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Table 5.0-2: Regulatory Primacy

Media or Environmental Issue (from ISR GEIS, NRC, 2009)	Regulatory Agency (in order of perceived jurisdictional primacy)
Land Use	NRC, DENR, BLM
Transportation	NRC, DOT
Geology	NRC, EPA, BLM, DENR
Water Resources	NRC, DENR, EPA, BLM
Ecology	NRC, DENR, BLM, USFWS, SDGF&P
Meteorology, Climatology & Air Quality	NRC, EPA, DENR, BLM
Noise	NRC, OSHA, DENR, BLM
Historic and Cultural Resources	NRC, BLM, SHPO, DENR
Visual Resources	NRC, BLM, DENR
Socioeconomics	NRC, DENR, BLM
Public and Occupational Health	NRC, OSHA, BLM, EPA, DENR
Waste Management	NRC, DENR, BLM
Decontamination, Decommissioning, Reclamation	NRC, DENR, EPA, BLM
Accidents	NRC, OHSA, BLM, DOT, DENR
Environmental Justice	NRC, BLM, EPA
Cumulative Impacts	NRC, BLM, DENR, EPA
Monitoring	NRC, DENR, BLM
Financial Assurance	NRC, DENR, EPA, BLM

Notes:

1) NRC is the lead federal agency and is primarily responsible for licensing the construction, operation and closure of the ISR project. NRC is the primary enforcement regulator.
2) BLM is a cooperating agency with NRC for the NEPA review and is responsible for the issuance of an approved "Plan of Operations."
3) EPA has permitting authority for the UIC Class V and Class III permits dealing with underground injection of liquid wastes and lixiviant for the recovery of uranium. EPA also is attempting to require air quality permit for radon releases from impoundments.
4) DENR - Chief Engineer is responsible for issuing water rights. DENR – Water Quality is responsible for approving the Groundwater Discharge Plan and NPDES permit for releases to surface water. DENR - Minerals and Mining is responsible for issuing a permit to mine.
5) Considering the implications of the 2011 South Dakota Legislature's Senate Bill 158 that tolled the regulations promulgated for ISR operations, DENR regulations may not be duplicative of either NRC's or EPA's regulations that apply to ISR operations. However, since the authority to mine in South Dakota still resides with DENR and the contents of an acceptable application are still listed in SDCL 45-6B, Powertech (USA) suggests that complying with the application content requirements is necessary and appropriate, considering the intent of SB 158.
6) USFWS has regulatory primacy of the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. SDGF&P enforces the South Dakota laws pertaining to the protection and propagation of all game animals, game birds, fish, and harmless birds and animals.

Measurements during pump testing will include instantaneous and totalized flow, periodic pressure transducer measurements, barometric pressure, and time. A step rate test will be performed initially. There will be an initial stabilization phase with no flow, a stress period of constant flow, and a recovery period with no flow.

Pump Test Evaluation

Evaluation of pump test data will address the following:

1) Demonstration of hydraulic connection between the production and injection wells and all perimeter monitor wells and across the production zone.
2) Verification of the geologic conceptual model for the well field.
3) Evaluation of the vertical confinement and hydraulic isolation between the production zone and overlying and underlying units.
4) Calculation of the hydraulic conductivity, storativity, and transmissivity of the production zone sand unit.
5) Evaluation of anisotropy within the production zone sand unit.

5.3.3.4 Well Field Hydrogeologic Data Packages

Pump testing data and results will be included in the well field hydrogeologic data packages, which will be prepared in accordance with NRC license requirements. Upon completion of field data collection and laboratory analysis, the well field hydrogeologic data packages will be assembled and submitted for review by the Safety and Environmental Review Panel (SERP) for evaluation. The SERP is described in Section 5.7.2.3. The SERP evaluation will determine whether the results of the hydrologic testing and the planned ISR operations are consistent with standard operating procedures and technical requirements stated in the NRC license. The evaluation will include review of the potential impacts to human health and the environment. Following SERP evaluation, well field hydrogeologic data packages will be submitted to NRC for review and approval/verification in accordance with NRC license requirements. A copy of each well field package also will be submitted to DENR for information purposes. The well field hydrogeologic data package and written SERP evaluation will be maintained at the site and available for regulatory agency review.

Each well field hydrogeologic data package will contain the following:

1) A description of the proposed well field (location, extent, etc.).

2) Map(s) showing the proposed production and injection well patterns and locations of all monitor wells.
3) Geologic cross sections and cross section location maps.
4) Isopach maps of the production zone sand and overlying and underlying confining units.
5) Discussion of how pump testing was performed, including well completion reports.
6) Discussion of the results and conclusions of the pump testing, including pump testing raw data, drawdown match curves, potentiometric surface maps, water level graphs, drawdown maps and, when appropriate, directional transmissivity data and graphs.
7) Sufficient information to show that wells in the monitor well ring are in adequate communication with the production patterns.
8) Baseline water quality information including proposed upper control limits (UCLs) for monitor wells and target restoration goals (TRGs).
9) Any other information pertinent to the proposed well field area tested will be included and discussed.

In addition to the well field hydrogeologic data packages, Powertech (USA) will prepare and submit injection authorization data packages to EPA for each well field. The injection authorization data packages will contain much of the information described previously for well field hydrogeologic data packages, including well field designs, pump testing results, calculated formation fracture pressure for each header house and the designated maximum injection pressure for each header house. A copy of each injection authorization data package will be submitted to DENR for information purposes.

5.3.3.5 Well Field Operation

Refer to Section 5.1.3 for an overview of well field operations. The following sections describe key operating provisions in greater detail, including hydraulic well field control, injection pressure, and the water balance.

5.3.3.5.1 Hydraulic Well Field Control

Powertech (USA) will maintain hydraulic control of each well field from the first injection of lixiviant through the end of aquifer restoration. During uranium recovery, the groundwater removal rate in each well field will exceed the lixiviant injection rate, creating a cone of depression within each well field. During aquifer restoration, the groundwater removal rate in each well field will exceed the injection rate of permeate and clean makeup water from the Madison Limestone or another suitable formation. If there are any delays between uranium recovery and aquifer restoration, production wells will continue to be operated as needed to

Chilson. This unit is at least 200 feet beneath the base of the Fuson Shale and is well below the historical mining disturbance in the Fall River Formation.

Powertech (USA) also will install and sample operational monitor wells in the Fall River, Chilson, and alluvium between the surface (open-pit) mines and well field areas. For additional information, refer to Section 5.5.2.3.

5.3.3.8 Approach to Well Field Development with Respect to Alluvium

This section summarizes Powertech (USA)'s approach to well field development in areas of Beaver Creek and Pass Creek alluvium, including alluvial characterization, pump testing, and operational monitoring. This section consolidates information presented elsewhere in the application and includes references to the applicable sections.

Alluvial Characterization

Powertech (USA) completed an alluvial drilling program in 2011 to characterize the thickness, extents, and saturated thickness (if water was present) of the alluvium along Beaver Creek and Pass Creek. Alluvial characteristics will be further evaluated during well field delineation drilling described in Section 5.3.3.3.

Pump Testing

As described in Section 5.3.3.3, an extensive pump testing program will be designed and implemented prior to operation of each well field to evaluate the hydrogeology and assess the ability to operate the well field. Monitor wells will be completed in the alluvium, if present.

Operational Monitoring

Section 5.3.3.1.2.2 describes how alluvium will be treated as an overlying hydrogeologic unit and monitored appropriately during operational groundwater monitoring. Powertech (USA) also will monitor potential changes in alluvial water quality throughout the permit area through the monitoring network described in Section 5.5.2.3.

5.3.3.9 Approach to Well Field Development with Respect to Historical Exploration Holes

Powertech (USA) has extensive information about the location of exploration holes within the permit area. A map of historical exploration holes is provided as Figure 3.2-7, and a detailed inventory is provided as Appendix 3.2-A. The vast majority of historical drill holes were plugged and abandoned in accordance with State of South Dakota requirements in place during drilling. Historical TVA drilling and Powertech (USA)'s exploration drilling were conducted through

DENR-issued Permits to Explore. These permits required exploration holes to be plugged with bentonite or cement grout. An exploration bond was held by the State to ensure the proper plugging of all exploration holes. A 1989 letter from TVA to DENR describes how to the best of TVA's knowledge, all TVA test holes were properly plugged and abandoned in accordance with applicable regulations. The letter discusses attempted mitigation of the one drill hole known to be seeping to the surface in the "alkali area." Throughout the entire proposed permit area, there is only one recorded instance ("alkali area") where water seepage to the surface is suspected to have come from an exploration hole (refer to Section 3.4.2.2.3).

Prior to developing each well field, Powertech (USA) will use best available information and best professional practices to locate exploration holes or wells in the vicinity of the planned well field, including historical records, color infrared imagery, field investigations, and potentiometric surface evaluation and pump testing conducted for each well field. Section 5.3.3.3 describes the procedures that will be followed to demonstrate that the production and injection wells are hydraulically isolated from overlying and underlying aquifers. These include static potentiometric water level evaluations to identify any anomalous conditions indicative of leakage across aquitards; water quality sampling and evaluation to identify any potential areas of leakage; and drawing down the production zone sand unit through pump testing while recording the presence or lack of response in vertical monitor wells to evaluate vertical confinement. This information will be contained within well field hydrogeologic data packages submitted to NRC for review and verification/approval and submitted to DENR prior to operating each well field (see Section 5.3.3.4).

If it is determined that an unplugged exploration hole has the potential to impact the control and containment of ISR solutions, Powertech (USA) will plug and abandon or mitigate the exploration hole (see Section 5.6.3.2). It is not surprising that there is little evidence of unplugged holes in the permit area, due to the well-known natural tendency of drill holes to seal themselves by collapsing and swelling of the formations.

5.3.4 Ponds

5.3.4.1 Pond Design

Lined ponds will be used to temporarily store liquid waste generated at the Satellite Facility and CPP. The pond lining systems will vary according to pond use. Ponds containing untreated liquid waste or ponds used in the treatment process (e.g., radium settling ponds) will be provided with two geosynthetic liners, a clay liner, and a leak detection system. Ponds containing treated water

will be provided with a single geosynthetic liner underlain by a clay liner. The pond capacity will vary according to the liquid waste disposal option. Greater capacity is required for the land application option, since liquid waste will be stored during times of year when the land application systems are not operated.

The pond design for both liquid waste disposal options is summarized below. Appendix 5.3-A provides detailed pond design information, and Appendix 5.3-B contains pond construction specifications, testing and QA/QC procedures. Section 5.3.4.2 provides detailed descriptions of pond sizing calculations. Powertech (USA) will provide as-constructed drawings of the ponds to DENR.

Land Application Option

The land application disposal option will include the following ponds:

- **Two (2) Radium Settling Ponds** - one near each land application area (Dewey and Burdock). Each pond will have an operating capacity of 39.4 acre-feet. Radium settling ponds for the land application disposal option were designed such that a single pond has sufficient capacity for radium removal of the entire project-wide wastewater stream at the maximum expected production bleed of 3% while maintaining a minimum retention time of 14.1 days.
- **Two (2) Spare Ponds** - one at each area. Each pond will have an operating capacity of 39.4 acre-feet. The spare ponds will be designed with the same dimensions and liner system as the radium settling ponds so that they can be used as either spare radium settling ponds or spare central plant ponds.
- **Two (2) Outlet Ponds** - one at each area. Each pond will have an operating capacity of 4.9 acre-feet. The outlet ponds will be designed to temporarily store treated water from the radium settling ponds and provide extra capacity for the radium settling ponds during large precipitation events.
- **Eight (8) Storage Ponds** - four at each area. Each pond will have an operating capacity of 63.8 acre-feet. The storage ponds will be used to store treated water during the winter months when no liquid waste disposal by land application systems is available. The total storage required at each area was obtained using the SPAW model, which is discussed in more detail in Appendix 5.3-A and the GDP.
- **Two (2) Spare Storage Ponds** - one at each area. Each pond will have an operating capacity of 63.8 acre-feet. The spare storage ponds will be designed with the same dimensions and liner system as the storage ponds so that they can be used in the event of an upset condition.
- **One (1) Central Plant Pond** - located at the CPP, with an operating capacity of 36.2 acre-feet. The storage capacity design for the central plant pond allows for over 18 months of CPP liquid waste storage, which will be required during initial uranium

Powertech (USA) will be required by NRC license conditions to develop standard operating procedures (SOPs) prior to operations for leaks or spills, including pond leakage. Powertech (USA) will provide DENR with a copy of the SOP(s) addressing response actions to leakage in the pond liners. Following is a summary of the procedures that will be followed in the event of a pond leak. If significant water is found in the leak detection system, the water in the standpipes will be sampled immediately for indicator parameters to confirm that the water in the detection system is from the pond. The indicator parameters will be chloride and conductivity. If the analysis confirms a leak, a secondary sample shall be collected and analyzed within 24 hours. Upon confirmation of a leak by the second analysis, the pond will be taken out of service until repairs can be completed. The leak will be reported to the NRC within 24 hours of the confirmation. In addition, Powertech (USA) will notify DENR by phone or email of any pond leak within 48 hours of the confirmation. A pond removed from service because of a confirmed leak will be dewatered by transferring the contents to a spare pond. Regardless of the disposal option used at the project, the Dewey and Burdock areas each will have a spare pond of identical capacity, construction, and dimensions as the primary radium settling ponds. At the Burdock area, the spare pond also may serve as a spare for the central plant pond.

If recurring water is present in a leak detection system and it is confirmed through laboratory analysis that it is not caused by a leak (e.g., condensation could collect in the leak detection system), Powertech (USA) may elect to install a submersible pump in the leak detection system sump to routinely dewater the leak detection system and minimize the hydraulic head on the secondary liner. The pond design drawings in Appendix 5.3-A and 5.3-B show that an access port and 8-inch diameter PVC pipe will be available to lower a submersible pump into the leak detection sump.

5.3.5 Instrumentation and Emergency Shutdown

Powertech (USA) will install automated control and data recording systems at the Satellite Facility and CPP which will provide centralized monitoring and control of the process variables including the flow rate and pressure of production, injection, and waste streams. The systems will include alarms and automatic shutoffs to detect and control a potential release or spill.

Pressure and flow sensors will be installed, for the purpose of leak detection, on the main trunklines that connect the CPP and Satellite Facility to the well fields. In addition, the flow rate of each production and injection well will be measured automatically. Measurements will be collected and transmitted to both the CPP and Satellite Facility control systems. Should pressures

or flows fluctuate outside of normal operating ranges, alarms will provide immediate warning to operators which will result in a timely response and appropriate corrective action.

Both external and internal shutdown controls will be installed at each header house to provide for operator safety and spill control. The external and internal shutdown controls will be designed for automatic and remote shutdown of each header house. In the event of a header house shutdown, an alarm will occur and the flows of all injection and production wells in that header house will be stopped automatically. The alarm will activate a blinking light on the outside of the header house and will cause an alarm signal to be sent to the CPP and Satellite Facility control rooms.

An external header house shutdown will activate an electrical disconnect switch located on the outside of the header house or at the transformer pole which will shut down all electrical power to the header house. This will mitigate potential electrical hazards while de-energizing the header

submergence. Figures 5.3-10 and 5.3-11 show that all ISR wells and monitor wells will be sealed.

Estimates of peak flood discharges and water levels produced by floods on Pass Creek, Beaver Creek and local small drainages are provided in Section 3.5.2.3 and Appendix 3.5-A. Plate 3.5-1 depicts the modeled flood inundation areas for all surface water features during the 100-year, 24-hour storm event in relation to proposed facilities and infrastructure. As described in Appendix 3.5-A, HEC-HMS models were used to calculate peak discharges, and HEC-RAS models were used to compute water-surface profiles and inundated areas for the respective runoff events.

Any disturbance to the prevailing hydrologic balance of the affected land and of the surrounding area and to the quality and quantity of water in surface water systems both during and after ISR operations and during reclamation will be minimized in accordance with SDCL 45-6B-41. No diversions will be constructed on perennial stream channels, and only relatively minor quantities of surface runoff will be captured in sediment ponds. Therefore, little or no impacts to the surface water hydrologic balance will occur. Surface water quality will be protected through erosion control BMPs and sediment control measures described below. Section 5.6.5 describes mitigation measures to protect surface and groundwater from potential leaks or spills.

5.3.9.1 Diversion Channels

Following is a description of the diversion channels that will be constructed within the permit area for the processing facilities and ephemeral stream channels.

Diversion channel designs for the processing facilities are provided on Plates 5.3-13, 5.3-14, and 5.3-19. These supersede the diversion channel designs for the processing facilities in Appendix 5.3-B. In accordance with ARSD 74:29:07:09(6), the diversions around the CPP, Satellite Facility and associated radium settling ponds and central plant pond have been designed for the 6-hour PMP event. Diversions were not designed for the PMP event around the storage ponds or spare storage ponds, since a) these ponds will store only treated water en route to the land application that will not contain radionuclides in excess of allowable discharge limits, b) the treated water storage ponds are not associated with uranium processing or wastewater treatment, and c) NRC guidance in Regulatory Guide 3.11 indicates that diversion designs for isolated areas where pond failure would neither jeopardize human life nor create damage to property or the environment beyond Powertech (USA)'s financial assurance capabilities do not need to use extremely conservative flood design criteria. Powertech (USA) will not change the use of the treated water storage ponds or spare storage ponds without obtaining DENR authorization through a technical revision or permit amendment, the application for which would include

diversion designs for the 6-hour PMP event. In the land application option, no diversions will be required around the processing facilities or radium settling ponds due to the small drainage area above these facilities.

Plates 5.3-17b and 5.3-18 depict diversions designed to keep storm water out of the treated water storage ponds and spare storage pond in the Dewey area (land application option). Plate 5.3-17a depicts a diversion for the Dewey area surge pond (deep disposal well option). These diversions are capable of passing the 2-year, 6-hour storm event without erosion and have the capacity for a 100-year, 24-hour event. In the Burdock area, drainage areas above the treated water storage ponds and surge pond are less than 10 acres. There are also small drainage areas between the catchment areas and Dewey treated water storage ponds of less than 10 acres. Diversions are not planned in these areas due to the small drainage area and small size of the associated runoff events. The pond embankments in these cases will extend at least 1 foot above ground, which along with grading and drainage plans will be sufficient to ensure that no runoff will enter any of the ponds up to the 100-year, 24-hour storm event. Prior to construction, Powertech (USA) will prepare grading and drainage plans for the ponds and processing facilities and provide copies to DENR.

With the exception of Beaver Creek, all stream channels within the permit area are ephemeral. Pass Creek above the permit area could be considered intermittent, but it is ephemeral within the permit area since there is no groundwater component and flows only occur in response to precipitation or snowmelt events. No diversions are planned on Beaver Creek or Pass Creek, and no diversions are planned on perennial or intermittent streams.

Plates 5.3-6 and 5.3-7 provide the locations of planned ephemeral stream channels within the permit area. The designs for the diversions associated with the initial well fields and land application areas are presented on Plates 5.3-9 through 5.3-11. Diversion designs for future well fields, if needed, will be provided to DENR for review and verification prior to construction.

Diversions of ephemeral channels will be designed to maintain channel velocities equal to or less than 5 feet per second for the discharge from a 2-year, 6-hour precipitation event and have the ability to contain the discharge from a 100-year, 24-hour precipitation event.

Interim revegetation will be performed on the bottoms and side slopes of all diversions to reduce erosion. In instances where the diversion channel velocity during the design storm exceeds 5 feet per second, other erosion control measures will be implemented such as geosynthetic liners, geosynthetic filter media, or riprap. Diversions will be constructed with 3:1 or shallower side slopes to reduce the risk of slope failure, promote interim revegetation, and allow safe passage for humans, wildlife and livestock. Diversion bottom elevations will tie to undisturbed upstream

and downstream channel elevations to eliminate increased erosion potential. Diversions will not discharge onto topsoil or spoil stockpiles or other unconsolidated material such as newlyreclaimed areas. Culvert or bridge crossings over the diversions are not planned. If it becomes necessary to cross a diversion in the future, Powertech will submit design drawings to DENR for review and approval prior to construction.

5.3.9.2 Erosion Control

Powertech (USA) will minimize erosion of disturbed, reclaimed and native areas through proper land management and farming techniques. Typically, following ground disturbance, areas will be prepared and seeded as soon as possible to reduce the possibility of erosion. Also, erosion control measures will be used to reduce overland flow velocity, reduce runoff volume or trap sediment. Examples include rip-rap, vegetative sediment filters, check dams, mulches, cover crops, and other measures. Plates 5.3-6 through 5.3-8 show the sediment control measures that will be used in the permit area.

used (typically November through early March). Additional design information for the land application systems is presented in the GDP. Figure 5.3-1 depicts the proposed facilities in the land application option.

Each of the two land application systems will have up to 315 acres of irrigated area and an additional 65 acres of center pivots on standby. Each of the two land application systems is designed for an average annual application rate of 310 gpm and an instantaneous application rate of 297 to 653 gpm.

Plates 5.4-1 and 5.4-2 depict the conceptual catchment area designs in the Dewey and Burdock areas, respectively. The conceptual designs are described in the GDP and consist of earthen berms located at or near the downgradient edges of the center pivot areas. Sufficient capacity for containment of the 100-year, 24-hour runoff event will be provided for all land application areas. Plates 5.4-1 and 5.4-2 show that most conceptual catchment area designs include excess capacity beyond that required for 100-year, 24-hour runoff storage resulting from the upgradient drainage area. In these cases, the conceptual catchment area designs include a designated "normal operating level," which is the maximum level allowed to fill with runoff and snowmelt while still maintaining adequate freeboard for the 100-year, 24-hour runoff event. The catchment areas will not be used to store land applied solutions and only will contain water following rainfall or snowmelt events in accordance with GDP permit conditions. The normal operating level will be delineated with a clearly visible marker such as a t-post, which will be installed on the catchment berm or another highly visible location.

In some cases, more than one catchment area may be used to contain the 100-year, 24-hour runoff volume. In these cases, there will not be a designated normal operating level in the upgradient catchment areas. Any time runoff or snowmelt accumulates in a catchment area without a designated normal operating level it will be dewatered to a downgradient catchment area with a designated normal operating level. It is anticipated that dewatering will occur via gravity discharge through a pipe with the inlet invert elevation at the bottom of the upgradient catchment area. In this case flow would be controlled by a manual valve, normally closed, in the discharge pipe. Following a rainfall or snowmelt event, the valve would be opened and the water drained to the downgradient catchment area at non-erosive velocity. Other alternatives may include pumping or water trucks. As described in Table 1.1-2 under ARSD 74:29:05:14(1), as-constructed plans of the land application systems, including catchment area dewatering systems, will be provided to DENR prior to operation.

If a catchment area fills above the normal operating level, a dewatering program will be initiated. The catchment area will be dewatered, with the excess water conveyed to another catchment area with excess operating capacity or the storage ponds, or pumped to a land application pivot area (primary or standby area). It is anticipated that pumps will be installed in the most downgradient catchment areas, with pump discharge piping routed to the storage ponds. In this case the piping would be installed in the same corridor as the pipelines from the ponds to the pivot areas wherever possible. These pipelines are shown on Plates 5.4-1 and 5.4-2. Alternately water trucks may be used in some circumstances to dewater catchment areas and transfer the contents to the storage ponds or another catchment area. If water trucks are to be used, Powertech will demonstrate in the as-constructed land application system plans that the catchment areas can be dewatered in a timely manner. A catchment area also will be dewatered if the water quality exceeds trigger values protective of livestock and wildlife as described in Section 5.5.4.2.

In the land application option, groundwater withdrawn during aquifer restoration will not be treated with RO. Instead, the aquifer restoration water will be disposed directly in land application systems following treatment to remove uranium and radium. The water balance for the land application option is presented in Section 5.3.3.5.3.

Following is a summary of how the proposed land application systems satisfy specific site evaluation and compatibility criteria in ARSD 74:29:05:16.

Potential Impacts to Wildlife Grazing in Land Application Areas (ARSD 74:29:05:16(1))

Potential impacts to wildlife grazing in the land application areas will be minimized through treating the land application effluent prior to application, monitoring vegetation within land application areas, and evaluating the monitoring results annually to detect potential increasing trends in constituent concentrations. As a condition of the GDP, the land application water quality will be required to meet effluent limits established by DENR that are protective of groundwater quality. Section 5.4.1.1.4.1 describes the anticipated land application water quality. Trace metal concentrations are anticipated to be at or below ARSD 74:54:01:04 human health standards. Radionuclide concentrations will be below 10 CFR Part 20, Appendix B, Table 2, Column 2 effluent limits for release of radionuclides to the environment. The suitability of land application vegetation to wildlife grazing will be verified through annual vegetation monitoring in the land application areas. Section 5.5.6.2 describe how vegetation in the land application areas will be sampled each year. Section 5.5.6.2 describes how this information will be evaluated annually and the results reported to DENR to determine whether there is any risk to wildlife.

Compatibility with Site Geology and Soils ((ARSD 74:29:05:16(2) and (4))

The site geology is well suited to land application. The depth to alluvial groundwater, where encountered, is greater than the maximum anticipated infiltration depth of the land application water. The Graneros Group shales will prevent the land application water from reaching bedrock aquifers. The thickness of the Graneros Group is approximately 500 to 550 feet beneath the proposed Dewey land application area and approximately 25 to 250 feet beneath the proposed Burdock land application area. Refer to Cross Sections 3.2-23 through 3.2-27, which depict the thickness of the Graneros within the proposed land application areas.

Geologic conditions make it unlikely that land applied water will reach the alluvium. These conditions include the limited presence of alluvium in the Dewey land application area and the thickness and composition of the material beneath the land application areas. In the Dewey area, most of the planned primary pivot areas do not overlie alluvium. Of the 315 acres of primary center pivots planned in the Dewey area, only about 55 acres (17 percent) occur within the extents of mapped alluvium (refer to Figure 6.1-1 in the GDP application). While most of the planned Dewey standby pivot areas overlie mapped alluvium, the potential for land applied water to reach the alluvium in the standby areas is much lower, since Powertech (USA) does not anticipate using these areas regularly.

In all potential land application areas (Dewey and Burdock), the thickness and composition of the material between the pivot areas and alluvial groundwater, where present, will act to prevent land applied water from reaching alluvial groundwater. In the Burdock area, the depth to the top of the alluvial gravel within the planned pivot areas ranges from about 12 to 35 feet and is typically 15 to 25 feet. The depth to alluvial groundwater, where present, is typically 13 to 35 feet. In the Dewey area, there are only limited areas in which the planned pivot areas overlie saturated alluvium. Based on ambient sampling conducted in support of the GDP application, the depth to alluvial groundwater, where present beneath the potential Dewey pivot areas, is anticipated to be at least 18 feet. By comparison, the SPAW model simulations predict that the land application water will not percolate deeper than 8 feet.

The soil hydraulic properties beneath the land application areas will help prevent the migration of water into the alluvial groundwater. Soils sampled from test pits in and around the land application areas predominantly contain clay and silt, with lesser amounts of sand and virtually no gravel to depths of 7 to 10 feet. The SPAW modeling simulations considered permeability measurements from soil samples collected in the land application areas.

Compatibility with Groundwater and Surface Water Systems (ARSD 74:29:05:16(3)

Land applied water has a very low potential to reach groundwater or to flow through the alluvium and reach Beaver Creek or Pass Creek based on geologic conditions, Powertech (USA)'s commitment to plug and abandon existing wells within the land application areas, operating plans, and the implementation of extensive monitoring systems. Each of these is described below with the exception of geologic conditions, which was described previously.

Plugging and Abandoning Existing Wells

Powertech (USA) has not identified any existing wells within the proposed Dewey land application area. Within the proposed Burdock land application area, there are two existing wells, including one former domestic well (well 43) and one stock well (well 15). Prior to operation of the Burdock land application system, both of these wells will be plugged and abandoned with bentonite or cement grout in accordance with the procedures in ARSD 74:02:04:67. This will eliminate the potential for vertical migration of land applied solutions through existing wells.

Operating Plans

The land application rate has been designed specifically to minimize percolation below the rooting zone. The typical application rate is about 19 inches during the land application season of approximately April through October. This is a typical agronomic rate for growing alfalfa and grasses in this region.

Monitoring Systems

Groundwater monitoring will allow Powertech (USA) to track the movement of land applied water through the subsoil beneath the land application areas, determine whether land applied water reaches the alluvium, and track changes in alluvial water quality within the POP zones to prevent migration of land applied water outside of the POP zones or into Beaver Creek or Pass Creek. Monitoring systems will include suction lysimeters installed beneath each land application and catchment area to track the movement of water through the subsoil, interior wells to track changes in alluvial water quality within the POP zones, and compliance wells established at the downgradient edges of the POP zones. Monitoring results from suction lysimeters and interior wells will provide early detection of potential migration of land applied water into and through the alluvium. Early detection of potential impacts will allow Powertech (USA) to adjust the operating parameters, such as the rate of application to various pivots, to avoid potential impacts to alluvial groundwater outside of the POP zone and to avoid potential impacts to Beaver Creek or Pass Creek.

The alluvial groundwater monitoring program associated with the GDP also will detect any potential impacts to Cheyenne River alluvium. The mapped Beaver Creek and Pass Creek alluvium are contiguous with the Cheyenne River alluvium, and the position of the interior and compliance monitor wells will ensure that any land applied water entering Beaver Creek or Pass Creek alluvium will be detected. There is no pathway for land applied water to eventually reach the Cheyenne River alluvium without first passing a compliance well. Further, Powertech (USA) will monitor other alluvial wells farther downgradient in the Beaver Creek and Pass Creek alluvium (e.g., wells 677 and 678). Periodic monitoring of these downgradient alluvial wells will allow detection of any potential impacts from the land applied water on Beaver Creek, Pass Creek, or Cheyenne River alluvium.

If the results of monitoring show that groundwater outside of the POP zone or surface water in Beaver Creek or Pass Creek have potential to be impacted, Powertech (USA) will initiate a corrective action plan as described in the GDP application. Potential corrective actions include adjusting operating parameters and/or initiating a pump back or pump and treat system to recover alluvial groundwater.

Compatibility of Slopes with Land Application Systems (ARSD 74:29:05:16(5))

In the proposed Dewey land application area, the average slope is approximately 3.5 percent. The maximum slope is between 15 and 25 percent in a small area (approximately 5 acres) at the northern edge of one proposed land application area (refer to page 5.3-B-42 in Appendix 5.3-B). In the proposed Burdock land application area, the average slope is approximately 2 percent. Only about 2 acres of the proposed Burdock land application area has a slope greater than 15 percent (refer to page 5.3-B-43 in Appendix B). These slopes will be compatible with center pivot irrigation.

During final design of the land application systems and catchment areas, Powertech (USA) will evaluate any areas with slopes greater than 15 percent to determine whether they can be avoided or whether they require mitigation. The evaluation will consider the maximum manufacturer-recommended slope based on the center pivot climbing capability and ground clearance requirements. It also will consider whether regrading will be necessary to reduce the potential for runoff and erosion. It is currently anticipated that approximately 5 acres in the proposed Dewey land application area and 2 acres in the proposed Burdock land application area will be regraded to a maximum slope of 15 percent unless these areas are avoided during final design.

Potential for Erosion (ARSD 74:29:05:16(6))

The potential for erosion within the land application areas will be minimized through siting land application areas in relatively flat terrain, maintaining vegetation, optimizing the irrigation rate to avoid runoff, using low-impact sprinkler heads, and capturing any runoff in catchment areas. The average slopes in the proposed land application areas are 2 to 3.5 percent. Small areas with slopes greater than 15 percent are anticipated to be regraded to minimize the potential for erosion and to meet the maximum manufacturer-recommended slopes for the center pivots. Relatively flat slopes along with maintenance of the land application areas in a vegetated state will limit the potential for erosion. The land application water will be applied at an agronomic rate to prevent runoff into the catchment areas. Should runoff from precipitation or snowmelt occur, the runoff and sediment will be captured in the catchment areas and will not reach perennial or ephemeral stream channels.

Daily inspections of the land application areas and catchment berms during operation of the land application systems will determine whether there are any unplanned effects such as erosion.

Distance to Flowing Streams (ARSD 74:29:05:16(7))

Beaver Creek is the only flowing stream within the proposed permit area. The minimum distance from a proposed Dewey land application area to Beaver Creek is approximately 280 feet. The minimum distance from a proposed Burdock land application area to Beaver Creek is approximately 1.1 miles.

Potential Impacts to Adjacent Land Uses (ARSD 74:29:05:16(8))

Land uses adjacent to the proposed land application areas includes livestock grazing on rangeland and recreational use (primarily hunting) on private lands. No effects from land application on adjacent land uses are anticipated due to the operation of land application systems to minimize overspray and due to Powertech (USA)'s commitment to limit hunting within the proposed permit area. Section 3.1.2 describes how Powertech (USA) will work with BLM, SDGF&P and private landowners to limit hunting within the proposed permit area to the extent practicable.

The land application systems have been sited and will be operated to avoid any potential impacts to nearby cropland. No cropland is within or immediately adjacent to the proposed land application areas, and the land application systems will be operated to avoid overspray as a condition of the GDP. As described above, potential impacts to alluvial groundwater will be limited by geologic conditions, plugging existing wells, applying water at an agronomic rate, and

extensive monitoring. This in turn will prevent potential impacts to adjacent cropland via groundwater pathways.

Consideration of Weather Conditions (ARSD 74:29:05:16(9))

Prior to operation of the land application systems, Powertech (USA) will develop a standard operating procedure (SOP) for land application system operation that will include provisions to minimize overspray outside of the center pivot areas. The SOP will include using the results of meteorological monitoring (wind speed, wind direction and temperature) to modify operating parameters. It will include maximum wind speed/wind direction combinations for land application system operation. The SOP also will address precipitation thresholds to avoid land application during heavy or prolonged precipitation events. Temperature thresholds also will be included to avoid land application when water cannot infiltrate due to frozen ground.

5.4.1.1.3 Wastewater Treatment

Prior to discharge to the storage ponds, Powertech (USA) will treat all wastewater associated with ISR operations to meet the requirements of 10 CFR 20, Appendix B, Table 2, Column 2, which are the established limits for discharge of radionuclides to the environment and include limits for natural uranium, radium-226, lead-210 and thorium-230 (see Table 5.4-1). Powertech (USA) anticipates that the GDP will include effluent limits established according to ARSD 74:54:01:04 groundwater standards and ambient alluvial water quality. Treatment will be accomplished by ion exchange for uranium removal followed by radium removal through co-precipitation with barium sulfate in radium settling ponds. It is not anticipated that thorium-230, lead-210 or other radionuclides will be present at concentrations above the limits. If concentrations in the storage ponds are above the release limits, the effluent will be treated as necessary to satisfy the GDP limits.

5.4.1.1.4 Treated Wastewater Quality

The types of wastewater that will be disposed in the DDWs or land application systems include production bleed, groundwater generated during aquifer restoration, affected groundwater generated during well development, and liquid process waste such as resin transfer water and the brine generated during uranium processing. Of these, the largest contributors will be the production bleed and groundwater generated during aquifer restoration.

Table 5.4-2 presents the estimated end-of-production water quality in the ISR well fields. This represents the untreated water quality extracted from the ore zone at the end of uranium recovery and at the beginning of aquifer restoration. This table represents the worst-case water quality

Table 5.4-2. Estimated End-of-Production Groundwater Quality

Parameter	Units	Typical Dewey Baseline[1]	Typical Burdock Baseline[2]	Typical Change[3]	End-of-Production Dewey Estimate	End-of-Production Burdock Estimate
Physical Properties						
pH	s.u.	7.9	7.3	-1.2	6.5 - 7.5	6.5 - 7.5
TDS	mg/L	908	2,293	2,127	3,035	4,420
EC	µmhos/cm	1,323	2,621	2,974	4,297	5,595
Common Elements and Ions						
Bicarbonate[4]	mg/L	211	304	1,320	1,531	1,624
Carbonate	mg/L	<5	<5	-16	<5	<5
Chloride	mg/L	15	13	252	267	265
Sulfate	mg/L	483	1,351	400	883	1,751
Calcium	mg/L	63	386	211	274	597
Magnesium	mg/L	24	124	45	69	169
Sodium[4]	mg/L	211	138	465	676	603
Potassium	mg/L	10	19	10	20	29
Minor Ions and Trace Elements						
Arsenic	mg/L	0.002	0.0045	0.027	0.03	0.03
Barium	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	mg/L	<0.005	<0.005	<0.01	<0.01	<0.01
Chromium	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Copper	mg/L	<0.01	<0.01	0.013	0.013	0.013
Iron	mg/L	<0.03	0.17	0.291	0.31	0.46
Lead	mg/L	0.007	<0.001	<0.05	<0.05	<0.05
Molybdenum	mg/L	<0.1	<0.1	<0.2	<0.2	<0.2
Nickel	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Selenium	mg/L	<0.005	0.0009	1.0	1.0	1.0
Uranium	mg/L	0.01	0.034	22	22	22
Vanadium	mg/L	<0.1	<0.1	0.7	0.7	0.7
Zinc	mg/L	0.01	0.007	0.034	0.04	0.04
Radiological Parameters						
Goss alpha	pCi/L	1,502	4,991	ND	ND	ND
Radium-226	pCi/L	380	1,289	681	1,061	1,970
Calculated Parameters						
SAR (calc.)	unitless	5.7	1.6	ND	9.5	5.6
ESP (calc.)	unitless	6.7	1.0	ND	11.3	6.6
RSC (calc.)	meq/L	-1.7	-24.5	ND	5.9	-16.9

[1] Hydro ID 681 (see Appendix 3.4-G); [2] Hydro ID 680 (see Appendix 3.4-G)
[3] Changes in groundwater quality were calculated based on historical baseline and end-of-production groundwater quality from ISR facilities in Wyoming and Nebraska.
[4] Sodium and bicarbonate estimates may be conservatively high, since the Dewey-Burdock project will use a lixiviant comprising groundwater fortified with dissolved oxygen and carbon dioxide instead of a sodium-bicarbonate solution, which is used at some other ISR facilities.
ND - no data available

encountered in the well fields, and it was used to estimate the range of concentrations of the treated effluent proposed for land application after accounting for treatment and blending.

5.4.1.1.4.1 Land Application Water Quality

The typical water quality during land application will be better than that shown in Table 5.4-2, since the water quality will be continually improving during aquifer restoration. Table 5.4-3 presents the anticipated land application water quality. The upper values shown in this table represent the estimated worst-case water quality to be land applied. The typical land application water quality will be better than the upper values, since multiple well fields typically will be in various stages of production and aquifer restoration at one time, with water quality gradually degrading toward the worst case during production and gradually improving to approximately baseline water quality during restoration. In addition, Madison water may be used at any time to improve the land application water quality.

It is anticipated that trace metal concentrations will be at or below ARSD 74:54:01:04 human health standards. In addition, the effluent concentration limits will be met for the release of radionuclides to the environment as defined in 10 CFR Part 20, Appendix B, Table 2, Column 2. This will be accomplished through treating the water as described previously.

The values shown in Tables 5.4-2 and 5.4-3 were estimated by Powertech (USA) based on historical baseline and end-of-production water quality data from other ISR facilities in Wyoming and Nebraska, with adjustments as necessary to account for planned post-production water treatment(s).

The primary source of land application water, production and restoration bleed, will result from multiple well fields undergoing differing phases of production and restoration. During production, the concentrations of dissolved constituents in each well field will gradually increase from the baseline quality to the post-production quality estimated in Table 5.4-2. During restoration, the water quality will be returned to approximately baseline water quality. The water from multiple well fields will be combined in the storage ponds, where increasing concentrations from producing well fields will be offset by decreasing concentrations from well fields undergoing restoration. This, combined with adequate pond capacity, will ensure that the land application water has relatively consistent water quality throughout the project duration. Additional information is found in the GDP.

Table 5.4-3. Estimated Land Application Water Quality

Parameter	Units	Land Application Water Estimate
Physical Properties		
pH	s.u.	6.5 - 7.5
TDS	mg/L	1,000 - 5,000
EC	µmhos/cm	1,500 - 6,000
Common Elements and Ions		
Bicarbonate	mg/L	500 - 2,000
Carbonate	mg/L	<1
Chloride	mg/L	100 - 400
Sulfate	mg/L	500 - 2,000
Calcium	mg/L	200 - 1,000
Magnesium	mg/L	50 - 300
Sodium	mg/L	200 - 1,000
Potassium	mg/L	10 - 50
SAR	unitless	5 - 10
Minor Ions and Trace Elements		
Arsenic	mg/L	<0.03
Barium	mg/L	<0.1
Cadmium	mg/L	<0.01
Chromium	mg/L	<0.05
Copper	mg/L	<0.02
Iron	mg/L	<1
Lead	mg/L	<0.05
Molybdenum	mg/L	<0.2
Nickel	mg/L	<0.05
Selenium	mg/L	<1
Vanadium	mg/L	<1
Zinc	mg/L	<0.05
Radiological Parameters		
Lead-210	pCi/L	<10
Polonium-210	pCi/L	<40
Radium-226	pCi/L	<60
Thorium-230	pCi/L	<100
U-natural	pCi/L	<300

Note: Estimates of land application water quality were based on Dewey-Burdock Project baseline water quality and historical baseline and end-of-production groundwater quality from ISR facilities in Wyoming and Nebraska, with adjustments as necessary to account for planned post-production water treatments.

5.5.3.2 Reporting

Powertech (USA) will provide DENR with the results of all operational surface water monitoring, including impoundment and stream sampling results. These will be provided in the annual environmental monitoring report described in Section 5.7.2.6.

5.5.4 Land Application System Monitoring

The following describes the monitoring programs that will be implemented if land application is used as a wastewater disposal option. Land application system reporting also is described.

5.5.4.1 Land Applied Effluent Monitoring

Powertech (USA) will collect and analyze effluent water quality samples using a progressive sampling schedule that includes volume-based grab samples in accordance with ARSD 74:29:05:15 and time-based grab samples designed to detect any changes in the land application water quality. ARSD 74:29:05:15 specifies the following sampling requirements: "Sampling of solution to be applied to the land shall consist of not less than one grab sample per 100,000 gallons of solution. If less than 100,000 gallons is to be applied to land, at least one grab sample must be taken and analyzed for the required parameters. Each grab sample must be of sufficient volume so the sample can be split. Each split of the sample must be of a volume sufficient to allow for analysis for all operational monitoring parameters. At every fifth sampling, one split sample of each five consecutive grab samples shall be preserved and analyzed for the required monitoring parameters." To meet these requirements, Powertech (USA) proposes to collect a grab sample of the water pumped from the storage ponds to the land application systems at a frequency of at least one sample per 100,000 gallons. This will be accomplished by manually filling the sample containers or installing an automated grab sampler. At every fifth sampling, five consecutive grab samples will be composited and analyzed for the parameters shown in Table 5.5-5.

Justification for a relatively small list of sample parameters for the volume-based grab sampling is based on the large storage capacity available in the storage ponds at each land application site. Based on an anticipated land application rate of 297 to 653 gpm, grab samples representing each 100,000 gallons of effluent will be collected every 2.6 to 5.6 hours, and composite samples representing each 500,000 gallons of effluent will be collected every 12.8 to 28.1 hours. By comparison, the available storage capacity at each site will be 247.2 ac-ft, which is equal to 86 to 188 days of water storage at the typical pumping rates of 297 to 653 gpm, respectively. Changes

in water quality in the storage ponds will occur very slowly, since the storage capacity far exceeds the pumping rate and since changes in well field water quality will occur slowly. The primary source of land application water, production and restoration bleed, will result from multiple well fields undergoing differing phases of uranium recovery and aquifer restoration. This water will be combined in the storage ponds, where increasing concentrations in water quality constituents from well fields undergoing production will tend to be offset by decreasing concentrations in water quality constituents from well fields undergoing aquifer restoration.

In addition to the volume-based effluent sampling, Powertech (USA) will collect grab samples monthly during operation of each land application system and have them analyzed for the parameters listed in Table 6.2-1. In addition to the parameters in Table 6.2-1, monthly effluent samples will be analyzed for compliance with the anticipated NRC effluent limits listed in Table 5.4-1. These anticipated NRC effluent limits are the 10 CFR Part 20, Appendix B, Table 2, Column 2 established limits for discharge of radionuclides to the environment.

Prior to operation of the land application systems each year, Powertech (USA) will sample the storage ponds and have the samples analyzed for the parameters in Table 6.2-1.

5.5.4.2 Catchment Area Water Quality Monitoring

Powertech (USA) will sample the water in catchment areas monthly (when present) and initiate mitigation measures if the water quality exceeds trigger values, which are listed in Table 5.5-6. Parameters listed in Table 5.5-6 without trigger values will be monitoring only. If the concentration of any parameter exceeds the trigger value, Powertech will dewater the catchment area as described in Section 5.4.1.1.2.

5.5.4.3 Soil and Vegetation Monitoring

Section 5.5.6.1 describes the soil monitoring program for land application areas. Monitoring results will be compared to trigger values and a contingency plan (described in Section 5.6.2.2) will be implemented if trigger values are approached. Section 5.5.6.2 and GDP Section 6.5 describe the vegetation monitoring program for land application areas. Samples of vegetation will be collected from three pivot areas in each of the Dewey and Burdock areas each year during land application system operation and evaluated for increasing trends in constituent concentrations and comparison with trigger values for specific constituents of concern. Contingency measures described in GDP Section 8.4 will be implemented if increasing trends are observed or trigger values are approached.

Table 5.5-6: Sample Parameters and Trigger Values for Water in Catchment Areas

Parameter	Unit	Trigger Value
EC	µmhos/m	4,000
SAR	unitless	10
pH	s.u.	<6.5 or >8.5
Arsenic[1]	mg/L	1
Copper	mg/L	---
Lead	mg/L	---
Molybdenum[1]	mg/L	0.3
Selenium[1]	mg/L	0.1
Uranium[2]	mg/L	0.2
Vanadium	mg/L	---
Zinc	mg/L	---
Gross alpha	mg/L	---
Radium-226	mg/L	---

[1] From Raisbeck et al. (2007)
[2] From Canadian Livestock and Water Quality Guidelines *in* Raisbeck et al. (2007)

5.5.4.4 Livestock Monitoring

Section 5.5.8 describes how livestock will be sampled annually if allowed to graze in the land application areas or consume crops grown the areas.

5.5.4.5 Prairie Dog Monitoring

Section 5.5.9 describes how Powertech (USA) will sample prairie dogs prior to initial land application and every year during land application system operation to evaluate the potential impacts to prairie dogs and the potential for bioaccumulation in the terrestrial food chain.

5.5.4.6 Groundwater and Surface Water Monitoring

Sections 5.4.1.1.2 and 5.5.2.4 describes the groundwater monitoring programs associated with the land application systems, including suction lysimeters installed beneath each land application and catchment area to track the movement of water through the subsoil, interior wells to track changes in alluvial water quality within the POP zones, and compliance wells established at the downgradient edges of the POP zones. Section 5.5.3 and GDP Section 6.2 describe how streams and impoundments downgradient from land application systems will be sampled during operations.

5.5.4.7 Land Application System Reporting

Powertech (USA) will establish and maintain records and prepare and submit reports for land application system operation in accordance with the requirements of ARSD 74:29:05. Refer to Section 5.7.2.6 for a description of land application system reporting, including written notice to implement land application and a written report following each land application cycle, which is defined as the last land application operational period during each calendar year. Additional reporting will be done in accordance with DENR requirements in the approved GDP.

5.5.5 Pond Monitoring

Section 5.3.4.5 describes the monitoring and inspection program that will be implemented to document pond conditions, including inspections of liners, liner slopes and other earthwork features; measurement of pond freeboard to ensure that adequate containment capacity is available; monitoring for water accumulation in leak detection systems; and routine inspections of leak detection system functionality, embankment settlement, and slope stability.

5.5.6 Soil Sampling

5.5.6.1 Land Application Systems

If land application is used to dispose treated wastewater, soil sampling will occur as described in the GDP. Baseline soil samples will be collected prior to operation of each land application system. During operation, soil samples will be collected each year from each land application pivot that was active during that year. Soil samples also will be collected from each catchment area each year.

Potential impacts will be mitigated by monitoring soil concentrations during operations and implementing a contingency plan if concentrations approach trigger values. The proposed trigger values are provided in Table 5.5-7. In addition, Powertech (USA) will monitor additional constituents listed in Table 6.4-1 of the GDP. Powertech (USA) will analyze the annual monitoring results and propose additional trigger values if increasing trends are observed. This analysis will be completed annually and provided in the written report submitted to DENR each year that is described in Section 5.7.2.6.

Table 5.5-7: Trigger Values for Land Application Area Soils

Parameter	Units	Trigger Value
Arsenic	mg/kg-dry	Baseline average concentration plus 2 standard deviations
Lead	mg/kg-dry	Baseline average concentration plus 2 standard deviations
Molybdenum	mg/kg-dry	Baseline average concentration plus 2 standard deviations
Selenium	mg/kg-dry	Baseline average concentration plus 2 standard deviations
Uranium-natural	mg/kg-dry	Baseline average concentration plus 2 standard deviations
Chloride	mg/L	250
SAR	unitless	10

5.5.6.2 General Permit Area Soil Sampling

During operation, Powertech (USA) will collect and analyze soil samples from the air particulate monitoring locations as required by the NRC license. The anticipated sample requirements include sampling surface soils (0-5 cm) annually from each air particulate monitoring location once per year and having the samples analyzed for natural uranium, radium-226, and lead-210. This sampling will provide detection of potential aerial deposition of radionuclides from the Dewey-Burdock Project.

In addition, as described in Section 6, Powertech (USA) will conduct radiological surveys during decommissioning to identify areas for cleanup operations. A pre-reclamation survey will be used to identify cleanup areas, and a post-reclamation survey will be used to ensure that radium and

other radionuclides do not exceed NRC standards. The radiological surveys will use gamma-ray detectors that are calibrated to soil radium-226 concentrations.

5.5.6.3 Vegetable Garden Soil Sampling

In accordance with NRC license conditions, Powertech (USA) will sample vegetable garden soil within 2 miles (3.3 km) of the permit area prior to operations. Plant-to-soil concentration factors will be then be used to estimate the levels of radionuclide concentrations in locally grown vegetables. Powertech (USA) anticipates modifying the NRC monitoring program to exclude vegetable garden soil sampling if the pre-operational sample results along with modeling potential radiological impacts demonstrate no significant exposure pathway from vegetable gardens to potential human receptors.

5.5.7 Vegetation Sampling

5.5.7.1 Land Application Systems

If land application is used to dispose treated wastewater, vegetation sampling will occur as described in the GDP. Vegetation samples will be collected annually from the land application areas. Vegetation samples also will be collected from each catchment area each year. Powertech (USA) will monitor for the potential buildup of metals, metalloids, and radionuclides in irrigated vegetation. The vegetation sampling parameters are listed in Table 6.5-1 of the GDP application. Metals and metalloids to be monitored include natural uranium, selenium and arsenic. Prior to operation, Powertech (USA) will develop trigger values for arsenic and selenium based on the preoperational concentrations and the variability in each parameter. Should routine operational monitoring indicate an increasing trend in constituent concentrations with potential to approach trigger values, a contingency plan will be implemented as described in Section 8.4 of the GDP application. The proposed trigger values will be provided to DENR for review and approval prior to initiating land application. The results of annual monitoring and evaluation of potential increasing trends will be provided in the written report submitted to DENR each year that is described in Section 5.7.2.6.

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5.5.7.2 General Permit Area Vegetation Sampling

During operation, Powertech (USA) will collect and analyze vegetation samples from the air particulate monitoring locations as required by the NRC license. The anticipated sample requirements include sampling vegetation annually from each air particulate monitoring location once per year and having the samples analyzed for radium-226 and lead-210. The air particulate monitoring locations are located in areas having the highest predicted airborne radionuclide concentrations due to operation of the Dewey-Burdock Project.

In addition, Powertech (USA) will sample general grazing vegetation during the first year of operations in accordance with NRC license conditions. Powertech (USA) anticipates modifying the NRC monitoring program to exclude vegetation or forage sampling after the first year of operations if the initial monitoring results demonstrate that there is no ingestion pathway from grazing animals to potential human receptors. This will not impact vegetation sampling described in 5.5.7.1.

5.5.8 Livestock

In accordance with NRC license conditions, Powertech (USA) will collect livestock samples during the first year of operations for comparison to baseline. The anticipated sample requirements include collecting tissue samples at the time of slaughter of cattle, pigs and other livestock grazing within the permit area and analyzing samples for natural uranium, radium-226, lead-210, polonium-210 and thorium-230. Powertech (USA) anticipates modifying the NRC monitoring program to exclude livestock sampling after the first year of operations if the initial monitoring results demonstrate that there is no ingestion pathway from grazing animals to potential human receptors.

If land application is used and livestock is allowed to graze on the land application areas or consume crops grown in the areas, livestock will be sampled annually during land application system operation and analyzed for constituents listed in GDP Table 6.6-1 including selenium.

5.5.9 Wildlife

Powertech (USA) will analyze prairie dogs for potential bioaccumulation if land application is used. Prairie dogs were selected since they have been identified as a primary prey source for raptors and especially for the state-listed bald eagle. Three prairie dogs will be sampled prior to land application and each year during land application. The prairie dogs will be collected as close as possible to the land application systems. The samples will be analyzed for arsenic, molybdenum, selenium, and uranium. The specific sampling methodology (i.e., whole tissue versus specific organs) will be submitted to DENR and SDGF&P for approval prior to initial sampling. Following pre-operational sampling, Powertech (USA) will submit trigger values for review and approval by DENR and GFP. Should monitoring results indicate potential impacts to wildlife, mitigation measures will be implemented as described in Section 5.6.2.2. An additional mitigation measure that will be considered if potential impacts to wildlife are identified is wildlife exclusion fencing around the land application areas. If wildlife exclusion fencing is used around land application areas, Powertech will submit the fence design to DENR and SDGF&P for approval prior to installation.

Powertech (USA) will collect samples of fish species with the potential for human consumption in accordance with NRC license conditions. The anticipated sample requirements include semiannual sampling of species with the potential for human consumption (green sunfish and channel catfish) if present in water bodies potentially affected by contamination. Analytes required by the NRC license are anticipated to include natural uranium, radium-226, lead-210, polonium-210 and thorium-230. In addition, Powertech (USA) will analyze all fish samples for selenium.

In the unlikely event that a spill or leak results in solutions reaching Beaver Creek, Powertech (USA) will sample fish and macro-invertebrates for potential impacts according to a sampling and analysis plan approved by DENR and SDGF&P.

5.5.10 Air Monitoring

Powertech (USA) will conduct an airborne radiation monitoring program at the Dewey-Burdock Project in accordance with NRC license conditions. The airborne radiation monitoring program will be designed to detect potential worker doses from radon and radionuclide particulates. It will include measurement of radon decay products and radionuclide particulates in the facilities and at effluent release points (e.g., vents).

Powertech (USA) also will conduct an airborne effluent and environmental monitoring program in accordance with NRC license conditions. The anticipated sampling requirements include continuously operating air monitoring stations located around the permit boundary. Filters from air particulate samplers operating continuously will be analyzed quarterly for natural uranium, thorium-230, radium-226, and lead-210. Radon gas will be measured monthly using passive track-etch detectors at each air monitoring station.

5.5.11 Meteorological Monitoring

The meteorological station at the site will continue to be operated by SDSU, or Powertech (USA) may install and operate a new meteorological station. A meteorological station within the permit area will be operated in accordance with NRC license requirements.

5.6 Potential Impacts and Mitigation

5.6.1 Land Use

5.6.1.1 Potential Land Use Impacts

Rangeland and agricultural cropland are the primary land uses within the permit area and the surrounding area. A portion of the land within the permit area will be temporarily converted from its previous use as rangeland and cropland to ISR use on a progressive, phased basis during construction and operation of ISR well fields, processing facilities, and associated infrastructure. However, most of the permit area will be undisturbed, and surface operations (e.g., wells and processing facilities) will affect only a small portion of it. Section 5.3.7 describes the total anticipated disturbance (topsoil stripping) area over the life of the project.

The land likely will experience an increase in human activity also contributing to land disturbance. The disturbance associated with drilling, pipeline installation, and facility construction will be limited and temporary as vegetation will be re-established through concurrent reclamation. The construction of access roads will be minimized to the extent possible by using and upgrading existing roads.

Operation of the project facilities will restrict the use of a portion of the land as rangeland and cropland for the duration of operations. This includes fenced well field areas, facility areas, and land application areas. This temporary change in land use will last until these areas are reclaimed and released for unrestricted use. Given the relatively small size of the impacted areas, the exclusion of grazing from well field and facility areas over the course of the project is

- Reestablish temporary or permanent native vegetation as soon as possible after disturbance utilizing the latest technologies in reseeding and sprigging, such as hydroseeding (refer to Section 6.4.3.4).
- Decrease runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface runoff from undisturbed areas (refer to Section 5.3.9).
- Retain sediment within the disturbed areas by using silt fencing, sediment ponds, and other ASCMs (refer to Section 5.3.9).
- Fill pipeline and utility trenches with appropriate material and regrade and reseed surface soon after completion.
- Drainage design will minimize potential for erosion by creating slopes less than 4 to 1 and/or provide rip-rap or other soil stabilization controls.
- Construct roads using techniques that will minimize erosion, such as surfacing with a gravel road base, constructing stream crossings at right angles with adequate embankment protection and culvert installation.
- Implement spill prevention and cleanup standard operating procedures to minimize soil contamination from vehicle accidents and/or well field spills or leaks; collect and monitor soils and sediments for potential contamination including areas used for land application, transport routes for yellowcake and ion exchange resins, and well field areas where spills or leaks are possible.
- Excavate contaminated soil as described in Section 6.3.3 and replace with uncontaminated soil as needed.
- Specific mitigation measures for potential soil impacts from land application are addressed in the GDP and summarized as follows:
    - The expected land application water quality is described in Section 5.4.1.1.4.1. With an anticipated TDS concentration of 1,000 to 5,000 mg/L, the water will pose a low to moderate risk to the growth of moderately salt-sensitive crops such as alfalfa. Soil salinity levels will be controlled by blending the land application water in the ponds and by leaching salts below the root zone during land application. Powertech (USA) will operate the land application systems to balance the downward migration of water, which has potential alluvial groundwater impacts, with the leaching that will be used to control salt buildup in the root zone. Madison water may be used in leaching, and the leaching efficiency may be improved by leaching during the cool season, applying water intermittently rather than continuously, and using tillage, including potentially deep tillage.
    - The anticipated SAR levels in the land application water are 5 to 10, which should pose a low risk to soil infiltration rates. Should soil SAR increase and pose a risk to soil infiltration, Powertech (USA) will apply amendments such as sulfur or gypsum at agronomic rates.

- Since Powertech (USA) will treat the land application water to meet effluent limits, including the 10 CFR 20, Appendix B, Table 2, Column 2 standards for release of radionuclides to the environment, it is unlikely that radionuclides will build up to potentially harmful levels. This will be verified through operational soil monitoring and additional surveys during decommissioning.
- During decommissioning, Powertech (USA) will conduct land cleanup in accordance with NRC license and DENR permit requirements. This includes cleaning up surface soils to standards for radium-226 and natural uranium that will be established as conditions in the NRC license as protective of human health and the environment. This applies to the entire permit area and is not limited to the land application areas.
- The concentrations of metals and metalloids, including arsenic and selenium, are anticipated to be low as shown in Table 5.4-3 Nevertheless, there is potential for buildup of metals and metalloids over time in the land application areas. Potential impacts will be mitigated by monitoring soil concentrations during operations and implementing a contingency plan if concentrations approach trigger values. The contingency plan will consist of one or more of the following items:
    - Verify sample results and precisely delineate affected areas through additional soil sampling and analysis.
    - Modify land application system operating parameters to reduce the discharge rate in specific pivots or throughout the land application area.
    - Implement water treatment if necessary for radionuclides, metals or metalloids.
    - Implement a phytoremediation plan to control buildup of selenium in soil.
    - Excavate soil contaminated above the reclamation standards established in the NRC license and LSM permit and dispose excavated soil in an appropriately permitted disposal facility.
- Powertech (USA) may apply fertilizer to the land application areas to maximize crop production and maintain adequate soil fertility.
- Powertech (USA) will prepare an annual report evaluating the potential for saline seeps near the land application areas (see Section 5.7.2.6) and develop a site-specific mitigation plan for DENR review and approval if a saline seep occurs.

5.6.3 Groundwater

5.6.3.1 Potential Groundwater Impacts

Potential groundwater impacts include groundwater consumption, drawdown in nearby water supply wells, and potential groundwater quality impacts. Each of these is discussed below.

- Proper plugging and abandonment of all wells which do not pass MIT or that become unnecessary for use;
- Proper plugging and abandonment of exploration holes with potential to impact ISR operations; and
- Sampling monitor wells located within the overlying and underlying hydrogeologic units on a frequent schedule.

These controls work together to prevent and detect ISR solution migration. Plugging any exploration holes that pose the potential to impact the control and containment of ISR solutions prevents connection of the production zone to overlying and underlying units. The EPA UIC requirements for MIT assure proper well construction, which is the first line of defence for maintaining appropriate pressure without leakage. Sampling the monitor wells will enable early detection of any ISR solutions should an excursion occur.

Excursion Corrective Actions

Powertech (USA) will implement the following corrective action plan for excursions occurring during production or restoration operations. Corrective actions to correct and retrieve an excursion may include but will not be limited to:

- Adjusting the flow rates of the production and injection wells to increase the aquifer bleed in the area of the excursion;
- Terminating injection into the portion of the well field affected by the excursion;
- Installing pumps in injection wells in the portion of the well field affected by the excursion to retrieve ISR solutions;
- Replacing injection or production wells; and
- Installing new pumping wells adjacent to the well on excursion status to recover ISR solutions.

In the event of an excursion, the sampling frequency will be increased to weekly. NRC will be notified within 24 hours by telephone or email and within 7 days in writing from the time an excursion is verified. DENR will be notified within 48 hours by telephone or email and within 7 days in writing from the time an excursion is verified. In addition, if the excursion has potential to affect a USDW, EPA will be notified verbally within 24 hours and in writing within 5 days. A written report describing the excursion event, corrective actions taken and the corrective action results will be submitted to all involved regulatory agencies within 60 days of the excursion confirmation.

If wells are still on excursion status when the report is submitted, the report also will contain a schedule for submittal of future reports describing the excursion event, corrective actions taken,

SDGF&P does not consider the permit area to be within the crucial habitat range of any big game species. A letter from SDGF&P confirming this statement and updating the status of big game species as of May 2010 is provided in Appendix 5.6-B. Sightings of those species in that vicinity are often seasonal and less common.

5.6.11.1.4 Other Mammals

As indicated in Appendix I to Appendix 3.9-A, 14 mammal species tracked by SDNHP have the potential of occurring in the permit area (Merriam's shrew, dwarf shrew, long-eared myotis, fringe-tailed myotis, northern myotis, silver-haired bat, Townsend's big-eared bat, northern flying squirrel, northern river otter, meadow jumping mouse, swift fox, black-footed ferret, eastern spotted skunk, and mountain lion). Only the northern river otter was observed in the vicinity of the permit area; this was a carcass observed at the upstream sampling point on Beaver Creek.

Medium-sized mammals (such as lagomorphs, canids, and badgers) may be displaced temporarily to other habitats during the initial construction activities. Direct losses of some small mammal species (e.g., voles, ground squirrels, mice) may be higher than for other wildlife due to their more limited mobility and likelihood that they would retreat into burrows when disturbed, and thus be potentially impacted by topsoil scraping or staging activities. However, given the limited area expected to be disturbed by the project, such impacts would not be expected to result in major changes or reductions in mammalian populations for small or medium-sized animals. This is supported by NRC guidance in NUREG-1910 (NRC, 2009), which states, "Displaced species may re-colonize in adjacent, undisturbed areas or return to their previously occupied habitats after construction ends and suitable habitats are reestablished." Few bats were recorded in the area despite extra efforts to observe them during the baseline surveys. Those that were seen were near water bodies near treed habitats, which are not currently scheduled for disturbance. The mammalian species known to be, or potentially, present in the permit area have shown an ability to adapt to human disturbance in varying degrees, as evidenced by their continued presence in other mining and residential areas of similar, or greater, disturbance levels elsewhere in the region. Additionally, small mammal species in the area have a high reproductive potential and tend to re-occupy and adapt to altered and/or reclaimed areas quickly.

5.6.11.1.5 Raptors

As indicated in Appendix I to Appendix 3.9-A, 16 raptor species tracked by SDNHP have the potential of occurring in the permit area (osprey, bald eagle, sharp-shinned hawk, Cooper's hawk, northern goshawk, broad-winged hawk, Swainson's hawk, ferruginous hawk, golden eagle, merlin, peregrine falcon, prairie falcon, barn owl, northern saw-whet owl, long-eared owl, and burrowing owl). The bald eagle, long-eared owl, and merlin are known or are suspected to have nested in or within 1 mile of the permit area based on evidence (young present) or persistent defensive behavior.

ISR activities in the permit area would not impact regional raptor populations. As described in Section 3.9.2 and in Appendix 3.9-A, five confirmed, intact (i.e., material present) raptor nests or potential nest sites were located in the permit area and two additional nest sites (one confirmed and one potential) were recorded in the one-mile survey perimeter. The species represented by these nests or potential nest sites include great-horned owls, long-eared owls, red-tailed hawks, merlins, and bald eagles. Monitoring and mitigation measures presented in the Avian Monitoring and Mitigation Plan (Appendix 5.6-C) will be used to avoid potential impacts to individual birds or pairs such as raptors abandoning nest sites proximate to disturbance, injury or mortaility due to colissions with project-related vehicular traffic, and indirect impacts such as reduction or avoidance of foraging habitats for nesting birds. Additional information is provided in Section 5.6.11.2 and Appendix 5.6-C. Surface disturbance will only occur in a small percentage of the overall permit area, and the low density of nesting raptors relative to the apparent availability of suitable habitat suggests that alternate nesting habitat is available for all known nesting raptor species in the permit area.

Except for the bald eagle, the same species that nest in the permit area are known to regularly nest and fledge young at or near surface mines and ISR facilities throughout the region. Those efforts have succeeded due to a combination of raptors becoming acclimated to the relatively consistent levels of disturbance and gradual encroachment of production operations, and successfully executed state-of-the-art mitigation techniques to maintain viable raptor territories and protect nest productivity. Some individuals nest on active production facilities themselves, including both great horned owls and red-tailed hawks. The lack of bald eagle examples is more likely related to the general absence of nesting bald eagles in the vicinity, rather than an increased sensitivity to production activities. Bald eagles are discussed further in Section 5.6.11.1.11. Due to the paucity of river cliffs in the permit area, falcons and other raptors known to nest in that habitat are not as abundant as those that nest in trees or even on the ground.

Based on the location of known nest sites relative to future construction sites, no raptor nests will be disturbed physically by the project during either construction or operations. Additionally,

Powertech (USA) has incorporated the baseline wildlife information into the planning process and sited plant facilities (areas of greatest sustained future disturbance) outside the recommended buffer zone for raptor nests in the permit area, including the bald eagle nest site identified in the baseline survey. Since the baseline survey was completed, a new bald eagle nest has been documented in the permit area. This is described in Section 5.6.11.1.11 and Appendix 5.6-C. Some new infrastructure will be located within the suggested buffer areas. However, pipelines will be buried, and new overhead power lines will be constructed using designs and specifications to reduce injuries and mortalities on overhead power lines. Land application center pivots, if used, can be put into place prior to the nesting season, and run automatically with little human contact once they are turned on. Additionally, new roads, power lines, and pipelines will be constructed in the same corridors to the extent possible to reduce overall disturbance, and along existing access roads when available to minimize new surface disturbance.

5.6.11.1.6 Upland Game Birds

ISR activities in the permit area would potentially impact the foraging and nesting habitat of mourning doves, though such disturbance is not expected to have any marked impacts on this species. No woody corridors will be disturbed by the proposed activities, and additional trees are present in the cottonwood gallery along the Cheyenne River, located approximately 2 miles south of the permit area. Additionally, doves are not restricted to treed habitats, nor are they subject to any special mitigation measures for habitat loss.

Annual monitoring surveys conducted by SDGF&P biologists and a year-round baseline study for the project have demonstrated that sage-grouse do not currently inhabit that area, and have not for many years. As described previously, those surveys encompassed the entire permit area and the vast majority of its 2.0-km (1.2-mi) perimeter, particularly as part of baseline monitoring. The nearest known sage-grouse lek is approximately 6 miles north of the permit area (SDGF&P records). Given the lack of sage-grouse observations in the area and the scattered stands of marginal quality sage-grouse habitat, the project will not result in negative impacts to existing or potential sage-grouse leks, or important sagebrush habitats.

5.6.11.1.7 Other Birds

As indicated in Appendix I to Appendix 3.9-A, 19 other bird species (non-raptors, non-game, and non-waterfowl/shorebirds) tracked by SDNHP have the potential of occurring in the permit area. These include: common poorwill, Lewis' woodpecker, three-toed woodpecker, black-backed woodpecker, olive-sided flycatcher, Cassin's kingbird, Clark's nutcracker, brown

creeper, pygmy nuthatch, veery, northern mockingbird, sage thrasher, Sprague's pipit, black-and-white warbler, Virginia's warbler, Brewer's sparrow, Baird's sparrow, McCown's longspur and Cassin's finch. Only one of these species (Clark's nutcracker) was documented in or within 1 mile of the permit area during the baseline survey period. The nutcracker was observed once flying over the permit area, but no known nesting or other targeted use was recorded by this species.

Direct impacts could include injury or mortality due to encounters with vehicles or heavy equipment during construction or maintenance operations. Indirect impacts could include habitat loss or fragmentation and increased noise and activity that may temporarily deter use of the area by some species. Surface disturbance would be relatively minimal and would be greatest during construction. Enforced speed limits and use of common right-of-way corridors will reduce impacts to wildlife throughout the year, particularly during the breeding season.

5.6.11.1.8 Waterfowl and Shorebirds

As indicated in Appendix I to Appendix 3.9-A, 18 waterfowl/shorebird species tracked by SDNHP have the potential of occurring in the permit area (common loon, horned grebe, American white pelican, great blue heron, black-crowned night heron, green-backed heron, white-faced ibis, bufflehead, hooded merganser, common merganser, whooping crane, mountain plover, piping plover, long-billed curlew, California gull, common tern, black tern, and interior least tern). The long-billed curlew, great blue heron, and American white pelican were documented in or within 1 mile of the permit area during the baseline survey period. The long-billed curlew is suspected to have nested in or within 1 mile of the permit area based on persistent defensive behavior.

Construction and operation of the ISR project would have a negligible effect on migrating and breeding waterfowl and shorebirds. Existing habitat is limited and seasonally available in the permit area, so it does not currently support large groups or populations of these species. Multiple approaches are being considered to minimize impacts to wildlife that may be associated with the operation of the ponds. Any new treated water sources could enhance current habitat conditions for these species, though such effects would be temporary in nature.

5.6.11.1.9 Reptiles and Amphibians

As indicated in Appendix I to Appendix 3.9-A, three reptile species and zero amphibian species tracked by SDNHP have the potential of occurring in the permit area (northern sagebrush lizard,

smooth green snake and brown snake). None of these species was observed in or around the permit area.

As with waterfowl, potential habitat for aquatic and semi-aquatic amphibians and reptiles is limited within the permit area and occurs primarily along Beaver Creek in the western portion of the area. Other water bodies are ephemeral, and thus offer only short-term habitat. Activities associated with the project are not expected to disturb existing surface water or alter the topography in the area. Those species residing in rocky outcrops located in potential disturbance areas could be impacted by construction and maintenance operations. However, few non-aquatic herptile species were observed in the permit area and surrounding perimeter. Any impacts that would occur would affect individuals, but would not likely impact the population as a whole.

5.6.11.1.10 Fish and Macro-Invertebrates

As indicated in Appendix II to Appendix 3.9-A, one fish species tracked by SDNHP has the potential of occurring in the permit area (plains topminnow). The plains topminnow was captured during fish sampling efforts in the Cheyenne River and the downstream sampling site along Beaver Creek during baseline surveys; both sites are outside of the permit area.

The planned locations for new facilities and infrastructure do not overlap any perennial aquatic features; therefore, no loss of aquatic habitat would occur as the result of their construction. The risk of impaired water quality will be reduced or avoided through project siting, and implementation of standard construction erosion and sediment control measures. The location of project facilities (CPP, Satellite Facility, pipelines, well fields, access roads and power lines), as well as the proposed land application sites (center pivot irrigation sites), will avoid direct impacts to perennial streams.

Due to the arid climate and proposed location of new project facilities, operation of the well fields is not expected to alter aquatic habitat or water quality in perennial streams. No surface water will be diverted for use in the operation, and no process water will be discharged into aquatic habitat.

Pass Creek provides only seasonal drainage and does not support fish or significant amphibian habitat. Some of the proposed land application sites west of the Satellite Facility would be located in general proximity to Beaver Creek, the primary aquatic habitat in the project vicinity. All land application areas will be surrounded by catchment areas that will prevent runoff. Beaver Creek will not be directly affected by the well field operations or land application sites.

Section 3.5.4.1.1 describes how Beaver Creek and the Cheyenne River near the permit area are classified as warmwater, semipermanent fisheries. No coldwater fisheries are present in the permit area, and no impacts to coldwater fisheries will occur as a result of the Dewey-Burdock Project.

5.6.11.1.11 Threatened, Endangered, or Candidate Species and Species Tracked by SDNHP

Federally Listed Species

As described in the preceding sections of this document, no federally listed vertebrate species were documented in the project survey area (permit area and 1-mile perimeter) during the year-long survey period, or during previous targeted surveys conducted for the original claims (TVA, 1979). Additionally, the USFWS has issued a block clearance for black-footed ferrets in all black-tailed prairie dog colonies in South Dakota except northern Custer County, and in the entire neighboring state of Wyoming. That clearance indicates that ferrets do not currently, and are not expected to, occupy the permit area. The project area also is not within any proposed ferret reintroduction sites. Only one small black-tailed prairie dog colony was present in the permit area itself during the 2007-2008 baseline surveys, and local landowners are actively working to remove the animals from their lands. Consequently, the proposed project will have no direct, indirect, or cumulative effects on black-footed ferrets.

State-Listed Species

ISR activities within the permit area are not likely to adversely affect bald eagles, the only state-listed species known to inhabit the permit area. Bald eagles were documented at winter roosts and an active nest within the permit area during the 2007-2008 baseline surveys. One additional nest site has been identified in the permit area since the baseline inventories were conducted. Appendix 5.6-C discusses both nest sites and includes monitoring and mitigation measures to avoid potential impacts, including pre-disturbance monitoring, monitoring during construction and operation, siting facilities outside of the buffer area and constructing facilities outside of the breeding season where possible, among others. No more than two or three bald eagles were observed during any given winter survey conducted during the baseline period or more recent (winter 2012/2013) monitoring, despite the numerous available (and unoccupied) mature trees along Beaver Creek, Pass Creek, and the pine breaks located in and near the permit area.

Potential direct impacts to bald eagles include the potential for injury or mortality to individual birds foraging in the permit area due to electrocutions on, or collisions with, new overhead power lines or collisions with vehicles due to increased traffic during construction and/or operation of new facilities. The potential for electrocution or collision with power lines will be

reduced by using current Avain Power Line Interaction Committee (APLIC) recommendations for overhead power line construction. Enforced speed limits during all phases of the project will reduce the potential for vehicular impacts. Although not expected, disturbance activities near an active nest could result in abandonment and, thus, the loss of eggs or young. The increased human presence and noise associated with construction activities, if conducted while eagles are wintering within the area, could displace individual eagles from using the area during that period. Monitoring and mitigation of these potential impacts are addressed in Appendix 5.6-C.

Given the low number of wintering and nesting bald eagles in the permit area, potential impacts would be limited to individuals rather than a large segment of the population. The use of existing or overlapping right-of-way corridors along with best management practices will minimize potential direct impacts associated with overhead power lines. If necessary, the majority of other potential impacts could be mitigated if construction activities were conducted outside the breeding season and/or winter roosting months, or outside the daily roosting period, should eagles be present near construction. Any bald eagles that might roost or nest in the area once the project is operational would be doing so in spite of continuous and ongoing human disturbance, indicating a tolerance for such activities.

Indirect impacts as a result of noise and human presence associated from project-related operations could include area avoidance by avian species. Potential winter foraging habitat could be further fragmented by linear disturbances such as overhead power lines and new roads associated with the project. Given the size of the project, those disturbances would occur within narrow corridors over relatively short distances. Nevertheless, the use of common right-of-way corridors to consolidate new infrastructure will reduce these potential indirect impacts.

The only other state-listed species recorded in the general area was the river otter. An otter carcass was discovered lodged in debris in the stream channel at fisheries sampling station BVC04 in mid-April 2008. That site is approximately 12 river miles upstream from the permit area boundary in eastern Wyoming. The carcass had washed away by the July 2008 fisheries sampling session. The monthly sampling at BVC04 during the monitoring period confirmed no additional observations of otters. Likewise, no evidence of otters was report by biologists along any drainage elsewhere in the survey area during the year-long baseline survey period. Given the fact that no stream channels will be physically impacted in the permit area, the lack of otter sightings or sign in the permit area itself, and the stringent water processing and water quality monitoring that will occur, this project is not likely to directly or indirectly impact river otters.

Species Tracked by SDNHP

As indicated in Appendices I and II to Appendix 3.9-A, 71 vertebrate wildlife species tracked by the SDNHP have been documented or have the potential of occurring in the permit area. These are described in the previous sections and are summarized briefly as follows:

- Mammals: Of the 14 mammal species tracked by SDNHP that could potentially occur in the permit area, only the northern river otter has been documented in the general vicinity during or since the baseline inventory (see Section 5.6.11.1.4 and discussion above under State-listed species).
- Raptors: Of the 16 raptor species tracked by SDNHP that could potentially occur in the permit area, three (bald eagle, long-eared owl, and merlin) are known or are suspected to have nested in or within 1 mile of the permit area (see Section 5.6.11.1.5 and discussion above under State-listed species). Potential nesting habitat is present in the area for other tracked raptor species, but no nests of those species have been documented to date.
- Waterfowl/shorebirds/waterbirds: Of the 18 waterfowl/shorebird/waterbird species tracked by SDNHP that could potentially occur in the permit area, only three (long-billed curlew, great blue heron, and American white pelican) were documented in or within 1 mile of the permit area during the baseline survey period (see Section 5.6.11.1.8). At least one additional species (mountain plover) could occur in the area, but none has been recorded to date.
- Other birds: Of the 19 other bird species species tracked by SDNHP that could potentially occur in the permit area, only the Clark's nutcracker was documented in or within 1 mile of the permit area during the baseline survey period (see Section 5.6.11.1.7).
- Reptiles and amphibians: Of three reptile species tracked by SDNHP that could potentially occur in the permit area, none was observed during baseline surveys. No amphibian species tracked by SDNHP have been identified with potential to occur in the permit area (see Section 5.6.11.1.9).
- Fish and macro-invertebrates: The plains topminnow is the only fish species tracked by SDNHP that could potentially occur in the area (see Section 5.6.11.1.10).

The seven SDNHP species recorded in or flying over the permit area could potentially experience the same type of direct and/or indirect impacts from construction and operation of the proposed operation as those described previously for other species: e.g., injury, mortality, avoidance, displacement and increased competition for resources. Those potential impacts will be minimized by the timing, extent, and duration of the proposed activities. Enforced speed limits during all phases of the project will further reduce potential impacts to wildlife throughout the year, particularly during the breeding season. Once facilities and infrastructure are in place, animals remaining in the permit area would demonstrate an acclimation to those disturbances.

5.6.11.2 Mitigation of Potential Ecological Resources Impacts

The following is a list of proposed mitigation measures for such potential impacts:

- Design barbed wire perimeter fencing to permit big game passage to the extent practicable. Unless otherwise approved by DENR and SDGF&P, the design will include: a bottom, smooth wire at least 15" to 16" above ground for pronghorn passage, a top wire no more than 42" high to facilitate passage of deer and elk, and a space at least 11" to 12" between the top two wires to prevent entanglement.
- Provide fencing around facility ponds to exclude large and small mammals, including installing durable mesh (e.g., woven wire) along the base of the chain link pond fencing for small mammal exclusion. The mesh will extend at least 30 inches above ground and will be buried at least 3 inches below ground or will extend horizontally along the ground away from the fence to ensure there are no gaps and to discourage burrowing.
- Design all facilities including sediment ponds and any areas that could accumulate water to avoid wildlife entrapment.
- Use existing roads when possible and limit construction of new access roads to provide for access to more than one well site or well field, if possible.
- Enforce speed limits to minimize collisions with wildlife, especially during the breeding season.
- Adhere to the provisions of the Avian Monitoring and Mitigation Plan (Avian Plan) approved by SDGF&P and DENR and reviewed by USFWS. A copy of the approved plan is provided in Appendix 5.6-C and briefly summarized as follows.
    - Purpose: The primary purpose of the Avian Plan is to address potential impacts to nesting bald eagles in the proposed permit area and surrounding area, since the bald eagle is a South Dakota-listed threatened species. The Avian Plan also addresses monitoring and mitigation of potential impacts to other avian species of concern, including other nesting raptors, breeding birds, waterfowl/shorebirds, species tracked by the SDNHP, and migratory birds other than raptors.
    - Monitoring: Ensure that monitoring and survey data are available for the life of the mine to accomplish the following goals:
        - Bald eagles
            - Conduct pre-construction monitoring to determine normal habitat use and movements, the location and status of nests and winter roost sites, the occurrence and outcome of nesting bald eagle pairs, existing disturbance activities, and eagles' response to existing activities.
            - Conduct monitoring during construction and operations to document disturbance activities within buffer areas and eagles' response to those activities.

- Other nesting raptors
  - Conduct annual monitoring of all known raptor nests and annual searches for new nests based on existing and planned disturbance.
  - Document disturbance activities within buffer areas and raptors' response to those activities during facility construction and operation to identify additional mitigation measures to address potential impacts.

- Mitigation of potential impacts
  - Bald eagles and other nesting raptors
    - Identify local breeding seasons for each nesting raptor species.
    - Establish buffer zones for each raptor nest depending on species and screening options (terrain, trees, etc.).
    - Consider nest buffers in facility planning, including consolidating infrastructure within buffer zones, siting facilities outside of the buffer zones, and scheduling activities outside of the breeding season within buffer zones to the extent possible.
    - Use current APLIC recommendations for overhead power line construction to reduce the possibility of electrocution and collision.
    - Authorize "stop work" authority to biologist if project activities are at risk of impacting nesting raptors.
    - Address prey abundance and potential impacts to raptors through potential bioaccumulation or other potential impacts to prairie dogs.
    - Reestablish the ground cover necessary to attract and sustain a suitable raptor prey base.
    - Powertech (USA) may apply for a USFWS-issued permit and any necessary State permits for non-purposful/incidental eagle take, the application for which would demonstrate that the proposed activity meets the requirements of 50 CFR § 22.26, which contain the federal requirements for non-purposeful take. Any non-purposeful take permit application will be coordinated with SDGF&P and DENR to ensure compliance with SDCL 34A-8 and other applicable rules and regulations
  - Waterfowl and shorebirds
    - Implement an avian deterrent system such as physical barriers (netting or "bird balls") or aversion technology (sound/visual hazing system) for all ponds containing untreated wastewater or ponds used in the treatment process (i.e., central plant pond, radium settling ponds, spare ponds, and surge ponds). These are ponds that include dual synthetic liners and leak detection systems. For ponds storing only treated water (i.e., treated water storage ponds, spare storage ponds, and outlet ponds), avian deterrent

systems will be provided if the water quality exceeds trigger values designed to be protective of wildlife. Trigger values are provided in Table 5.6-2a.

- Establish trigger values for water in catchment areas and dewater catchment areas if trigger values are exceeded (see Section 5.5.4.2)

- Breeding birds
  - Conduct surveys for nesting species in areas of planned disturbance and schedule disturbance activities outside of the breeding season where possible.

Table 5.6-2a: Trigger Values for Avian Deterrent Systems in Treated Water Ponds

Parameter	Units	Trigger Value
Arsenic	mg/L	0.34 (2)
Selenium	mg/L	Formula (2)(3)
Uranium	pCi/L	300 (4)
Radium-226	pCi/L	60 (4)
Lead-210	pCi/L	10 (4)
Polonium-210	pCi/L	40 (4)
Thorium-230	pCi/L	100 (4)

[1] Treated water ponds include, treated water storage ponds, spare storage ponds, and outlet ponds.
[2] EPA Section 304(a) aquatic life criteria (EPA, 2013)
[3] Trigger value = 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 0.1859 mg/l and 0.01282 mg/l, respectively (EPA, 2013)
[4] 10 CFR 20, Appendix B, Table 2, Column 2

- Restore pre-mining native habitats for species that nest and forage in those vegetative communities.
- Restore diverse landforms, replace topsoil, and construct brush piles, snags, and/or rock piles to enhance habitat for wildlife.
- Conduct weed control as needed to limit the spread of undesirable and invasive, non-native species on disturbed areas.

Adjusting the timing of various construction, operational, and reclamation activities to avoid the breeding season can also be an effective way to minimize impacts related to such activities in the permit area. As a practical matter, worker crews conducting construction or reclamation activities typically work during daylight hours, so potential impacts to year-round residents, particularly more nocturnal species such as bats, rodents and others, should not be increased significantly. Following completion of construction in a given area, access roads would be blocked with berms or fencing to prevent use by casual traffic. Site reclamation/ decommissioning, including surface reclamation, will be completed in the same manner, with activities timed to minimize disturbance to nesting or migrating species. Relevant agency standards for reclamation will be followed and this phased, systematic approach will allow more mobile wildlife species to relocate into adjoining, undisturbed habitat and then return following completion of construction or reclamation in a particular area. Thus, the sequential, phased nature of this approach will decrease potential direct and indirect impacts on all wildlife species and their habitat.

5.6.12 Cultural Resources

5.6.12.1 Potential Cultural Resources Impacts

As discussed in Section 3.11, a Level III Cultural Resources Evaluation was conducted in the permit area. Personnel from the Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota, conducted on-the-ground field investigations between April 17 and August 3, 2007. Potential impacts to historic and cultural resources will be minimized by implementing the mitigation measures described below.

package will be submitted to NRC for review. All well field packages and written SERP evaluations will be maintained at the site and available for regulatory review.

The SERP will have the authority to raise issues regarding the health and safety of the workers, general public, and/or the environment due to the operation of the facility to the Facility Manager and the Vice President of Environmental Health & Safety Resources.

An annual report will be prepared which describes actions taken by the SERP including changes to operating procedures, the facility, or tests and experiments that involve safety or the environment enacted since the previous report was issued. The report also will document the reason for each change, whether the change required an NRC license amendment, and the basis for determination.

5.7.2.4 Radioactive Material Postings

All entrances to the facility will be conspicuously posted with the following statement: "ANY AREA WITHIN THIS FACILITY MAY CONTAIN RADIOACTIVE MATERIAL."

5.7.2.5 Recordkeeping

All records will be maintained as hard copy originals or stored electronically.

The following information will be permanently maintained both on-site and at an off-site location until NRC license termination:

- Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.
- Records of spills, excursions, facility stoppages, contamination events, and unusual occurrences.
- Records of inspections of ponds.
- Records of the occupational monitoring.
- Information related to the radiological characterization of the facility.
- Drawing and photographs of structures, equipment, restricted areas, well fields, and storage areas with radioactive materials and all of their modifications.
- Records of survey and calibrations will be maintained for at least 3 years.

In addition, records of the locations of all injection, production, and monitor wells will be retained throughout the postclosure monitoring period. Well locations will be determined using a survey-grade GPS or equivalent.

All records will be stored in manner to prevent record loss from fire, flood, or other unforeseen events beyond the control of Powertech (USA). All records will be legible throughout the retention period described above.

5.7.2.6 Reporting

Powertech (USA) has committed to developing written operating procedures within the management control program to address all NRC license reporting requirements. These will be prepared after NRC license issuance but prior to ISR operations. Specific reporting requirements will include items such as reports of theft or loss of licensed material, notification of incidents, reports of exposures of radioactive material exceeding limits, and effluent monitoring reporting.

Powertech (USA) will prepare and submit reports in accordance with the requirements of SDCL 45-6B-36, ARSD 74:29:05:18 and ARSD 74:29:05:20. The following reports will be provided to DENR at the specific frequency.

Updated Baseline Surface and Groundwater Report

Powertech (USA) has committed to collecting additional surface water and groundwater samples prior to operations (refer to Sections 5.5.2 and 5.5.3). The results will be provided to DENR in an updated baseline surface and groundwater report prior to ISR operations.

Annual Environmental Monitoring Report

Powertech (USA) will prepare and provide to DENR an annual environmental monitoring report, which will include the results of the following operational monitoring programs.

- Operational groundwater monitoring, including domestic wells, stock wells, irrigation wells and monitor wells.
- Operational surface water monitoring, including streams and impoundments.
- Soil sampling, including soil samples collected from the air particulate monitoring locations and from the land application areas (if used).
- Vegetation sampling, including vegetation samples collected from the air particulate monitoring locations and from the land application areas (if used).
- Livestock and wildlife sampling.
- Environmental air monitoring, including air particulate and radon gas sampling at operational environmental air monitoring stations.

Per ARSD 74:29:05:20, Powertech (USA) will submit a written report to DENR following each land application cycle, which is defined as the last land application operational period during each calendar year. Prior to the end of each year, Powertech (USA) will prepare and submit a written report including the following information for each of the land application systems (Dewey and Burdock):

1) The total amount of land application solution applied;
2) The total hydraulic loading rate per acre;
3) The total metals loading rate per acre, including all of the trace and minor elements and radiological parameters in Table 6.2-1;
4) The duration of the land application cycle;
5) All environmental monitoring data associated with the land application systems, including effluent, catchment area water, soils, vegetation, and wildlife monitoring;
6) Evaluation of potential increasing trends in constituent concentrations and potential for bioaccumulation;
7) Description of any mitigation measures implemented;
8) Evaluation of the potential development of saline seeps, including the results of annual surveys of drainage channels near the land application areas for signs of potential saline seeps; and
9) A general discussion of the success of the system.

Well Completion Reports

Powertech (USA) will submit well completion reports within 1 month of completing each injection, production, or monitor well. Well completion will be defined as the point at which the well screen has been installed and initial well development has occurred. In accordance with SDCL 46-6-11, the well completion reports will be provided to DENR on a form supplied by the Chief Engineer.

Well Plugging Reports

Powertech (USA) will provide an annual well plugging report to DENR including the following elements for each plugged well in accordance with ARSD 74:02:04:71:

1) The name and complete mailing address of the owner;
2) The legal description of the well or hole location;
3) The completion date;
4) The casing or hole size, type of well, and well or hole depth;
5) A general description of the condition of the well;
6) A description of the plugging procedure;
7) The grout or material used to plug the well or test hole; and
8) The date and the signature of the license representative.

Wildlife Report

Powertech (USA) will prepare an annual wildlife report for SDGF&P and DENR that will address:

1) Bald Eagles and Other Nesting Raptors
    a. Results of annual monitoring of all known raptor nests and annual searches for new nests based on existing and planned disturbance, including a map showing current nest locations and conditions (intact, former) and the most recent 5-year history of each nest site, subject to data availability
    b. Discussion of surface disturbance and project activities within buffer distances of raptor nests
    c. Other monitoring requirements as listed in Appendix 5.6-C
2) Waterfowl and Shorebirds
    a. Operation and effectiveness of avian deterrent systems for facility ponds and results of water quality monitoring in treated water storage ponds if avian deterrent systems are not used
    b. Other monitoring requirements as listed in Appendix 5.6-C
3) Breeding Birds and Other Avian Species of Concern or Interest
    a. Results of clearance surveys for ground-nesting species in areas of planned disturbance
    b. Observations of avian species tracked by the SDNHP (location, habitat, etc.)
    c. Other monitoring requirements as listed in Appendix 5.6-C
4) Prairie Dogs and Lagomorphs
    a. Mapping and monitoring results of prairie dog colonies in and within 1.0 mile of permit area
    b. Description of prairie dog management efforts in and within 1.0 mile of permit area
    c. Results of annual nocturnal spotlight surveys for lagomorphs
5) Land Application (if used)
    a. Annual land application monitoring results (effluent, catchment areas, soil, vegetation, and prairie dogs) evaluating potential bioaccumulation of selenium and other metalloids/metals, and description of mitigation measures (if required).
6) Wildlife Mortalities
    a. Description of any wildlife mortalities observed within the permit area

In addition, Powertech (USA) will report any wildlife mortalities to SDGF&P within 24 hours by telephone and/or email.

Postclosure Monitoring Report

During postclosure monitoring, Powertech (USA) will provide an annual report to DENR describing the following:

Davis, 2011, personal communication between James F. Davis, former Susquehanna Western geologist, and Jim Bonner, Powertech (USA) Inc., April 15, 2011.

DENR (South Dakota Department of Environment and Natural Resources), 2005, Standard Operating Procedures for Field Samplers, Volume I, Tributary and In-Lake Sampling Techniques, February 2005.

DeVoto, R.H., 1978, Uranium Geology and Exploration, Colorado School of Mines Press, Golden Colorado.

Dorn, R.D., 2001, *Vascular Plants of Wyoming*, 3rd Edition, Mountain West Publishing, Cheyenne, Wyoming, 289 p.

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POWERTECH (USA) Inc.
DEWEY-BURDOCK PROJECT
Technical Revisions

Powertech (USA) Inc. proposes the following list of technical revisions for which the Board of Minerals and Environment will authorize the Department of Environment and Natural Resources (department) to review and approve pursuant to ARSD 74:29:03:16.

1. Modify monitoring plans, locations, parameters, and time frames;
2. Modify monitoring analytical methods, limits of detection and reporting requirements;
3. Modify compliance limits or trigger values for chemical parameters;
4. Modify the chemicals added to the lixiviant to include alternative oxidizing agents such as hydrogen peroxide and alternate complexing agents such as sodium bicarbonate;
5. Modify plans and specifications for permitted facilities;
6. Submitting and modifying quality control and quality assurance plans;
7. Add contiguous, affected land within the permit boundary with the total of such additions not to exceed twenty (20) percent of the permitted affected land area of 2,528 acres for this permit if deep disposal wells are used without land application to dispose treated wastewater or 3,793 acres for this permit if land application is used. The maximum amount of expansion allowed without land application (20% of 2,528 acres) is 252.8 acres, and the maximum amount of expansion allowed with land application (20% of 3,793 acres) is 379.3 acres;
8. Modify the mine plan within the constraints of ARSD 74:29:03;
9. Modify or relocate diversions or erosion, sedimentation, or drainage control structures;
10. Modify or relocate ancillary facilities within the permit boundary, including equipment storage areas, parking lots, office buildings, septic systems, perimeter fencing, utilities (phone lines, natural gas lines, power lines, water lines), sediment ponds, and stockpiles;
11. Modify well field configurations within permitted disturbance limits;
12. Modify mine designs and disturbance areas to include contiguous areas of potential ore;
13. Modify the recovery process within the processing facilities to improve performance, recovery or environmental aspects, including the potential recovery of vanadium;
14. Relocate processing facilities to improve operations aspects and recovery;
15. Relocate chemical or petroleum storage areas;
16. Develop and implement other mineral processing technologies that would improve both economic and environmental aspects;
17. Modify or relocate roads within the permit boundary;
18. Modify or relocate pipelines and utilities within the permit boundary;
19. Modify topsoil stripping plans and relocate topsoil and spoil stockpiles;
20. Modify the size of area to be worked at any one time;
21. Modify dust control measures;
22. Modify operating time tables for proposed operations;
23. Modify groundwater restoration methods or schedule;
24. Change, modify, develop, enhance, or increase water treatment technology and water treatment regimens;
25. Modify water usage and sources as allowed by water rights permits;
26. Modify water storage capacity and pond configurations;
27. Modify the size and configuration of the land application areas and catchment areas;
28. Modify the reclamation plan within the constraints of ARSD 74:29:03;
29. Modify the reclamation time tables for proposed reclamation and decommissioning;
30. Implementing new and improved reclamation techniques as they are developed;
31. Modify seeding mixtures or rates;

32. Use irrigation, fertilizer or nurse crops in reclamation;
33. Modify reclamation or vegetation performance standards;
34. Relocate, add or remove reference areas used to establish revegetation success;
35. Modify stocking guidelines and reclamation success standards to reflect climatic conditions;
36. Modify reclamation monitoring techniques;
37. Modify livestock carrying capacities of surrounding areas;
38. Modify areas designated with postmining land uses of rangeland or agricultural or horticultural cropland.
39. Modify designated crop types for areas designated with postmining land use of agricultural or horticultural cropland.
40. Modify reporting procedures and parameters as allowed within the mining laws and mine permit; and
41. Modifying postclosure plans and monitoring time frames;

Powertech (USA) understands that technical revisions must comply with ARSD 74:29:03:03 and must be submitted to the department in writing. The department shall approve, disapprove, conditionally approve, or request additional information deemed necessary to approve technical revisions within 30 days of receipt.

APPENDIX 3.2-D

TVA Exploration Hole Plugging Correspondence

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Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota 57735

December 21, 1989

DEC 27 1989
Uranium Operations
Casper, Wyoming

Mr. Robert D. Townsend, Program Chief
Exploration and Mining Program
South Dakota Department of Water and
Natural Resources
Joe Foss Building
523 E. Capitol
Pierre, South Dakota 57501

RE: EX-5 BOND RELEASE

Dear Mr. Townsend:

I am writing as a follow up to my October 13, 1989 letter to you regarding SKM's request for a bond release on EX-5. We are providing the following additional information that was requested by Tom Durkin in his telephone conversation with Doug Yoder of TVA.

1. As previously reported, to the best of our knowledge the 36 holes mentioned in my October 13, 1989 letter have been properly plugged with low shrink, high sulfate resistant cement grout from the bottom of the hole to within three feet of the surface. The upper three feet of the holes were filled with suitable soil materials.

2. In addition, to the best of our knowledge <u>all</u> of the TVA test holes, whether drilled prior to or after issuance of the EX-5 in 1979, were properly plugged according to the applicable state regulations at the time of drilling. In fact, during the course of the drilling program your department asked SKM to work with the Department to develop and upgrade the State plugging standards. As a result of that combined effort, during which the Department was actively involved in working with SKM and monitoring the drilling program, the State plugging standards changed and evolved. Once again, however, at any given time the hole plugging was conducted in full compliance with the then existing State requirements.

Burdock Area Test Holes

3. A brief history of the Burdock test holes is as follows: On June 30, 1986 we submitted our closing report to the DWNR and made reference to addressing the concern expressed by Peterson and Son, Inc. regarding the seepage occuring in the "alkali area" of their property. On September 12, 1986 we submitted to you our investigation of the problem and our proposed plan of mitigation. The TVA contracted with a Newcastle, Wyoming drilling company which carried out the mitigation plan. That work was observed by DWNR inspectors and reported in inspection reports of October 16, 1987 (Tom Durkin) and November 13, 1987 (Dale Snyder).

4. As was noted in those inspection reports, extensive mitigation was conducted at the Burdock site including redrilling of the test holes and replugging them with cement. Tom Durkin's report states that "TVA is very definitely making an earnest attempt to rectify the problem. From field observance it is my opinion that it may be impossible to have every hole redrilled and replugged to depth."

5. To date, TVA has already expended a substantial amount of time and money in trying to rectify the seepage problem. In addition, we have consulted with our attorney, Marv Truhe, as to the proper course of action under these circumstances. Tom Durkin's inspection report states that if reclamation proves unsuccessful then an alternative may be the working out of suitable compensation to the landowner. Dale Snyder's subsequent report also discusses the extensive redrilling efforts and mentions the possible reasons for the continuing water leakage including joints and fractures in the soil, lateral underground infiltration water into the area, or test holes which were not properly plugged. As has been previously pointed out, there are "pre-TVA' exploration drill holes in this area that were left by prior mineral lessees before the State's plugging standards were enacted. Dale Snyder's report also mentions the option of landowner compensation.

6. TVA is now convinced that further redrilling efforts would not be successful in completely eliminating the seepage and has therefore adopted the alternate course of action suggested in the DWNR reports, namely mitigation of the site and compensation to the landowner. We continued negotiations with the landowner this year and on July 12, 1989 reached an agreement whereby a berm was constructed and TVA paid the landowner $7372.00 in full settlement for all damages which had occurred or which may occur as a result of the seepage. Enclosed is a copy of the TVA letter to Peterson and Son, Inc. dated July 12, 1989 (a copy of which was also sent on that date to Tom Durkin). Enclosed also is a copy of the Memorandum of Damage Settlement in which TVA has also agreed to monitor the area for a period of five years and also to maintain the berm that controls the seepage.

Pre-Permit Test Hole

7. As you know, an old test hole (not in the alkali area) which was drilled on the Peterson property several years prior to the issuance of EX-5 is now apparently seeping. That test hole was drilled in March of 1976 and is identified as PT-31. We are currently working with Mr. Peterson to mitigate the seepage and/or compensate him for any potential damages. As indicated, however, the reclamation of this test hole is unrelated to the EX-5 bond release matter.

In conclusion, we feel that whatever seepage that still may be occurring in that area is not as a result of TVA's exploration drill holes. Regardless of whether the seepage is from pre-TVA test holes or from other sources, however, TVA has done everything possible regarding redrilling and replugging efforts, has paid the landowner for all damages sustained, and has received the landowner's approval of the reclamation, including berm construction and maintenance, and ongoing monitoring for a five-year period. Accordingly, we would request your recommendation of approval for the release of the bond at this time. If you still have additional questions following your review of this information, we would be available to meet with you in Pierre to discuss this further.

I also want to advise you that as of December 31, 1989, I will no longer be working for SKM. TVA's decommissioning project in Edgemont is now complete. The SKM/TVA contract for the project will terminate and the Edgemont office of SKM will close at the end of the year. Any further contacts with SKM regarding EX-5 will be handled by Gary Cummings. Gary was formerly general manager for SKM in Edgemont and was the general superintendent in charge of the EX-5 drilling program. He was also involved in the developments outlined in paragraph 2 above. Gary's address and phone number are as follows: Alta Gold Co., P.O. Box 382, Ruth, Nevada, 89319, (702) 289-4470. In addition, TVA has requested that all future correspondence from the State to SKM regarding this matter be copied to Chuck Wolff, Manager of Uranium Operations, Tennessee Valley Authority, P.O. Box 2957, Casper, Wyoming, 82602. Thank you for your consideration and we will wait to hear from you.

Sincerely,

Kurtis T. Barker

Kurtis T. Barker
General Manager
Wyoming/South Dakota Projects

MDT/dlg
KTB; 171,89
cc: T. L. Hayslett
D. H. Marks
C. E. Wolff
H. D. Yoder
M. R. P. Central Files
M. D. Truhe
G. W. Cummings
S. R. Havenstrite

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NOXIOUS WEED CONTROL PLAN

Powertech (USA) will maintain an active weed control program based on a yearly inspection of the property during the active growing season of weeds to identify the locations of weed growth and on the treatment of weed infestations, with an emphasis on noxious weeds. An effective weed control program utilizes a number of management practices. The following plan outlines the various weed management techniques that could be implemented at the Dewey-Burdock Project. Consultation letters indicating that the plan has been reviewed and approved by the Custer and Fall River County Weed and Pest Boards are included with this appendix.

Noxious weeds will be controlled throughout the life of the Dewey-Burdock Project to reduce the seed source available to invade reclaimed areas. A list of the South Dakota state noxious weeds and the Custer and Fall River counties locally noxious weeds is provided in Table 1. It is anticipated that herbicides will be the primary method utilized to control weeds, but all weed control methods listed below will be considered.

Herbicides are important tools for controlling noxious weeds. Selective herbicides kill a specific type of plant and they perform best if conditions are favorable for plant growth (South Dakota State University Extension, 2013). Since some of these herbicide treatments, especially those targeting broadleaf weeds, also remove all or many of the desirable forbs or legumes, Powertech (USA) will selectively use herbicides, thereby reducing the potential impacts to beneficial plant species. Herbicide application will be performed by a South Dakota-certified licensed pesticide applicator. Powertech (USA) will follow all grazing and haying restrictions on the herbicide label. Combined with proper grazing management and other control tactics, proper use of herbicides can encourage the recovery of reseeded areas that have become infested with weeds. Powertech (USA) will use herbicides that are labeled for the target weed and registered for use on pasture and range and will follow recommended application rates to ensure control of undesirable forage while limiting potential desirable vegetative species impacts.

Prescribed grazing is the application of livestock grazing at a specified season, duration, and intensity to accomplish specific vegetation management goals. By itself, grazing will rarely, if ever, completely eradicate invasive plants. However, when grazing treatments are combined with other control techniques, such as herbicides or biological control, severe infestations can be reduced and small infestations may be eliminated (Frost and Launchbaugh, 2003). A successful grazing prescription should cause significant damage to the target plant, limit irreparable damage to the surrounding vegetation, be consistent with livestock production goals, and be integrated with other control methods as part of an overall weed management strategy. Prescribed grazing

for weed control requires grazing when the weed is most palatable to livestock and most susceptible to defoliation (Frost and Launchbaugh, 2003).

Deferred grazing gives the grasses the opportunity to build up root reserves, develop more topgrowth and produce more herbage (South Dakota State University Extension, 2013). In some pastures, desirable native species no longer abundant will become re-established during the rest period. Deferred grazing can be used in conjunction with other improvement practices to speed recovery.

Mowing, chopping, or clipping temporarily removes weed topgrowth (South Dakota State University Extension, 2013). This system stops seed production but has different effects on the weeds. Annual forbs can be controlled by cutting below the lowest leaf early in the growing season. Undesirable annual grasses should be mowed after the seed stalk has elongated but prior to seed formation. Mowing perennial weeds one time usually reduces seed production; repeated mowing reduces vigor and slows spread. Clipping perennials like Canada thistle or leafy spurge in the spring works well as a set up for fall herbicides when moisture encourages new growth. Digging or chopping works well for scattered biennial thistle. Musk thistle rosettes can be stopped when the root is cut several inches below ground level. This technique requires more labor and is limited to small patches or scattered plants (South Dakota State University Extension, 2013).

Biological control is another weed control tool, especially for noxious weeds. Biological control utilizes natural enemies as a means of weakening or killing the host plant. Insects have been the most common approach to biological control in South Dakota (South Dakota State University Extension, 2013). Noxious weeds that have approved biological control agents (insects) in the state include leafy spurge, musk thistle, Canada thistle, toadflax, St. Johnswort, and biennial knapweeds. South Dakota currently has a collection and release program for leafy spurge flea beetles *(Aphthona* species), coordinated by the South Dakota Department of Agriculture (South Dakota State University Extension, 2013). Powertech (USA) will consult with the Custer and Fall River County Weed and Pest Boards if the use of flea beetles on leafy spurge is considered.

Table 1: South Dakota, Custer County and Fall River County Lists of Noxious Weeds

SOUTH DAKOTA NOXIOUS WEEDS
(South Dakota Department of Agriculture, 2012)

Leafy spurge (*Euphorbia esula*)
Canada thistle (*Cirsium arvense*)
Perennial sow thistle (*Sonchus arvensis*)
Hoary cress (*Cardaria draba*)
Russian knapweed (*Centaurea repens*)
Purple loosestrife (*Lythrum salicaria*)
Saltcedar (*Tamarix aphylla, T. chinensis, T. gallica, T. parviflora and T. ramosissima*)

CUSTER COUNTY LOCALLY NOXIOUS WEEDS
(Custer County, 2012; National Park Service, 2011)

Absinth wormwood (*Artemisia absinthium*)
Black henbane (*Hyoscyamus niger*)
Bull thistle (*Cirsium vulgare*)
Chicory (*Cichorium intybus*)
Common Burdock (*Arctium minus*)
Common mullein (*Verbascum thapsus*)
Common tansy (*Tanacetum vulgare*)
Dalmatian toadflax (*Linaria dalmatica*)
Diffuse knapweed (*Centaurea diffusa*)
Field bindweed (*Convolvulus arvensis*)
Giant knotweed (*Polygonum sachalinense*)
Houndstongue (*Cynoglossum officinale*)
Musk thistle (*Carduus nutans*)
Phragmites (*Phragmites australis*)
Plumeless thistle (*Carduus acanthoides*)
Poison hemlock (*Conium maculatum*)
Puncturevine (*Tribulus terrestris*)
Scotch thistle (*Onopordum acanthium*)
Spotted knapweed (*Centaurea maculosa*)
Sulfur cinquifoil (*Potentilla*)
St. Johnswort (*Hypericum perforatum*)
White horehound (*Marrubium vulgare*)
Yellow toadflax (*Linaria vulgaris*)

FALL RIVER COUNTY LOCALLY NOXIOUS WEEDS
(Fall River County, 2012)

Common mullein (*Verbascum thapsus*)
Dalmatian toadflax (*Linaria dalmatica*)
Scotch thistle (*Onopordum acanthium*)

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DEWEY-BURDOCK PROJECT RECLAMATION PERFORMANCE CRITERIA

1.0 INTRODUCTION

The primary goal of the reclamation program is to rehabilitate the affected land to a condition that meets the selected postmining land uses (ARSD 74:29:07:01). The designated postmining land uses include rangeland (ARSD 74:29:07:20) and agricultural or horticultural crops (ARSD 74:29:07:21). This appendix presents the reclamation performance criteria to establish the success of revegetation for each of these postmining land uses. For agricultural and horticultural cropland, the final bond release criteria will be a demonstration that the productive capacity is equal to or exceeds that of similar crop production areas in the surrounding region for two consecutive crop years. For rangeland, four criteria will be used to establish successful revegetation: vegetative ground cover, usable forage production, species composition and reclamation sustainability. Each of these is briefly described in the following subsections. Section 2 describes the specific methodology to measure reclamation performance for rangeland, Section 3 describes the comparison process, and Section 4 provides references.

1.1 Vegetative Cover

To meet final bond release criteria for rangeland, the total vegetative cover (not including noxious weed) in a revegetated unit must equal or exceed the total vegetative cover on reference areas.

1.2 Usable Forage Production

To meet final bond release criteria, the reclaimed rangeland must support a livestock carrying capacity equivalent to reference areas (ARSD 74:29:07:20). The carrying capacity will be determined by measuring the usable forage production (biomass of usable forage) of the land. Usable forage is defined as the average palatability of individual plant taxa (for consumption by cattle) based on the U.S. Forest Service publication, "Check List, Palatability Table and Standard Symbol List of Colorado and Wyoming Range Plants (USFS, 1937). As indicated in the publication, the list is appropriate for plants of the Black Hills of South Dakota.

1.3 Species Composition

According to ARSD 74:29:07:06, postmine vegetative species and composition must be appropriate for the designated postmining land use. Species composition of the reclamation will be measured to document that species present are appropriate for the rangeland postmining land use.

1.4 Sustainability of the Reclamation

Disturbed lands will be revegetated in accordance with SDCL 45-6B-39, which requires that a diverse, effective, and long lasting vegetative cover be established that is capable of self-regeneration and at least equal in extent of cover to the natural vegetation of the surrounding

area. Compliance with the cover requirement will be demonstrated using the reference area concept, as described in Section 3.0 below. As stated in ARSD 74:29:07:20, rangeland reclamation will be complete when the reclaimed range is capable of withstanding proper stocking rates for 2 consecutive years prior to bond release. Disturbance will be reclaimed using methods outlined in Section 6.4 of the LSM permit application and monitored using methods described below. These reclamation techniques and monitoring methods were developed in accordance with SDCL 45-6B-39 and ARSD 74:29:07:20 and will ensure that adequate cover, species composition, usable forage production, and reclamation sustainability will be attained on the reclamation.

2.0 SAMPLING METHODOLOGY

2.1 Vegetative Cover

The initial step in determining the success of the rangeland revegetation is to determine vegetative cover and production using line transect/point-intercept transects. Due to the two distinct configurations of reclamation (large area parcels associated with well fields and facilities) and linear parcels associated with corridor disturbance, transect locations will be determined based on the configuration of the reclamation unit. Linear reclamation units will be no wider than an average of 50 feet over the length of the unit.

Large Area Parcels: For each 10 acres of revegetated rangeland, one randomly located line transect/point-intercept transect will be used to collect percent absolute vegetative cover data. For parcels of revegetated rangeland smaller than 10 acres, one transect will be used. Transects will be located randomly in the field within each 10-acre unit using a computerized systematic grid (through AutoCAD or ArcGIS). These computer-generated random numbers will be uploaded to a hand-held GPS unit for actual location in the field. Random numbers between 1 and 360 will be generated to determine cover transect direction, and compasses will be used to orient transects to the nearest 1/8 of 360º in the field. Each 50-meter transect will represent a single sample point. Transects that exceeded the boundaries of the vegetation community being sampled will be redirected back into its vegetation community at a 90º angle from the original transect direction at the point of intercept. In instances where a 90º angle of reflection does not place the transect within the sampled community, a 45º angle of reflection will be used. Percent cover measurements will be taken from point-intercepts at 1-meter intervals along the 50-meter transect. Transect locations will be submitted to DENR for review and verification prior to sampling.

Linear Parcels: One 50-meter transect will be located for each 1,640 feet (500 meters) of linear rangeland reclamation unit. The initial transect of a linear unit will be randomly located in the field within the first 50 feet of the unit using a computerized systematic grid (through AutoCAD or ArcGIS). These computer-generated random numbers will be uploaded to a hand-held GPS unit for actual location in the field. Subsequent transects will start 1,640 feet from the end of the preceding transect until a transect no longer fits entirely within the linear unit. Percent cover