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 a groundwater discharge permit (GDP) from the South Dakota Department of Environmental and Natural Resources (SDDENR). 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 would 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 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.

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 would 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 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,

Table 4.2-1. Breakdown of Land Disturbance for the Class V Injection Well and Land Application Disposal Options at the Proposed Dewey-Burdock ISR 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)

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 Deweysatellite 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 is 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) would 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 Games 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 wellfileld, 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 pump 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 the NRC-approved decommissioning plan for 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 preextraction condition and available for its preextraction use of 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 or decontaminated in place. 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 preextraction land use of livestock grazing and wildlife habitat, unless the state and the landowner justify or approve an alternative use (e.g., landowners would 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 cannot be 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 would 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 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 preextraction 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 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.

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 ISR 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.

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 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 farther 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 livestock kills are discussed as potential ecological impacts 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 cannot be 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 exceeds the construction traffic evaluated in GEIS Section 2.8; however, the difference is small, an increase of approximately 7 percent. Commuting workers constitute the majority of road traffic the applicant proposed for the construction phase. The applicant estimated a number of commuting workers that was similar to the upper value considered in the GEIS (205 workers for the proposed project compared to 200 workers 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 notably increase the existing traffic on low-traffic roads, such as unpaved Dewey Road (Fall River County Road 6463 and Custer County Road 769), State Highway 89, and U.S. Highway 18 traveling from Edgemont, but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 near Hot Springs or State Highway 79 at the junction with State Highway 18. The projected daily traffic on Dewey Road, the road nearest the proposed site, represents an increase of about 16 times the existing low level of traffic. State Highway 89 traffic was projected to increase by 68 percent if all workers commuted on 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. 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 here relative to other routes. While the projected increase in traffic on some road segments is a

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

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	25	25	—	435	18	1640	—
US 18 (Edgemont to US 89)	1,782	1,361	421	1,771	439	30	4
US 18 (Hot Springs to SR 79)	5,075	4,725	350	5,135	368	9	5
SR 89 (US 385 to US 18)	659	604	55	1,014	73	68	33
SR 79 (at US18)	3,172	2,569	603	2,979	621	16	3

Sources: BLM (2009); SDDOT(2011)
*Traffic counts are annual average daily traffic for both directions of travel (SEIS Section 3.3). NRC calculated the auto traffic count as the difference between the all vehicle count and reported truck count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2009 (BLM, 2009).
†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 one-way values reported in Table 2.1-7.
‡This analysis assumes all projected traffic would travel on each road. If proposed action traffic used multiple routes then this analysis overestimates impacts to each road segment.

notable 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 453 to 5,503 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., 2,752 vehicles per day for the U.S. Highway 18 total of 5,503 (2,752 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 significant increase in traffic volumes to the local and unpaved Dewey Road will result in MODERATE impacts under the Class V injection well disposal option. The staff concludes there will be a significant increase in existing traffic on Dewey Road. This increase in traffic would 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 that was within the range considered in the GEIS (60 employees for the proposed project compared to 20 to 200 workers 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. Estimated Daily Traffic on Regional Roads for the Operations Phase of the Proposed Dewey-Burdock ISR Project

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	25	25	—	145	4	480	—
US 18 (Edgemont to US 89)	1,782	1,361	421	1,481	423	9	<1
US 18 (Hot Springs to SR 79)	5,075	4,725	350	4,845	352	2	1
SR 89 (US 385 to US 18)	659	604	55	724	57	20	4
SR 79 (at US18)	3,172	2,569	603	2,689	605	5	<1

Sources: BLM (2009); SDDOT(2011)
*Traffic counts are annual average daily traffic for both directions of travel (SEIS Section 3.3). NRC calculated the auto traffic count as the difference between the all vehicle count and reported truck count. Data for all roads are for year 2011 and are from SDDOT (2011) except the Dewey count is from 2009 (BLM, 2009).
†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 one-way values reported in Table 2.1-7.
‡This analysis assumes all projected traffic would travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

Table 4.3-2, the proposed traffic, if allocated completely to the individual road segments, will notably 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 State Highway 18. The projected daily traffic on Dewey Road, the road nearest the proposed site, represents an increase of about five times the existing low level of traffic. State Highway 89 traffic was projected to increase by 20 percent if all workers commuted on 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. While the projected increase in auto traffic on some road segments is a notable change in conditions, the magnitude of the projected operational traffic for all the roads evaluated (ranging from approximately 150 to 5,200 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 significant increase in traffic volumes to the local and unpaved Dewey Road will result in MODERATE impacts under the Class V injection well disposal option. The staff conclude there will be a significant increase in existing traffic on Dewey Road. This increase in traffic would 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 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 would 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 would 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) would 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 occurred, spill response will be handled via emergency response procedures, although a spill of nonradiological materials would 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 significant increase in traffic volumes to the local and unpaved Dewey Road will result in MODERATE impacts from travel on that 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 workers will be 15 (compared to 20 to 200 workers 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 approximately double 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 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

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

Road Segment	Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	25	25	—	55	4	120	—
US 18 (Edgemont to US 89)	1,782	1,361	421	1,391	423	2	<1
US 18 (Hot Springs to SR 79)	5,075	4,725	350	4,755	352	1	1
SR 89 (US 385 to US 18)	659	604	55	634	57	5	4
SR 79 (at US18)	3,172	2,569	603	2,599	605	1	<1

Sources: BLM (2009); SDDOT(2011)
*Traffic counts are annual average daily traffic for both directions of travel (SEIS Section 3.3). NRC calculated the auto traffic count as the difference between the all vehicle count and reported truck count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2009 (BLM, 2009).
†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 one-way values reported in Table 2.1-7.
‡This analysis assumes all projected traffic would travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

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 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 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 approximately double 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 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 4.3-4. Estimated Daily Traffic on Regional Roads for the Decommissioning Phase of the Proposed Dewey-Burdock ISR Project

Road Segment	2011 Traffic Count*			Projected Traffic†		Percent Increase‡	
	All Vehicles	Auto	Truck	Auto	Truck	Auto	Truck
Dewey Road	25	25	—	55	2	120	—
US 18 (Edgemont to US 89)	1,782	1,361	421	1,391	423	2	<1
US 18 (Hot Springs to SR 79)	5,075	4,725	350	4,755	352	1	1
SR 89 (US 385 to US 18)	659	604	55	634	57	5	4
SR 79 (at US18)	3,172	2,569	603	2,599	605	1	<1

Sources: BLM (2009); SDDOT(2011)
*Traffic counts are annual average daily traffic for both directions of travel (SEIS Section 3.3). NRC calculated the auto traffic count as the difference between the all vehicle count and reported truck count. Data for all roads are for year 2011 and are from SDDOT (2011), except the Dewey count is from 2009 (BLM, 2009).
†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 one-way values reported in Table 2.1-7.
‡This analysis assumes all projected traffic would travel on each road. If proposed action traffic used multiple routes, then this analysis overestimates impacts to each road segment.

(Table 2.1-7) (approximately 31 annually for the Class V injection well option compared to 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 would 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 cannot be 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 notably increase the existing traffic on low-traffic roads,

such as Dewey Road, State Highway 89, and U.S. Highway 18 traveling through Edgemont, but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 near Hot Springs or State Highway 79 at the junction with State 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 453 to 5,503 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 significant increase in traffic volumes to the local and unpaved Dewey Road will result in MODERATE impacts under the land application disposal option. The projected daily traffic on Dewey Road represents an increase of about 16 times the existing low level of traffic (see Table 4.3-1). This increase in traffic would 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 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 notably increase the existing traffic on low-traffic roads, such as Dewey Road, State Highway 89, and U.S. Highway 18 traveling through Edgemont, but will not substantially increase traffic on more heavily traveled road segments, such as U.S. Highway 18 near Hot Springs or State Highway 79 at the junction with State 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 150 to 5,200 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 significant increase in traffic volumes to the local and unpaved Dewey Road will result in MODERATE impacts under the land application disposal option. The projected daily traffic on Dewey Road represents an increase of about five times the existing low level of traffic (see Table 4.3-2). This increase in traffic would 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 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 significant increase in traffic volumes to the local and unpaved Dewey Road will result in MODERATE 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 approximately double 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 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 approximately double 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

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

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
Construction	MODERATE	MODERATE	MODERATE
Operations	MODERATE	MODERATE	MODERATE
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.

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).

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 (months) 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 pores in 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 establish immediate spill responses through 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)

<u>GEIS Aquifer Restoration Phase Summary</u>

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 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). The applicant estimates that 5.3 ha [13 ac] of topsoil will be stripped and removed during the life of the project (Powertech, 2009b). The area of topsoil disturbance will be small (approximately 5 percent of the area) when compared to the applicant's estimated land disturbance of approximately 98 ha [243 ac] for the Class V deep well injection option and approximately 566 ha [1,398 ac] for the land application option to dispose of treated wastewater generated by the proposed project (see Table 2.4-1).

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 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 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 potential 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. Construction activities at the proposed Dewey-Burdock site have the potential to compact soils. Compaction of soils could lead to decreased infiltration and increased 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 would 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 or structure 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.

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 concentrations below hazardous levels and radioactive waste thresholds 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 EPA UIC permit will require liquid wastes to be treated to meet drinking water standards. 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 21.1 to 56.3 kg/cm^2 [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 or structure, 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 will require liquid wastes to be treated prior to deep well injection to meet NRC release limit criteria contained in 10 CFR Part 20, Subparts D and K, and Appendix B or drinking water standards if the injection zones are underground source of drinking water. 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 would 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 would 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 or structure (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 of 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 cannot be 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 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 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 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, would be abandoned in place according to SDDENR regulations established in Administrative Rules of South Dakota (ARSD) 74:11:08 (Powertech, 2009a). 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 ditch 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 ditches 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 would disperse soil particles, making 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. As stated in SEIS Section 2.1.1.1.6.2, land application will be carried out under a GDP through 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. 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 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 would 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.

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 ISR 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.

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

GEIS Construction Phase Summary

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 also include accidental spills or leaks of fuels and lubricants from construction equipment and 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 during operation activities may also involve accidental spills or leaks of process-related water and the

discharge of storm water runoff and process-related water. The impact from spills on surface waters 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 surficial aquifer discharge to the surface waters. NRC staff noted in the GEIS that during operational activities, federal and state agencies regulate the discharge of storm water 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 during operations will be SMALL to MODERATE. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

NRC staff noted in the GEIS impacts to surface waters during the aquifer restoration phase may result from (i) produced water, (ii) storm water 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, storm water 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 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. 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 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 intermittent 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 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 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 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 found it to be limited in area and quantity; Pass Creek and the tributaries to both Pass Creek and Beaver Creek are intermittent 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 storm water 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 that can enter surface water bodies, such as streams 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 facilities 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 are 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

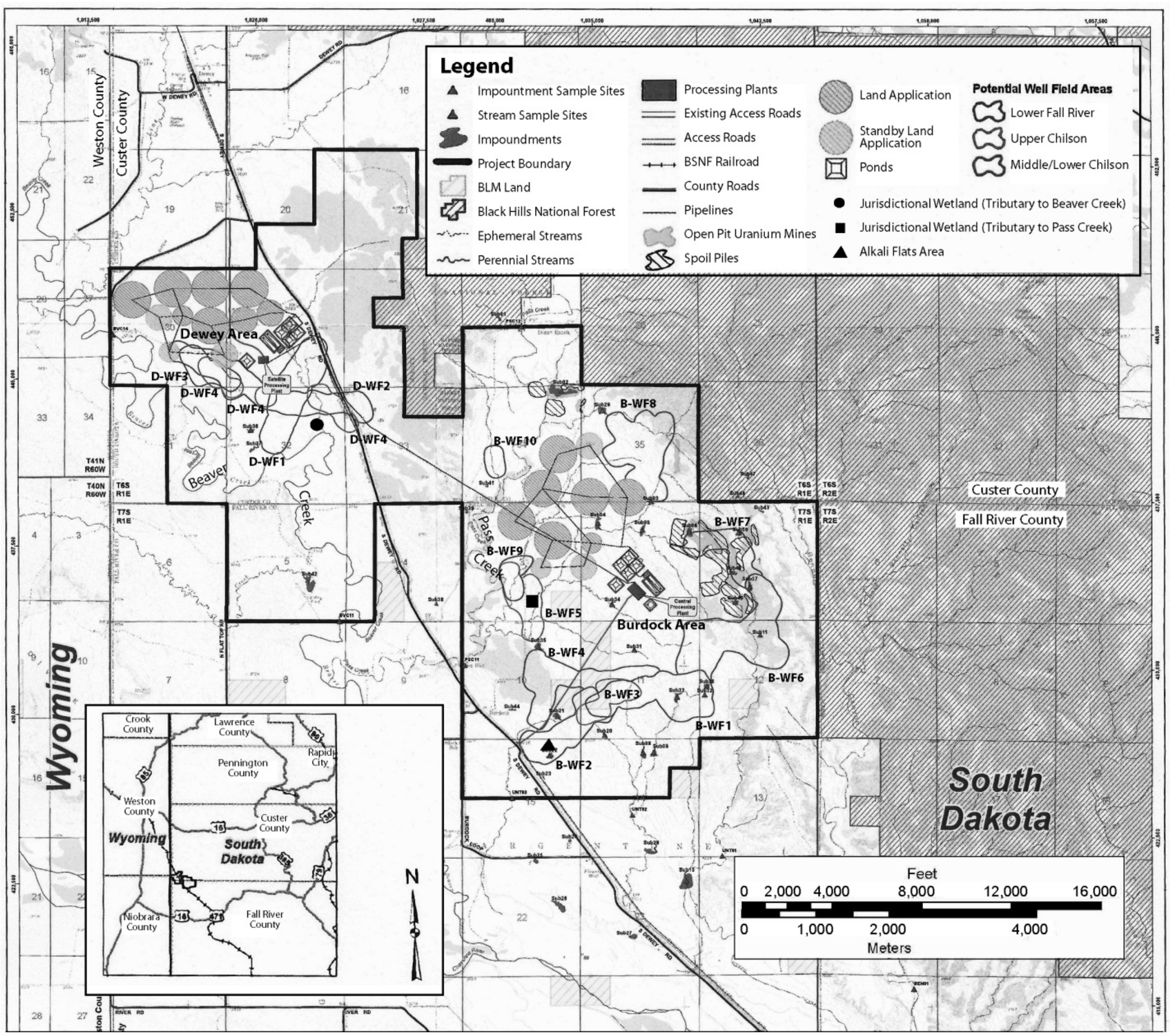

Figure 4.5-1. Map Showing Locations Identified as Jurisdictional Wetlands on Ephemeral Tributaries to Beaver Creek (Black Circle) and Pass Creek (Black Square) and Their Relation to Proposed Site Facilities in the Proposed Dewey-Burdock ISR Project Area.
Source: Modified From Powertech (2011).

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 that are located within the 100-year inundation boundary from flood damage, the applicant proposes a system of structures, such as straw bales, collector ditches, and engineered diversion structures or berms (Powertech, 2011).

Other applicant-proposed measures to protect against flooding 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 waters of the United States (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).

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 storm water pollution management plan (SWMP) to control storm water runoff during construction and to ensure that surface water runoff from disturbed areas will not contaminate surface waters (Powertech, 2009a). SWMP control measures will (i) minimize disturbance of surface areas, drainage channels, and vegetation; (ii) employ grading to direct 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, 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 during ISR operations in conjunction with the deep well disposal of liquid wastes option. The staff evaluated the occurrence of surface water 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 intermittent 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 that could be impacted by the discharging groundwater. 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 any boreholes that will potentially affect surface waters during ISR operations (Powertech, 2011).

The Class V injection well injection 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 when 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 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 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 runoff for these facilities and to ensure that runoff does not contaminate surface waters (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 storm water contamination. 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 reverse osmosis (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 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 to preoperational 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, runoff, and sedimentation during decommissioning activities. The applicant's NPDES permit requirements will ensure that 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 cannot be 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 from construction of Class V deep injection wells, would 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 existing soil after it has been prepared to grow crops, such as alfalfa and corns, to reduce the possibility of undesirable plant species. 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, 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

Runoff from land irrigation areas and their potential discharge into surface waters would be the primary differences in surface water 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 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. 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 will not contaminate surface water bodies. 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 a GDP and to comply with applicable state discharge requirements for land application of treated wastewater. The GDP includes regulations requiring no surface runoff from permitted land application areas to ensure that any pollutants originating from the land application areas are contained. Therefore, the NRC staff conclude that treated liquid wastes applied to land application areas will contain contaminate 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 a 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 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, 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 due to erosion and surface runoff over land application sites will be eliminated. Therefore, the resultant environmental impacts to surface water 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) would be constructed, operated, and decommissioned for the combined Class V injection well and land application option. Therefore, potential environmental impacts to surface waters for the combined disposal option would 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 Operation. The central processing plant in the 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 cannot 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, 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)

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 ISR 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

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)

GEIS Operations Phase Summary

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 pumping 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. BMPs will also be in place to prevent surface runoff and erosion. 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 and vertical lixiviant excursions occur beyond the production zone. The production portion of an ore-bearing aquifer would 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 restorations 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).

<u>GEIS Aquifer Restoration Phase Summary</u>

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, 2012).

In the construction phase of the proposed Dewey-Burdock ISR 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 would likely be localized and limited to near-surface aquifers. Near-surface aquifers include unconfined portions of the Fall River aquifer in the northeastern part of the Burdock area where land application of treated wastewater may take place.

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 underground injection control (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 0.8×10^5 m^3 and 1.2×10^5 m^3 [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 estimates consumptive groundwater use during construction to be the same as currently being withdrawn for domestic use and livestock watering from the Inyan Kara Group aquifers within a 2-km [1.2-mi] radius of the site (see SEIS Section 4.5.2.1.1.2.2). The applicant plans to install wells in the deeper Madison aquifer early in the construction phase (Powertech, 2010a). In June 2012, the applicant submitted a water appropriation permit application to use Madison aquifer water (see Table 1.6-1). 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, 2008). 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 0.8×10^5 m^3 and 1.2×10^5 m^3 [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, impacts will be MODERATE if the water appropriation permit is denied, because 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. In this case, it will be necessary to identify an alternative source of water, or reduce pumping rates during construction, to reduce the impacts to shallow local aquifers and domestic and livestock wells from consumptive water uses to 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 and Mowry Shale. Within the project area, the Graneros Group ranges in thickness from 61 to 122 m [200 to 400 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- to 122-m [200- to 400-ft]-thick confining layer composed of the combined Skull Creek Shale and Mowry Shale (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 (Powertech, 2010a).

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)

Based on historical records and field investigations of the proposed project area, a total of 107 producing 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 was 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 producing wells are screened in the following aquifers: Fall River (33 wells), Chilson (41 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). The total

estimated groundwater use from wells placed in the Fall River aquifer is 0.057 m^3/min [15 gpm]. From wells placed in the Chilson aquifer, the total estimated groundwater use is 0.174 m^3/min [46 gpm] (Powertech, 2009a). The total estimated flow from wells placed in the Inyan Kara Group aquifers (Fall River, Chilson, or both) is 0.265 m^3/min [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 drawdown in the Fall River aquifer at the nearest domestic well, located 4,595 m [15,075 ft] from the production well, will range from 3 to 13 m [9.9 to 42.8 ft]; these estimates assume a 1 percent bleed rate over 9 years of ISR production and restoration (Powertech, 2009a, 2011). The estimates are based on aquifer parameters (transmissivity and storativity) obtained from pumping-test analyses conducted by the Tennessee Valley Authority in 1979 and the applicant in 2008 (Powertech, 2009a). Similarly, the applicant estimates that drawdown in the Chilson aquifer at the nearest domestic well, located 3,107 m [10,195 ft] from the production aquifer, will range from 1.5 to 3.8 m [4.9 to 12.6 ft]; these estimates assume a 1 percent bleed rate over 9 years of ISR production and restoration (Powertech, 2009a, 2011). The staff analyzed the hydrogeologic characteristics of the Fall River and Chilson aquifers (i.e., formation thicknesses and potentiometric surfaces) and conclude 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. Drawdowns resulting from higher bleed rates (i.e., bleed rates greater than 1 percent) could result in impacts to water yields and pumping costs in nearby wells used for agricultural, livestock, and domestic use. However, these impacts 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. 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.

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 project boundary 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).

In June 2012, the applicant submitted a water appropriation permit to SDDENR for groundwater use from the Madison aquifer during the operational phase of the proposed project. 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] below ground surface in the Burdock area and approximately 945 m [3,100 ft] below ground surface in the Dewey area (Powertech, 2011, Appendix 2.7–L). Otherwise, the applicant will pump water from the Inyan Kara Group aquifers at an estimated sustainable rate of 0.15 m^3/min [40 gpm] for the life of the project (Powertech, 2010a). However, the applicant noted that water requirements for the Burdock central processing plant will be as high as 0.25 m^3/min [65 gpm] (Powertech, 2009a), which will exceed the estimated sustainable pumping rate of 0.15 m^3/min [40 gpm] (Powertech, 2010a). Therefore, if the applicant cannot secure a water appropriation to use Madison aquifer water during ISR operations, the applicant will have to either identify an alternative source of water to meet the operational water requirements or reduce pumping rates to meet the estimated sustainable pumping rate of 0.15 m^3/min [40 gpm] from the Inyan Kara Group aquifers. Reducing the pumping rate to 0.15 m^3/min [40 gpm] would extend the aquifer restoration process (Powertech, 2010a).

If SDDENR approves the water appropriation permit application, NRC staff conclude that the environmental impacts on local aquifers and domestic and livestock wells from consumptive water use during ISR operations will be SMALL. However, if the water appropriation permit is denied, the impacts will be MODERATE. In this case, identification of an alternative source of groundwater or a reduction in pumping rates to meet operational water requirements will be necessary to reduce the impacts to SMALL. 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 would 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 alternate concentrations limits (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 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 not 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 Shale) at the Dewey-Burdock site has a

thickness of approximately 61 m [200 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 m [200 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 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, TVA drilled several hundred 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 a pathway to aquifers above and below production zone confining units, such as alluvial aquifers above the Graneros Group and deep aquifers below the Morrison Formation. 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 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 subject to change, 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. 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, 2012).

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 Skull Creek Shale 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 Safe Drinking Water Act (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. 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. 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 that the injectate meets drinking water standards. 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). The Englewood Formation underlies the Madison Formation and should provide a confining layer between the Madison Formation and the underlying Deadwood Formation. 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.

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 simultaneously operate one wellfield in restoration for each wellfield in production in each area for the duration of the project.

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 consists of groundwater treatment with reverse osmosis and permeate injection (Powertech, 2009b, 2011). This method uses a reverse osmosis system consisting of pressurized, semipermeable membranes that will treat groundwater removed from the wellfields in the Dewey and Burdock areas. The reverse osmosis system removes more than 90 percent of the total dissolved solids in groundwater being restored. The reverse osmosis 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 reverse osmosis membranes will be recovered as permeate. Before reinjection into the wellfields, the permeate would 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.

Based on the total liquid waste flow rates discussed in the previous paragraph, the flow rates of makeup water needed during concurrent uranium production and aquifer restoration will be approximately 224 Lpm [59 gpm] and approximately 170 Lpm [45 gpm] for aquifer restoration

alone. As described in SEIS Section 4.5.2.1.1.2.2, 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 pumping rate of 0.15 m^3/min [40 gpm] from the Inyan Kara Group aquifers (see SEIS Section 4.5.2.1.1.2.2.). Reducing the pumping rate to 0.15 m^3/min [40 gpm] 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). 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.

Based on aquifer pumping tests and potentiometric surface differences, it is possible that hydraulic connection (leakage) exists between the Fall River and Chilson aquifers through the intervening Fuson Shale in the Burdock area. This has important implications for aquifer restoration at the proposed project. 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 northern and eastern portions of the Burdock area (e.g., Triangle Pit mine) through the Fall River aquifer into the hydraulically connected Chilson aquifer. Although drawdown-induced migration of contaminants may not be a critical issue during ISR operations, it could affect groundwater restoration goals at the proposed wellfields in the Burdock area and threaten groundwater quality outside the exemption boundary. Therefore, if contaminants are drawn into production zones within the Chilson aquifer from abandoned open pit mines through the hydraulically connected Fall River aquifer during aquifer restoration, the impacts will be MODERATE.

NRC requires the applicant to conduct hydrogeological characterization and aquifer pumping tests in each wellfield 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). NRC requires by license condition that the applicant provide the results of the hydrogeological characterization and aquifer pumping tests for review and written verification before any proposed wellfields are developed (NRC, 2012). As described in SEIS Section 4.5.2.1.1.2.2, NRC staff have reviewed the applicant's numerical model constructed to investigate groundwater leakage through the Fuson Shale in the Burdock area as part of the safety review of the Dewey-Burdock ISR Project. As discussed previously, the applicant has committed to locating unknown boreholes or 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). These commitments will ensure that

contaminants are hydrologically isolated in the exempted portion of the ore-bearing aquifers during restoration.

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. Although plans exist to ensure restoration standards are met, drawdown-induced potential migration of radiological and nonradiological contaminants from abandoned open pit mines (e.g., Triangle Pit mine) in the Burdock area into the hydraulically connected Chilson aquifer during aquifer restoration may adversely impact aquifer restoration goals. 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 to MODERATE.

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 runoff. The applicant’s NPDES permit will ensure that storm water 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 cannot be 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 would 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 could be MODERATE if SDDENR denies the applicant's water appropriation permit to use groundwater from the Madison aquifer. In this case, identifying an alternative source of water or reducing pumping rates during construction will be necessary to reduce the impacts to shallow local aquifers and domestic and livestock wells from consumptive water uses to SMALL. However, near-surface aquifers do not serve as a water supply for domestic use or livestock watering within the project area (Powertech, 2009a). 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 irrigation areas in the Dewey area and in the Burdock area (see Figure 2.1-12) cover approximately 509 ha [1,258 ac] of the permitted land. 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. However, in the Burdock area, the easternmost irrigation fields are situated over or close to unsaturated portions and outcrops of the Fall River aquifer (Figures 2.1-12 and 3.5-7). Therefore, treated liquid waste applied to the easternmost irrigation fields may locally recharge the Fall River aquifer at and near its outcrop areas. For the rest of the proposed land application sites, the impacts to groundwater would 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 a 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. Therefore, the NRC staff conclude that applied treated effluents on land application sites will not introduce any additional contamination to the soil or surface runoff.

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 Madison aquifer. If SDDENR approves the permit application, NRC staff conclude that the impacts on local aquifers and domestic and livestock wells from consumptive water use during ISR operations will be SMALL. However, if the water appropriation permit is denied, the impacts will be MODERATE. In this case, identification of an alternative source of groundwater or a reduction in pumping rates to meet operational water requirements will be necessary to reduce the impacts to 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 Skull Creek Shale 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) except for the easternmost portion of the irrigation fields in the Burdock area, the irrigation fields are underlain by low permeability shale layers (Skull Creek). Any recharge to the Fall River aquifer from land application of liquid wastes during proposed ISR operations would 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 4.5.2.1.1.2.2, 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 pumping rate of 0.15 m^3/min [40 gpm] from the Inyan Kara Group aquifers (see SEIS Section 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 0.15 m^3/min [40 gpm] will significantly extend the aquifer restoration phase. After production and restoration are complete and groundwater withdrawals are terminated, groundwater levels will tend to recover with time. 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, drawdown-induced potential migration of radiological and hazardous contaminants from abandoned open pit mines (e.g., Triangle pit mine) in the northeastern part of the Burdock area into the hydraulically connected Chilson aquifer during aquifer restoration may adversely 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 to MODERATE.

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 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 at its outcrops at and near the easternmost irrigation fields in the Burdock area. 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 irrigation fields, 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 plans and operations. The Burdock central processing

Table 4.5-2. Significance of Environmental Groundwater Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock ISR 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 to MODERATE If groundwater pumping causes mobilization and migration of radiological and hazardous contaminants from abandoned open pit mines into Fall River aquifer, impacts will be MODERATE	SMALL to MODERATE If groundwater pumping causes mobilization and migration of radiological and hazardous contaminants from abandoned open pit mines into Fall River aquifer, impacts will be MODERATE	SMALL to MODERATE If groundwater pumping causes mobilization and migration of radiological and hazardous contaminants from abandoned open pit mines into Fall River aquifer, impacts will be MODERATE
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.

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 would 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, 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) would 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 would 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 would 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 would 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 would limit the magnitude of impacts to terrestrial ecology. The implementation of spill detection and response

plans would mitigate impacts to aquatic species from spills around well heads and from pipeline leaks. Mitigation measures, such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys, would also limit the potential impact, and the NRC staff concluded in the GEIS that the impact to wildlife and vegetation would 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 would be used during aquifer restoration, little additional ground disturbance would 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 would be comparable to, but overall less than, those described for construction and would further decrease as decommissioning and reclamation proceed. As described in GEIS Section 4.4.5.4, during decommissioning and reclamation, there would be temporary land disturbance from soil excavation, recovery and removal of buried piping, and demolition and removal of structures. Wildlife would be temporarily displaced, but would 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 would recover quickly as sediment load decreases. However, revegetation and recontouring would restore habitat previously altered during construction and operations. Land that is used for irrigation would be included in decommissioning surveys to ensure potentially impacted (contaminated) areas would 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 Regional 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 disposal options. Plant and animal community alteration will be greatest under the land application option because of the large amount of land {about 426 ha [1,052 ac]} that would 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 would deposit on vegetation, both on- and offsite, affecting the forageability for obligate species. 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, fencing and netting, 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 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,c,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 would 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 (*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.

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								

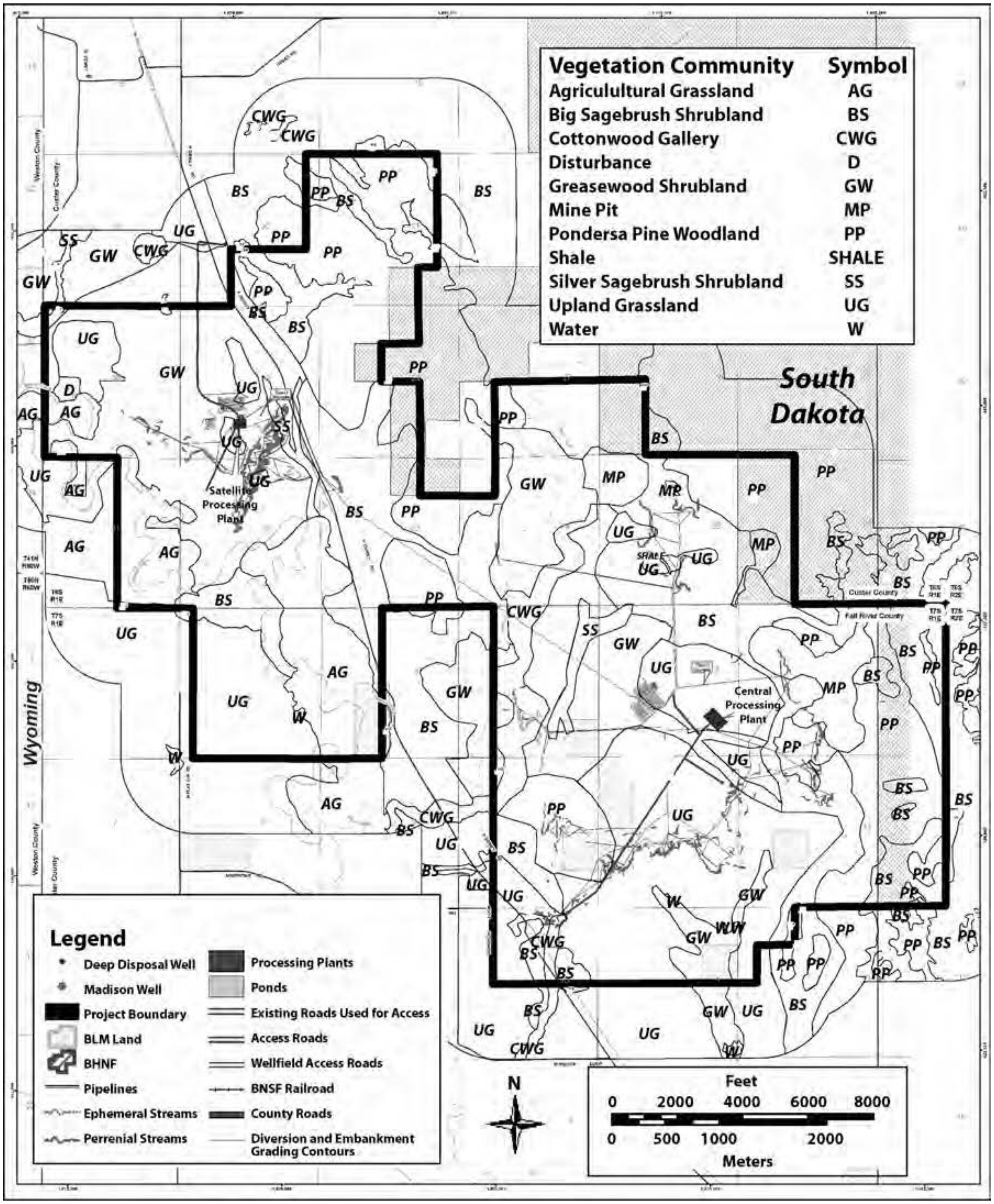

Figure 4.6-1. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Deep Class V Injection Well Disposal Option (Source: Powertech, 2012a)

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. North Dakota State University published a 2012 weed control guide (Zollinger, 2012) and associated circulars with recommended techniques, herbicides, and precautions to control regional noxious, invasive, and nonnative vegetative species that the applicant could employ. The U.S. Geological Survey (USGS) recommends weed control techniques in sagebrush habitats that are optimal for Greater sage-grouse (*Centrocercus urophasianus*) populations (USGS, 2009). Applicant use of weed control techniques that incorporate BLM mitigation and reclamation guidelines (BLM, 2012a) would 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.

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 would 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 SDDNER-approved native seed mixture and rate provided in Table 4.6-2 (Powertech, 2009a, 2012b).

Construction of wellfields will be phased and some vegetation would 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

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		

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 would 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 the greasewood shrubland vegetation community. A proposed “restoration line” would 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 other 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 recruitment 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 missing unit [243 missing unit] 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 wild horses and domestic 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 and for several years thereafter until growth on the revegetated areas becomes productive enough to support big game. 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 sixteenfold (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 would 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 permit 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 would not threaten the continued existence of mourning doves.

Within the proposed project area, wild turkeys would 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 would 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. 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 FWS evaluated for the nearby Buffalo Gap Nation 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 listed the sage-grouse as threatened or endangered. BLM is in the process of revising regional management plans (RPMs) and has initiated scoping to prepare an EIS; this will require detailed studies on proposed and alternative policies, and analyze 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 Endangered Species Act (FWS, 2012). 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 would 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 would 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, hunt, 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 would 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.

Table 4.6-3. BLM 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 Prohibit surface disturbance/occupancy or human activity year round Siting structures that are more than 3 m [10 ft] tall or power lines	Within a 3.2-km [2-mi] radius of a lek in nesting/brood-rearing habitat* Within a 0.4-km [0.25-mi] radius of an occupied lek* 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*

Table 4.6-3. BLM Seasonal Wildlife Stipulations (continued)

Affected Areas/Species	Activities and/or Timing Restriction	Restricted Area
Greater sage-grouse	December 1–March 31 March 1–July 1 Prohibit surface disturbance/occupancy or human activity year round	Within crucial winter range for greater sage-grouse. Routine maintenance, production, and emergency response activities are allowed.* Within a 3.2-km [2-mi] radius of a lek in general habitat areas. Routine maintenance, production, and emergency response activities are allowed.* 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

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 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 would affect nesting and breeding curlew the most from early March to mid-July.

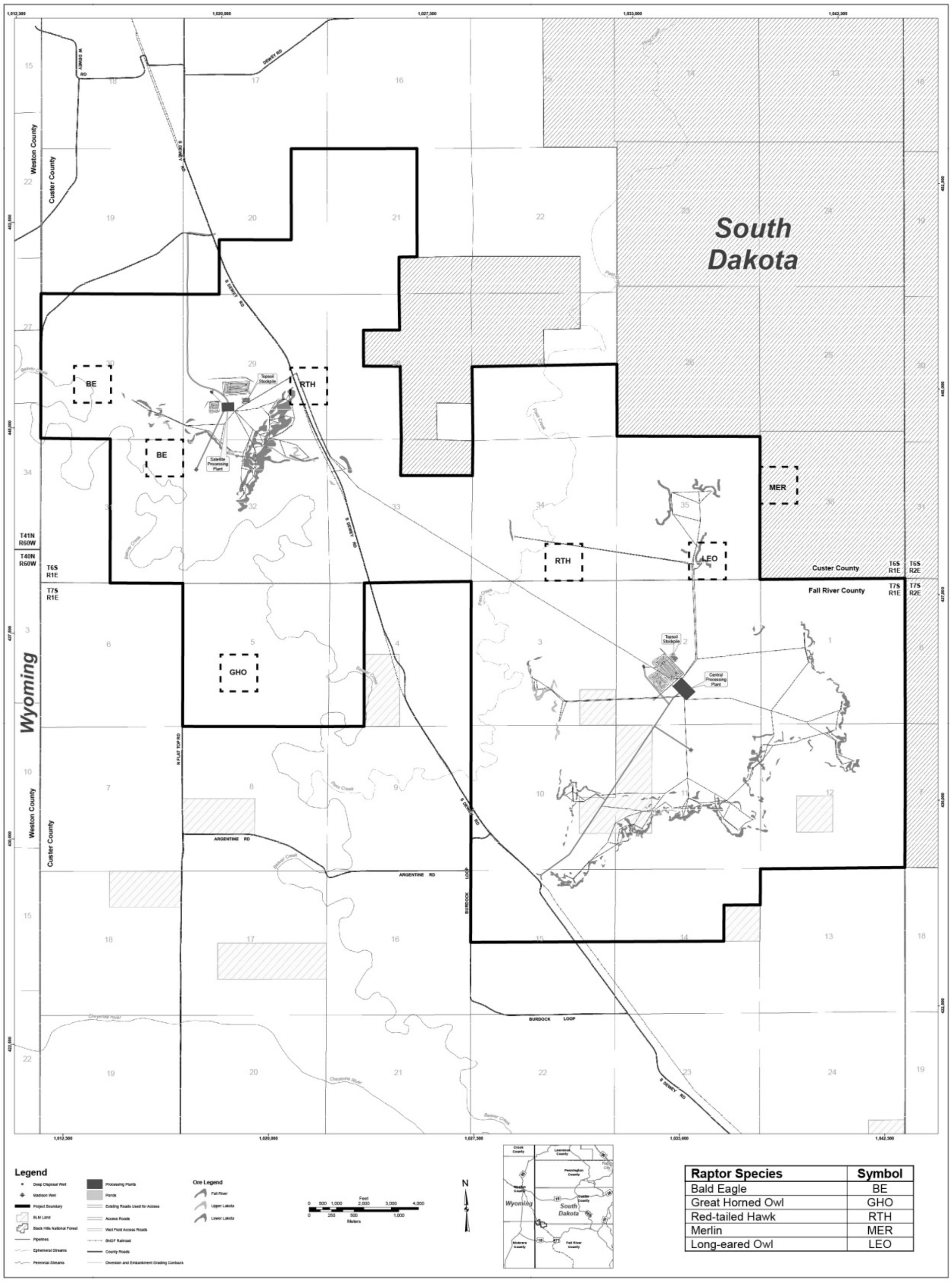

Figure 4.6-2. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Deep Class V Injection Well Disposal Option. Sources: BLM, 2012c; SDGFP, 2012c; Powertech, 2012a.

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.

<u>Nongame and Migratory Birds</u>

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.

Direct loss of ground nests, eggs, and birds from construction activities could occur; however, these impacts would 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 would 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.

<u>Other Mammals</u>

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, gophers, 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 would 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 would 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.

<u>Reptiles and Amphibians</u>

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. Streams that do occur within the proposed project area, including Beaver Creek, are intermittent. 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 and 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 in the state 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 would 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 would 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 storm water 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 underground injection control (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 would be developed. (NRC, 2009a)

No federally listed species are known to occur on the proposed Dewey-Burdock ISR Project site (FWS, 2010). 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.

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 likely 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 has proposed to follow BLM-approved raptor monitoring and mitigation activities to minimize conflicts between active nest sites and project-related activities if direct impacts to raptors occur. 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 Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA), by which the applicant will have to abide. Although these statues 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 would 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. Because only a few threatened, endangered, or candidate animals will be directly affected, most of them being birds, and because construction activities for the deep Class V injection well option will not noticeably alter protected species' patterns or behaviors, NRC staff conclude the potential impact on federally threatened endangered, candidate, or delisted species from construction activities at the proposed project will be SMALL.

State and BLM Species of Concern

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 would 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 BLM established stipulations for certain raptor species with respect to restricting human proximity at a designated distance from a raptor nest. 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 would 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 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 would 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 Black Hills National Forest 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, 2000). 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, 2000). Other threats include the fact that swift fox are easily trapped or shot and can experience mortality from vehicle collisions (FWS, 2000). 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, 2000). For the proposed Dewey Conveyor Project, BLM concluded activities may impact individual prairie dogs and swift foxes or their habitat, but would 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, 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)* would 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 would be expected to increase as animals became 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. Further mitigation measures, such as the use of fencing and continuation of grazing described in SEIS Sections 4.2.1 and 4.6.1.1.1.1.2 will be used to mitigate impacts to wildlife.

Potential conflicts between active raptor nest sites and operations-related activities, especially the expansion of wellfield areas, will be mitigated by adherence to BLM timing and spatial restrictions within specified distances of active raptor nests during the breeding season, as outlined in Table 4.6-3. 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 applicant has proposed predisposal wastewater treatment, including reverse osmosis, ion-exchange, and radium settling to remove or reduce regulated and hazardous 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 by land application or injection into permitted Class V (nonhazardous) deep disposal wells (Powertech, 2009a), thus minimizing impacts to wildlife, especially birds.

The types of potential impacts (chemical and radiological) to aquatic species and habitat during operations will be similar to those described for potential aquatic impacts from construction (SEIS Section 4.6.1.1.1.1.3). 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. 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 would 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 plans 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 cannot be 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,

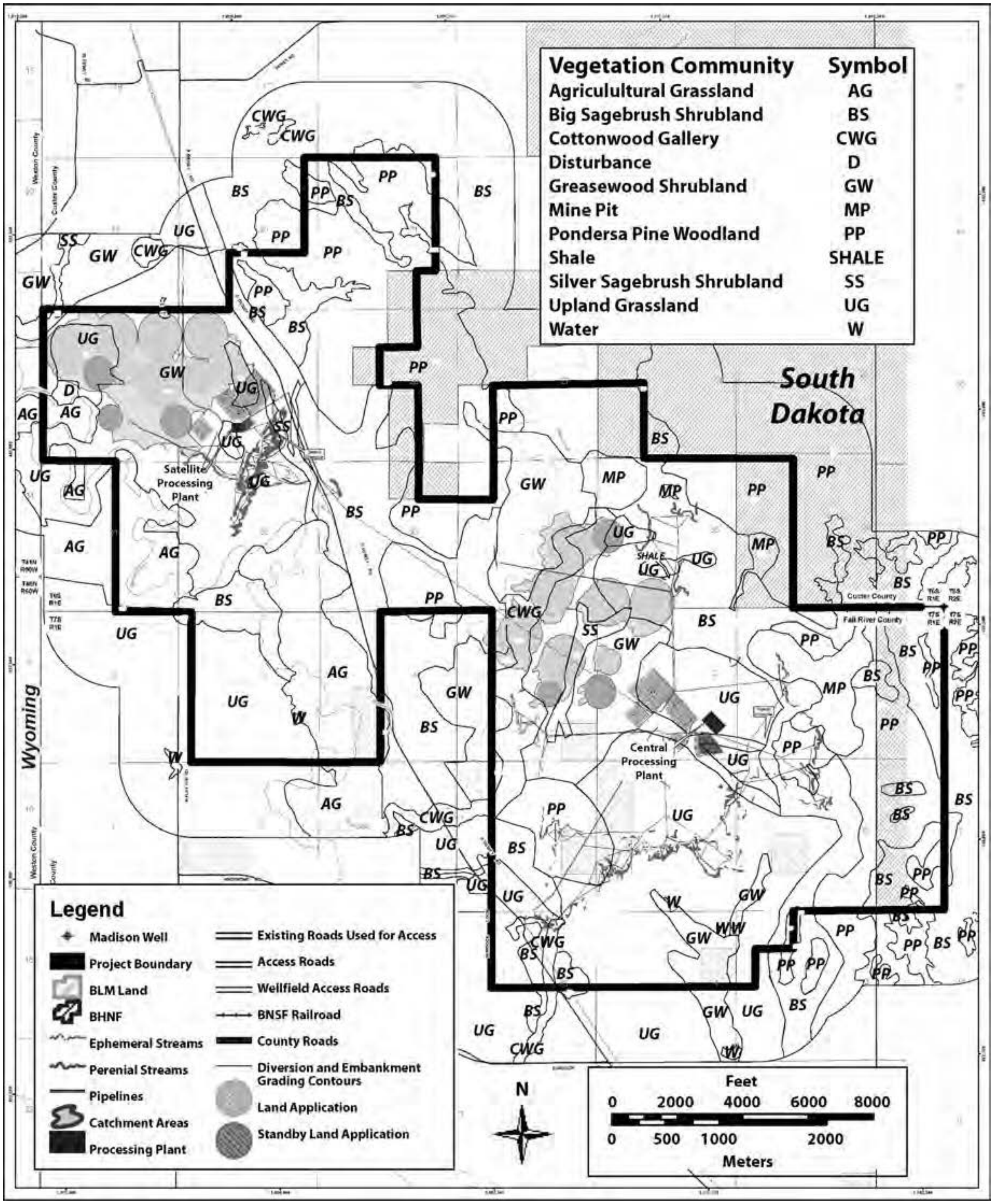

Figure 4.6-3. Map of Dewey-Burdock Planned Facilities and Vegetation Communities for the Land Application Option.
Source: Powertech, 2012a.

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 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	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								

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 entire land application area to be converted into agricultural land where alfalfa, corn, sorghum, and several species of 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 of 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 irrigation 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 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 426 ha [1,052 ac] will 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 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 would 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 would be altered within the irrigation areas during construction activities and prey–predator species would 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.

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, 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.

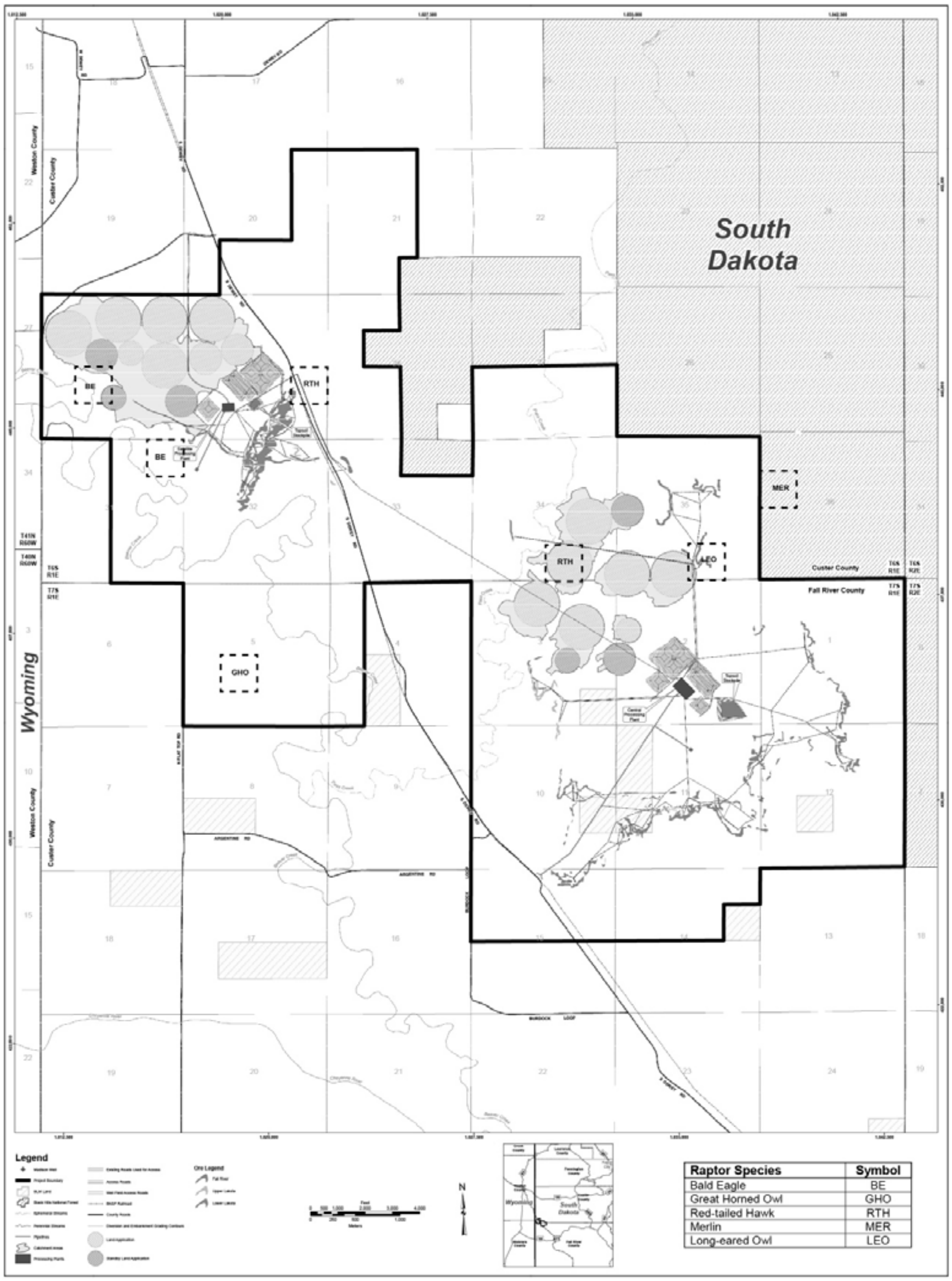

Figure 4.6-4. Map of Raptor Nest Locations in the Dewey-Burdock Project Area and Planned Facilities for the Land Application Option.
Source: Powertech, 2012a.

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 irrigation 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 overall impact on wildlife as those expected during the construction phase under the deep Class V injection well disposal option 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.

At NRC-licensed ISL facilities, the licensee is required to monitor and control irrigation areas to maintain levels of radioactive constituents within allowable release standards outlined in 10 CFR Part 20, Appendix B both during and after disposal by land application (NRC, 2009a). In addition, South Dakota regulates land application of wastewater and may impose release limits on nonradiological constituents to reduce negative impacts on soils and vegetation. As stated in SEIS 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. Monitoring results must be reported to NRC semiannually (see SEIS Chapter 7).

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 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 would not disturb any additional water bodies and perennial streams within the proposed project area (Powertech, 2009a), 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 each land application area 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). This expected rate of liquid waste land application is less than the maximum rate predicted for each land application area during operations, approximately 2,472 Lpm [653 gpm] from May 11 to September 24.

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 contaminants in treated waste water to allowable release limits contained in 10 CFR Part 20, Appendix B (Powertech, 2009a, 2011). Thus, 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. 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 placement of soil will have fewer ecological impacts than those experienced during the construction phase due to continuous revegetation efforts during the ISR lifecycle. However, 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.

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 and extraction activities. 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.

Table 4.6-5. Significance of Ecological Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock ISR 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 to MODERATE for vegetation, terrestrial, and aquatic species

Table 4.6-5. Significance of Ecological Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock ISR Project (continued)

	Class V Injection Wells	Land Application	Combined Class V Injection Wells and Land Application*
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.			

4.7 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 would be expected to be at such low levels that they would 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.

GEIS Construction Phase Summary

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 would 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 would be SMALL. (NRC, 2009a)

GEIS Operations Phase Summary

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 would be expected to be at such low levels that they would be negligible and were not considered in the analysis. For NAAQS attainment areas, NRC staff concluded in the GEIS that nonradiological air quality impacts would be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

As described in GEIS Section 4.4.6.3, because the same infrastructure would be used during the aquifer restoration as during operations, air quality impacts from aquifer restoration would be similar to, or less than, those during operations. Additionally, fugitive dust and combustion emissions from vehicles and equipment during aquifer restoration would 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 would 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 would 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 would be expected to decrease as decommissioning proceeds, and therefore, overall, impacts would be similar to, or less than, those associated with construction; would be short term; and would be reduced through BMPs (e.g., dust suppression). NRC staff concluded in the GEIS that for NAAQS attainment areas, nonradiological impacts would 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 would 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).

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.

Classification as a major or minor source is the purview of the regulatory authority, SDDENR. NRC staff acknowledge that SDDENR has not yet conducted the formal air quality permitting for the proposed Dewey-Burdock ISR Project (see Table 1.6-1). In the absence of a formal determination and permitting by SDDENR, 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. The NRC description in this SEIS does not document or represent the formal SDDENR determination. As such, the SDDENR determination and permitting may vary with the NRC description.

Expressing the proposed project's emissions in concentrations can help in characterizing the magnitude of the emission levels because regulatory standards, such as NAAQS and PSD, are also expressed in concentrations. The AERMOD dispersion model was used to predict pollutant concentrations at 47 locations on and in the vicinity of the proposed site based on the annual emission mass flow rates from the sources in Tables 2.1-1 and 2.1-2. These concentrations were calculated for the construction, operation, aquifer restoration, and decommissioning phases and are based on the emission estimates from stationary and mobile sources. Figure 4.7-1 identifies the locations. Tables C–5 to C–8 presents the detailed modeling results. This modeling used the initial emission inventory the applicant provided (Powertech, 2010a). However, the applicant revised the mobile source emission inventory in part to incorporate mitigation measures and improve the accuracy of the emissions expected from the ISR activities (Powertech, 2012d). Section C.2.1 describes the differences between the initial and revised emission inventory. The applicant committed to perform air dispersion modeling using the revised emission inventory before the final SEIS is prepared (Powertech, 2012d). Hence, this updated modeling has not yet been provided to NRC. Therefore, the modeling results based on the initial inventory were used to generate the peak year pollution concentrations for the updated emission inventory. Section C.2.3 explains how this was done. Table 4.7-1 contains the peak year pollutant concentrations from combustion emissions from stationary and mobile sources. This table also compares these concentrations to NAAQS and PSD standards. These standards are described in SEIS Section 3.7.2.

The modeling and associated impact analyses in the final SEIS should be updated to include the following:

- Incorporate the revised fugitive dust emission inventory, including both the project-specific onsite and offsite emissions, into the air dispersion modeling.

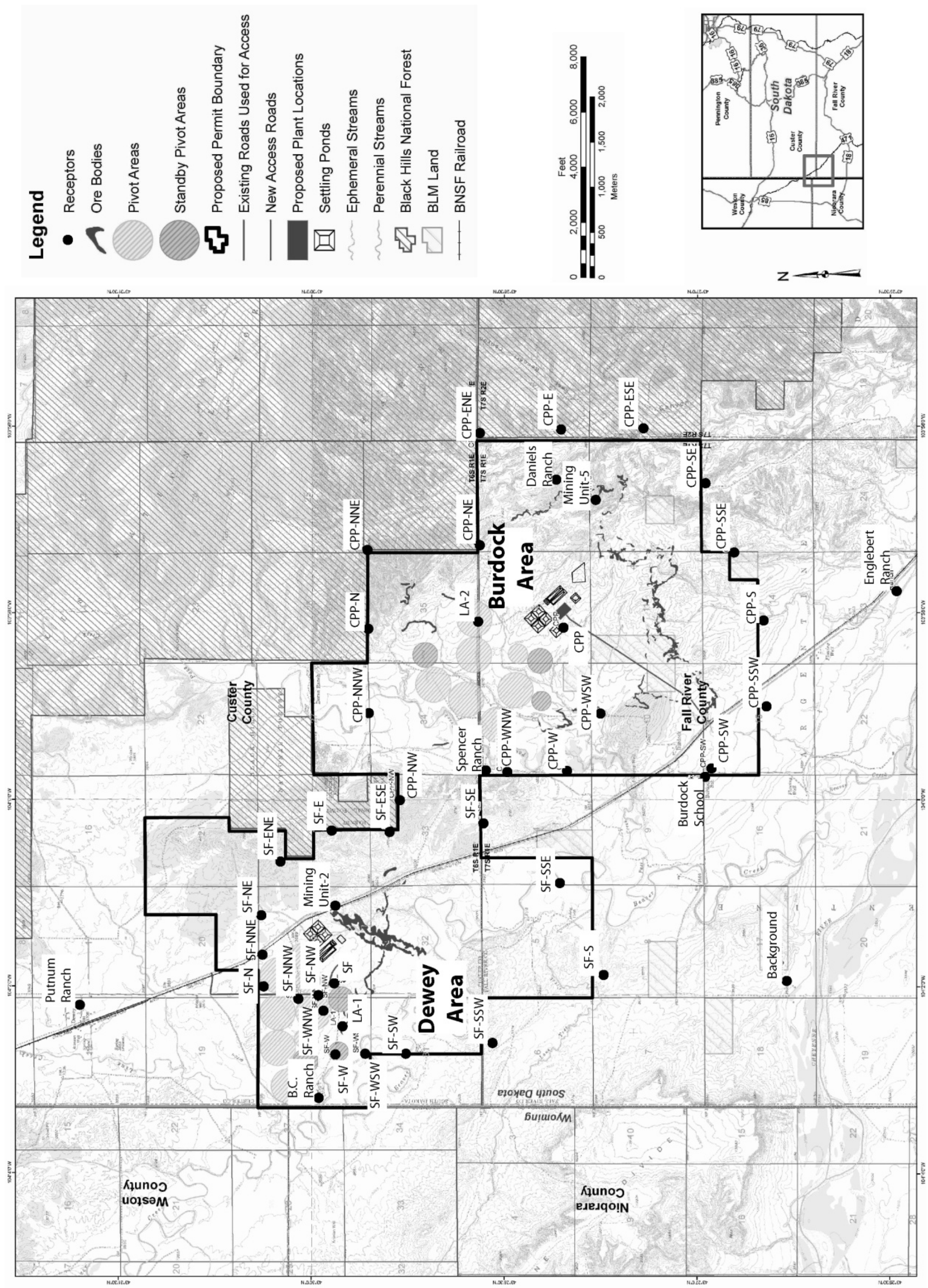

Figure 4.7-1. Locations Where Nonradiological Combustion Estimates (Concentrations) Were Calculated Using the AERMOD Dispersion Model.
Source: Modified From Powertech (2010a).

Table 4.7-1. NAAQS Pollutant Concentrations from the Nonradiological Combustion Emissions from Stationary and Mobile Sources for the Peak Year* of the Proposed Action

Pollutant	Time	Concentration for Peak Year†	Percentage of NAAQS‡	Percentage of Prevention of Significant Deterioration Class II Standards ‡
PM_{10}§	24-hour mean	8.2 $\mu g/m^3$	5.5	27.3
Sulfur Dioxide§	24-hour mean	9.6 ppb	6.8	26.0
	Annual mean	0.25 ppb	0.8	3
Nitrogen Oxides	Annual mean	1.3 ppb	2.4	18.9
Carbon Monoxide	8-hour mean	0.0459 ppm	0.5	na
	1-hour mean	0.359 ppm	1.0	na

Source: Modified from Powertech (2010a, 2012d)
*Because ISR phases can overlap, the peak year accounts for when all four phases occur simultaneously and represents the highest amount of emissions the proposed action would generate in any one project year.
†Values not the result of direct modeling of the revised inventory (see SEIS Section C.2.3 for a detailed explanation).
‡See SEIS Section 3.7.2 for discussion of NAAQS and Prevention of Significant Deterioration Class II standards.
§Sulfur dioxide concentrations compared to the previous standards as presented in GEIS Table 3.2-8.

- Update the air dispersion modeling for NAAQS compliance by (i) using the revised inventory and (ii) including the following information not provided in the initial modeling: $PM_{2.5}$ (annual and 24 hour), SO_2 (1 hour), and NO_2 (1 hour).

- Update the air dispersion modeling for PSD compliance by (i) using the revised inventory, (ii) analyzing for both Class II (at site) and Class I (at Wind Cave National Park), and (iii) including modeling results for all of the pollutants and timeframes as described in 40 CFR 52.21.

- Provide modeling results for the Air Quality Related Values for the Wind Cave National Park.

- Revise the level of detail associated with the emission inventory, if needed, to accommodate for the air dispersion modeling associated with short timeframes (e.g., 1-hour or 24-hour averaging periods).

- Use the appropriate emission inventory data for determining NAAQS or PSD modeling results for specific averaging times (e.g., an annual emission value may not be the appropriate information base for determining a 1-hour or 24-hour averaging time concentration).

- Provide model receptor diagrams with the modeling analyses (i.e., identify the receptor locations where the pollutant concentrations were calculated).

If during the process of conducting the revised air modeling it is determined that any of the topics for the model update are not addressed as indicated here, NRC shall provide a justification for this change. The Dewey-Burdock site-specific modeling results in the final SEIS will replace the modeling results (i.e., pollutant concentrations) in the draft SEIS as described in the preceding paragraph. This impact analysis in the final SEIS will be based on the new modeling results. Potentially, the impact magnitude in the final SEIS could be different than that

in the draft SEIS. As described in Table 4.7.1, the draft SEIS categorizes the air quality impacts for the various phases and waste disposal options as ranging from SMALL to MODERATE. For particular phases or waste disposal options, the new modeling results could indicate that the impact magnitude could be reduced to only SMALL. In this case the draft SEIS, which characterizes the impact magnitude up to MODERATE, presents a conservative or bounding analysis. Conversely, the impact magnitude could be greater and classified as LARGE. For example, if the revised pollutant concentration exceeded a regulatory NAAQS or PSD standard, the impact magnitude would be changed to LARGE. Mitigation could be implemented that could reduce the emission levels and associated pollutant concentrations. If mitigation is incorporated into the final SEIS impact analysis (e.g., to lower emission levels or pollutant concentrations such that the impact magnitude level was changed), the final SEIS would describe the effectiveness of the mitigation. SEIS Chapter 6 identifies various air quality mitigation measures. However, possible mitigation measures for implementation based on the results of the modeling effort would not be limited to the ones identified in SEIS Chapter 6.

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 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 level of activity for the proposed project is greater than that cited in the GEIS in terms of the amount of equipment used and amount of time this equipment is operated. For example, drill rigs are the primary source for emissions for the mobile construction and drilling field equipment category (see Table C–2). For the proposed Dewey-Burdock ISR Project, these estimates were calculated utilizing 13 drilling rigs each operating 10 hours a day (Powertech, 2010a). Estimates in GEIS Table 2.7-1 cite the use of up to eight drilling rigs for 8 hours a day (NRC, 2009a).

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. Based on stationary source emission levels from Table 2.1-1, NRC staff would not consider the proposed facility to be classified as a major source for air emissions under the New Source Review program described in SEIS Section 2.1.1.1.6.1.1. The New Source Review permitting program threshold for classification as a major source in an attainment area for the proposed Dewey-Burdock ISR Project would be 227 metric tons [250 short tons]. 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 this threshold with the highest estimate at 2.4 metric tons [2.6 short tons] for NO_x. All of the estimated annual emission

levels of nonradiological pollutants from mobile sources the NRC staff evaluated (see Tables 2.1-2, 2.1-3, and 2.1-6) were lower than the New Source Review thresholds except for fugitive dust, which was higher.

Air emission during the construction phase of the proposed Dewey-Burdock ISR Project would consist primarily of combustion emissions and fugitive road dust. The construction phase emissions from mobile sources generate the highest levels of NAAQS pollutants when compared to the other three phases (Table 2.1-2) and the stationary sources (Table 2.1-1). For the construction phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2).

For combustion emissions, the peak year concentrations for each of the NAAQS pollutants are below the NAAQS (see Table 2.1-4). These concentrations include both stationary sources from Table 2.1-1 and mobile sources from Table 2.1-2. The estimated project level sulfur dioxide concentration is at 7 percent of the NAAQS. The estimated PM_{10} level (24-hour mean) is about 6 percent of the NAAQS. All of the other pollutant concentrations are no more than about 2 percent of the NAAQS. As described in Table C–11, the construction phase contribution to the peak year emissions varies between 67 and 78 percent depending on the particular pollutant. For the construction phase only, the estimated sulfur dioxide concentration is about 5 percent of the NAAQS and the PM_{10} concentration is about 4 percent of the NAAQS.

While the NAAQS primarily relate to an area’s attainment classification (see SEIS Section 3.7.2), the PSD standards relate to pollution levels made by individual projects. The peak year concentrations for each pollutant are below the PSD Class II standards (see Table 2.1-4). The estimated project level PM_{10} concentration is about 27 percent of the PSD Class II standard. The estimated sulfur dioxide (24-hour mean) concentration is about 26 percent of the PSD Class II standard. All of the other pollutant concentrations are no more than about 19 percent of the PSD Class II standards. For the construction phase only, the estimated PM_{10} concentration is about 19 percent of the PSD Class II standard and the sulfur dioxide concentration is about 18 percent of the standard. The applicant did not provide air dispersion modeling beyond the immediate vicinity of the proposed site, a Class II area. Wind Cave National Park is a Class I area located about 46.7 km [29.0 m] northeast of the proposed project area, and the predominant wind direction is from the southeast (see Figure 3.7-1). The applicant has committed to update the air dispersion modeling before the final SEIS is prepared (Powertech, 2012d). The final SEIS analyses would be based on this updated modeling. SEIS Section 4.7.1 describes the scope of this update, which would include PSD and Air Quality Related Values modeling for the Wind Cave National Park. The applicant has yet to complete the formal air quality permit process including providing any SDDENR-required documentation and information (Powertech, 2010a).

The pollution concentrations described in this SEIS section are based on the revised emission inventory (Powertech, 2012d). The applicant revised the initial mobile combustion emission inventory, in part, to incorporate mitigation measures and improve the accuracy of the emissions expected from the ISR activities. In association with the revised inventory, the applicant committed to the following actions (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

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 stricter emission standards and lower pollutant levels. Section C.2.1 describes how changes in engines used are incorporated into the calculation of the revised emissions inventory. Table C–4 describes the effectiveness (i.e., the percentage of emissions reduction) of the different tier levels based on the associated emission factors. 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.

Revised air dispersion modeling results (i.e., pollutant concentrations) were not provided with the revised emission inventory. As stated earlier in this section, the applicant committed to perform air dispersion modeling using the revised emission inventory before the final SEIS is prepared (Powertech, 2012d). The scope of the modeling update is described in SEIS Section 4.7.1. Meanwhile, NRC staff used the modeling results based on the initial emission inventory to generate pollutant concentrations for the revised emission inventory (see Table 2.1-4). This process is described in Section C.2.3.

All phases of the proposed Dewey-Burdock ISR Project would also result in greenhouse gas emissions (see Table 2.1-5). These estimated levels of greenhouse gas emissions for the construction phase are lower than the current EPA permitting threshold, as described in SEIS Section 3.7.2. For comparison, the annual estimated greenhouse gas emissions for the construction phase from all sources (i.e., stationary, mobile, and electrical consumption) were at 23,748 metric tons [26,178 short tons], which is a small fraction of those produced annually in South Dakota at 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.

The construction phase generates the highest levels of fugitive dust relative to the other phases (see Table 2.1-6). Travel on unpaved roads generates more fugitive emissions than wind erosion (see Tables 2.1-6 and 2.1-7). The fugitive road dust estimate exceeds the New Source Review permitting threshold for classification as a major source as described in SEIS Section 2.1.1.1.6.1.1. For travel on unpaved roads, the onsite construction phase (facilities and well field) emission levels are at 290.7 metric tons [320.4 short tons] for PM_{10} and 29.1 metric tons [32.1 short tons] for $PM_{2.5}$. Inclusion of the wind erosion emission would slightly increase these totals. The peak year onsite emission level estimates for travel on unpaved roads are at 481.8 metric tons [531.1 short tons] for PM_{10} and 48.2 metric tons [53.1 short tons] for $PM_{2.5}$. The fugitive dust estimate calculation incorporates one mitigation measure. The estimate credits water spray for a 50 percent reduction of all fugitive emissions generated from onsite unpaved roads. In addition, the applicant has proposed the following mitigation measures to further reduce and control air emissions (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.
- Encourage employee carpooling.

As previously described, the fugitive dust emissions are not included in the modeling results in Table 2.1-4. The applicant committed to perform air dispersion modeling using the revised emission inventory before the final SEIS is prepared (Powertech, 2012d). The final SEIS analyses would be based on this updated modeling. SEIS Section 4.7.1 describes the scope of this update, which would include incorporating fugitive dust emissions from the proposed project. Meanwhile, as described in Section C.4.2, the modeling results for pollution concentrations from a similar project are used to generate pollution concentrations for the proposed project. By this method, the Dewey-Burdock onsite peak year fugitive dust concentrations (24-hour mean) would be 23.3 μg/m^3 for PM_{10} and 1.2 μg/m^3 for $PM_{2.5}$. These concentrations are below the applicable NAAQS with PM_{10} at about 15 percent and $PM_{2.5}$ at about 3 percent. These concentrations are also below the applicable PSD Class II standards with PM_{10} at about 78 percent and $PM_{2.5}$ at about 13 percent. Table C–18 contains the pollution concentrations for the construction phase fugitive emissions. These concentrations are below the applicable NAAQS with PM_{10} at about 7 percent and $PM_{2.5}$ at about 2 percent. These concentrations are also below the applicable PSD Class II standards with PM_{10} at about 32 percent and $PM_{2.5}$ at about 6 percent.

The proposed action's dispersion modeling results that address emissions from the burning of fossil fuels for the stationary and mobile sources indicate that pollution concentration levels in and around the proposed site are low. Both the peak year and construction phase only pollutant concentrations are below the NAAQS. In addition, both concentrations are below the PSD standards, which relate to the pollution concentration increment a project is allowed. Therefore, the low level of combustion emissions would result in a SMALL impact on air quality.

The fugitive dust emissions are below NAQQS and PSD standards. However, the mass of particulate matter generated from fugitive emissions is much greater than that generated from combustion emissions (see Tables 2.1-2 and 2.1-6). In addition, these fugitive dust emission sources consist of many sources spread out over a large area that tend to generate emissions sporadically. Due to the level and nature of these fugitive emissions, there is a potential for noticeable localized dust emissions. 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 would result in a MODERATE impact on air quality. The NRC staff conclude that the overall air quality during the construction phase for the Class V injection well disposal option would range from SMALL to MODERATE.

4.7.1.1.2 Operations Impacts

The construction phase combustion emission impact analyses in SEIS Section 4.7.1.1.1 present (i) the description and use of the revised emission inventory, (ii) inclusion of mitigation in the calculation of the revised inventory emission levels, (iii) lack of air dispersion modeling beyond the proposed site, and (iv) the use of the modeling results based on the initial emission inventory to generate pollutant concentrations for the revised emission inventory. SEIS Section 4.7.1 describes the applicant's commitment to provide updated air dispersion modeling for incorporation into the final SEIS as well as the scope of this updated modeling. This information also applies to the operation phase impact analyses.

For the proposed Dewey-Burdock ISR Project, all of the air emissions from stationary sources were attributed to the operations phase (Table 2.1-2). NRC staff would not consider the proposed facility to be a major source for air emissions based on the emission levels of the stationary sources identified in Table 2.1-1. The Title V or operating permit threshold for classification as a major source in an attainment area is 90.7 metric tons [100 short tons] for any

of the NAAQS regulated pollutants. The estimated emission levels of NAAQS pollutants for stationary sources for the proposed action listed in Table 2.1-1 are well below the major source threshold. The pollutant with the highest emission level, NO_x, was under 3 percent of this threshold. The estimated annual emission levels of nonradiological pollutants from nonstationary sources the NRC staff evaluated (see SEIS Section 2.1.1.6.1.1) were lower than the operating permit threshold, except for fugitive road dust, which was higher.

Air emissions during the operation phase of the proposed Dewey-Burdock ISR Project would consist primarily of combustion emissions and fugitive road dust. For the operations phase combustion emissions, the NAAQS pollutants with the highest emission levels are NO_X and CO (see Table 2.1-2).

As described previously in SEIS Section 4.7.1.1.1, the peak year concentrations for each NAAQS pollutant are below the NAAQS (see Table 2.1-4). These concentrations include both stationary sources from SEIS Table 2.1-1 and mobile sources from SEIS Table 2.1-2. As described in Table C–11, the operation phase contribution to the peak year emissions varies between 13 and 19 percent depending on the particular pollutant. For the operation phase only, both sulfur dioxide and PM_{10} are about 1 percent of the NAAQS. The peak year concentrations for each pollutant are also below the PSD Class II standards. For the operation phase only, the PM_{10} concentration is about 5 percent of the PSD Class II standard and the sulfur dioxide concentration is about 4 percent of the standard.

The operations phase generates the most overall greenhouse gas emissions relative to the other three phases. The annual estimated emissions for the operation phase from all sources (i.e., stationary, mobile, and electrical consumption) were at 55,764 metric tons [61,469 short tons] of CO_2e. Stationary sources accounted for less than 5 percent of the overall carbon dioxide emissions (Table 2.1-5). These estimated levels of greenhouse 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.

For the operation phase, travel on unpaved roads generates more fugitive emissions than wind erosion (see Tables 2.1-6 and 2.1-7). The fugitive road dust estimate exceeds the Title V or operating permit threshold for classification as a major source. For travel on unpaved roads, the onsite operation phase emission levels are at 155.6 metric tons [171.5 short tons] for PM_{10} and 15.6 metric tons [17.2 short tons] for $PM_{2.5}$. Inclusion of the wind erosion emission would slightly increase these totals. The peak year onsite emission level estimates for travel on unpaved roads are at 481.8 metric tons [531.1 short tons] for PM_{10} and 48.2 metric tons [53.1 short tons] for $PM_{2.5}$. The fugitive dust estimate calculation incorporates one mitigation measure. The estimate credits water spray for a 50 percent reduction of all fugitive emissions generated from onsite unpaved roads. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see Table 6.2-1).

As previously described, the fugitive dust emissions are not included in the modeling results in Table 2.1-4. The applicant committed to perform air dispersion modeling using the revised emission inventory before the final SEIS is prepared (Powertech, 2012d). The final SEIS analyses would be based on this updated modeling. SEIS Section 4.7.1 describes the scope of this update, which would include incorporating fugitive dust emissions from the proposed project. Meanwhile, as described in Section C.4.2, the modeling results (i.e., pollution concentrations) from a similar project are used to generate pollution concentrations for the

proposed project. SEIS Section 4.7.1.1.1 describes the Dewey-Burdock onsite peak year fugitive dust concentrations and compliance with applicable NAAQS and PSD standards. Table C–18 contains the pollution concentrations for the operation phase fugitive emissions. These concentrations are below the applicable NAAQS with PM_{10} at about 5 percent and $PM_{2.5}$ at about 1 percent. These concentrations are also below the applicable PSD Class II standards with PM_{10} at about 25 percent and $PM_{2.5}$ at about 4 percent.

The proposed actions dispersion modeling results that address emissions from the burning of fossil fuels for the stationary and mobile sources associated with the operation phase indicate that the PM_{10} pollution concentration levels in and around the proposed site are low. Both the peak year and operation phase only pollutant concentrations are below the NAAQS. In addition, both concentrations are below the PSD Class II standards, which relate to the pollution concentration increment a project is allowed. Therefore, the low level of combustion emissions would result in a SMALL impact on air quality.

The fugitive dust emissions are below NAQQS and PSD Class II standards. However, the mass of particulate matter generated from fugitive emissions is much greater than that generated from combustion emissions (see Tables 2.1-2 and 2.1-6). In addition, these fugitive dust emission sources consist of many sources spread out over a large area that tend to generate emissions sporadically. Due the level and nature of these fugitive emissions, there is a potential for noticeable localized dust emissions. 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 would result in a MODERATE impact on air quality. The NRC staff conclude that the overall air quality during the construction phase for the Class V injection well disposal option would range from SMALL to MODERATE.

4.7.1.1.3 Aquifer Restoration Impacts

The construction phase combustion emission impact analyses in SEIS Section 4.7.1.1.1 present (i) the description and use of the revised emission inventory, (ii) inclusion of mitigation in the calculation of the revised inventory emission levels, (iii) lack of air dispersion modeling beyond the proposed site, and (iv) the use of the modeling results based on the initial emission inventory to generate pollutant concentrations for the revised emission inventory. SEIS Section 4.7.1 describes the applicant's commitment to provide updated air dispersion modeling for incorporation into the final SEIS as well as the scope of this updated modeling. This information also applies to the aquifer restoration phase impact analyses.

Air emissions during the aquifer restoration phase of the proposed Dewey-Burdock ISR Project would 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, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2).

As described previously in SEIS Section 4.7.1.1.1, the peak year concentrations for each of the NAAQS pollutant are below the NAAQS (see Table 2.1-4). These concentrations include both stationary sources from Table 2.1-1 and mobile sources from Table 2.1-2. As described in Table C–11, the aquifer restoration phase contribution to the peak year emissions varies between 0.7 and 1.8 percent depending on the particular pollutant. For the aquifer restoration phase only, both sulfur dioxide and PM_{10} are less than 0.1 percent of the NAAQS. The peak year concentrations for each pollutant are also below the PSD Class II standards. For the

aquifer restoration phase only, both sulfur dioxide and PM_{10} concentrations are less than 0.5 percent of the PSD Class II standard.

Overall, the total CO_2e emissions from the aquifer restoration phase are about six times lower than the operations phase (see Table 2.1-5). Most of the aquifer restoration phase greenhouse gas emissions are attributed to indirect electrical consumption (Table 2.1-5). These estimated levels of greenhouse 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.

For the aquifer restoration phase, wind erosion can generate higher fugitive dust level emissions compared to travel on unpaved roads (see Tables 2.1-6 and 2.1-7). For travel on unpaved roads, the onsite aquifer restoration phase emission levels are at 11.8 metric tons [13.0 short tons] for PM_{10} and 1.2 metric tons [1.3 short tons] for $PM_{2.5}$. Wind erosion emission levels can generate up to 29.7 metric tons [32.7 short tons] for PM_{10} and 4.4 metric tons [4.8 short tons] for $PM_{2.5}$. The peak year onsite emission level estimates for travel on unpaved roads are at 481.8 metric tons [531.1 short tons] for PM_{10} and 48.2 metric tons [53.1 short tons] for $PM_{2.5}$. The fugitive dust estimate calculation incorporates one mitigation measure. The estimate credits water spray for a 50 percent reduction of all fugitive emissions generated from onsite unpaved roads. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see SEIS Section 4.7.1.1.1).

As previously described, the fugitive dust emissions are not included in the modeling results in Table 2.1-4. The applicant committed to perform air dispersion modeling using the revised emission inventory before the final SEIS is prepared (Powertech, 2012d). The final SEIS analyses would be based on this updated modeling. SEIS Section 4.7.1 describes the scope of this update, which would include incorporating fugitive dust emissions from the proposed project. Meanwhile, as described in Section C.4.2, the modeling results (i.e., pollution concentrations) from a similar project are used to generate pollution concentrations for the proposed project. SEIS Section 4.7.1.1.1 describes the Dewey-Burdock onsite peak year fugitive dust concentrations and compliance with applicable NAAQS and PSD Class II standards. Table C–18 contains the pollution concentrations for the aquifer restoration phase fugitive emissions. These concentrations are below the applicable NAAQS with PM_{10} under 1 percent and $PM_{2.5}$ under 0.1 percent. These concentrations are also below the applicable PSD Class II standards with PM_{10} at about 2 percent and $PM_{2.5}$ under 1 percent.

The proposed action dispersion modeling results that address emissions from the burning of fossil fuels for the stationary and mobile sources associated with the aquifer restoration phase indicate that the PM_{10} pollution concentration levels in and around the proposed site are low. Both the peak year and aquifer restoration phase only pollutant concentrations are below the NAAQS standard. In addition, both concentrations are below the PSD Class II standards, which relate to the pollution concentration increment a project is allowed. Therefore, the low level of combustion emissions would result in a SMALL impact on air quality.

The fugitive dust emissions are below NAQQS and PSD standards. However, the mass of particulate matter generated from fugitive emissions is much greater than that generated from combustion emissions (see Tables 2.1-2 and 2.1-6). In addition, these fugitive dust emission sources consist of many sources spread out over a large area that tend to generate emissions sporadically. Due the level and nature of these fugitive emissions, there is a potential for noticeable localized dust emissions. 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 would result in a MODERATE impact on air quality. The NRC staff conclude that the overall air quality during the construction phase for the Class V injection well disposal option would range from SMALL to MODERATE.

4.7.1.1.4 Decommissioning Impacts

The construction phase combustion emission impact analyses in SEIS Section 4.7.1.1.1 present (i) the description and use of the revised emission inventory, (ii) inclusion of mitigation in the calculation of the revised inventory emission levels, (iii) lack of air dispersion modeling beyond the proposed site, and (iv) the use of the modeling results based on the initial emission inventory to generate pollutant concentrations for the revised emission inventory. SEIS Section 4.7.1 describes the applicant's commitment to provide updated air dispersion modeling for incorporation into the final SEIS as well as the scope of this updated modeling. This information also applies to the decommissioning phase impact analyses.

Air emissions during the decommissioning phase of the proposed Dewey-Burdock ISR Project would consist primarily of combustion emissions and fugitive road dust. For the decommissioning phase, the NAAQS pollutants with the highest emission levels are NO_x and CO (see Table 2.1-2). As described previously in SEIS Section 4.7.1.1.1, the peak year concentrations for each of the NAAQS pollutant are below the NAAQS. These concentrations include both stationary sources from SEIS Table 2.1-1 and mobile sources from SEIS Table 2.1-2. As described in Table C–11, the decommissioning phase contribution to the peak year emissions varies between 8 and 15 percent depending on the particular pollutant. For the decommissioning phase only, the pollutant concentrations are below about 1 percent of the NAAQS. The peak year concentrations for each pollutant are also below the PSD Class II standards. For the decommissioning phase only, the pollutant concentrations are no more than about 4 percent of the PSD Class II standards.

All phases of the proposed Dewey-Burdock ISR Project generate greenhouse gases with the operation phase producing the most. Overall, the total greenhouse gas emissions from the decommissioning phase are about 11 times lower than the operations phase. Most of the aquifer restoration phase greenhouse gas emissions are attributed to mobile sources (Table 2.1-5). These estimated levels of greenhouse gas emissions are 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.

For the decommissioning phase, travel on unpaved roads generates more fugitive emissions than wind erosion (see Tables 2.1-6 and 2.1-7). For travel on unpaved roads, the onsite decommissioning phase emission levels are at 84.9 metric tons [93.6 short tons] for PM_{10} and 8.5 metric tons [9.4 short tons] for $PM_{2.5}$. Inclusion of the wind erosion emission would slightly increase these totals. The peak year onsite emission level estimates for travel on unpaved roads are at 481.8 metric tons [531.1 short tons] for PM_{10} and 48.2 metric tons [53.1 short tons] for $PM_{2.5}$. The fugitive dust estimate calculation incorporates one mitigation measure. The estimate credits water spray for a 50 percent reduction of all fugitive emissions generated from onsite unpaved roads. In addition, the applicant has proposed other mitigation measures to further reduce and control air emissions (see SEIS Section 4.7.1.1.1).

As previously described, the fugitive dust emissions are not included in the modeling results in Table 2.1-4. The applicant committed to perform air dispersion modeling using the revised

emission inventory before the final SEIS is prepared (Powertech, 2012d). The final SEIS analyses would be based on this updated modeling. SEIS Section 4.7.1 describes the scope of this update, which would include incorporating fugitive dust emissions from the proposed project. Meanwhile, as described in Section C.4.2, the modeling results (i.e., pollution concentrations) from a similar project are used to generate pollution concentrations for the proposed project. SEIS Section 4.7.1.1.1 describes the Dewey-Burdock onsite peak year fugitive dust concentrations and compliance with applicable NAAQS and PSD Class II standards. Table C–18 contains the pollution concentrations for the decommissioning phase fugitive emissions. These concentrations are below the applicable NAAQS with PM_{10} at about 3 percent and $PM_{2.5}$ under 1 percent. These concentrations are also below the applicable PSD Class II standards with PM_{10} at about 14 percent and $PM_{2.5}$ at about 2 percent.

The proposed action dispersion modeling results that address emissions from the burning of fossil fuels for the stationary and mobile sources associated with the decommissioning phase indicate that the PM_{10} pollution concentration levels in and around the proposed site are low. Both the peak year and decommissioning phase only pollutant concentrations are below the NAAQS. In addition, both concentrations are below the PSD Class II standards, which relate to the pollution concentration increment a project is allowed. Therefore, the low level of combustion emissions would result in a SMALL impact on air quality.

The fugitive dust emissions are below NAQQS and PSD Class II standards. However, the mass of particulate matter generated from fugitive emissions is much greater than that generated from combustion emissions (see Tables 2.1-2 and 2.1-6). In addition, these fugitive dust emission sources consist of many sources spread out over a large area that tend to generate emissions sporadically. Due the level and nature of these fugitive emissions, there is a potential for noticeable localized dust emissions. 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 would result in a MODERATE impact on air quality. The NRC staff conclude that the overall air quality during the construction phase for the Class V injection well disposal option would range from SMALL to MODERATE.

4.7.1.2 Disposal Via Land Application

If a permit for Class V injection wells cannot be 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 would 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 61 to 81 percent depending on the pollutant (see Table C–4). However, the drilling of eight Class V deep disposal wells constitutes no more than about a third 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 would 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 would result in more land being disturbed than in the deep well disposal option. Specifically, the land application would 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, would 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 would 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 would 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 would 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 would mirror the NAAQS analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS 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 would not require more access roads to be constructed. Furthermore, the land application option would not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option would 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 2.1-7, 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 onsite fugitive emissions from unpaved roads, the deep well and land application generate 300.8 metric tons [331.6 short tons] and 320.4 metric tons [353.2 short tons] of PM_{10}, respectively. The overall difference in fugitive emission level is about 6 percent.

NRC staff do not expect to see any appreciable difference in the overall fugitive dust emission levels between the land disposal option and the deep well disposal option. Therefore, the fugitive dust analyses presented for the deep well disposal option would still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts would 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 low level of combustion emissions would result in a SMALL impact on air quality. At times, the fugitive emission would 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 air quality during the construction phase for the land application disposal option would range from SMALL to MODERATE.

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 would result in more land being disturbed than in the deep well disposal option. Specifically, the land application would 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, would 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 would 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 would 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 would be expected to the same for the two disposal options for both the operation phase and the peak year.

The land application option analysis for greenhouse gases would mirror the NAAQS analyses because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS 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 would not require more access roads to be constructed. Furthermore, the land application option would not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option would 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 2.1-7, 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 onsite fugitive emissions from unpaved roads, the deep well and land application generate 165.7 metric tons [182.6 short tons] and 185.3 metric tons [204.3 short tons] of PM_{10}, respectively. The overall difference in fugitive emission level is about 9 percent.

NRC staff do not expect to see any appreciable difference in the overall fugitive dust emission levels between the land disposal option and the deep well disposal option. Therefore, the fugitive dust analyses presented for the deep well disposal option would still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts would be expected to the same for the two disposal options for the operation phase. The low level of combustion emissions would result in a SMALL impact on air quality. At times, the fugitive emission would 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 air quality during the operation phase for the land application disposal option would range from SMALL to MODERATE.

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 would result in more land being disturbed than in the deep well disposal option. Specifically, the land application would 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, would 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 would 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 would be expected to the same for the two disposal options for both the aquifer restoration phase and the peak year.

The land application option analysis for greenhouse gases would mirror the NAAQS analysis because the combustion emission sources for the NAAQS pollutants and the greenhouse gases are the same. Using the same rationale as the NAAQS 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 would not require more access roads to be constructed. Furthermore, the land application option would not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land

disposal option would 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 2.1-7, 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 onsite fugitive emissions from unpaved roads, the deep well and land application generate 21.9 metric tons [24.1 short tons] and 41.5 metric tons [45.7 short tons] of PM_{10}, respectively. The overall difference in fugitive emission level is about 47 percent.

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 would be expected to be similar. Therefore, the fugitive dust analyses presented for the deep well disposal option would still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts would be expected to be the same for the two disposal options for the aquifer restoration phase. The low level of combustion emissions would result in a SMALL impact on air quality. At times, the fugitive emission would 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 air quality during the aquifer restoration phase for the land application disposal option would range from SMALL to MODERATE.

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 would result in more land being disturbed than in the deep well disposal option. Specifically, the land application would 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 would 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 would be expected to the same for the two disposal options for both the decommissioning phase and the peak year.

The land application option analysis for greenhouse gases would mirror the NAAQS analysis because the emission sources for the NAAQS and greenhouse gases are the same. Using the same rationale as the NAAQS 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 would not require more access roads to be constructed. Furthermore, the land application option would not require additional land for wellfield or facility construction. Therefore, NRC staff conclude that the additional land disturbance associated with the land disposal option would 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 2.1-7, 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 onsite fugitive emissions from unpaved roads, the deep well and land application generate 95.0 metric tons [104.7 short tons] and 114.6 metric tons [126.3 short tons] of PM_{10}, respectively. The overall difference in fugitive emission level is about 17 percent.

NRC staff do not expect to see any appreciable difference in the overall fugitive dust emission levels between the land disposal option and the deep well disposal option. Therefore, the fugitive dust analyses presented for the deep well disposal option would still apply.

As mentioned earlier in this section, the magnitude of the air quality impacts would be expected to the same for the two disposal options for decommissioning phase. The low level of combustion emissions would result in a SMALL impact on air quality. At times, the fugitive emission would 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 air quality during the decommissioning phase for the land application disposal option would range from SMALL to MODERATE.

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 would 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 would 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 would only affect the operation phase because this is where all of the drill rig emissions occur. For the combustion emissions, the potential environmental impacts for the operations phase would be greater for the Class V injection well option because of the additional drill rig emissions. For the remaining three phases, the combustion emissions would basically be 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 would 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 would include the additional contribution of the wind erosion from the increased land disturbance from the land application option. The operations phase would 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 would be greater than either the Class V deep injection well option or the land application option. However, the changes in air emissions levels would be subtle and not result in any distinctions concerning the magnitude of the environmental impacts (see Table 4.7.2).

4.7.2 No Action (Alternative 2)

Under this alternative, there would 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 would 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.

Table 4.7-2. Significance of the Air Quality Environmental Impacts for the Proposed Liquid Waste Disposal Options for Each Phase* of the Proposed Dewey-Burdock ISR 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 to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Aquifer Restoration	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Decommissioning	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
*The peak year (i.e., when all four phases occur simultaneous) impacts would also range between SMALL to MODERATE.			

GEIS Construction Phase Summary

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 would 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) at 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 BSNF 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 Black Hills National Forest (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, furnish 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 (Putnum residence and Beaver Creek Ranch Headquarters), one vacant dwelling (Spencer residence), and one seasonally occupied dwelling (Daniels 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 Putnum 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 Daniels 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 Daniels 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 injectionl 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 would 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 also locate all planned facilities outside of BLM recommended buffer zones for all raptor nests identified within the proposed project area (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 Daniels residence in the Burdock area, noise levels associated with project-related construction activities will not impact onsite or offsite residential receptors. Residents at the Daniels 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, locating all planned facilities outside of BLM recommended buffer zones for all 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 Daniels 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 Daniels 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 Daniels 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 Daniels 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 Daniels residence will be short

term (1 to 2 years for each wellfield). In addition, the Daniels 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, vehicular traffic, and human proximity guidelines 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 Daniels 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 Daniels residence will be short term (1 to 2 years for each wellfield). In addition, the Daniels 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 Daniels 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 Daniels residence during wellfield decommissioning will be temporary and the Daniels 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 cannot be 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, furnish 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 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 would 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 Daniels 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 Daniels 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 Daniels 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 Daniels 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 Daniels 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 to irrigate alfalfa (May 11 to September 24). 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 Daniels 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 Daniels 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 (May 11 to September 24). 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 Daniels 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 Daniels 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. 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 would 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 Daniels 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 Daniels residence and the Beaver Creek Ranch Headquarters during decommissioning will be temporary. In addition, the Daniels 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

Table 4.8-1. Significance of Environmental Noise Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock ISR 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.

damage to historic, cultural, and archaeological resources may result from land disturbance as part of construction, operations, aquifer restoration, and decommissioning activities.

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 will be required, under conditions in its NRC license, to stop work upon discovery of previously undocumented historic or cultural resources and notify the appropriate federal, tribal, and state agencies with regard to 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 the presence or absence of historic and cultural resources within the project area. (NRC, 2009a)

GEIS Operations Phase Summary

As discussed in GEIS Section 4.4.8.2, 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. 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 with regard to mitigation measures. For these reasons, NRC staff determined in the GEIS that ISR operation impacts to historic and cultural resources will be SMALL. (NRC, 2009a)

GEIS Aquifer Restoration Phase Summary

In GEIS Section 4.4.8.3, NRC staff determined that aquifer restoration impacts to historic and cultural resources 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, conditions in the NRC license regarding the discovery of previously undocumented historic or cultural resources will remain in effect. 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 previously disturbed areas, and historic and cultural resources within the potential area of effect will already be known. As a result, 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)

Impacts on historic and cultural resources at the proposed Dewey-Burdock ISR Project will be linked to the physical footprints of 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. The applicant is proposing the following options for liquid waste disposal that include deep well disposal via Class V injection wells, land application, or disposal via combination of Class V injection and land application (see SEIS Section 2.1.1.1.2.4). The locations of proposed site facilities and infrastructure for the Class V injection well and land application disposal options are shown in Figures 2.1-10 and 2.1-12, respectively. The locations of wellfields for the proposed project are shown in Figure 2.1-6.

The applicant plans to use existing power line corridors wherever possible when constructing new power lines. However, a new power line corridor will be constructed alongside the county road between the Dewey and Burdock areas to connect the Dewey satellite facility and the Burdock central processing plant. This proposed corridor is approximately 9 m [30 feet] in width; the poles are approximately 0.3 m [1.0 ft] in diameter and will be placed every 30-91 m [100-300 ft]. No roadways will be built during construction of the power lines and minimal disturbance to the ground surface is anticipated. No sites currently listed or eligible for listing in the NRHP or unevaluated sites will be adversely impacted by the proposed construction of new power lines.

The 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).

NRC evaluated the results of historic and cultural resource surveys, conducted as part of prelicense application activities, in making recommendations on the eligibility of historic properties for the NRHP. NRC applies the criteria in found in the NHPA implementing regulations at 36 CFR 60.4(a)–(d) in making its National Register eligibility recommendations. These determinations are discussed in the sections below. Efforts to identify and evaluate places of religious and cultural importance to Indian tribes through consultation are on-going.

Consultation involving NRC, the applicant, South Dakota State Historical Preservation Office (SD SHPO), BLM, and EPA, and 20 Indian tribes is being conducted (see SEIS Section 1.7.3.5) to determine: 1) whether significant properties are present, 2) whether properties will be disturbed by site activities, and 3) what mitigation measures should be implemented. NRC also requires licensed facilities to submit a decommissioning plan for review, which will ensure compliance with Section 106 of the NHPA during the decommissioning phase.

As described in SEIS Section 3.9.2.1, more than 300 archaeological sites were recorded during the field investigations. Two-hundred and twenty sites were recommended as ineligible for listing in the NRHP and 80 sites consisted of isolated finds. At this time a total of 18 historic properties within the proposed project area are listed or recommended as eligible for listing on the NRHP. As of this date, SD SHPO has not concurred with sites recommended eligible to the NRHP. Avoidance of historic properties is the goal during development and production of the proposed project. The applicant committed to fencing known historic properties in areas where construction, wellfield development and project operations will occur so disturbance to these areas can be avoided. In addition, the location of historic properties will be made known to employees in advance of ground disturbing activities. The use of archaeological and tribal monitors has been proposed during ground disturbing activities, as well (Powertech, 2009a).

As described in SEIS Section 4.10.1.1.1, the applicant has committed to minimize potential impacts to visual and scenic resources with the use of building materials and paint colors that complement the natural environment, in keeping with BLM guidelines. Construction and placement of proposed structures will use topography to conceal wellheads, plant facilities, and roads from public vantage points in order to mitigate visual impacts (Powertech, 2009b).

The 18 historic properties currently listed or recommended eligible for listing on the NRHP, including their impact analyses, are listed in Tables 4.9-1 and 4.9-2 and discussed below.

Sites 39CU577, 39CU578, 39CU586, 39CU588, 39CU2733, 39CU2738, and 39CU590 are Native American occupation sites. Site 39CU2735 is an Archaic occupation site. Site 39CU593 contains both Native American and Euroamerican components, with artifact scatters extending down a hillslope. Site 39CU584 is a Native American occupation site and burial (affiliation unknown) located on a ridge slope. Each of these sites has been recommended as eligible for listing in the NRHP (Kruse, et al., 2008). However, all are located outside of proposed areas of development in the Dewey area. 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 Section 3.9.2.2. The properties are located south of Beaver Creek in the northwestern part of the APE, southwest of the proposed wellfield areas in the Dewey area. As noted in Section 4.10.1.1.1, the applicant has committed to use building materials and paint colors that complement the natural surroundings in accordance with BLM guidelines to mitigate visual impacts. These properties are located outside the area that will be affected by construction, operations, or decommissioning; therefore, no impacts to these historic properties are anticipated.

Five historic properties (39CU3592, 39CU271, 39FA1941, 39CU2000, and 39FA2000) could 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 39CU271 is an Archaic occupation site with 238 associated hearth features and a cairn feature. Site 39CU271 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).

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. If avoidance of this historic property is not possible, NRC staff has recommended that a treatment plan be developed in consultation involving the NRC, SD SHPO, BLM, tribal representatives, and the applicant to formalize mitigation and data recovery measures.

Table 4.9-1. Historic Properties Within or Adjacent to the APE That Are Currently Listed in NRHP or Sites Recommended as Eligible for Listing in the NRHP

Historic Property (Site Number, Structure Identification, or Historic District)	Description	Currently Listed on the NRHP or Eligible for Listing on NRHP	Evaluation Criteria—Determination of Eligibility for Listing in NRHP Under Criteria A, B, C, or D	Impact Analysis
39CU3592	Native American artifact scatter and hearth site	Eligible	D	Site is located within a proposed wellfield area south of the Dewey satellite facility. Site will need to be fenced off to ensure avoidance.
Log Barn (Structure CU02500002)	Log barn was found eligible for listing on NRHP in April 2012 under Criteria A.	Eligible	A	Site is located approximately 76 m [250 ft] south of land application areas. The site will be fenced off to ensure avoidance. No adverse visual impacts are anticipated.

Table 4.9-1. Historic Properties Within or Adjacent to the APE That Are Currently Listed in NRHP or Sites Recommended as Eligible for Listing in the NRHP (continued)

Historic Property (Site Number, Structure Identification, or Historic District)	Description	Currently Listed on the NRHP or Eligible for Listing on NRHP	Evaluation Criteria—Determination of Eligibility for listing in NRHP Under Criteria A, B, C, or D	Impact Analysis
39CU577	Native American/ Euroamerican/ Occupation site; artifact scatter	Eligible	D	Site will be avoided; no impact anticipated.
39CU2735	Archaic-Prehistoric occupation site	Eligible	D	Site will be avoided; no impact anticipated.
39CU578	Euroamerican/ Native American Historic dump and occupation site located on a ridge slope	Eligible	D	Site will be avoided; no impact anticipated.
39CU586	Native American and Late Archaic occupation site on a ridge crest	Eligible	D	Site will be avoided; no impact anticipated.
39CU588	Native American occupation site on a ridge crest	Eligible	D	Site will be avoided; no impact anticipated.
39CU2733	Native American hearth and artifact scatter on a ridge slope	Eligible	D	Site will be avoided; no impact anticipated.

Table 4.9-1. Historic Properties Within or Adjacent to the APE That Are Currently Listed in NRHP or Sites Recommended as Eligible for Listing in the NRHP (continued)

Historic Property (Site Number, Structure Identification, or Historic District)	Description	Currently Listed on the NRHP or Eligible for Listing on NRHP	Evaluation Criteria—Determination of Eligibility for listing in NRHP Under Criteria A, B, C, or D	Impact Analysis
39CU2738	Native American occupation site on a ridge crest	Eligible	D	Site will be avoided; no impact anticipated.
39CU590	Native American artifact scatter on a ridge saddle	Eligible	D	Site will be avoided; no impact anticipated.
39CU593	Native American and Euroamerican occupation and artifact scatter on a hillslope	Eligible	D	Site will be avoided; no impact anticipated.
39FA1941	Native American artifact scatter and hearth site	Eligible	D	Site is located approximately 91 m [300 ft] east of the proposed Burdock central processing plant and is within a proposed wellfield area;
39CU2000	Historic Railroad	Eligible	A and C	Site crosses proposed wellfield areas; however, no portion of the site will be adversely impacted.
39FA2000	Historic Railroad	Eligible	A and C	Site crosses proposed wellfield areas; however, no portion of the site will be adversely impacted.

Table 4.9-1. Historic Properties Within or Adjacent to the APE That Are Currently Listed in NRHP or Sites Recommended as Eligible for Listing in the NRHP (continued)

Historic Property (Site Number, Structure Identification, or Historic District)	Description	Currently Listed on the NRHP or Eligible for Listing on NRHP	Evaluation Criteria—Determination of Eligibility for listing in NRHP Under Criteria A, B, C, or D	Impact Analysis
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.	Listed in the NRHP in 1990	A	National Register Historic District will be avoided; no impact anticipated. No adverse visual impacts are anticipated.
Bakewell Ranch (Structure CU00000050)	The Bakewell Ranch is located within the Edna and Ernest Young Ranch National Register Historic District.	Listed on the NRHP	A	Historic property will be avoided; no impact anticipated. No adverse visual impacts are anticipated.

Sites 39CU2000 and 39FA2000 are historic properties with 1889 portions of the Burlington Northern Railroad that run the length of the APE. 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 recommend avoidance of the railroad segments and the applicant has committed to avoid these historic properties (Powertech, 2012e).

As discussed in SEIS Sections 3.9.2.1 and 3.9.3, historic and ethnographic evidence indicate that sites with cairn features served as markers for trails, camps, burials, caches, and ceremonial centers. Sites with burials or cairn features are listed in Table 4.9-2 and are protected by law in South Dakota (South Dakota Codified Law (SDCL) 34-27). Sites 39FA1902 and 39FA778, and 39FA96 are located near proposed construction activities for the Class V injection well disposal option and are discussed next.

Table 4.9-2. Burial, Cairn, and Other Sites Within or Adjacent to APE

Site Number	Description	Eligibility Designation	Evaluation Criteria—Determination of Eligibility for Listing in NRHP Under Criteria A, B, C, or D	Impact Analysis
39CU271	Native American and Archaic artifact scatter and occupation site on a ridge slope with a cairn feature	Eligible	D	Site is located approximately 61 m [200 ft] east of proposed wellfield areas; site will be avoided.
39CU584	Native American occupation site and burial (affiliation unknown) on a ridge slope	Eligible	D	Site will be avoided; no impact anticipated.
39FA1902	Historic site with Euroamerican burial	Unevaluated		Euroamerican burial site is located approximately 152 m [500 ft] west of the proposed Burdock central processing plant. The site will be protected by a buffer zone and fencing.

Table 4.9-2. Burial, Cairn, and Other Sites Within or Adjacent to APE (continued)

Site Number	Description	Eligibility Designation	Evaluation Criteria—Determination of Eligibility for Listing in NRHP Under Criteria A, B, C, or D	Impact Analysis
39CU3584	Cairn site	Not Eligible		Site is located in an area of potential impacts within land application areas. The site will be protected by a buffer zone and fencing.
39CU3587	Two historic Euroamerican burials	Unevaluated		Site will be avoided; no impact anticipated.
39CU530	Cairn site	Unevaluated		Site will be avoided; no impact anticipated.
39CU3564	Cairn site	Unevaluated		Site will be avoided; no impact anticipated.
39CU3620	Cairn site	Unevaluated		Site will be avoided; no impact anticipated.
39FA1862	Cairn site with stone circles	Unevaluated		Site will be avoided; no impact anticipated.
39FA1863	Cairn site with stone circles	Unevaluated		Site will be avoided; no impact anticipated.
39FA1881	Cairn site	Unevaluated		Site will be avoided; no impact anticipated.
39FA1890	Cairn site	Unevaluated		Site will be avoided; no impact anticipated.
39FA1927	Cairn site	Unevaluated		Site will be avoided; no impact anticipated.

Site 39FA1902 is a historic site with a Euroamerican burial located approximately 152 m [500 ft] west of the proposed Burdock central processing plant and will not be affected by project construction or operational activities. As described in SEIS Section 3.9.2.1, this site contains a historic bridge structure (FA00000151). The site has not been evaluated for eligibility for listing on the NRHP. The applicant has committed to avoid this site through the use of a buffer zone and protective fencing (Powertech, 2012e).

Site 39FA778 is an historic farmstead located within the center of the proposed Burdock central processing plant footprint. NRC staff has recommended that construction activities that may affect site 39FA778 be delayed until evaluative testing is completed and a determination of eligibility for listing on the NRHP is made.

Area 8 is an historic component of the multi-component site 39FA96. As discussed in Section 3.9.2.1, evaluative testing of the prehistoric component of site 39FA96 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). However, preliminary information gathered through consultation with the tribes indicate Areas 1 and 6 at site 39FA96 have the potential to be of religious and cultural importance to the tribes based on the number of hearth features and extensive size of the site. NRC staff is awaiting additional information from the tribes before making a recommendation of eligibility.

The historic component in Area 8 consists of two log cabins, a cistern, a collapsed outbuilding, a remnant of a foundation, and piles of foundation rubble. Additional evaluative testing within the historic cabin structures is planned to allow for a determination of NRHP eligibility (Powertech, 2012f). For this reason, NRC staff recommend that disturbance of Area 8 at 39FA96 be delayed until evaluative testing is completed and a recommendation on the eligibility for listing the property on the NRHP is made.

Archaeological investigations have not identified other cairn sites within or in the vicinity of construction impact areas for the Class V injection well disposal option. No other listed or sites eligible for listing on the NRHP have been identified within proposed Class V construction areas. The sites discussed above would be avoided during the construction phase of the Class V injection well disposal facilities, if implemented; therefore, impacts to these sites are not anticipated.

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). Unevaluated sites that lie within 76 m [250 ft] of proposed wellfields and land application areas are presented in Table 4.9-3. The applicant does not plan to engage in actions that will disturb these sites and for this reason the sites remain unevaluated. Areas containing historic properties and unevaluated sites will be fenced to ensure their protection. In addition, construction personnel will be advised of the location of historic properties and unevaluated sites prior to any ground-disturbing activities (Powertech, 2009a). If construction plans change and NRHP-eligible properties are impacted, mitigation strategies must be developed, evaluated, and completed prior to the start of construction. Prior to construction, the applicant will also develop an Unexpected Discovery Plan that would outline

Table 4.9-3. List of Unevaluated Sites Within 76 m [250 ft] of Project Activity Areas

Unevaluated Site	Location
39FA778	This historic farmstead is located within the proposed Burdock central processing plant footprint. Site will undergo further evaluative testing. Until testing is completed, avoidance of the site is recommended.
Areas 1, 6, and 8 at 39FA96	Areas 1, 6, and 8 at site 39FA96 are located within a proposed wellfield area. Until testing at Area 8 is completed, avoidance of the site is recommended. Until tribes review Areas 1 and 6, avoidance is recommended.
39CU3624	Site 39CU3624 is located south of Pass Creek less than 30.5 m [100 ft] north of a proposed wellfield area.
39FA1920	Site 39FA1920 is located at the southeast corner of the APE approximately 30.5 m [100 ft] south of a proposed wellfield area.

the steps required in the event that unexpected historical and cultural resources are encountered.

The NRC review is based on analyses of the historic and cultural resource investigations; a review of available literature; a search of records and collections maintained by the South Dakota Archaeological Research Center; and supplemental field investigations, including evaluative testing, and commitments made by the applicant to implement mitigation measures when sites will be affected. The NRC staff conclude the impacts to historic and cultural resources at the proposed Dewey-Burdock site will range from SMALL to LARGE. This finding reflects that efforts to identify and evaluate properties of religious and cultural significance to tribes are incomplete and Section 106 consultation is ongoing (see SEIS Section 1.7.3.5 and Appendix A).

4.9.1.1.2 Operations Impacts

There would be minimal impacts from facility operations or maintenance on historic and cultural resources because any impacts to these sites will be mitigated prior to facility construction. Visual impacts for cultural resources are the same as described in Section 4.9.1.1.1. If there is an inadvertent discovery of historic and cultural resources during routine maintenance activities, the Unexpected Discovery Plan committed to by the applicant will be implemented. For these reasons, the impacts to historic and cultural resources during the operations phase for the Class V injection well disposal option will be SMALL.

4.9.1.1.3 Aquifer Restoration Impacts

Aquifer restoration impacts to historic and cultural resources will be similar to, or less than, impacts from operations. Impacts to these resources would have been mitigated prior to the facility construction. Historic and cultural resources encountered during aquifer restoration activities, will be dealt with under the applicant’s Unexpected Discovery Plan will be implemented. Work at the immediate area would stop and proper notifications would be undertaken. Therefore, the impacts to historic and cultural resources during the aquifer restoration phase for the Class V injection well disposal option will be SMALL.

4.9.1.1.4 Decommissioning Impacts

Decommissioning and reclamation activities will be limited to previously disturbed areas. Therefore, there will be minimal impacts on historic and cultural resources. These sites would have been avoided from the construction phase through the decommissioning phase. Visual impacts for cultural resources are discussed in Section 4.9.1.1.1. If historic and cultural resources are encountered during decommissioning and reclamation activities, the Unexpected Discovery Plan will be implemented. Work would stop in the immediate area and proper notifications would be undertaken. Therefore, the 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 cannot be 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 4.2.1.2.1, approximately 566 ha [1,398 ac] of land are projected to be disturbed by construction activities for the land application option (see Table 4.2-1). As with the Class V injection well disposal option, mitigation measures, such as limiting construction of new access and secondary roads, would minimize surface disturbance (Powertech, 2009a) during this option and would limit impacts to historic and cultural resources.

As discussed in SEIS Section 4.9.1.1.1, the applicant has conducted historic and cultural resource surveys and provided eligibility recommendations under criteria in 36 CFR 60.4(a)–(d) as part of prelicense application activities. To determine impacts, consultations involving NRC, the applicant, SD SHPO, BLM and EPA, and Native American tribes are being conducted as part of the NEPA review process. NRC also requires licensed facilities to submit a decommissioning plan for review, which will ensure compliance with Section 106 of the NHPA during the decommissioning phase.

Sites listed or recommended as eligible for listing on the NRHP are presented in Table 4.9-1 with an assessment of the expected impact on the properties for each proposed waste disposal method (see also, SEIS Section 4.9.1.1.1). With the exception of site CU02500002, 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 CU02500002 is a log barn structure located approximately 76 m [250 ft] south of proposed land application areas in the Burdock area, end therefore, outside the area of impact. NRC recommends that a buffer zone and protective fencing be erected around the perimeter of the log barn structure to minimize impacts during construction. If avoidance is not possible, NRC recommends that the structure be mitigated through Historic American Buildings Survey (HABS) level documentation. Visual impacts for historic and cultural resources are the same as described in Section 4.9.1.1.1.

As noted in SEIS Section 3.9.2.1, historic and ethnographic evidence indicate that sites with cairn features may have served as markers for trails, camps, burials, caches, and ceremonial centers for Native American tribes. Sites with burials or cairn features are listed in Table 4.9-2 (see SEIS Section 4.9.1.1.1). Measures that should be employed in order to avoid or mitigate impacts to sites 39FA1902 (Euroamerican burial) and 39FA778 (Euroamerican farmstead) are described in SEIS Section 4.9.1.1.1. Cairn site 39CU3584 is located within a proposed land application area at the Dewey site. Site 39CU3584 was recommended as not eligible for listing in under Criterion D, due to a lack of diagnostic artifacts and intact cultural deposits. To date, preliminary information from the tribes regarding cairn and burial sites suggest that 39CU2584 would be significant to tribes. Consultation with tribal representatives on the significance of this site and others is on-going. With the exception of 39CU2584, no other unevaluated cairn sites or those recommended as eligible for listing on the NRHP are located within proposed construction impact areas for the land application disposal option. If avoidance of these sites during the construction phase of the project is possible, impacts to these sites are not anticipated.

Four unevaluated sites (39FA778, Areas 1, 6, and 8 at 39FA96, 39CU3624, and 39FA1920) are located within 76 m [250 ft] of proposed wellfields and plant facilities (see Table 4.9-3). To ensure these unevaluated sites not disturbed prior to evaluation, NRC staff recommend use of a

buffer zone and protective fencing around the perimeter of the sites prior to construction. If the sites cannot be avoided, NRC staff recommend evaluative testing to determine NRHP-eligibility and data recovery efforts.

The NRC review is based on analyses of the historic and cultural resource investigations; a review of available literature; a search of records and collections maintained by the South Dakota Archaeological Research Center; and supplemental field investigations, including evaluative testing, and commitments made by the applicant to implement mitigation measures when sites will be affected. NRC staff conclude that the impacts to historic and cultural resources at the proposed Dewey-Burdock site under this alternative would range from SMALL to LARGE. This finding reflects that efforts to identify and evaluate properties of religious and cultural significance to tribes are incomplete and Section 106 consultation is ongoing (see SEIS Section 1.7.3.5 and Appendix A).

4.9.1.2.2 Operations Impacts

Only minimal impacts are expected from facility operation or maintenance on historic and cultural resources because impacts to these properties will be mitigated prior to facility construction. Visual impacts for historic properties are the same those as described in Section 4.9.1.1.1. If there is an inadvertent discovery of historic and cultural resources during routine maintenance activities, the Unexpected Discovery Plan committed to by the applicant will be implemented. For these reasons, the impacts to historic and cultural resources during the operations phase for the land application disposal option will be SMALL.

4.9.1.2.3 Aquifer Restoration Impacts

Aquifer restoration impacts to historic and cultural resources will be similar to, or less than, the impacts from operations. Impacts to these resources will have been mitigated prior to the construction phase of the proposed project. Historic and cultural resources encountered during aquifer restoration activities, will be dealt with under the applicant’s Unexpected Discovery Plan will be implemented. Work at the immediate area would stop and proper notifications would be undertaken. Therefore, the impacts to historic and cultural resources during the aquifer restoration phase for the land application disposal option will be SMALL.

4.9.1.2.4 Decommissioning Impacts

Decommissioning and reclamation activities will focus on previously disturbed areas. Therefore, there will be minimal decommissioning impacts on historic and cultural resources These sites would have been avoided from the construction phase through the decommissioning phase. Visual impacts for cultural resources are discussed in Section 4.9.1.1.1. If historic and cultural resources are encountered during decommissioning and reclamation activities, the Unexpected Discovery Plan will be implemented. Work would stop in the immediate area and proper notifications would be undertaken. Therefore, the 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 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 4.9-4.

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 would be affected by the No-Action alternative. The impacts associated with current land activities, such as, CBM extraction, oil and gas extraction, and cattle ranching would continue.

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)

Table 4.9-4. Significance of Historic and Cultural Resources Impacts for the Proposed Liquid Waste Disposal Options for Each Phase of the Proposed Dewey-Burdock ISR 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	SMALL	SMALL
Aquifer Restoration	SMALL	SMALL	SMALL
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.

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 temporary 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 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 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 cannot be 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-ha [50-ac] pivots, four 10-ha [25-ac] pivots, and one 6-ha [15-ac] pivot and the Burdock area will contain six 20-ha [50-ac] pivots, two 10-ha [25-ac] pivots, and two 6-ha [15-ac] pivots.

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 would 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 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.

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 ISR 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 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 Region of Influence (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 maximum), 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, towns in South Dakota may 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 $165 million for Custer County and $134 million for Fall River County in 2011 (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 would 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 would 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; however, this tax will go to the State of South Dakota general fund and not be directly returned to the counties in the ROI (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 construction workforce (86 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.

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, 2012). 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.

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 Council on Environmental Quality (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

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

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.

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 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

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						

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, would 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 would 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 TCPs) within the proposed Dewey-Burdock ISR Project area will be addressed through the National Historic Preservation Act (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 Tribal Historic Preservation Oficer (THPO)], and other government agencies (e.g., BLM, ARC). The Section 106 consultation process

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		

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 storm water 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, if identified in the proposed project area.

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.

GEIS Construction Phase Summary

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 would 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 bound 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 would 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 would result in a radiological dose that is well below the 10 CFR Part 20 occupational and public dose limits of 0.05 Sv/yr and 1 mSv/yr [5 and 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 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 would 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 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 would 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

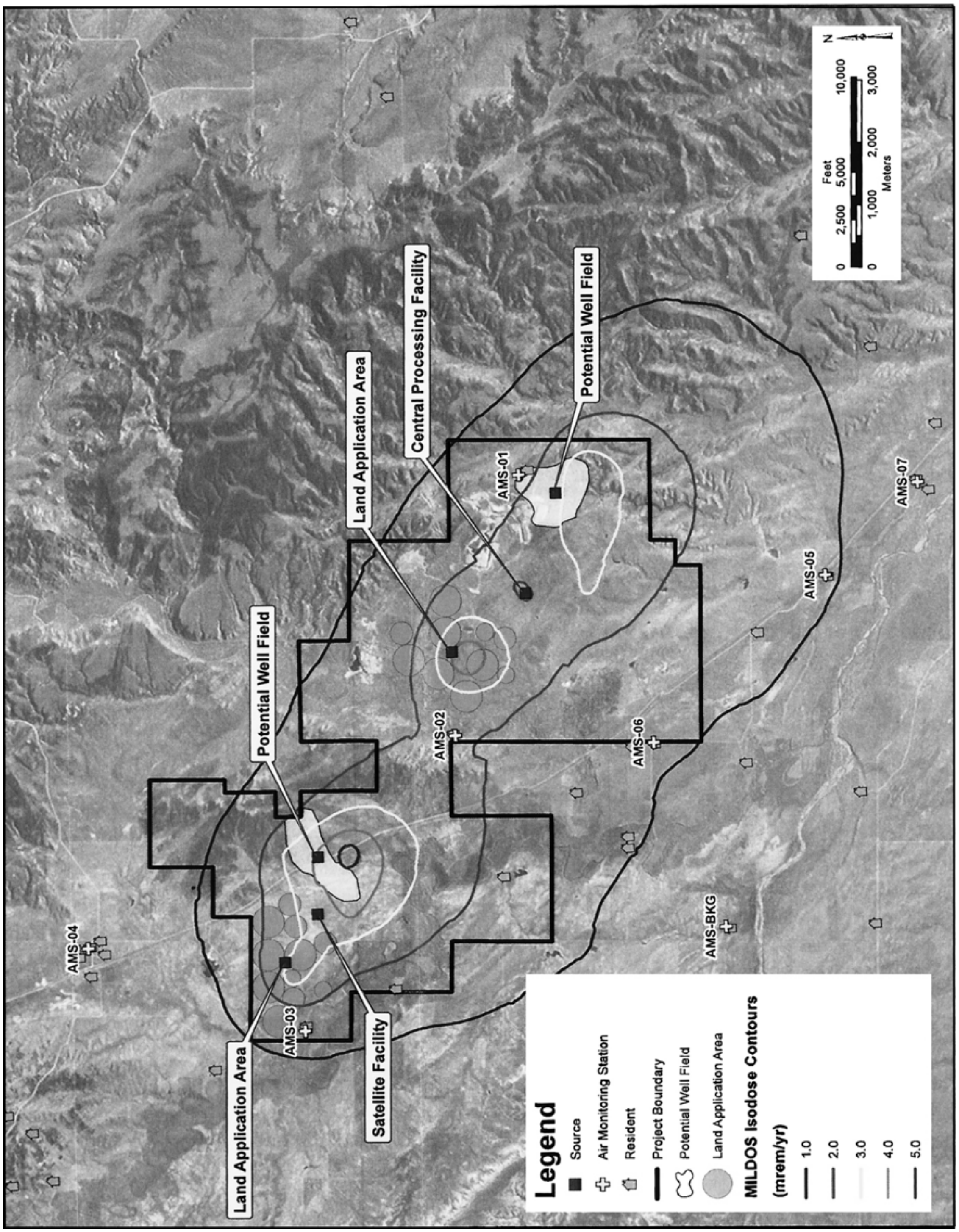

Figure 4.13-1. Map SHowing Isodose Contours Obtained From MILDOS Modeling at the Proposed Dewey-Burdock ISR Project Site.
Source: Modified From Powertech (2011).

locations surrounding the facility would 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).

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.

Table 4.13-1. Generic Accident Dose Analysis for ISR 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)		

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 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 would 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 would be 304 m^3 [80,308 gal]; it would 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 would 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.

Pregnant Lixiviant and Loaded Resin Spills. 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 would 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 would 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 would be 1 kg [2.2 lb] of yellowcake. The rapid fallout within the building and the atmospheric dispersion would 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, Resource Conservation and Recovery Act, and the Toxic Substances and Control Act.

Chemicals would 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.

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). 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 Occupational Safety and Health Administration 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 would 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 would 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 would 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 would 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 cannot 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 demonstrated 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 demonstrated 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 would 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] would 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 would 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 would be no occupational exposure. There would be no additional radiological exposures to the general public from project-related effluent releases, and there would be no impact on long-term environmental radiological conditions. Radiation exposure and risk to the general public would 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.

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 ISR 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.

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 temporary cessation of operations.

<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)

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 would 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 would 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) would 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 would 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 constructed, operated, and monitored to ensure requirements 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 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 constructed, operated, and monitored to ensure requirements 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 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 would 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

[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].

projected year 2028 remaining capacity of 6,473 t [7,136 T] would 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 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 would 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

[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.

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 cannot 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 through 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 constructed, operated, and monitored to ensure requirements 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 at least 1,124 L/min [297 gal/min] during the period from March 29 to through October 31. The applicant proposes two land application areas, which will provide at least 2,248 L/min [594 gal/min] 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 through 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 constructed, operated, and monitored to ensure requirements 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 at least 1,124 L/min [297 gal/min] during the period from March 29 to through October 31. The applicant proposes 2 land application areas, which will provide at least 2,248 L/min [594 gal/min] 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 would 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 would 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 would 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]

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 would 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] would 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

[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].

[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.

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 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 cannot obtain a UIC Class V injection well permit or the necessary permits for land application, it will have to identify another wastewater disposal option. Because these options are hypothetical and not proposed by the applicant, this section evaluates the environmental impacts broadly on any resource from implementing the alternate wastewater disposal options identified in SEIS Section 2.1.1.2. All of 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

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 ISR 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.

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.

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, if 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 would 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 regulatory provisions 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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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 draft 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 will respond to public comments received on the draft SEIS in the final SEIS.

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