending on the long-term status of the existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning period, the staff conclude that there will be no impacts to the Newcastle landfill because it will not be open to accept waste at the planned time of decommissioning and the proposed Dewey-Burdock ISR Project will not be able to dispose waste at that location. In turn, impacts to the Custer-Fall River landfill will be MODERATE because the increased demand for capacity will more rapidly consume the waste management resources during the last years of its projected operational life. Any waste disposed at the Rapid City landfill will have SMALL impacts based on the projected operational life and available capacity. Alternatively, if the local landfill capacity is expanded prior to the proposed project decommissioning phase, the impacts on the available capacity of the expanded landfill (Newcastle or Custer-Fall River) will be SMALL.

The applicant estimates the volume of hazardous waste generated from decommissioning activities will be less than 91 kg [200 lb] (Powertech, 2009b). The hazardous waste streams from decommissioning will be similar to the waste streams generated during the ISR construction phase and could include used oil, batteries, and cleaning solvents. The applicant will have in place a hazardous material program that complies with applicable EPA and SDDENR requirements for its handling, storage, and disposal at approved facilities. Because the volume of hazardous wastes generated by the proposed action will be small and the waste will be handled, stored, and disposed of in accordance with applicable regulations, the NRC staff conclude the impacts on waste management will be SMALL.

In summary, NRC staff conclude the impacts to waste management resources during the decommissioning phase of the proposed project for the deep Class V injection well disposal option will be SMALL for all materials except nonhazardous solid waste, which will be SMALL to MODERATE depending on the long-term status of the existing local landfill resources. Based on the type and quantity of waste expected to be generated and the available capacity for disposal, waste management actions during the decommissioning phase will have a SMALL impact on waste management resources for byproduct material and hazardous waste and a SMALL to MODERATE impact for nonhazardous solid waste.

4.14.1.2 Disposal Via Land Application

If a permit for Class V injection wells is not be obtained from EPA or the capacity of the Class V wells is insufficient, the applicant proposes to dispose of liquid byproduct material generated at the proposed Dewey-Burdock ISR Project by land application (see SEIS Section 2.1.1.1.2.4.2). The locations of land application areas for this disposal option are shown in Figure 2.1-12. Potential environmental impacts on waste management resources from construction, operations, aquifer restoration, and decommissioning associated with the land application disposal option are discussed in the following sections.

4.14.1.2.1 Construction Impacts

The primary wastes to be disposed of during this phase of the ISR facility lifecycle will be nonhazardous solid waste, such as building materials and piping. As discussed in SEIS

Sections 2.1.1.1.6.3 and 3.13.2, the applicant has proposed to dispose of nonhazardous solid wastes at the Custer-Fall River Waste Management District landfill located at Edgemont, South Dakota, approximately 24 km [15 mi] southeast of the proposed Dewey-Burdock Project site or at the Newcastle, Wyoming, landfill, approximately 64 km [40 mi] north of the proposed Dewey-Burdock Project site if additional capacity is needed (Powertech, 2010a). As described in SEIS Section 3.13.2, these landfills are not at or near capacity.

The proposed activities to manage construction waste generated by the proposed project are discussed in SEIS Section 2.1.1.1.6. The proposed action will annually generate a volume of 144 m^3 [188 yd^3] of nonhazardous solid waste during the construction phase (SEIS Section 2.1.1.1.6.3), which is 1 percent or less of the volume of waste disposed at either the Custer-Fall River Waste Management District landfill or the Newcastle landfill (SEIS Section 3.13.2). Nonhazardous solid waste generated at the proposed annual rate for the duration of the construction phase (6 years) will account for 1 percent or less of the capacity of either landfill. Because there is available capacity and the ISR construction phase will annually generate a small volume, the NRC staff conclude the impact on waste management from the land application disposal option at the proposed project will be SMALL.

4.14.1.2.2 Operations Impacts

Liquid byproduct material generated during operations is composed of production bleed, waste brine streams from elution and precipitation, resin transfer wash, laundry water, plant washdown water, and laboratory chemicals (SEIS Section 2.1.1.1.6.2). The applicant estimates the maximum production of liquid byproduct material at any time, considering concurrent uranium recovery operations and aquifer restoration activities, is 2,080 L/min [547 gal/min] for the land application option (Powertech, 2011). The applicant proposes to treat this combined liquid byproduct material stream onsite using ion exchange and radium settling prior to land application. The applicant proposes to treat the liquid waste (SEIS Section 2.1.1.1.6.2) to reduce radionuclide activities below the established NRC limits under 10 CFR Part 20, Appendix B, Table 2, Column 2 (Powertech, 2011) for discharge of radionuclides to the environment. 10 CFR Part 20, Appendix B, Table 2, Column 2 includes effluent concentration limits for natural uranium, Ra-226, Pb-210 and Th-230. As stated in SEIS Section 2.1.1.1.6.2, the land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state groundwater quality standards. NRC will require (i) liquid byproduct material be treated prior to injection and (ii) treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. While land application capacity varies throughout the year, the applicant estimates that each land application area will be able to dispose of 1,173 Lpm [310 gpm] (Powertech, 2012c). The applicant proposes two land application areas, which will provide 2,347 Lpm [620 gpm] of capacity. The applicant's proposed disposal capacity is sufficient to accommodate the proposed maximum generation rate of liquid byproduct material. Based on the applicant's proposal to obtain adequate disposal capacity and comply with state groundwater quality standards, NRC effluent limits, and other NRC safety regulations, the NRC staff conclude that the waste management impacts from the disposal of liquid byproduct material via land application during the ISR operation phase will be SMALL.

Solid byproduct material generated during operations could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS

Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 50 m^3 [66 yd^3] of solid byproduct material from the land application option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the impacts on waste management from the disposal of solid byproduct material under the land application option during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during operations could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of byproduct material and waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management activities during the ISR operations phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.2.3 Aquifer Restoration Impacts

For the proposed Dewey-Burdock ISR Project, the applicant will use the same waste management systems for aquifer restoration as used during ISR operations discussed in SEIS Section 2.1.1.1.6.

Liquid byproduct material generated during aquifer restoration is composed of produced water from the ore zone aquifer (Powertech, 2009b). The applicant estimates the maximum production of liquid byproduct material at any time, considering concurrent uranium recovery operations and aquifer restoration activities, is 2,080 L/min [547 gal/min] for the land application option (Powertech, 2011). The applicant proposes to manage aquifer restoration wastewater (i.e., liquid byproduct material) by treating the wastewater onsite by ion exchange and radium settling prior to land application (SEIS Section 2.1.1.1.6.2). As stated in Section 2.1.1.1.6.2, the land application will be carried out under a GDP approved by SDDENR (Powertech, 2012c). In accordance with permit program objectives, the applicant's proposed land application operations will have to meet applicable state groundwater quality standards. NRC will require liquid byproduct material be treated prior to injection and treatment systems be approved, constructed, operated, and monitored to ensure release standards in 10 CFR Part 20, Subparts D and K and Appendix B are met. While land application capacity varies throughout the year, the applicant estimates that each land application area will be able to dispose of 1,173 Lpm [310 gpm] (Powertech, 2012c). The applicant proposes 2 land application areas, which will provide 2,347 Lpm [620 gpm] of capacity. The applicant's proposed disposal capacity is sufficient to accommodate the proposed maximum generation rate of liquid byproduct material. Based on the applicant's proposal to obtain adequate disposal capacity and comply with state groundwater quality standards, NRC effluent limits, and other NRC safety regulations, the staff

conclude that the waste management impacts from the disposal of liquid byproduct material via land application during the ISR aquifer restoration phase will be SMALL.

Solid byproduct material generated during aquifer restoration could include maintenance and housekeeping rags and trash; packing materials; replaced components; filters; protective clothing; and solids removed from process pumps, vessels, and ponds. As discussed in SEIS Section 2.1.1.1.6.3, the applicant estimates, during the operational period and assuming combined operations and aquifer restoration, the proposed Dewey-Burdock facility will produce 50 m^3 [66 yd^3] of solid byproduct material from the land application option (Powertech, 2011). Solid byproduct material will be stored onsite within a restricted area until sufficient volume is generated for disposal. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations (SEIS Section 2.1.1.1.6.3), the NRC staff conclude that the waste management impacts from the generation of byproduct material during the ISR operations phase will be SMALL.

Nonhazardous solid wastes generated during aquifer restoration could include facility trash, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). Because the proposed generation rate of nonhazardous solid waste (SEIS Section 2.1.1.1.6.3) will be a small percentage of the landfill capacity (SEIS Section 3.13.2), the NRC staff conclude the impact on waste management will be SMALL.

As discussed in SEIS Section 2.1.1.1.6.3, the applicant has stated it will likely be classified as a CESQG. The applicant will transport its hazardous waste to a permitted hazardous waste facility for disposal (Powertech, 2009a).

Based on the type and quantity of waste expected to be generated and the available capacity for disposal, the NRC staff conclude the waste management actions during the ISR aquifer restoration phase of the proposed project will have a SMALL impact on waste management resources.

4.14.1.2.4 Decommissioning Impacts

The anticipated decommissioning activities occurring at the proposed Dewey-Burdock ISR Project site will be comparable to those described in GEIS Section 2.6. The applicant proposed to conduct radiological surveys of decommissioned facilities and equipment and classify materials in accordance with the applicable disposition of the materials (Powertech, 2009b, 2011), including decontamination, recycling and reuse, disposal as byproduct material at a licensed facility, or disposal as nonhazardous solid waste at a municipal solid waste landfill (Powertech, 2009b, 2011).

As discussed in SEIS Section 2.1.1.1.6.3, the applicant's estimate for byproduct material generated from decommissioning the plant facilities and all wellfields (over a planned 2-year period) is 1,580 m^3 [2,067 yd^3] for the land application option (Powertech, 2011). As discussed in SEIS Section 2.1.1.1.6.3, the applicant does not have a disposal agreement in place with a licensed site to accept solid byproduct material, and as discussed in SEIS Section 4.14.1.1.2, NRC will require that the applicant enter into a written agreement with a disposal site to ensure adequate capacity for byproduct material disposal. The applicant has proposed to pursue an agreement with the White Mesa site in Blanding, Utah, for disposal of solid byproduct material (SEIS Section 3.13.2). Based on the disposal options currently available for byproduct material and the disposal agreement, which NRC will require by license condition prior to operations, the

NRC staff conclude that the impact on waste management from the generation of byproduct material under the land application option during decommissioning will be SMALL.

The applicant's estimate of the total volume of nonhazardous solid waste that will be generated from decommissioning is 12,496 m^3 [16,344 yd^3] for the land application option (Powertech, 2011). From this estimate, the NRC staff derived an annual nonhazardous solid waste generation of 6,248 m^3 [8,172 yd^3] from decommissioning by dividing the applicant's total estimate by 2 (the applicant's proposed decommissioning period in years). This estimated solid waste volume is greater than what was analyzed in the GEIS {715 m^3 [935 yd^3]} and thus not bounded by the GEIS impact assessment; therefore, the NRC staff considered additional site-specific information to evaluate impacts.

Although permitted landfill disposal capacities at the Custer-Fall River Waste Management District landfill and the Newcastle landfill are currently available (SEIS Section 3.13.2), considering the proposed project duration and limited future disposal capacity, the NRC staff evaluated the estimated landfill capacities and demand at the time of decommissioning. Based on the current operational life of 12 years (SEIS Section 3.13.2), the Newcastle landfill will not be open to accept waste at the planned time of decommissioning (15 and 16 years after the start of construction; SEIS Figure 2.1-1) unless the landfill capacity was expanded. The Custer-Fall River landfill, with an estimated operational life of 17 years after mid-year 2012, will still be in operation at the time of decommissioning if project construction started in 2013; Section 106 consultation between NRC, SD SHPO, BLM, tribal representatives, and the applicant therefore, this landfill was evaluated in more detail. NRC staff projections suggest the remaining capacity of the Custer-Fall River landfill at the time of proposed decommissioning will be insufficient to accommodate all decommissioning nonhazardous solid waste and serve the regional annual demand for disposal capacity unless existing landfill capacity and operations were expanded. Furthermore, the NRC staff estimate the additional demand for capacity will consume the remaining landfill capacity at a faster rate with the landfill reaching full capacity approximately 1 year earlier than current projections. The NRC staff's projections supporting these conclusions are detailed in the following paragraphs.

The NRC staff's landfill capacity analysis calculated the total disposal demand from mid-year 2012 through the end of the proposed decommissioning period and compared it with the reported remaining landfill capacity as of mid-year 2012. NRC staff used this comparison of projected demand and capacity to evaluate whether sufficient capacity will be available to dispose of the additional waste from the proposed Dewey-Burdock ISR Project. The total disposal demand of 150,730 t [166,152 T] was based on the sum of the regional disposal demand[8] and the project disposal demand[9] from mid-2012 through the end of the proposed decommissioning period in 2028. The projected demand exceeds the available capacity of 139,619 t [154,000 T][10] by 11,024 t [12,152 T].[11]

[8]The regional demand of 134,717 t [148,500 T] was calculated based on the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 16.5 (the number of years from mid-2012 to the end of proposed decommissioning in 2028).
[9]The project demand (i.e., total nonhazardous solid waste volume from decommissioning) of 16,003 t [17,652 T] is the volume of this waste from SEIS Section 2.1.1.1.6.3 converted to mass using 1.08T/yd^3 as a multiplier.
[10]The available landfill capacity reported in SEIS Section 3.13.2 as of the end of June 2012 is 139,619 t [154,000 T].
[11]The available capacity of 139,619 t [154,000 T] was subtracted from the total disposal demand of 150,730 t [166,152 T] (the sum of footnotes 8 and 9) to obtain the result of 11,024 t [12,152 T].

The staff also evaluated the difference in the projected time the landfill will reach full capacity with and without disposal of waste from the proposed Dewey-Burdock ISR Project. The purpose of this analysis was to evaluate the impact of the additional disposal demand on the projected operational life of the landfill. The NRC staff calculated when the landfill will reach full capacity with the additional disposal of proposed project waste by first calculating the available landfill capacity at the end of 2027 after 1 year of decommissioning waste disposal and 15.5 years of post mid-2012 regional waste disposal.[12] Next, the NRC staff derived a combined monthly disposal demand[13] for year 2028 from the projected disposal rates for decommissioning waste and regional waste. At the combined monthly disposal demand the projected year 2028 remaining capacity of 5,147 t [5,674 T] will be depleted within the first half of 2028.[14] For comparison, the projected operational life of the landfill without disposal of waste from the proposed action (SEIS Section 3.13.2) is 17 years beyond mid-2012 or mid-year 2029. Therefore, the analysis suggests disposal of waste from the proposed Dewey-Burdock ISR Project will cause the Custer-Fall River landfill to reach full capacity 1 year earlier than expected if the proposed decommissioning was executed on schedule and regional disposal demand continued at the current rate.

The potential for future expansion of capacity is being considered at both landfills (AET, Inc., 2011; SDDENR, 2010); however, specific long term actions remain uncertain. If one of these landfills does not expand capacity in the future, the applicant will have to dispose of waste elsewhere. Another more distant and higher capacity landfill serving Rapid City is projected to be operational until 2050 (HDR Engineering Inc., 2010). Therefore, the staff consider regional capacity will be available during the period of decommissioning if local capacity is limited or otherwise unavailable.

Based on the preceding capacity analysis, the NRC staff conclude that the potential impacts on waste management resources will vary depending on the long-term status of the existing local landfill resources. If local landfill capacity is not expanded prior to the proposed decommissioning period, the NRC staff conclude that there will be no impacts to the Newcastle landfill because it will not be open to accept waste at the planned time of decommissioning and the proposed Dewey-Burdock IRS Project will not be able to dispose waste at that location. In turn, impacts to the Custer-Fall River landfill will be MODERATE because the increased demand for capacity will more rapidly consume the waste management resources during the last years of its projected operational life. Any waste disposed at the Rapid City landfill will have SMALL impacts based on the projected operational life and available capacity. Alternatively, if the local landfill capacity is expanded prior to the proposed project decommissioning phase, the

[12]The calculated available capacity at the beginning of year 2028 is 5,147 t [5,674 T]. This is the result of subtracting the combined disposal demand (from regional and decommissioning wastes) from mid-2012 to year 2027 from the available landfill capacity as of mid-2012 of 139,619 t [154,000 T] (SEIS Section 3.13.2). The combined disposal demand was calculated as the product of the annual average disposal volume received by the Custer-Fall River landfill of 8,160 t/yr [9,000 T/yr] (SEIS Section 3.13.2) and 15.5 (the number of years from mid-2012 to the end of the first year of proposed decommissioning in 2027) added to the volume of nonhazardous decommissioning solid waste for year 2027 of 8,007 t [8,826 T] {half of the 2 year decommissioning total waste volume of 16,003 t [17,652 T]}.
[13]The combined monthly disposal demand for year 2028 of 1,348 t/month [1,486 T/month] is the sum of derived monthly disposal demands (i.e., waste generation rates) for proposed decommissioning and regional waste. Specifically, the derived monthly proposed decommissioning disposal demand is the total amount of proposed decommissioning waste of 16,003 t [17,652 T] for 2 years converted to a monthly rate of 667 t/month [736 T/month]. Similarly, the derived monthly regional disposal demand is the Custer-Fall River landfill annual average disposal amount of 8,160 t/yr [9,000 T/yr] converted to a monthly rate of 680t/month [750 T/month].
[14]The time to reach full capacity of 3.8 months was calculated as the ratio of the available year 2028 capacity of 5,147 t [5,674 T] from footnote 10 and the combined monthly disposal demand of 1,348 t/month [1,486 T/month] from footnote 11.

impacts on the available capacity of the expanded landfill (Newcastle or Custer-Fall River) will be SMALL.

The applicant estimates the volume of hazardous waste generated from decommissioning activities will be less than 91 kg [200 lb] (Powertech, 2009b). The hazardous waste streams from decommissioning will be similar to the waste streams generated during the ISR construction phase and could include used oil, batteries, and cleaning solvents. The applicant will have in place a hazardous material program that complies with applicable EPA and SDDENR requirements for its handling, storage, and disposal at approved facilities. Because the volume of hazardous wastes generated by the proposed action will be small and the waste will be handled, stored, and disposed of in accordance with applicable regulations; the NRC staff conclude the impacts on waste management will be SMALL.

In summary, NRC staff conclude the impacts to waste management resources during the decommissioning phase of the proposed project for the land application liquid waste disposal option will be SMALL for all materials except nonhazardous solid waste, which will be SMALL to MODERATE depending on the long-term status of the existing local landfill resources. Based on the type and quantity of waste expected to be generated and the available capacity for disposal, waste management actions during the decommissioning phase will have a SMALL impact on waste management resources for byproduct material and hazardous waste and a SMALL to MODERATE impact for nonhazardous solid waste.

4.14.1.3 Disposal Via Combination of Class V Injection and Land Application

If a permit for Class V injection wells is obtained from EPA but the capacity of the wells is insufficient to dispose of all liquid wastes generated at the proposed Dewey-Burdock ISR Project, the applicant has proposed to dispose of liquid waste by a combination of deep well disposal using Class V injection wells and land application (see SEIS Section 2.1.1.1.2.4.3). For the combined deep Class V injection well and land application disposal option, land application facilities and infrastructure will be constructed, operated, restored, and decommissioned on an as-needed basis depending on the deep Class V injection well disposal capacity (Powertech, 2011). The land application option will require the construction and operation of irrigation areas and increased pond capacity for storage of liquid wastes during nonirrigation periods (see SEIS Section 2.1.1.1.2.4.2), whereas the deep Class V injection well disposal option will require the construction and operation of four to eight deep disposal wells (see SEIS Section 2.1.1.1.2.4.1).

The relative volumes of byproduct material generated by the two disposal options differ during operations, aquifer restoration, and decommissioning phases with the land application option generating the larger amount of material for offsite disposal in each phase. The relative volumes of nonhazardous solid waste generated by the two disposal options differ during the decommissioning phase. The significance of these differences with regard to environmental impacts is low and does not change the impact conclusions for each disposal option. Therefore, the environmental impacts on waste management resources associated with the land application option will be the same for the deep Class V injection well disposal option for all phases of the ISR process. Furthermore, only a portion of land application facilities and infrastructure (e.g., irrigation areas and storage ponds) will be constructed, operated, and decommissioned for the combined disposal option. Therefore, the significance of environmental impacts on waste management resources for the combined disposal option will be less than for the land application option alone. Based on this reasoning, NRC staff conclude that the

environmental impacts on waste management of the combined deep Class V injection well and land application disposal option for each phase of the proposed Dewey-Burdock ISR Project will be bounded by the significance of environmental land use impacts of the deep Class V injection well disposal option and the land application disposal option as summarized in Table 4.14-1.

4.14.1.4 Alternative Wastewater Disposal Options

If the applicant does not obtain a UIC Class V injection well permit or the necessary permits for land application, it will have to identify another wastewater disposal option. This section evaluates the environmental impacts from implementing the alternate wastewater disposal options identified in SEIS Section 2.1.1.2, namely evaporation ponds and surface water discharge. These alternative wastewater disposal options will involve treatment of the wastewater resulting in the generation of solid waste, which also must be managed.

In the alternative wastewater disposal options considered in the following sections, the footprint of the disposal system would be similar to or increase as compared to disposal via a UIC Class V injection well (the applicant's preferred waste disposal option) (SEIS Section 4.14.1.1) and be similar to or decrease as compared to the applicant's land application option or combination of both. Increasing the size of the proposed facility would lead to more land disturbance and a heavier use of construction equipment, with an anticipated increase in potential impacts to resource areas, such as ecological and wetland systems, cultural and historical resources, and nonradiological air quality. The applicant would have to amend its license application to select one of these alternative wastewater disposal options. NRC staff would perform an additional environmental and safety review before deciding whether to grant or deny the license amendment request for the new wastewater disposal option. The applicant would survey the areas to be affected prior to construction, and the applicant and NRC staff would consult with agencies such as the SD SHPO, SDGFP, and FWS, as appropriate. Mitigation measures, such as avoidance of sensitive areas or documentation of cultural resources, would be discussed and implemented, as appropriate, as part of these consultations. If mitigation measures were implemented, the estimated impacts would be SMALL.

Table 4.14-1. Significance of Environmental Impacts on Liquid Waste Management for the Proposed Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock *In-Situ* Recovery Project

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	SMALL	SMALL	SMALL
Operations	SMALL	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
Decommissioning	SMALL, MODERATE depending on future status of local landfills	SMALL, MODERATE depending on future status of local landfills	SMALL, MODERATE depending on future status of local landfills
*Significance of environmental impact for the combined disposal option is bounded by the significance of environmental impacts for the deep Class V injection well disposal and land application disposal options.			

4.14.1.4.1 Evaporation Ponds

The types of waste streams and the infrastructure necessary for the use of evaporation ponds as a wastewater disposal option are described in SEIS Section 2.1.1.2.1. The type and volume of wastewater that would be disposed in an evaporation pond would be the same as described in SEIS Section 4.14.1.1 for disposal by injection into a deep Class V UIC well. Before the applicant could begin disposing wastewater into an evaporation pond system, the NRC staff would review the design and construction of the ponds and monitoring system against the criteria in 10 CFR Part 40, Appendix A (NRC, 2003b, 2008), taking into consideration EPA criteria in 40 CFR Part 61, Subpart W. The applicant would be required to demonstrate that the evaporation ponds could be designed, operated, and decommissioned to prevent migration of wastewater to subsurface soil, surface water, or groundwater. The applicant would also be required to demonstrate that monitoring requirements would be established to detect migration of contaminants to groundwater. The NRC staff would establish needed license conditions to ensure that the applicant met the necessary requirements.

Individual evaporation ponds could have a surface area of up to 2.5 ha [6.25 ac], and the total pond system could be as much as 40 ha [100 ac]. During the ISR operations period for the proposed Dewey-Burdock ISR Project, this area would be fenced to exclude wildlife and livestock. A 40-ha [100-ac] footprint would be less than about 1 percent of the total permitted area {4,282 ha [10,580 ac]} for the proposed Dewey-Burdock ISR Project (including both the Dewey and Burdock sites), but it would be much larger than the footprint for a central processing plant without evaporation ponds (Powertech, 2009b). The additional land disturbance required to install an evaporation pond system for wastewater disposal would be similar in scale to the current proposed action for the land application option {55 ha [136 ac]} for the proposed Dewey-Burdock ISR Project. It is also anticipated that the applicant would need to have at least one other wastewater disposal option or additional storage capacity during the winter months in South Dakota because of the low evaporation rates during that season.

Although a wastewater disposal option that uses an evaporation pond system would roughly double the facility footprint relative to UIC Class V injection wells, the total amount of disturbed and fenced land would be small compared to the permitted area and comparable to the generic conditions evaluated in the GEIS with respect to land use. For these reasons, the overall impact on land use associated with an evaporation pond system would be SMALL.

Construction of an evaporation pond system would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment. The equipment would produce diesel emissions and fugitive dust emissions during construction that could have a temporary effect on nonradiological air quality. Depending on how the applicant elected to phase in the pond system, these effects could extend into the operational phase of the facility as well. BMPs, such as wetting unpaved roads, would minimize fugitive dust, and the anticipated impacts to nonradiological air quality would be SMALL. The applicant may also need to obtain a National Emission Standards for Hazardous Air Pollutants (NESHAP) review to evaluate whether the anticipated radiological releases to air from the evaporation ponds would meet the criteria in 40 CFR Part 61, Subpart W. The applicant would also be required to have an NRC-approved air monitoring system for the wastewater disposal system. Keeping the pond wet to reduce dust and radon emissions would effectively reduce potential air emissions, and the estimated impacts on radiological air quality would be SMALL.

Evaporation ponds designed and constructed following NRC guidance (NRC, 2008) would utilize clay or geotextile liners to reduce the potential for infiltration into the subsurface. An NRC-approved monitoring system would be installed to detect leaks from the ponds, and the applicant also implement an NRC-approved inspection plan for the ponds (NRC, 2008). Based on these measures, the estimated impacts on surface water and groundwater resources would be SMALL.

The evaporation ponds would be constructed at the same time and with the same mitigation measures described in SEIS Section 4.6 (Ecological Resources) for the construction of the rest of the facility. For these reasons, the estimated impact on ecological resources from an evaporation pond disposal system would be the same as identified in SEIS Section 4.6 and could be reduced to SMALL.

At the end of the operational phase of the facility, all of the pond liners and berms, as well as accumulated precipitates and sludges, would be classified as solid byproduct material. For example, the GEIS indicates that about 52 m^3 [68 yd^3] of byproduct material would be generated during evaporation pond decommissioning. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of decommissioning byproduct material, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct waste disposal capacity, it is anticipated that the impacts from an evaporation pond wastewater disposal system to waste management would be SMALL to MODERATE during the decommissioning phase of the facility. Note that at the conclusion of operations, the licensee would be required to provide a decommissioning plan for NRC review that demonstrates it has a disposal path for any decommissioning wastes, including those related to the wastewater disposal system. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.4.2 Surface Water Discharge

For surface discharge of wastewater, the applicant would be required to meet the release standards in 10 CFR Part 20, Subparts D and K and Appendix B. The applicant would also be required to obtain a zero-release surface water discharge permit from SDDENR. In accordance with EPA regulations, the applicant would not be allowed to discharge process wastewater to navigable waters of the United States (NRC, 2003b). The applicant would need to develop storage capabilities prior to treatment to 10 CFR Part 20 standards. In addition, the applicant would need to characterize and remediate any residual radioactivity at the discharge point or from storage facilities (tanks, impoundments), radium settling basins, and related liners and sludges above NRC limits as part of the decommissioning of the facility (NRC, 2003b; Sanford Cohen and Associates, 2008).

Establishing the discharge point for the treated effluent would likely require short-term use of earthmoving equipment to install pipelines, small berms, access roads, and fencing to exclude livestock and wildlife. The amount of land to be fenced for the discharge point alone would be limited (see SEIS Section 2.1.1.2.2), and the estimated impact on land use would likely be SMALL. As is the case with both land application and a deep Class V disposal well, the wastewater would likely require treatment to meet state surface water discharge zero-release permit requirements, including treatment facilities to provide an ion-exchange circuit, reverse osmosis, one or more radium settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, or purge storage reservoirs {4 ha [10 ac] or more}. These treatment facilities would also be fenced to exclude

wildlife and livestock and limit public access. The amount of land needed for the wastewater treatment facilities would be similar to that for land application and deep Class V disposal wells. As with evaporation ponds, land application, and Class V disposal wells, the increased footprint for the additional wastewater treatment facilities needed to meet state surface water discharge requirements would be small relative to the entire permitted area {4,282 ha [10,580 ac]}, but large relative to the central processing plant as described for the proposed action (SEIS Section 4.2.1) (Powertech, 2009b). The proposed action would further disturb about 98 ha [243 ac] of previously disturbed land under the deep well disposal option and about 566 ha [1,398 ac] of previously disturbed land under the land application option or a combination of both for the proposed Dewey-Burdock Project. Overall, the increase in the disturbed area to accommodate the addition of a wastewater treatment facility would be about 1 to 4 percent and would have a SMALL impact on land use.

Constructing the wastewater treatment facilities (e.g., radium settling basins) would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment(s). This would be similar to the proposed action (both deep Class V disposal well and land application options) because wastewater treatment facilities are included in the proposed plans for the Dewey-Burdock Project. The equipment would produce diesel emissions and fugitive dust emissions during construction that could temporarily affect nonradiological air quality. BMPs, such as wetting unpaved roads, would reduce fugitive dust emissions. Taking into consideration the likely short-term duration of the construction period, the anticipated impacts to nonradiological air quality would be SMALL. The applicant may also need to consider emissions of radionuclides such as radon from the surface discharge points. Because the SDDENR permit would require the applicant to monitor and maintain low radionuclide concentrations for the treated wastewater, the estimated impacts on radiological air quality would be SMALL.

The proposed Dewey satellite facility and wellfields would be developed in the Beaver Creek drainage basin, while the Burdock central processing facility and wellfields would be developed within the Pass Creek drainage (SEIS Section 3.5.1). Beaver Creek is a perennial drainage with periods of low flow, but a surface water discharge option would increase water flow and result in the development of aquatic habitat. Pass Creek is intermittent, and surface discharge could result in increased erosion and suspended sediments in the existing stream channel. Sediment loads would likely taper off quickly both in time and distance; therefore, the long-term impact would be SMALL.

As noted previously, the applicant would not be allowed to discharge treated wastewater into navigable waters of the United States. A recent wetlands delineation survey identified four potential jurisdictional wetlands in the Dewey-Burdock ISR Project (SEIS Section 3.5.1 and Figure 4.5-1). These jurisdictional wetlands include Beaver and Pass Creeks and two tributaries. A Nationwide Permit 44 under Section 404 of the Clean Water Act would be required for discharges of dredged or fill material into a wetland or WUS exceeding 0.2 ha [0.5 ac]. The NRC staff assume that, if the applicant pursued surface discharge of treated effluent, the proposed Dewey-Burdock ISR Project would avoid surface discharge points that might disturb any of these wetlands areas, and potential impacts to these wetlands from surface discharge of treated wastewater would be SMALL.

The applicant would be required to demonstrate that any soil affected by the surface discharge of treated wastewater would meet 10 CFR Part 20 requirements. In addition, during operations the applicant would be required to routinely monitor the soils and discharged water to ensure

predicted concentrations were not exceeded. For these reasons, it is not anticipated that decommissioning the surface discharge point would produce additional solid byproduct material for disposal. As with the land application wastewater disposal option, however, decommissioning wastewater treatment facilities may produce solid byproduct material, such as spent resins, sludges, and liners from radium settling basin(s), or contaminated building debris. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of decommissioning byproduct materials, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct material disposal capacity, it is anticipated that the potential impacts on waste management from decommissioning the radium settling basin(s) and other storage facilities associated with treating wastewater for surface water discharge would range from SMALL to MODERATE.

Note that at the conclusion of operations, the licensee would be required to provide a detailed decommissioning plan for NRC review. The decommissioning plan would include final radiological surveys to identify whether there were any areas of soil contamination that would require disposal as byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time. Topsoil that was removed and stored during construction would be reapplied during land reclamation. Final revegetation of the project area would involve seeding the area with a seed mixture approved by SDDENR, the local conservation district, BLM, and landowners. SDDENR would determine when final revegetation is complete and when the conditions for bond release have been met.

4.14.2 No-Action (Alternative 2)

Under the No-Action alternative, there will be no waste generated from the proposed action. There will be neither deep Class V well injection nor land application of liquid wastes and no disposal of byproduct material, hazardous wastes, or nonhazardous solid wastes. Therefore, there will be no impact on waste management from implementing this alternative.

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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 Supplemental Environmental Impact Statement (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; *in-situ* uranium recovery (ISR) operations; conventional uranium mining; wind farms; transportation projects, 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 U.S. 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.

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

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 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

Existing and potential 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 existing and potential 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

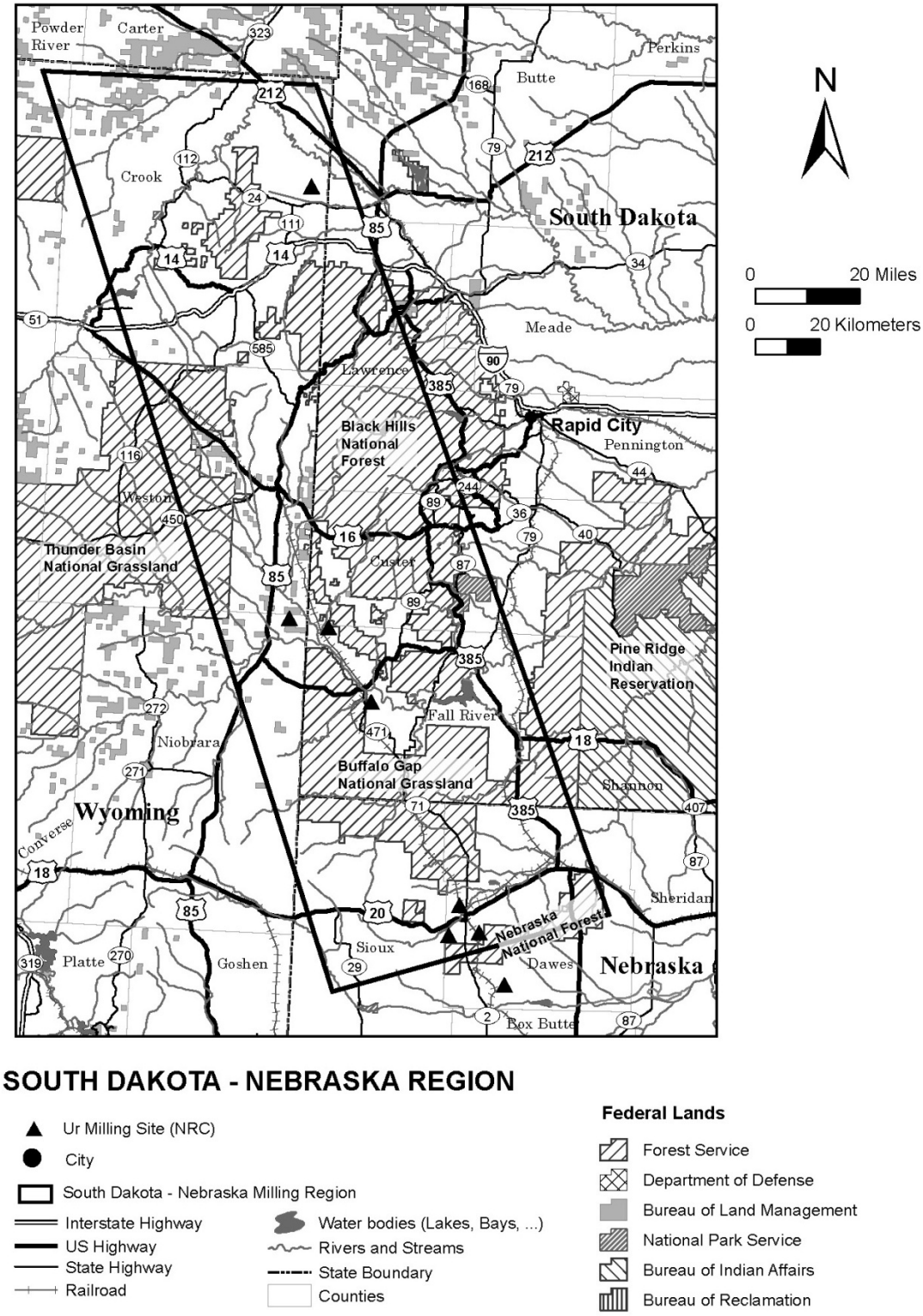
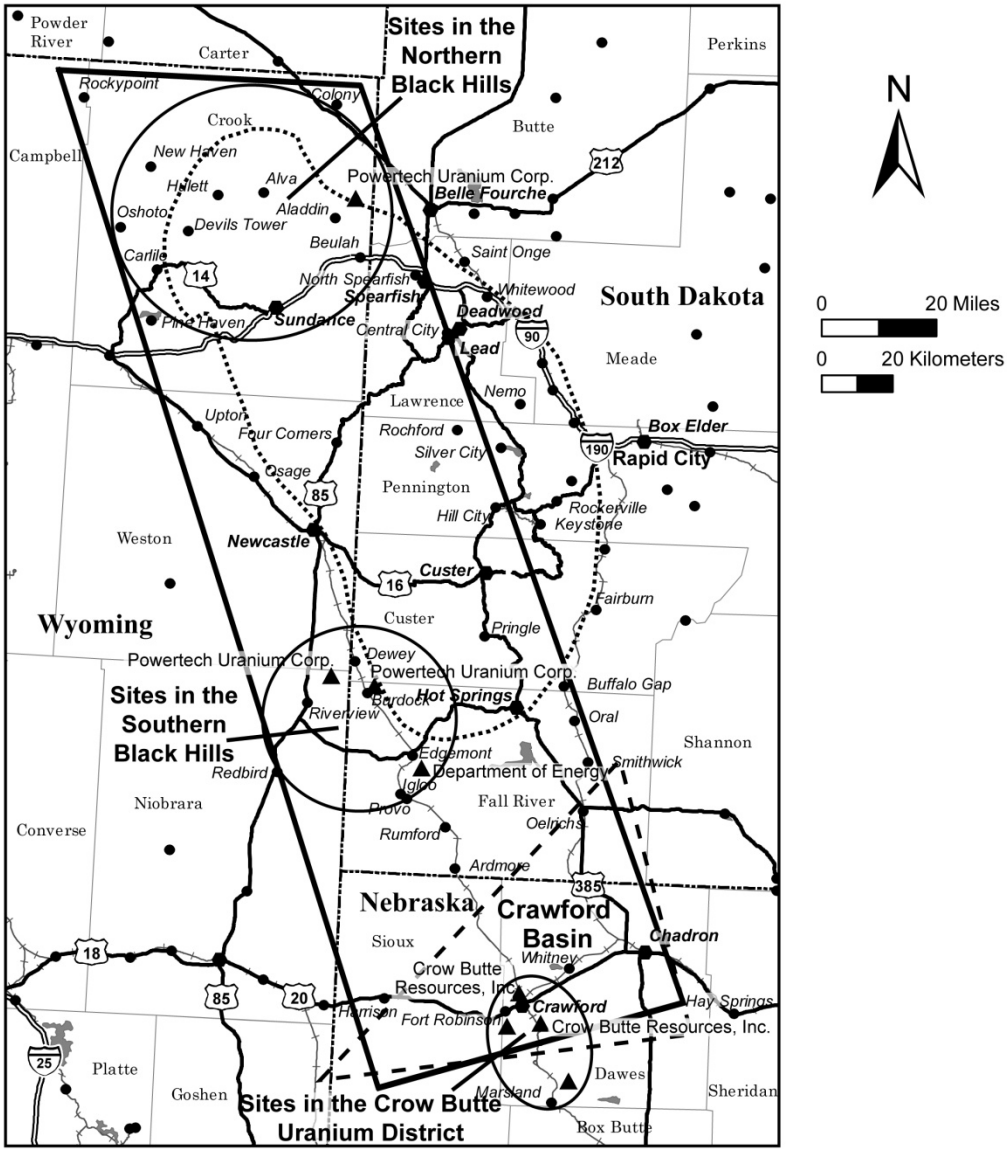


Figure 5.1-1. Nebraska-South Dakota-Wyoming Uranium Milling Region General Map With Current (Crow Butte, Nebraska) and Potential Future Uranium Milling Site Locations
Source: Modified From NRC (2009a)



SOUTH DAKOTA - NEBRASKA REGION

- ▲ Ur milling Sites (NRC)
- South Dakota - Nebraska Milling Region
- Outline of Black Hills
- Basin outline
- Interstate Highway
- US Highway
- Water bodies (Lakes, Bays, ...)
- State Boundary
- Counties
- Railroad

Cities by Populatioin

- Over 50,000
- 10,001 - 50,000
- 1,000 - 10,000
- Less than 1,000

Figure 5.1-2. Map Showing the Nebraska-South Dakota-Wyoming Uranium Milling Region and Existing and Potential 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.)	*In-situ* uranium recovery (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	U.S. Department of Energy (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 Title II sites are uranium mill processing or tailings sites that have been decommissioned. The DOE is the long-term custodian of these sites.

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. 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

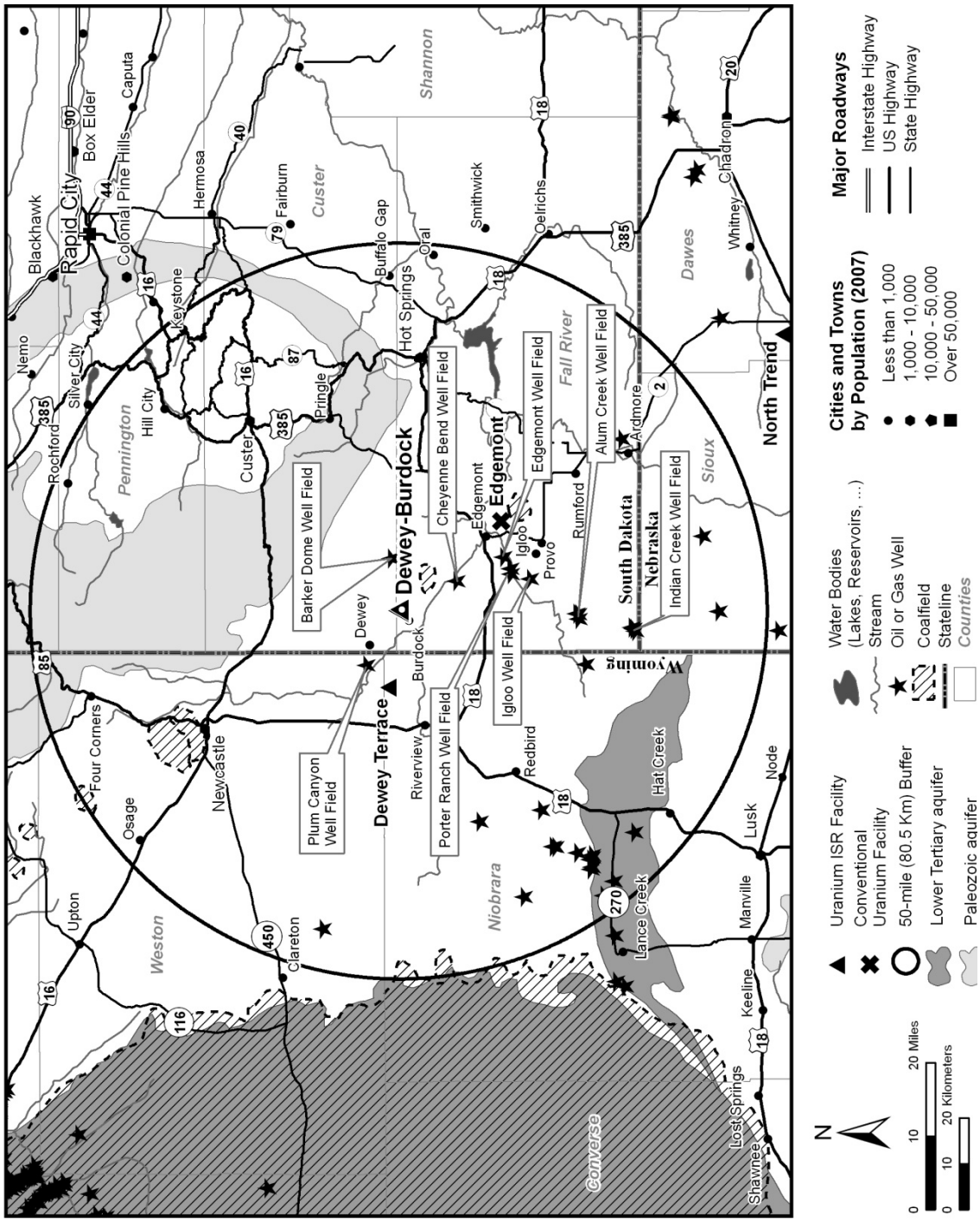


Figure 5.1-3. Oilfields, Coalfields, and Uranium Occurrences Near the Proposed Dewey-Burdock *In-Situ* Recovery Project
Sources: ESRI (2008); National Atlas of the United States (2009); WYOGCC (2012); NOGCC

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 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 has a reported total depth of 588 m [1,928 ft] but a completion depth of 415 to 418 m [1,363 to 1.370 ft], which also targets the Minnelusa Formation (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 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 3.2-5). 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, 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.

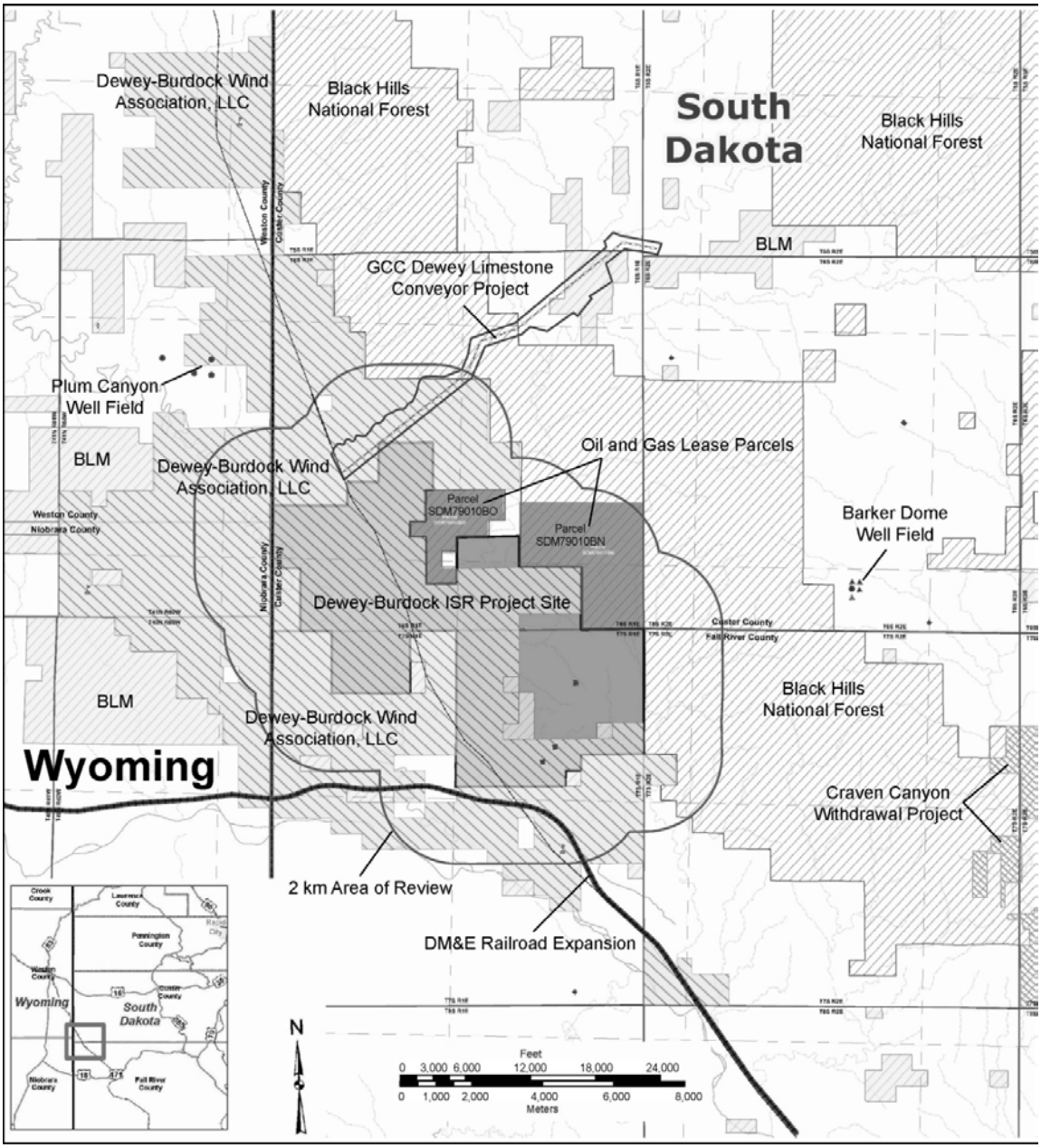


Figure 5.1-4. Existing, Pending, and Future Projects Within and in the Vicinity of the Proposed Dewey-Burdock *In-Situ* Recovery Project
Source: Modified from Powertech (2010)

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				

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

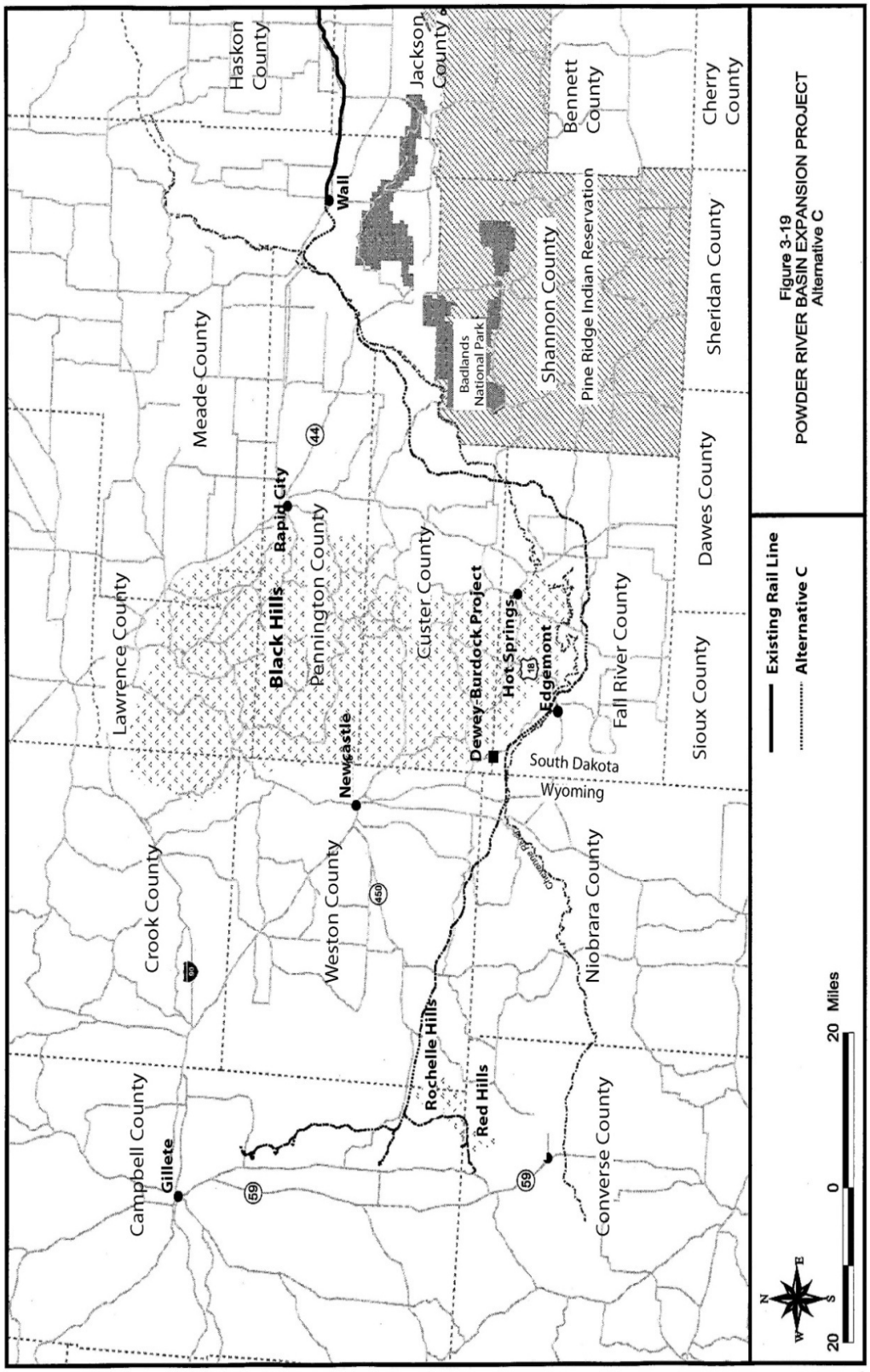


Figure 5.1-5. Map Showing Proposed New Rail Construction (Alternative C) for Dakota Minnesota and Eastern Railroad Powder River Basin Expansion Project From Wall, South Dakota, West Into the Powder River Basin of Wyoming
Source: Modified from STB (2001)

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, 2005), 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 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).

Table 5.1-4. Draft and Final National Environmental Policy Act Documents Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region

November 19, 2001	Surface Transportation Board (STB), Final Environmental Impact Statement (EIS), Dakota, Minnesota and Eastern Railroad Corporation Powder River Basin Expansion Project
June 2005	U.S. Bureau of Land Management (BLM), Final Programmatic EIS on Wind Energy Development on BLM-Administered Lands in the Western United States
June 3, 2005	U.S. Forest Service (USFS), Final EIS, Dean Project Area, Proposal To Implement Multiple Resource Management Actions, Black Hills National Forest (BHNF), Bearlodge Ranger District, Sundance, Crook County, Wyoming (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, South Dakota (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, South Dakota (resource management)
November 20, 2005	USFS, Final EIS, Deerfield Project Area, Proposal To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, South Dakota (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, South Dakota (resource management)
October 31, 2005	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, South Dakoa; Crook and Weston Counties, Wyoming (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, Nebraska, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, South Dakota (resource management—prairie dog)
May 12, 2006	USFS, Final SEIS, Dean Project Area, Proposal To Implement Multiple Resource Management Actions, New Information To Disclose Direct, Indirect, and Cumulative Environmental Impacts, BHNF, Bearlodge Ranger District, Sundance, Crook County, Wyoming (resource management)
June 1, 2007	USFS, Final EIS, Norwood Project, Proposal To Implement Multiple Resources Management Actions, BHNF, Hell Canyon Ranger District, Pennington County, South Dakota, and Weston, Crook Counties, Wyoming (resource management)

Table 5.1-4. Draft and Final National Environmental Policy Act Documents Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region (Cont'd)

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, Nebraska, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, South Dakota (resource management—prairie dog)
June 29, 2007	USFS, Final EIS, Mitchell Project Area, Proposal To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, South Dakota (resource management)
September 14, 2007	USFS, Final EIS, Citadel Project Area, Proposal To Implement Multiple Resource Management Actions, Northern Hills Ranger District, BHNF, Lawrence County, South Dakota (resource management)
February 22, 2008	USFS, Draft EIS, Upper Spring Creek Project, Proposal To Implement Multiple Resource Management Actions, Mystic Ranger District, BHNF, Pennington County, South Dakota (resource management)
January 2009	USFS/BLM, Draft EIS, Dewey Conveyor Project, Whether or Not to Issue Special Use Permit For 6.6 Mile Conveyor Along Dewey Road and Limestone Claims Northeast of Dewey, Custer County, South Dakota
May 7, 2010	USFS, Final EIS and Record of Decision, Black Hills National Forest Travel Management Plan, To Designate a Motorized Travel System, Lawrence, Meade, Pennington, Custer, and Fall River Counties, South Dakota; and Crook and Weston Counties, Wyoming
January 27, 2012	USFS, Final EA and Decision Notice/Finding of No Significant Impact, Southern Black Hills Water System Argyle Road Service Area Special Use Permit, Approve Occupancy of National Forest System Lands by Proponent to Provide Potable Water to Customers Along Arygle Road, BHNF Custer County, South Dakota
December 10, 2012	USFS, Final EIS and Record of Decision, Mountain Pine Beetle Response Project, Black Hills National Forest, To Implement Multiple Resource Management Actions to Reduce Threat to Ecosystem Components, Including Forest Resources, from the Existing Insect and Disease (Mountain Pine Beetle) Epidemic and Help Protect Local Communities and Resources from Large Scale, Severe Wildfire, Lawrence, Meade, Pennington, Custer, and Fall River Counties, South Dakota; and Crook and Weston Counties, Wyoming (resource management)

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 incremental impact when added to the MODERATE cumulative impacts to transportation.

Table 5.1-5. Cumulative Impacts on Environmental Resources (Cont'd)

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

Table 5.1-5. Cumulative Impacts on Environmental Resources (Cont'd)

Resource Category	Cumulative Impacts	Comment
Historic and Cultural Resources	MODERATE to LARGE	The proposed project will have a SMALL to LARGE incremental impact on historic and cultural resources when added to the MODERATE to LARGE cumulative impacts.
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 4.8 km [3 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 PRB, 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, and oil and gas production activities (BLM, 2005).

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, 2005).

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 the principal access road to the Dewey-Burdock site (Dewey Road) and heavily traveled regional and local highways will be SMALL during all phases of the proposed Dewey-Burdock ISR Project. As described in SEIS

Section 4.3.1, daily traffic on Dewey Road will increase by 42 percent during the construction phase and by 24 percent during the operations phase of the proposed project. The increase in traffic will incrementally accelerate the degradation of the road surface, increase fugitive dust emissions, and increase the potential for traffic accidents and wildlife or livestock kills. 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-MWcapacity 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 but will involve a much smaller workforce. Heavy equipment will be required for dismantling turbines and towers, breaking up tower foundations, and regrading and recontouring the site. (BLM, 2005)

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 operations 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 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

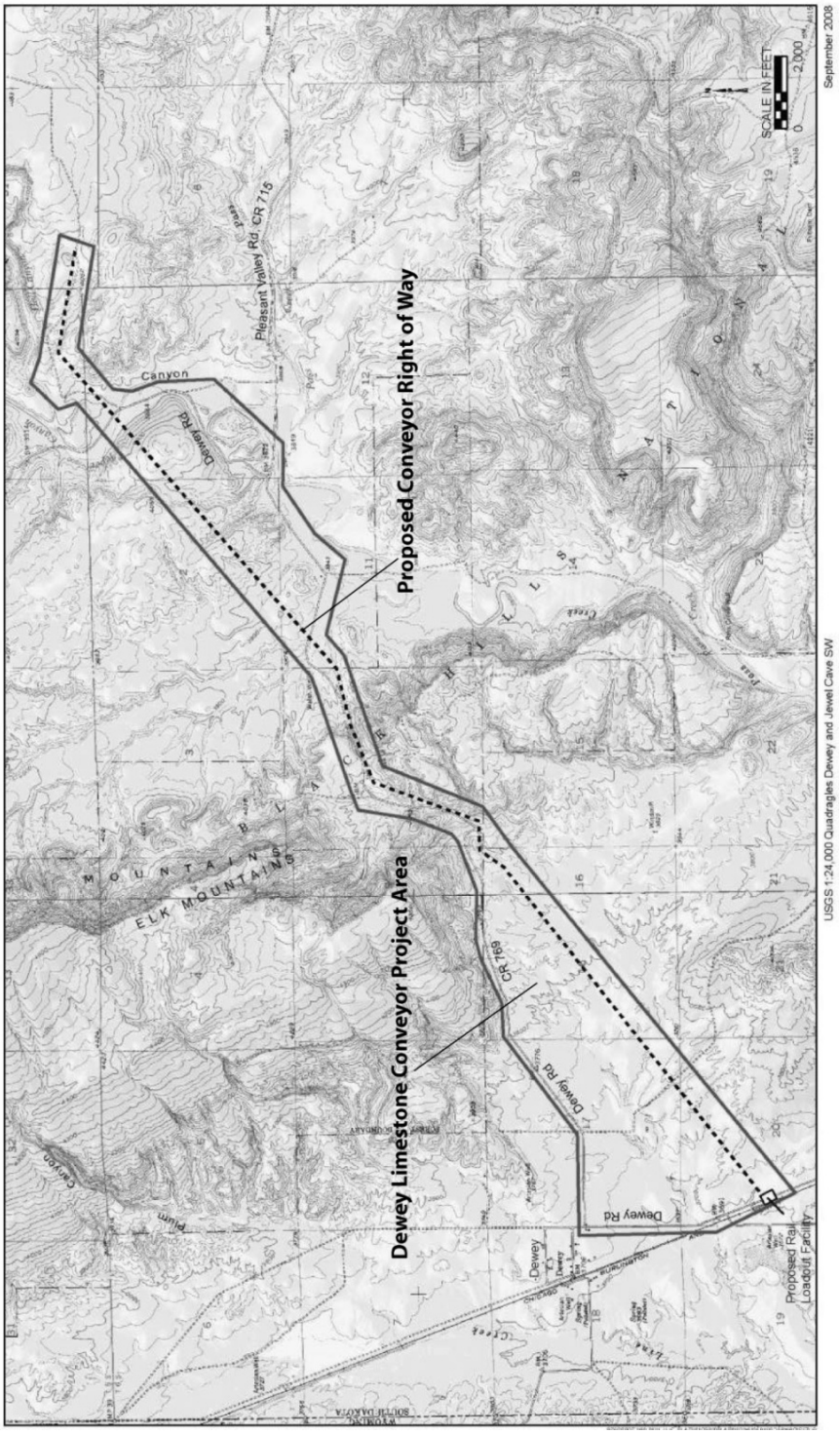


Figure 5.3-1. Map Showing Location of Dewey Road and Pass Creek in Relation to the Proposed Dewey Conveyor Project Source: Modified From BLM (2009a)

Dewey-Burdock ISR Project will have a SMALL impact. Because regional and local roadways have sufficient capacity to accommodate traffic associated with the proposed project, the proposed Dewey-Burdock ISR 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 an increase in daily traffic of 42 percent over current levels during the

construction phase and a 24 percent 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 SMALL 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. A numerical groundwater model developed by the applicant using site-specific geologic and hydrologic information suggested that leakage through the Fuson Shale is caused by improperly installed wells or improperly abandoned exploration holes completed in the Fall River and Lakota Formations (Petrotek, 2012).

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, 2005)

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. The U.S. Environmental Protection Agency (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 stormwater 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 stormwater 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). Water within the Beaver Creek watershed and Pass Creek watershed flows south into the Cheyenne River. The Cheyenne River empties into the Angostura Reservoir east of the proposed Dewey-Burdock ISR Project site. 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 would 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 would also be subject to mitigation through BMPs, required NPDES stormwater 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 SDDENR 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 stormwater 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 stormwater 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 stormwater 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 stormwater management plans to ensure compliance with applicable regulations and prevent offsite migration of contaminated stormwater or increased soil erosion. (BLM, 2005)

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 stormwater 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 stormwater NPDES permit from SDDENR. The NPDES permit will include plans and programs for spill prevention and cleanup, erosion mitigation, and stormwater 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 orebodies 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 wellfields 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 has begun 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 (USDA, 2012). 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 proposed Dewey-Burdock ISR Project is not expected to impact the Southern Black Hills Water System project because the pipeline and Madison aquifer well are upgradient of the proposed Dewey-Burdock site.

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. In some locations, these confining layers may be absent or provide ineffective confinement; this could enhance the hydraulic connection between the Minnelusa aquifer and the underlying Madison aquifer (Naus, et al., 2001). However, SDDENR concluded based on water levels in Minnelusa and Madison observation wells in the area that there is a significant difference in the potentiometric surfaces of the two aquifers, which suggests that the aquifers are hydraulically separated in the vicinity of the proposed project area (SDDENR, 2012c). Further, the UIC permit will not allow injection into the Class V deep disposal wells unless the permittee demonstrates the well 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 USFS-managed J.H. Keith Cascade Springs aquatic recreational area where Cascade Springs is located is 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). As described in SEIS Section 3.5.3.1, regional groundwater flow moves outward radially from the Black Hills, which results in a northeast to southwest regional flow direction in the vicinity of the proposed project site. Because the J.H. Keith Cascade Springs recreational area is located 40 km [25 mi] from the project site and is upgradient of the proposed project site with respect to regional groundwater flow, it is expected that estimated withdrawals of water from the Madison aquifer for operations and aquifer restoration and potential disposal of liquid wastes via deep Class V injection wells into the Minnelusa will have no impact on groundwater quantity and quality at Cascade Springs. The applicant's excursion monitoring program will ensure the protection of water quality in aquifers underlying production zone aquifers.

The former Black Hills Army Depot (BHAD) is approximately 14 miles south of the Dewey-Burdock ISR Project. The BHAD was established in 1942 and remained in continuous operation until 1967. It consisted of approximately 8,537 ha (21,095 ac) and was used to store, maintain, demilitarize, and issue conventional and chemical munitions. Three areas are associated with chemical munitions and chemical agent disposal: BG-1, BG-2, and the

Chemical Plant Area (USACE, 2012). The most likely mechanism by which the Dewey-Burdock ISR Project could affect contaminant migration at the former BHAD is by changing the groundwater gradients of the Inyan Kara aquifers during pumping to redirect groundwater toward the Dewey-Burdock ISR Project. However, the Inyan Kara aquifers must first be contaminated with constituents from the former depot in order for such a change in groundwater gradients to be of any consequence. In 2012, USACE reported that chlorinated solvents and fuel residues were discovered in shallow groundwater samples from the BHAD; however, no groundwater contamination was discovered in the BG-1 and BG-2 areas (USACE, 2012).

According to USACE, the Fall River aquifer is approximately 335 m (1,100 ft) deep at the former BHAD and is overlain by thick sequences of shales (USACE, 1992). Any surface contamination would be unlikely to penetrate such a thick shale sequence and contaminate the Fall River. Furthermore, the Fall River aquifer is artesian in this area (USACE, 1992). Therefore, if the overlying shales were perforated, water would move upward toward the ground surface, essentially preventing contamination from migrating downward into the aquifer. Considering the isolated nature of the Inyan Kara aquifers and the lack of significant groundwater contamination at the site, the NRC staff conclude that proposed operations at the Dewey-Burdock ISR Project will have no impact on site conditions at the former BHAD.

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 would 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 Formation at depths ranging from 415 to 1,081 m [1,363 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 for 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 use BMPs to mitigate impacts to both groundwater and surface water. Once a wind energy project is operating, minimal quantities of water are needed. (BLM, 2005)

Groundwater for the Dewey 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, 2005, 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 Game, Fish, and Parks (SDGFP), there are no crucial big game habitats or migration corridors in the ecological resources study. However, the area does provide 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; see SEIS Section 5.1.1) 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 and bat collisions, particularly in bird migration routes. BLM reported that the number of bird and bat collisions at wind energy projects is generally relatively small, when compared with collisions from other human-made structures (BLM, 2005).

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 concludes 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 ensure observed impacts to soils and vegetation that could adversely affect flora and fauna are addressed. 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

As described in SEIS Sections 4.6.1.1, 4.6.1.2 and 4.6.1.3, because of the limited and ephemeral nature of surface water at the proposed Dewey-Burdock Project, the occurrence of aquatic species is also limited. 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 stormwater 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 described in SEIS Section 5.1.1 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 Sections 4.6.1.1.1.1.4 and 4.6.1.2.1, 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 from the proposed project are unlikely because whooping cranes are not known to breed in South Dakota; however, cumulative impacts from oil and gas exploration and development, other ISR activities, wind energy projects, and transportation projects described in SEIS Section 5.1.1 could distress migrating cranes.

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).

Not including federally listed species, 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. Cumulative impacts to federally listed species would be SMALL. This finding is based on habitat disturbance to potential non-federal protected species resulting from actions described in SEIS Section 5.1.1 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, sulfur dioxide (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 National Ambient Air Quality Standards (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 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 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. Since 2007, 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 National 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 Resources 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 eastern Wyoming and southwestern 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, 2005). 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, 2005).

The proposed Dewey 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 most 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 other 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.

Cumulative impacts on air quality include the incremental effects from the proposed Dewey-Burdock ISR Project when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. The NRC staff conclude in SEIS Section 4.7.1 that the proposed Dewey-Burdock ISR Project will have a SMALL to MODERATE effect on air quality. As stated in the preceding paragraph, NRC staff find that the impact on air quality within the study area resulting from other past, present, and reasonably foreseeable future actions is MODERATE. When combining the Dewey-Burdock impacts with all other impacts from other past, present, and reasonably foreseeable future actions in the study area, NRC staff conclude that the overall cumulative impact would be MODERATE. Comparing the total pollutant concentration (i.e., the modeling results for the project emissions when added to the background concentration levels) to the NAAQS is useful in making a cumulative impacts assessment. For the final AERMOD modeling run, the peak year total concentration for all of the pollutants are below the NAAQS. Due to short-term PM_{10} fugitive emissions, which are primarily generated from travel on unpaved roads, the proposed project impacts are considered MODERATE at times. However, the modeling shows that this impact is limited to the immediate vicinity where the fugitive emissions are generated. For the visibility analysis, the peak year project-specific results were below the contribution threshold, which indicates whether a source can be reasonably anticipated to cause or contribute to visibility impairment. For the acid

deposition analysis, combining the peak year project-specific modeling results with the measured values at Wind Cave National Park, and comparing these to the critical load, provides another type of cumulative impacts assessment. All of the combined acid deposition results are below the critical load.

For information purposes, NRC staff has also presented the impact analyses using the PM_{10} modeling results that do not implement the AERMOD dry depletion option (i.e., the initial modeling run) and the staff has included the PM_{10} emissions in the CALPUFF visibility analysis. The NRC staff conclude in SEIS Section 4.7.1 that for analysis under these modeling assumptions and without additional considerations, the proposed Dewey-Burdock ISR Project will have a LARGE effect on air quality. As stated preveiously, NRC staff determined that the impact on air quality within the study area resulting from other past, present, and reasonably foreseeable future actions is MODERATE. When combining the Dewey-Burdock impacts with all other impacts from other past, present, and reasonably foreseeable future actions in the study area, NRC staff conclude that the overall cumulative impact will be LARGE.

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 more fully developed 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 4.7.1.1.2, the operation phase emissions bound the other phases in terms of carbon dioxide levels generated. However, the peak year carbon dioxide annual emission estimate (when all four phases occur simultaneously) of 38,621 metric tons [42,572 short tons] represents the highest amount of emissions the proposed action will generate in any one project year (see Table 2.1-6). Electrical consumption is the source that generates the most emissions followed by mobile sources and then the stationary sources. The mobile sources include equipment associated with the drilling activity with the primary contributor being the drill rig (IML, 2013). 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 peak year emission estimate of 38,621 metric tons [42,572 short tons] equates to less than 1 percent (0.11 percent) of 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 the U.S. Global Change Research Program (GCRP) served as a source for climate change information (GCRP, 2009). From 1993 to 2008, the average temperature in the Great Plains increased by approximately 0.83 °C [1.5 °F] compared to the 1961 to 1979 baseline. South Dakota and the proposed Dewey-Burdock site are considered part of the Great Plains in this study. From 2010 to 2029, the average temperature in the Great Plains is projected to increase approximately 1.7 °C [3 °F] relative to the 1961 to 1979 baseline. 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 project lifespan 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 the future. This could affect the proposed project by increasing the volume of groundwater in the orebody 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] west 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 (e.g., 1 to 2 years) 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, 2005)

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 PRB 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 PRB 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, 2005). 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, 2005).

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, archaeological field investigations identified 18 historic sites within the proposed project area that are listed in the National Register of Historic Places (NRHP) or are eligible for listing in the NRHP. As further described in SEIS Section 4.9.1, tribal cultural surveys recommended 17 known archaeological sites and 12 newly discovered cultural sites as eligible for listing in the NRHP. Mitigation measures that will be implemented to protect NRHP-eligible sites are described in SEIS Section 4.9.1.

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 sites described in SEIS Section 4.9.1 cannot be avoided, then treatment plans will require that the applicant complete mitigation prior to construction. Treatment plans will be established following the development of an agreement between the applicant, NRC, South Dakota State Historic Preservation Office (SD SHPO), interested federal and state agencies (e.g., BLM and EPA), and interested Native American tribes. As described in SEIS Section 4.9.1, if historical or cultural resources are encountered during ISR activities, the applicant is required by license condition to stop work (NRC, 2013; License Condition 9.8). The discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Work will not restart without authorization from the NRC, SD SHPO, and BLM to proceed.

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 5.1-4). 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, 2005)

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 a 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, archaeological field investigations identified 18 historic sites listed on or recommended as eligible for listing in the NRHP within the proposed Dewey-Burdock project area. In addition, tribal cultural surveys recommended 17 known archaeological sites and 12 newly discovered cultural sites as eligible for listing in the NRHP. 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, 2005)

The proposed 10.6-km [6.6-mi]-long Dewey 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, 2005). 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 Project 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. Contributions from the Dewey-Burdock ISR Project are expected to have a SMALL to MODERATE 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, local finance, and education will be SMALL to MODERATE, while impacts to employment and public services 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 includes ranching, government, tourism, 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 licensing 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, each 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 OSHA. 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, 2005, 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 solid 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.

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11. ABSTRACT (200 words or less)

By letter dated August 10, 2009, Powertech (USA), Inc. (Powertech, the applicant) submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Dewey-Burdock in-situ recovery (ISR) Project. Powertech is proposing to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the Dewey-Burdock ISR Project site, located in Fall River and Custer Counties, South Dakota. The NRC staff evaluated site-specific data and information to assess whether the applicant-proposed activities were consistent with activities considered in NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (GEIS) and determined which GEIS data and analyses could be incorporated by reference and what resource areas required site-specific review. The final SEIS describes the environment potentially affected by the proposed site activities, describes the potential environmental impacts, and describes Powertech's environmental monitoring program and proposed mitigation measures. The NRC staff has reviewed and considered comments received on the draft SEIS when developing the final SEIS. Comments received on the draft SEIS and associated responses can be found in Appendix E.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

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