APP-013

June 20, 2014

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

William J. Froehlich, Chairman
Dr. Richard F. Cole, Special Assistant
Dr. Mark O. Barnett, Special Assistant

In the Matter of:	)	
POWERTECH USA, Inc.	)	
(Dewey-Burdock Project	)	Docket No. 40-9075-MLA
In Situ Uranium Recovery Facility)	)	ASLBP No. 10-898-02-MLA-BD01
	)	
____________________________________	)	

WRITTEN TESTIMONY OF HAL DEMUTH

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1. WITNESS BACKGROUND INFORMATION

Q.1. Please state your name, position and employer, including duration of employment.
A.1. Hal Demuth. I am a senior engineer/hydrologist and principal of Petrotek Engineering Corporation, where I have been employed at Petrotek since 2001. My curriculum vitae is included as Exhibit APP-014.

Q.2. Please state your education, professional registration and memberships.
A.2. I hold an M.S. in Hydrogeology from the University of Idaho and a B.S. in Petroleum Engineering from the University of Tulsa. I am a member of the Association of Ground-water Scientists and Engineers (NGWA), the Society of Petroleum Engineers (SPE) and the Society of Mining Engineers (SME).

Q.3. What ISR projects have you worked on while with Petrotek and other entities?
A.3. I have worked on well over a dozen uranium ISR projects in the U.S. In addition to the Dewey-Burdock Project, these have included 12 Wyoming Projects (Irigaray Ranch, Christensen Ranch, Reno Creek, Ludeman, Allemand Ross, Lost Creek, Jab/Antelope, Moore Ranch, Smith Ranch/Highland, Reynolds Ranch, Ross and Hank-Nichols), four Nebraska projects (Crow Butte, North Trend, Three Crow and Marsland) and two Texas projects (Holiday El-Mesquite and La Palangana).

Q.4. How many of these projects have involved groundwater characterization?
A.4. All of them to some degree.

Q.5. Would you explain how groundwater characterization is done for a uranium ISR project?
A.5. As will be explained in greater detail in my written testimony below, groundwater characterization is a phased process. During preparation of a source and byproduct material license application for a uranium ISR facility, data are collected to characterize the project area and surrounding region, including its geology, groundwater hydrology and groundwater quality in the various aquifers. The purpose of this site characterization is to demonstrate that suitable hydrologic conditions are present to safely conduct uranium ISR. Following license issuance but prior to operating each ISR wellfield, additional characterization is done on the geology, groundwater hydrology and groundwater quality of that wellfield. This information is summarized in a wellfield hydrogeologic data package prepared for each wellfield.

Q.6. Generally, what type of groundwater characterization information is contained in the license application as compared with the wellfield packages?
A.6. The NRC guidance document NUREG-1569, Exhibit NRC-0013, describes the information needed for license applications in Section 2. This includes descriptions of regional and site geology, a description of the hydraulic properties of the production zone aquifer,

sufficient information on confining units to demonstrate that ISR solutions can be confined to the production zone, and groundwater quality characterization of the production zone aquifer and overlying and underlying aquifers. The application typically includes the results of one or more pumping tests used to determine the hydraulic characteristics of the production zone aquifer including hydraulic conductivity, transmissivity and storativity. These pumping tests are also used to characterize the confining properties of low-permeability overlying and underlying units. A conceptual hydrologic model is prepared to characterize the regional and site hydrology. Although not specifically required by NUREG-1569, for some ISR operations, a numerical groundwater flow model is prepared.

In addition to providing site-wide groundwater characterization information in the application, the applicant also is required to describe the procedures that will be used to assess the geology, groundwater hydrology and adequacy of the monitoring well network of each wellfield prior to operations. These procedures are described in Section 5 of NUREG-1569 and include items like detailed delineation drilling, preparing wellfield-specific geologic maps depicting the thickness and continuity of confining units, installing monitor well networks to detect the potential horizontal or vertical movement of ISR solutions away from the production zone, and verifying the effectiveness of the monitor well networks through pumping tests that are conducted for each wellfield. NRC staff also review the procedures used to sample pre-operational baseline groundwater quality in each wellfield and calculate Commission-approved background (CAB) water quality that is used to set restoration goals and upper control limits (UCLs) that are used for excursion monitoring.

The wellfield-specific data are collected after license issuance and wellfield construction, but before operating each wellfield. Federal regulations and NRC policy prohibit installing the monitor well network for the wellfields that would be needed to collect the wellfield-specific data prior to license issuance (refer to A.22 of this written testimony for more information). This phased, performance-based licensing approach has been used at ISR facilities in Nebraska, Texas and Wyoming for decades.

Q.7. Would you please explain for background information what an aquifer is?

A.7. Yes. Please refer to Exhibit APP-017 at 1, which is a conceptual diagram of a two-aquifer system that has been modified from U.S. Geological Survey Water Supply Paper 2220 (Exhibit APP-018). It notes that an aquifer "is a rock unit that will yield water in a usable quantity to a well or spring" (definition and original figure found in Exhibit APP-018 at 6). The shallower aquifer (colored in blue) is an unconfined aquifer, meaning that it does not have an overlying geologic confining unit. This is also known as a "water table aquifer." A well drilled in the shallower aquifer will be a "water table well," meaning the water level in the well is the same as the water level in the aquifer.

The conceptual diagram depicts a confining clay unit under the shallow aquifer, below which is a deeper aquifer. This aquifer is geologically confined, meaning that there is an overlying, geologic confining unit. A well drilled into a confined aquifer may be an artesian well, meaning that the water level (also known as potentiometric surface) is above the top of the aquifer. In some cases the potentiometric surface will be above ground surface, in which case the well will be known as a flowing artesian well, which will flow at the surface without pumping.

Within an aquifer water flows by porous media flow in interstitial spaces between the sand grains that make up the aquifer. This is depicted in the enlargement on the right of the conceptual diagram.

Q.8. Is it required that ISR take place in an aquifer?

A.8. Yes. This is described in the National Mining Association's Generic Environmental Report prepared in support of the GEIS (Exhibit APP-019 at P-iii, emphasis in original):

> "For a uranium ore body to be amenable to ISR uranium recovery using the typical recovery chemistry noted above, the ore zone must be saturated with relatively fresh water and the rock must have enough transmissivity for water to flow from injection to extraction wells. In other words, for ISR uranium recovery to work, the ore must be situated in an aquifer. *There are no ISR uranium recovery operations in ore bodies that are not in aquifers."*

Q.9. Please list the aquifers proposed for ISR at the Dewey-Burdock Project and indicate whether these are confined or unconfined aquifers.

A.9. Powertech proposes to conduct ISR in the Fall River aquifer (also known as the Fall River Formation) and the Chilson aquifer (also known as the Chilson Member of the Lakota Formation). The Chilson aquifer is geologically confined throughout the entire license area by the overlying Fuson Shale confining unit, which occurs between the Chilson (below) and Fall River (above). The Fall River aquifer is geologically confined by the overlying Graneros Group shales except in the eastern portion of the license area, where the Graneros Group has been eroded away and the Fall River is exposed at the ground surface. In these areas the Fall River is not geologically confined. However, as described below, Powertech has committed to not conducting ISR in the Fall River where it is not geologically confined. Therefore, all ISR will occur in geology confined aquifers.

Q.10. Will you please briefly describe the ISR process?

A.10. Yes. Again I will refer to Exhibit APP-019 at P-ii through P-v. The following information is summarized from that reference.

> ISR leaves the underground ore body in place and continuously re-circulates native groundwater, which has been fortified with oxygen and carbon dioxide, through the aquifer in which the ore body [is located]. Uranium deposits amenable to the ISR process occur in permeable sand or sandstones that are confined above and below by less permeable strata. These formations may either be tabular or C-shaped deposits within a permeable sedimentary layer formed as "roll-fronts." These uranium-bearing formations were formed by the lateral movement of groundwater bearing minute amounts of

oxidized uranium in solution through the aquifer with precipitation of the uranium occurring when oxygenated waters encounter a low oxygen reducing interface, causing precipitation of uranium minerals along that boundary. Most, if not all, of these *redistributed* ore deposits are present in sediments that have fluvial origins, which are common to ISR-amenable deposits in the states of Nebraska, Texas, Wyoming, South Dakota, Colorado, and New Mexico.

[T]he geologic structure and conditions in an ISR-amenable uranium ore body provide adequate natural safeguards against potential environmental impacts. After the uranium recovery and groundwater restoration operations cease, reducing conditions return over time. The same reducing processes that originally minimized the mobility of uranium and created the ore zone, continue to minimize its mobility after operations are complete. As a result, the uranium and other minerals remain in close proximity to the ore zone.

[T]he operational process of developing an ISR project site provides further safeguards against potential environmental impacts. After an ore body that is amenable to ISR is identified, the licensee develops well field designs to progressively remove uranium from the identified ore body. Well field design is based on grids with alternating extraction and injection wells, monitor wells above and below the recovery zone, and a ring of monitor wells surrounding the entire recovery zone to detect any potential *excursions* of recovery solutions from the uranium recovery production zone.

During active operations, native groundwater from the recovery zone in the aquifer is pumped to the surface for fortification with oxygen and carbon dioxide. This fortified water … is then circulated in the recovery zone through a series of *injection* wells in varying patterns in the well fields. The volume of water withdrawn from *extraction wells* in these patterns exceeds the volume injected into the patterns creating a "cone of depression" that assures a net inflow of water into the recovery zone. This ensures no horizontal or vertical water movement from the small portion of the aquifer where ISR operations will occur, towards adjacent, non-exempt USDWs.

The extraction pumping causes the injected recovery solutions to move through the uranium ore body oxidizing and solubilizing the uranium present in the host sandstone. The water from the extraction wells is then run through ion exchange (IX) columns containing synthetic resins, which remove the uranium[, which is processed,] dewatered and dried to produce saleable yellowcake.

After uranium removal in the IX column, the water in the circuit is re-fortified and re-injected as part of a continuous process until the uranium in the ore zone is exhausted.

After active ISR operations cease, the groundwater in the recovery zone is restored *consistent with baseline* or other water quality criteria that are approved by NRC prior to the commencement of active ISR operations.

Q.11. Do you have a visual aid to depict the typical ISR process?
A.11. Yes. Please refer to Exhibit APP-020, which depicts the typical ISR process.

2. CONTENTION 2

Q.12. What is the nature of your testimony regarding this contention?
A.12. It is my testimony that the site-wide baseline groundwater quality data were collected and presented in conformance with NUREG-1569 Section 2 (site characterization), and that the procedures for establishing baseline groundwater quality data for each wellfield are in conformance with NUREG-1569 Section 5 (operational monitoring).

It is also my testimony that, according to NUREG-1569 and federal regulations in 10 CFR Section 40.32(e), a license applicant is not permitted until after license issuance to install a complete wellfield monitor well network that is used to establish Commission-approved background (CAB) groundwater quality within the production zone of each wellfield and upper control limits (UCLs) that are used for excursion monitoring in underlying, overlying and perimeter monitor wells.

2.1 Acquisition of Baseline Groundwater Quality Data is a Phased Process

Q.13. Please respond to the allegation that NRC Staff will require additional data in order to establish a credible baseline for use in the regulatory process, and such data will be established at a future date, outside of the NEPA process, and outside of the public's review (CI 2010 at 37, CI 2014a at 21, Moran 2010 at 14-15, Moran 2014 at 19, OST 2014a at 15).
A.13. This allegation demonstrates a clear lack of understanding of the different phases of baseline groundwater quality data collection for an ISR facility. In order to permit an ISR facility, the applicant must demonstrate the adequacy of site characterization baseline groundwater quality in conformance with NUREG-1569 Section 2. Such data are collected on a site-wide basis. At the same time the applicant must demonstrate appropriate procedures for establishing baseline groundwater quality data for each wellfield in conformance with NUREG-1569 Section 5. It is not until after license issuance that the licensee is permitted to install the wellfield monitoring networks that allow the collection of pre-operational baseline groundwater quality data for each wellfield.

Q.14. Does NRC regulatory guidance address the different phases of baseline groundwater quality data collection?
A.14. NUREG-1569 clearly defines three phases of groundwater monitoring at 5-36:

> "There are three distinct phases of ground-water and surface-water monitoring: pre-operational, operational, and restoration. Pre-operational monitoring is conducted as a

part of site characterization, and review procedures are in Section 2 of this standard review plan."

Q.15. Has Powertech established credible baseline groundwater quality data with respect to the site characterization requirements in Section 2 of the standard review plan (NUREG-1569)?
A.15. Yes. Alleging that the pre-operational baseline groundwater quality characterization that is done in accordance with Section 2 of NUREG-1569 is not "credible" is refuted by the written testimony of Errol Lawrence (Exhibit APP-016) at A.8 through A.25, which describes how NRC staff determined that the site characterization baseline groundwater quality presented in the license application is in conformance with NUREG-1569 Section 2 acceptance criteria.

Q.16. Please summarize the baseline groundwater quality data that are considered "operational" and "restoration" data.
A.16. The operational and restoration groundwater monitoring requirements are summarized in Sec. 5.7.8.2 of NUREG-1569 (at 5-37):

> "Well field hydrologic and water chemistry data are collected before *in situ* leach operations to establish a basis for comparing operational monitoring data. Hydrologic data are used to (i) evaluate whether the well field can be operated safely, (ii) confirm monitor wells have been located correctly, and (iii) design aquifer restoration activities. Water chemistry data are used to establish a set of water quality indicators, and the concentrations of these indicators in monitoring wells are used to determine whether the well field is being operated safely. Water chemistry data are also used to set the water quality standard for restoring the production zones and adjacent aquifers after *in situ* leach extraction ceases."

Q.17. When will this "operational" and "restoration" data be collected?
A.17. Prior to operating each wellfield, the operator must establish baseline groundwater quality for that wellfield in order to define groundwater restoration goals and excursion detection limits. However, it is not the baseline groundwater quality for each wellfield that is required at the licensing stage but the <u>procedures</u> for establishing future baseline groundwater quality for each wellfield. This is clearly illustrated by NUREG-1569 acceptance criterion 5.7.8.3(1), the first paragraph of which states (Exhibit NRC-0013 at 5-39, emphasis added):

> "For **each new well field**, the **applicant's approach for establishing baseline water quality data** is sufficient to (i) define the primary restoration goal of returning each well field to its pre-operational water quality conditions and (ii) provide a standard for determining when an excursion has occurred. The reviewer should verify that acceptable procedures were used to collect water samples, such as American Society for Testing and Materials D4448 (American Society for Testing and Materials, 1992). The reviewer should also ensure that acceptable statistical methods are used to meet these three

objectives, such as American Society for Testing and Materials D6312 (American Society for Testing and Materials, 1998)."

Several important conclusions can be drawn from this citation from NUREG-1569:

- NUREG-1569, which is the primary guidance document for preparing and reviewing license applications for uranium ISR facilities, includes pre-licensing, site characterization baseline groundwater sampling requirements in Section 2 that are different from the operational baseline groundwater sampling requirements in Section 5; this is self-evident based on the titles of Section 2 (Site Characterization) and Section 5 (Operations).
- A license applicant must characterize site-wide baseline groundwater quality in conformance with Section 2 of NUREG-1569.
- Establishing baseline groundwater quality for each wellfield is a requirement of Section 5 (Operations), which requires the applicant to show that the procedures for obtaining such information are in conformance with NUREG-1569 acceptance criteria, specifically 5.7.8.3(1).
- All acceptance criteria in Section 5 are clearly in reference to operations as opposed to site characterization (Section 2).
- "[E]stablishing baseline water quality data" for "each new well field" is clearly part of operations (Section 5).

Q.18. Does the license application address the procedures for collecting baseline groundwater quality data for each wellfield?
A.18. Yes. Powertech's <u>procedures</u> for collecting baseline groundwater quality data for each wellfield and establishing target restoration goals (TRGs) and UCLs based on these data are described in Exhibit APP-043.

Q.19. Are these procedures also described in the FSEIS?
A.19. Yes, they are described in FSEIS (Exhibit NRC-008-A and 008-B) Sec. 7.3.1.1 and 7.3.1.2. Sec. 7.3.1.1 (FSEIS at 7-8) describes the procedures for establishing CAB for the production zone in each wellfield and confirmation that these procedures conform to NUREG-1569 (Section 5) requirements (emphasis added):

> "The applicant will establish Commission-approved background groundwater quality before beginning operations by sampling a subset of wells that will later serve as injection or production wells installed in the uranium mineralization zones (Powertech, 2011). The subset of wells will include at least one well per 1.6 ha [4.0 ac] of wellfield pattern area, or six wells, whichever is greater. In cases of wellfields smaller than 2.4 ha [6 ac], wells will be spaced at one well per 0.4 ha [1.0 ac]. These wells will be sampled four times for background characterization, with a minimum of 14 days between sampling events (Powertech, 2011). **Consistent with NUREG- 1569, Section 5.7.8.3**

(NRC, 2003), the applicant will be expected to sample wells over sufficiently spaced intervals to indicate seasonal variability. The water level in each well will also be measured and recorded prior to each sampling event (Powertech, 2009a). Samples will be analyzed for the parameters shown in Table 7.3-1. **The applicant's proposed well spacing, sampling frequency, and parameters for Commission-approved background production zone sampling are consistent with NUREG-1569** (NRC, 2003)."

FSEIS Sec. 7.3.1.2 (at 7-10 through 7-12) describes the procedures for situating underlying, overlying and perimeter monitor wells around each wellfield for excursion detection and establishing UCLs for excursion monitoring wells according to the baseline groundwater quality that is determined after installing and sampling the monitor wells. This section of the FSEIS concludes, "The applicant followed guidance in NUREG–1569 (NRC, 2003) to establish and set UCLs in wellfields" (FSEIS at 7-11).

Q.20. Are the procedures for establishing baseline groundwater quality for each wellfield specified in Powertech's license?
A.20. The procedures for establishing CAB and UCLs for each wellfield are enforced by LC 11.3 and 11.4 (Exhibit NRC-0012 at 10). These LCs require Powertech to establish CAB and UCLs according to the procedures in Section 5.7.8 of the approved license application.

Q.21. Did NRC staff review these procedures as part of its safety review?
A.21. Yes. NRC staff's review of Powertech's plans for establishing CAB and UCLs is documented in the SER, which states (Exhibit NRC-00134 at 181, emphasis added):

"The staff has reviewed the applicant's plans for performing CAB and excursion monitoring for the Dewey-Burdock Project. **The applicant has presented an appropriate monitoring well network, appropriate criteria for siting wells, and an appropriate CAB and excursion sampling scheme.** However, the staff is clarifying the operational excursion monitoring program. Although, the applicant states that it will collect operational excursion samples twice monthly, the standard review plan states that samples should be collected every 2 weeks (NRC, 2003b). The staff determined that samples collected twice monthly, and no more than 14 days apart, is sufficiently consistent with the recommendations in the standard review plan. Therefore, the staff is modifying the standard license condition regarding excursions to clarify that operational excursion samples will be collected no more than 14 days apart in any given month.

"The applicant has also properly stated the criteria for identifying excursions. For reasons stated in SER Section 2.4, the staff is not requiring underlying monitoring wells for aquifers below the Morrison Formation. Furthermore, corrective actions for excursions are discussed in SER Section 7.3.2.1. **Based on the staff's review of the information provided by the applicant, the staff is reasonably assured that the applicant will**

> **implement an appropriate CAB and excursion sampling program. This reasonable assurance determination is based on the information provided in the application as supplemented by the modified standard license condition. Therefore, the staff finds the applicant's description of the CAB and excursion monitoring programs is consistent with standard review plan [NUREG-1569] Section 5.7.8.3.** Therefore, the aforementioned information complies with 10 CFR 40.32(c), 10 CFR 40.41(c), 10 CFR Part 40, Appendix A, Criterion 5B(5), Criterion 7, and Criterion 7A."

Q.22. Is there anything that would have prevented Powertech from establishing CAB and UCLs for each wellfield prior to license issuance?
A.22. Yes. Installing all of the production zone wells, underlying monitor wells, overlying monitor wells and perimeter monitor wells needed to establish CAB and UCLs for an entire ISR wellfield specifically is prohibited prior to license issuance. This is illustrated in NUREG-1569 at xviii, emphasis added:

> "An *in situ* leach source and byproduct material **application may be denied or rejected under specific instances during the review process. Beginning construction of** process facilities, **well fields**, or other substantial actions that would adversely affect the environment of the site, **before the staff has concluded that the appropriate action is to issue the proposed license, is grounds for denial of the application** [10 CFR 40.32(e)]."

NRC's position of pre-license construction of a wellfield monitoring network is also described in the July 24, 2009 letter from NRC to Lost Creek ISR, LLC (Exhibit APP-024 at 1), which states:

> "The NRC staff's interpretation of 10 CFR 40.32(e) is that installation of a limited number of wells for pumping tests and baseline data collection for the site is permitted under 10 CFR 40.32(e). However, installation of the monitoring well network for a specific wellfield goes well beyond that needed for background data collection, and bears on how a licensee will ensure that public health and safety and the environment will be protected during operation. Accordingly, the NRC staff concludes that such activities are not permitted under 10 CFR 40.32(e) and can only be performed after a license is issued."

Q.23. Is this phased approach to collecting baseline groundwater quality data commonly used at ISR facilities?
A.23. Yes. Powertech's phased approach to licensing and developing a uranium ISR facility is the same approach that has been used in the industry for decades and that has been recently approved by the NRC in source and byproduct material licenses issued for the Moore Ranch Project (SUA-1596, issued 2010), Nichols Ranch Project (SUA-1597, issued 2011), and Lost Creek Project (SUA-1598, issued 2011).

Q.24. Please respond to the allegation that the DSEIS at 7-13 and 7-14 states that all domestic and stock wells within 2 km of the project area will be sampled quarterly for a year to establish baseline water quality after operations begin, and such samples collected after operations begin cannot be considered true baseline (Moran 2013 at 26-27).

A.24. This allegation mischaracterizes the statement in the DSEIS, which says that "all domestic and stock wells within 2 km [1.2 mi] of the project area and all monitoring wells will be sampled quarterly over a 1-year period to establish baseline water quality **before** operations begin" (Exhibit NRC-009-B at 7-14, emphasis added).

The FEIS similarly states, "all domestic and stock wells within 2 km [1.2 mi] of the wellfields and all [pre-existing] monitoring wells will be sampled quarterly over a 1-year period to establish baseline water quality **before** operations begin" (FSEIS at 7-14, emphasis added).

The language in the DSEIS and FSEIS is consistent with LC 12.10, which states, "**Prior to commencement of operations**, the licensee will collect four quarterly groundwater samples from each well within 2 km (1.25 mi) of the boundary of any wellfield, as measured from the perimeter monitoring well ring" (Exhibit NRC-0012 at 13, emphasis added).

Q.25. How will the pre-operational baseline groundwater quality data from domestic and stock wells be used?

A.25. The data collected prior to commencing operations will be compared to operational data for all domestic, livestock and irrigation wells within 2 km of the wellfield boundaries, which Powertech will be required to monitor as part of its routine environmental sampling program in accordance with LC 12.10.

3. CONTENTION 3

Q.26. Please describe the nature of your testimony on this contention.

A.26. Similar to Contention 2, my testimony focuses on the phased nature of hydrogeologic characterization for a uranium ISR facility. It is my testimony that the site-wide hydrogeologic characterization was performed in conformance with NUREG-1569 Section 2 (site characterization), and that the procedures for establishing hydrogeologic data for each wellfield are in conformance with NUREG-1569 Section 5 (operations). It is also my testimony that the information in the license application and FSEIS demonstrates that the production zone aquifers are sufficiently isolated such that ISR operations can be conducted safely in accordance with the NRC license.

3.1 Acquisition of Hydrogeologic Information is a Phased Process

Q.27. Please respond to the allegation that hydrogeologic information necessary to determine the impacts to groundwater (e.g., aquifer pump tests and mitigation of impacts from exploration holes) will only be obtained at a future time outside of the NEPA process (CI 2013 at 21, Moran 2013 at 9, 13, OST 2013 at 16-17).

A.27. This allegation is based on a false premise – that information required under Section 5 (operations) of NUREG-1569 is required during the licensing process in order to assess the potential impacts to groundwater. As explained in A.13 through A.23 of this written testimony, site characterization data are required under Section 2 (site characterization) criteria in NUREG-1569 prior to license issuance, while the procedures for establishing baseline groundwater quality and hydrologic information for each wellfield and for monitoring potential impacts are required under Section 5 (operations) criteria in NUREG-1569. The latter information is not required to assess potential impacts to groundwater but instead to confirm that proper operational and monitoring procedures are followed to prevent groundwater contamination.

Q.28. Please address specifically pumping tests conducted for each wellfield.
A.28. With respect to aquifer pumping tests that will be conducted for each wellfield prior to operations, the applicable NUREG-1569 acceptance criterion is 5.7.8.3(4), which includes the following guidance at 5-43:

> "The applicant establishes well field test procedures. Once a well field is installed, it should be tested to establish that the production and injection wells are hydraulically connected to the perimeter horizontal excursion monitor wells and are hydraulically isolated from the vertical excursion monitor wells. Such testing will serve to confirm the performance of the monitoring system and will verify the validity of the site conceptual model reviewed in Section 2 of this standard review plan."

The primary purpose of the aquifer pumping tests conducted for each wellfield is to ensure the adequacy of the monitoring well network. This confirms proper implementation of the procedures for establishing the monitoring well network, which are the subject of review under Section 5 of NUREG-1569 during the license application process.

Q.29. Can Powertech conduct pumping tests for each wellfield prior to license issuance?
A.29. No. Powertech cannot conduct the aquifer pumping tests for each wellfield prior to license issuance, since it cannot construct the wellfield monitoring network for any wellfield until the license is granted (see A.22 of this written testimony). However, this does not mean that information needed to assess potential groundwater impacts is lacking at this stage of the licensing process. NRC staff reviewed Powertech's procedures for locating and installing monitor wells and for conducting the pumping tests and determined those procedures meet regulatory requirements (see below). The results of those pumping tests will be provided to NRC and EPA staff for review and will have to demonstrate adequacy of the monitoring network prior to operating each wellfield. More specifically, Powertech will be required by its commitments and NRC license conditions to demonstrate that perimeter monitor wells are hydrologically connected to the production zone and that overlying and underlying monitor wells are hydrologically isolated from the production zone sufficiently such that ISR operations can be safely conducted. If a pumping test does not demonstrate these requirements (e.g., due to an

anomalous conditions such as an unplugged borehole) Powertech will be required to correct the anomaly and repeat the pumping test until the pre-operational requirements are met.

Q.30. Please describe NRC staff's review of Powertech's plans to conduct pumping tests for each wellfield.
A.30. The SER documents NRC staff's review of Powertech's pump testing procedures, including conformance with NUREG-1569 Section 5 acceptance criteria (Exhibit NRC-00134 at 183):

> "The staff determines that the aquifer test and analysis procedures are adequate to determine production zone confinement and monitoring network adequacy. Furthermore, the proposed wellfield hydrologic package contains the necessary information for the staff to understand wellfield hydraulics and the ability of the applicant to monitor, detect, and remediate excursions. Based on the staff's review of the information provided by the applicant, the staff determines that this information is consistent with standard review plan Section 5.7.8.3. Therefore, the information in the application complies with 10 CFR 40.32(c), 10 CFR 40.41(c), 10 CFR Part 40, Appendix A, Criterion 5B(5), Criterion 7, and Criterion 7A."

3.2 The Fall River and Chilson Aquifers are Isolated Sufficiently that ISR Operations Can Be Conducted Safely in Accordance with the NRC License

Q.31. How do you respond to the allegation that there is lack of confinement of the Inyan Kara aquifer or unsubstantiated assumptions as to the isolation of aquifers at the project site (LaGarry 2010 at 3, CI 2010 at 39-40, CI 2013 at 20, Moran 2013 at 16, OST 2010 at 22, OST 2013 at 16)?
A.31. Information in the license application and FSEIS demonstrates that the Fall River and Chilson aquifers are sufficiently isolated hydrologically such that ISR operations can be safely conducted in accordance with the NRC license. For example, FSEIS Sec. 3.4.1.2 (at 3-14 through 3-20) and the response to TR RAI P&R-1 (Exhibit APP-016-B at 1-3) describe the three major confining units with respect to the Inyan Kara aquifer:

- The overlying Graneros Group, which is composed of the Skull Creek, Mowry and Belle Fourche shales, is up to 550 feet thick in the western portion of the project area and present across the project area, except where it has been eroded and is absent in the eastern edge of the project area.
- The Fuson Shale is between the Fall River and Chilson aquifers and is 20 to 80 feet thick throughout the project area.
- The underlying Morrison Formation is 60 to 140 feet thick throughout the project area.

The continuity of the three major confining units across the project area is shown in Cross Section A-A'-A" described in the written testimony of Errol Lawrence (Exhibit APP-037) at A.39. Powertech also prepared detailed geologic cross sections through each of the proposed wellfields that show the major confining units associated with the Inyan Kara aquifer. These are available as Exhibits 2.7-1a through 2.7-1h and 2.7-1j in the June 2011 TR RAI responses (Exhibit APP-016-G at PDF pages 5-15). In particular, Cross Section A-A' (Exhibit APP-016-G at PDF page 5) is drawn through the initial planned wellfield in the Burdock (eastern) portion of the project area. This cross section shows that the uranium mineralization is present in the Chilson in this area. Cross Section A-A' shows the continuity of the Fuson Shale above the Chilson and Morrison Formation below the Chilson. It also shows that the Graneros Group is present above the Fall River in this planned wellfield. Cross Section H-H' (Exhibit APP-016-G at PDF page 12) is drawn through the initial planned wellfield in the Dewey (western) portion of the project area. Uranium mineralization in this wellfield is found primarily in the Lower Fall River, which is separated from the underlying Chilson by the Fuson Shale and from the surface by the overlying Graneros Group.

Q.32. Please address specifically evidence supporting the isolation of the Fall River and Chilson aquifers.

A.32. Hydraulic isolation between the Fall River and Chilson aquifers due to the Fuson Shale is demonstrated by differing potentiometric water level elevations in paired wells completed in the Fall River and Chilson aquifers. Exhibit APP-017 at 3 demonstrates this for two well pairs, one in the Dewey (western) portion of the project area and one in the Burdock (eastern) portion of the project area. In the Burdock area, wells 694 (Fall River) and 696 (Chilson) are located within several hundred feet of each other. The potentiometric water level elevations on April 25, 2011 were 3641.6 feet at well 694 (Fall River) and 3650.7 feet at well 696 (Chilson), which represents a 9.1-foot positive head difference between the Chilson and Fall River aquifers at this location (note that all values are in feet above mean sea level). If there were a strong hydraulic connection between the two aquifers at this location, the water level elevations would be similar. The substantial difference between the potentiometric heads in these paired wells indicates hydraulic separation between the Fall River and Chilson at this location.

An even greater difference in water level elevations between the Fall River and Chilson exists in the Dewey area. Exhibit APP-017 at 3 shows that the water level elevation on April 25, 2011 was 3644.4 feet in well 687 (Fall River) and 3684.0 feet in well 689 (Chilson). This represents approximately 40 feet of positive difference between the Chilson and Fall River aquifers at this location, again providing clear evidence of hydraulic separation between these units.

See also A.80 through A.84 of the written testimony of Errol Lawrence (Exhibit APP-037), which describe the confining properties of the Fuson Shale with respect to historical and recent aquifer pump test results. That testimony describes how the observed response through the Fuson Shale during pumping tests is attributed to one improperly installed well completed in both the Fall River and Chilson aquifers or improperly abandoned boreholes in one isolated area. With respect to the confinement of the Inyan Kara aquifer, which includes the Fall River and

Chilson aquifers, the Fuson Shale is an internal member of the Inyan Kara aquifer and does not affect its overall confinement.

Q.33. Are there also water quality differences between the site aquifers?
A.33. Yes. Further evidence of isolation of aquifers across the project site is available from USGS geochemistry research by Dr. Raymond Johnson. The written testimony of Errol Lawrence (Exhibit APP-037) at A.24 describes how the USGS collected 28 groundwater samples from monitoring wells in and around the Dewey-Burdock project area in June 2011. In February 2012 Dr. Johnson presented an update on USGS research at the project site to U.S. EPA Region 8 at their office in Denver, Colorado. The publicly available slides from that presentation are provided as Exhibit APP-026. The presentation summarizes sample results for groups of wells located in close proximity to each other but completed in different aquifers, including the alluvium, Fall River, Chilson and Unkpapa aquifers. The Unkpapa lies below the Chilson and is separated from the Chilson by the Morrison Formation. The presentation compares the concentrations of major ions, dissolved metals, and isotopes of uranium, oxygen, hydrogen, sulfur and carbon between the different aquifers and presents evidence that there is not a significant transfer of water across the confining units between the aquifers. This is summarized on Slide 77 in Exhibit APP-026, which includes the following two conclusions:

- "From the geochemistry, no evidence of natural groundwater flow across units in the project area (variety of indicators)
- "Alluvial groundwater is not connected to the rest of the system (variety of indicators)."

Q.34. Is there evidence that deeper aquifers are hydrologically isolated?
A.34. Aside from the aquifers previously discussed, there are three deeper aquifers of particular interest to the Dewey-Burdock Project. In descending order, these include the Minnelusa Formation, which is one of the proposed formations for Class V deep well disposal of treated wastewater from the project, the Madison Formation, which is the proposed source of supplemental water for production and groundwater restoration activities, and the Deadwood Formation, which is the second proposed disposal formation for Class V deep well disposal.

Evidence that the Minnelusa and Madison are hydraulically isolated within the project area is presented in the FSEIS at 5-32:

> "Confining units at the base of the Minnelusa Formation are expected to provide hydraulic separation between the Minnelusa Formation and the Madison aquifer. In some locations, these confining layers may be absent or provide ineffective confinement; this could enhance the hydraulic connection between the Minnelusa aquifer and the underlying Madison aquifer (Naus, et al., 2001). However, SDDENR concluded based on water levels in Minnelusa and Madison observation wells in the area that there is a significant difference in the potentiometric surfaces of the two aquifers, which suggests that the aquifers are hydraulically separated in the vicinity of the proposed project area (SDDENR, 2012c). Further, the UIC permit will not allow injection into the Class V deep

> disposal wells unless the permittee demonstrates the well[s] are properly sited, such that confinement zones and proper well construction minimize the potential for migration of fluids outside of the approved injection zone."

Q.35. Please provide additional explanation of the South Dakota Department of Environment and Natural Resources (SDDENR) observation wells.
A.35. The SDDENR observation wells discussed in the preceding quotation are paired Minnelusa and Madison wells which SDDENR uses to track water levels in these regional aquifers multiple times each year. According to SDDENR publicly available data (SDDENR, 2014), the three well pairs nearest the project area are designated CU-95A/B, FR-92A/94A and FR-95A/B. These well pairs are approximately 10 miles northeast, 15 miles east and 25 miles east of the Dewey-Burdock project area, respectively. SDDENR water level measurements show that the Madison potentiometric surface was approximately 36 feet higher than the Minnelusa at the CU-95A/B well pair, approximately 12 feet higher at the FR-92A/94A well pair and approximately 167 feet higher at the FR-95A/B well pair based on the most recent publicly available measurements in October 2013. Further, USGS researchers Long et al. (2012) show that the hydraulic head difference between the Madison and Minnelusa aquifers increases in directions to the south and west in this general vicinity southwest of the Black Hills. This is shown in Figure 3-17 in the Madison Water Right Permit Application (Exhibit APP-027-A at 48). It is reasonable to conclude from this information that the hydraulic head difference between the Madison and Minnelusa aquifers within the project area is equal to or greater than that in the nearest SDDENR observation wells.

Q.36. Did SDDENR draw any conclusions about the isolation of the Madison and Minnelusa aquifers beneath the project site?
A.36. Yes, their conclusion is found in SDDENR's review of Powertech's Madison water right permit application (Exhibit APP-028). Specifically, Exhibit APP-028 at 4 contains the following statement (emphasis added):

> "The water levels of DENR-Water Rights' observation wells in the area indicate **very distinct** potentiometric surfaces in the Minnelusa and Madison, and **suggest the aquifers are hydraulically separated**."

Q.37. Are there water quality differences between the Minnelusa and Madison aquifers in the project vicinity?
A.37. Yes. Further evidence for the hydraulic isolation of the Minnelusa and Madison aquifers beneath the project site is provided by the water quality information presented in the Class V UIC permit application (Exhibit APP-016-S through APP-016-V), and the Madison water right permit application (Exhibit APP-027-A through APP-027-C). The Class V UIC permit application presents evidence from the USGS Produced Waters Database and other publicly available data sources that the total dissolved solids (TDS) in the Minnelusa is above

10,000 mg/L (Exhibit APP-016-S at 2.7-L-52 and 2.7-L-56 and Exhibit APP-016-U at 2.7-L-70). By comparison, the Madison water right permit application presents evidence from the closest Madison wells to the project area that the salinity in the Madison is between 446 and 1,731 µS/cm expressed as electrical conductivity (Exhibit APP-027-A at 41, Exhibit APP-027-B at A-1, Exhibit APP-027-C at B-5). Using a rule-of-thumb that TDS may be approximated as 70% of electrical conductivity (when the electrical conductivity is lower than 2,000 µS/cm), a reasonable estimate of the Madison TDS in the project area is about 300 to 1,200 mg/L, or much lower than the TDS in the Minnelusa. This strongly suggests the two aquifers are hydraulically isolated beneath the project area.

It is important to point out that the Minnelusa Formation is one of the target formations for disposal of treated wastewater in Class V deep disposal wells. EPA will not authorize Powertech to inject treated wastewater into either the Minnelusa or Deadwood aquifers without first demonstrating hydraulic isolation of the injection zone.

Q.38. Are there similar requirements to demonstrate hydraulic isolation of the production zone prior to operating each wellfield?

A.38. Similar to the demonstration to EPA that will be required to receive authorization to inject treated wastewater into Class V deep disposal wells, Powertech will be required to demonstrate confinement of the production zone of each wellfield from overlying and underlying aquifers before receiving authorization from NRC and EPA to begin injecting lixiviant into the wellfield. Demonstration of geologic and hydrologic confinement will be required through detailed evaluation of lithology, potentiometric surfaces, and pump testing for each wellfield.

4. CONTENTION 4

Q.39. What is the nature of your testimony on this contention?

A.39. My testimony focuses on specific allegations related to the water balance and potential impacts to nearby water supply wells.

4.1 The Water Balance Satisfies its Intended Purpose

Q.40. Please respond to the allegation that the water balance contained in the FSEIS does not provide sufficient information to adequately analyze the groundwater quantity impacts in that it does not include measured data for all inputs and outputs and fails to calculate an actual balance (CI 2014a at 25, Moran 2014 at 24, OST 2014a at 20).

A.40. This allegation seems to be based on an incomplete understanding of the water balance provided in the license application and summarized in FSEIS Sec. 2.1.1.1.3.3 (FSEIS at 2-34 through 2-26). The water balance itself does not address "groundwater quantity impacts," but the various streams which make up the water balance explain how the aquifer pumping rates were determined and used as the basis for the impact analysis.

Q.41. Please explain the purpose of the water balance provided in the license application and summarized in the FSEIS.

A.41. The purpose of the water balance stems from NUREG-1569 guidance. In the TR RAIs (P&R-14(c) and 3.1-9), NRC staff requested water balance diagram(s) in support of the discussion on handling liquid wastes. TR RAI 3.1-9 (Exhibit APP-016-D at 393) stated that the water balance diagram should be consistent with guidance in NUREG-1569 Sec. 3.1.2, which states that license application should contain "a water balance diagram for the entire system" (Exhibit NRC-0013 at 3-1).

Q.42. Please describe the water balance.

A.42. In response to NRC staff's request, Powertech provided a water balance diagram showing the project-wide typical flow rates during uranium recovery, groundwater restoration, and concurrent uranium recovery/groundwater restoration. The figure and accompanying table show the estimated amount of net consumption from the Inyan Kara aquifer (Fall River and Chilson) and from the Madison aquifer. They also show the quantity of water disposed in each of the wastewater disposal options. The water balance is provided in Exhibit APP-016-B at 68-73).

The water balance diagram (Exhibit APP-016-B at 69) shows that in each wastewater disposal option and for each phase of operations, the inputs from the Inyan Kara and Madison (streams A, G, J and M) equal the output to liquid waste disposal (streams I and N). Thus, the diagram depicts an actual net zero balance.

The water balance diagram also graphically depicts the production and restoration bleed that will be maintained from the first injection of lixiviant through the end of active groundwater restoration to maintain hydraulic well field control. An example is given as follows for the Burdock area. Under the deep disposal well option and during restoration without groundwater sweep, the bleed stream from the Fall River and Chilson (stream A) is 2.5 gpm, or 1% of the total amount of water extracted from the Burdock well field (stream B). Of the 250 gpm extracted from the Burdock well field, 175 gpm, or 70%, is reinjected into the well field (stream C). (This 70% represents the permeate recovery rate from reverse osmosis, which will be used to restore groundwater if deep disposal wells are used.) To this is added 73 gpm from the Madison (stream E) so that the amount of water reinjected into the well field is less than the amount extracted by the amount of the bleed (the difference of 0.5 gpm is due to rounding to whole numbers in the water balance diagram).

The water sent to liquid waste disposal (streams I and N in the water balance figure) is routed to ponds that are used in the water treatment process and to store treated water temporarily (e.g., during the non-irrigation season in the land application option). Streams I and N represent the discharge to the ponds, such that any evaporation decreases the quantity of water that requires disposal but does not affect the water balance figure.

Q.43. Did the water balance satisfy its intended purpose?
A.43. Yes. NRC staff's review of Powertech's water balance in consideration of NUREG-1569 acceptance criteria resulted in the following determination in the SER (Exhibit NRC-00134 at 81):

> "The staff has reviewed the applicant's water balance information and finds that it is acceptable. Water balance information addresses both the operations and restoration phases, individually, and in combination. The applicant also provides water balance information for each individual restoration and disposal method … Based on its review of the water balance information, the staff finds that it is consistent with Section 3.1.3 of the standard review plan and complies with 10 CFR 40.32(c) and 40.41(c)."

Q.44. The allegation stated above requests "measured data" to compute the water balance. Is it possible to measure the inputs and outputs prior to constructing and operating the project?
A.44. No. It is impossible since measured data on water use will not be available until after operations commence.

4.2 Evaporation Will Not Impact the Project Water Usage since Water That Is Recirculated Will Not Be Subject to Evaporation

Q.45. Please respond to the allegation that since the project area evaporation rate is 3 to 4 times the precipitation rate, the project will result in tremendous volumes of water losses via evaporation (CI 2013 at 27, Moran 2010 at 9, Moran 2013 at 11, OST 2010 at 26).
A.45. This allegation is based on a false premise – that water loss through evaporation would somehow increase the overall water consumption rate. This could only occur if the water that is recycled to the wellfields during uranium production or groundwater restoration were subject to evaporation. In fact, the water that is recycled to the wellfields during uranium production and the water injected during groundwater restoration is always within a closed system of pipes and vessels and is never subject to evaporation.

The only water subject to evaporation is water stored temporarily in ponds en route to wastewater disposal (via deep disposal wells or land application) and the water that is land applied (if land application is used). The ponds are not used to store water that is recycled to the wellfields during production or groundwater restoration. Therefore, any water lost to evaporation merely represents less water requiring disposal via deep disposal wells or through land application.

4.3 The FSEIS and License Application Evaluate Potential Impacts on Local Wells and Determine That They Will Be Small

Q.46. Please respond to the allegation that the DSEIS fails to explore the impacts on local water sources of the projected large-volume water use at the site, including impacts to water levels and well yields (CI 2013 at 25, 29, Moran 2013 at 13-14, OST 2013 at 20).
A.46. This allegation was directed at the lack of a potential impacts analysis to local wells in the DSEIS. Although significant additional information was added in the FSEIS (as described

below), it is not accurate to say that the DSEIS failed to explore the impacts. DSEIS Sec. 4.5.2.1.1.2.2 (Exhibit NRC-009-A at 4-57 through 4-60) addresses potential impacts due to consumptive use, including:

- Inventory of wells within 2 km of the project site
- Estimated drawdown impacts in the Fall River and Chilson aquifers, which were updated in the FSEIS based on the February 2012 numerical groundwater modeling report
- Recovery of groundwater levels with time in the Fall River and Chilson aquifers
- Applicant's commitment to remove all domestic wells within project area from private use prior to ISR operations
- Applicant's commitment to remove all stock wells within ¼ mile of potential well fields from private use prior to operation of the well field
- Applicant's commitment to monitor private domestic and livestock wells
- Applicant's commitment to provide alternate source of water (e.g., a replacement well) to a well owner if there is significant drawdown in the Fall River and Chilson aquifers

Q.47. Please describe how potential impacts to local wells are addressed in the FSEIS.
A.47. The FSEIS describes in detail potential impacts to local wells due to consumptive water use in Sec. 4.5.2.1.1.2.2 (at 4-59 through 4-62), including:

- Updated estimates of drawdown in the Fall River (up to 12 feet) and Chilson (up to 10 feet) adjacent to the project area based on numerical modeling
- Numerical modeling results showing groundwater levels will recover to near pre-operational levels within 1 year after groundwater withdrawals cease
- Powertech's commitments to remove stock and domestic wells within the project area from private use prior to ISR operations, monitor during operations and mitigate potential impacts
- Demonstration from numerical groundwater modeling that the Inyan Kara aquifer can sustain the anticipated extraction rate

The FSEIS describes the updates to the drawdown estimates and NRC's review of the groundwater model at E-135:

> "NRC acknowledges that drawdown estimates for the Fall River and Chilson aquifers have been updated (Petrotek, 2012). The updated drawdown estimates are based on numerical modeling using site-specific parameters and calibrated to historical pumping test data. NRC staff reviewed the applicant's numerical model and calibration, and determined that the model was appropriately developed and sufficiently calibrated."

Further, as described in the written testimony of Doyl Fritz (Exhibit APP-046) at A.10, the FSEIS documents SDDENR's evaluation of water availability in the Inyan Kara and Madison aquifers and their determination that the requested maximum withdrawal rates will not exceed the water availability or recharge and will not unlawfully impact nearby water rights or domestic wells.

Also as described in Exhibit APP-046 at A.10, NRC performed an independent model of the Madison aquifer and determined that the project will not likely impact the nearby Edgemont Madison wells.

Although this and other allegations continue to claim that the project will consume "large" quantities of water, all technical analyses by NRC and SDDENR as referenced in this written testimony repeatedly show that the quantity of water is a small portion of the water in storage in the aquifers, is less than the annual recharge to these aquifers, and will not adversely impact other water users. Repeatedly saying the project will consume "large" or "massive" volumes of water will not make it true. Water use must be considered with respect to the resource available.

4.4 Information on Baseline Water Levels for Existing Wells Is Presented in the License Application

Q.48. Please respond to the allegation there is no information of baseline water level and pumping rate data for surrounding domestic and stock wells (CI 2013 at 29, Moran 2013 at 13, OST 2013 at 20).

A.48. Contrary to this allegation, significant information on baseline water levels and flow rates for existing wells is presented in the license application, including:

- Appendix 2.7-G in the June 2011 TR RAI responses (Exhibit APP-016-M at PDF pages 926-1072) presents water level elevation data for all wells for which measurements were performed during water quality sampling, including 5 alluvial wells, 9 Fall River wells, 10 Chilson wells and 4 Unkpapa wells.
- The February 2012 numerical groundwater modeling report presents water level data for 38 Inyan Kara wells in Table 3-1 (Exhibit APP-025 at PDF page 115).
- The February 2012 numerical groundwater modeling report also presents estimated flow rates for private wells in Table 3-2 (Exhibit APP-025 at PDF page 116).

Q.49. Will Powertech be required to collect additional water-level data from existing wells prior to operations?

A.49. Yes. License conditions will require Powertech to collect such data for all private wells within the license area and within 2 km of potential wellfields, where possible, prior to operations. These include:

- LC 12.4 requires Powertech to identify the location, screen depth and estimated pumping rate of any new groundwater wells or new use of an existing well within the license area and within 2 km of any proposed well field boundary since the application was submitted to NRC. Included in this LC is the requirement to evaluate potential impacts of ISR operations on any such wells and recommend any additional monitoring or other measures to protect groundwater users. (Exhibit NRC-0012 at 12)

- LC 12.10 requires Powertech to collect four quarterly groundwater samples from each well within 2 km of the boundary of any wellfield prior to operations (Exhibit NRC-0012 at 13). Powertech has committed in the license application to collect static water levels when access is available, including using pressure transducers, a portable electronic water level meter, or an ultrasonic water level sensor. For flowing artesian wells, the wells will be shut in to allow the pressure to stabilize and the shut-in pressure will be measured, where access is available, using a pressure gauge (Exhibit APP-016-C at 194-195).

Prior to operating each wellfield, Powertech has committed to evaluating nearby domestic and stock wells for potential impacts from operations and providing the results of these evaluations in wellfield packages that will be provided to NRC and EPA staff for review prior to operations. This commitment is enforced by LC 10.10, which requires Powertech to submit all wellfield packages to NRC for review (Exhibit NRC-0012 at 8-9).

Q.50. Please describe measures Powertech will take to protect existing wells during operations.
A.50. Powertech has committed to remove all domestic wells within the license area from private use prior to operations and to remove all stock wells within ¼ mile of wellfields from private use prior to operating nearby wellfields. Prior to removing the wells from private use, Powertech also has committed to working with each well owner to determine whether a temporary replacement water supply is needed and, if so, to provide a temporarily replacement water supply such as water from the Madison aquifer. (Exhibit APP-016-B at 35-36)

During operations, Powertech has committed to monitoring all private water supply wells, including domestic, stock and irrigation wells, within 2 km of existing or potential wellfield areas. This commitment is enforced by LC 12.10. Powertech will be required by LC 11.1(D) to submit the results to NRC in semiannual environmental monitoring reports (Exhibit NRC-0012 at 10).

5. CONTENTION 6

5.1 The FSEIS Adequately Describes Mitigation Measures with Respect to Groundwater Resources

Q.51. Do you agree with the allegation that the FSEIS fails to "adequately describe or analyze" mitigation measures with respect to groundwater resources (e.g., OST 2013 at 23)?
A.51. No. The broad allegation that the FSEIS fails to "adequately describe or analyze" mitigation measures is wholly unsupported for the many mitigation measures designed to protect groundwater resources. The FSEIS describes the mitigation measures that will be used to protect groundwater resources and evaluates their effectiveness based on a number of common factors such as compliance with applicable regulatory requirements, adherence to license conditions, and proven effectiveness at operating ISR facilities. The mitigation measures used to minimize and control potential adverse environmental impacts to groundwater are the same procedures and controls that NRC staff reviewed in the SER to ensure that the facility will be operated in a

manner that protects public health and the environment in accordance with federal regulations including 10 CFR Part 40.

Q.52. Will you explain how mitigation measures associated with groundwater resources are described or evaluated in the FSEIS, including providing an example?
A.52. The FSEIS describes the mitigation measures that will be used to protect groundwater resources and provides frequent references to the SER, license application and license conditions for additional explanation and commitments. The following example illustrates how this was done in the case of mitigation measures for potential pipeline leaks.

- The FSEIS at 7-12 describes the monitoring and mitigation measures used to control and minimize potential adverse impacts from pipeline leaks:

  > "The recovery and injection trunk lines will have electronic pressure gauges. Information from these gauges will be monitored from each unit's control room. The control system will have both high and low alarms for pressure and flow. If the pressure and/or flow are out of range, the alarms will sound, alerting personnel to make adjustments. Certain high or low readings will signal automatic shutoffs or shutdowns. Activation of the flow alarms will prompt the applicant to take corrective actions, which include inspections for leaks and spills."

- The FSEIS at 7-1 describes how additional information regarding mitigation measures for potential pipeline leaks can be found in the SER:

  > "Spills and leaks, including the design of the infrastructure to detect leaks, are described in the NRC safety evaluation."

- The SER (Exhibit NRC-00134) at 89 describes in greater detail the monitoring and mitigation measures for potential pipeline leaks, including daily inspections, remote flow and pressure monitoring, alarms, and shutdown controls. NRC staff's evaluation of the effectiveness wellfield operating procedures and controls, including those used to minimize potential impacts from pipeline leaks, is provided in the SER at 93:

  > "The staff conducted a detailed review and evaluation on the proposed ISR process and equipment presented in the application and found they are acceptable. License conditions will impose additional inspections, data collection, and reporting requirements on the applicant and provide additional assurance. The staff finds sections reviewed are consistent with the acceptance criteria of standard review plan Section 3.1.3 and comply with 10 CFR 40.32(c), which requires the applicant's proposed equipment, facilities, and procedures to be adequate to protect health and minimize danger to life or property. The staff also finds the proposed operations comply with 10 CFR 40.41(c), which requires the applicant to confine source or byproduct material to the location and purposes authorized in the license. Staff finds that the proposed ISR operations are consistent with NRC-accepted practices and are consistent with operations employed safely at existing NRC-licensed facilities. Based on commitments in the application and the license conditions identified above, NRC

staff concludes that the applicant will be able to operate the ISR process in a manner that is safe for workers and the public health and safety and the environment."

- NRC staff's evaluation of the procedures and controls proposed in Powertech's license application for safe wellfield operations (including mitigation measures specific to potential pipeline leaks) considers many factors that are worth restating: (1) the procedures are adequately described by Powertech, (2) license conditions will provide additional protection, (3) the procedures comply with NUREG-1569, (4) the procedures comply with federal regulations including the requirement in 10 CFR 40.32(c) to protect health and minimize danger to life or property and the requirement in 10 CFR 40.41(c) to confine source or byproduct material to the location and purposes authorized in the license, (5) the procedures are consistent with NRC-accepted practices, (6) the procedures are consistent with operations employed safely at existing NRC-licensed ISR facilities, and (7) the procedures will allow Powertech to operate the ISR process in a manner that is safe for workers, public health and safety, and the environment.
- This example illustrates how NRC staff extensively evaluated Powertech's proposed mitigation measures related to safe wellfield operations, including those for potential pipeline leaks, and based their determination that they will be effective on numerous factors, not the least of which is that Powertech will be required by license conditions and federal law to manage ISR solutions safely and to control and minimize impacts from potential unplanned releases such as pipeline leaks. Additional examples are provided in the following written testimony for specific allegations related to groundwater resources.

Q.53. Please respond to the allegation that the DSEIS or FSEIS fails to address the ISL industry's historic and ongoing inability to control aquifer contamination and does not detail how the Applicant will succeed in its own efforts to protect groundwater (OST 2013 at 25-26).
A.53. The allegation that the ISR industry has an "historic and ongoing inability to control aquifer contamination" is unsupported by facts. This is a heavily regulated industry that has been successful at protecting groundwater resources for decades. It is common for intervenors in these proceedings to point to excursions at operating ISR facilities as evidence that uranium ISR is unsafe or causes significant environmental impacts. However, excursions are merely the detection of nonhazardous indicator parameters (alkalinity, chloride and electrical conductivity in Powertech's case) within the exempted aquifer that provide early warning that corrective actions are needed to prevent groundwater contamination outside of the exempted aquifer. This is illustrated in the Moore Ranch FSEIS (Exhibit NRC-0087 at B-75, emphasis added):

> "**NRC does not define an excursion as contamination that moves into a USDW. An excursion is defined as an event where a monitoring well in overlying, underlying, or perimeter well ring detects an increase in specific water quality indicators, usually chloride, alkalinity and conductivity, which may signal that fluids are moving out from the wellfield**. These specific water quality parameters are used because they are present in high concentrations in the ISR production fluids and are "conservative" in the

sense that they move at roughly the same rate as the groundwater flow and are not significantly attenuated by adsorption or reduced by other factors. **Therefore, they serve as early indicators of imbalance in the wellfield flow system to notify operators to take appropriate actions**. The perimeter monitoring wells are located in a buffer region surrounding the wellfield within the exempted portion of the aquifer. These wells are specifically located in this buffer zone to detect and correct an excursion before it reaches a USDW. The overlying and underlying monitoring wells are located in aquifers that are separated from the ore zone by aquitards, which NRC has determined have sufficient thickness and integrity to prevent an excursion. However, in all cases, any excursion that lasts longer than 60 days is required to undergo corrective action to meet the drinking water protection standards in 10 CFR Part 40, Appendix A 5(B) 5. **To date, no excursions from an NRC-licensed ISR facility has contaminated a USDW**."

Also with respect to excursions at NRC-licensed ISR facilities, this is addressed in a July 10, 2009 memorandum from NRC staff to the Commissioners, in which NRC staff reviewed records from licensed ISR facilities and made the following conclusion (Exhibit NRC-0091 at 1-2, emphasis added):

"With regard to the migration of production liquids toward the surrounding aquifer, each licensee must define and monitor a set of nonhazardous parameters to identify any unintended movement toward the surrounding aquifer. Exceedances of those parameters result in an event termed an excursion; excursion events are not necessarily environmental impacts but just indicators of the unintended movement of production fluids. The data show over 60 events had occurred at the 3 facilities. For most of those events, the licensees were able to control and reverse them through pumping and extraction at nearby wells. Most excursions were shortlived, although a few of them continued for several years. **None had resulted in environmental impacts**."

NUREG/CR-6733 similarly addresses the history of excursions at U.S. ISR facilities and the finding that no off-site impacts have resulted (Exhibit APP-030 at 4-38, emphasis added):

"It is worth noting that, although the detection of horizontal and vertical excursions is frequent enough to be of concern, **there were no reports of extraction fluid excursions being detected in off-site water supplies in any of the documentation for U.S. uranium ISL sites reviewed for this report**. Therefore, for purposes of the following analyses of excursion risks, it is assumed that available technology and the resources set aside by surety arrangements would be sufficient for remediation of potential horizontal or vertical excursions before they could cause contamination of off-site water supplies. It is further assumed that current regulatory monitoring requirements are sufficient to preclude systematic or persistent human errors (e.g., failure to follow approved monitoring procedures) that might result in off-site excursions of uranium ISL fluids."

Since the allegation is attacking the "ISL industry" as a whole, it is also relevant to point out the Texas Commission on Environmental Quality's determination that decades of ISR in Texas have not resulted in off-site groundwater contamination (Exhibit APP-031 at 33):

> "The Executive Director is not aware of a documented case in over 30 years of *in situ* mining of off-site groundwater contamination from *in situ* uranium mining in South Texas."

Q.54. Please describe relevant information in the FSEIS that addresses this allegation.

A.54. The FSEIS specifically evaluates the effectiveness of operational controls to protect groundwater quality at historically and currently operated ISR facilities at the following locations:

- NRC staff evaluated groundwater restoration data from three NRC-licensed ISR facilities and determined that "the impacts to the exempted aquifer for each of the approved restorations do not pose a threat to human health and the environment" (FSEIS at 4-67 and E-61).
- "NRC staff analyzed the environmental impacts from both horizontal and vertical excursions that occurred at three NRC-licensed ISR facilities (NRC, 2009b). In that analysis, which considered 60 events at 3 facilities, NRC staff found that, for most of the events, the licensees were able to control and reverse the excursions through pumping and extraction at nearby wells. Most excursions were short-lived, although a few continued for several years. In all cases, however, no impacts occurred to nonexempted portions of the aquifer." (FSEIS at 4-64 and E-95)
- "Historical information on excursions that have occurred at operating ISR facilities are discussed in GEIS Section 2.11.4 (NRC, 2009a). This information indicates that most horizontal excursions can be recovered quickly (weeks to months) by fixing and reconditioning wells and adjusting pumping rates in the wellfields (NRC, 2009a). Vertical excursions tended to be more difficult to recover than horizontal excursions, and in a few cases a well could remain on excursion status for a period of as much as 8 years. In these cases, the excursion was believed to be due to improperly abandoned wells from earlier exploratory programs before UIC program regulations were established." (FSEIS at E-94)
- "Historical occurrences of spills and leaks at operating ISR facilities are discussed in GEIS Section 2.11.2 (NRC, 2009a). Spills at operating ISR facilities have been predominantly caused by the failure of joints, flanges, and unions of pipelines and at wellheads. Licensees of ISR facilities are expected to establish immediate spill responses through onsite standard operating procedures (e.g., NRC, 2003, Section 5.7). As part of the monitoring requirements at ISR facilities, licensees must report spills to the NRC within 24 hours. This is followed by a written report addressing items such as the conditions leading to the spill, the corrective actions taken, and the results achieved. In

addition, regular inspection and monitoring that licensees must conduct minimizes the potential for spills and leaks through early detection." (FSEIS at E-95)

- "NRC regulation of ISR facilities includes ensuring ISR operators take necessary measures to confine mobilized uranium and other constituents within the wellfield where the facility is operating, ensuring monitoring programs are in place to provide early detection of any migration or process fluids away from the wellfield, and enforcing necessary corrective actions to prevent uranium from contaminating adjacent water sources to ensure the public is protected" (FSEIS at E-24 and E-25).
- "Historically, with NRC oversight, the ISR and milling industry has not had these same legacy issues" that resulted from "decades of mining and recovery activities from the 1940s through the 1970s when waste from uranium mines was not cleaned up after the mines/mills were shut down" that occurred prior to NRC regulatory oversight beginning in 1978 (FSEIS at E-109).

5.2 The FSEIS Describes Mitigation Measures to Minimize Potential Impacts from Historical Mine Pits

Q.55. Please respond to the allegation that the FSEIS lacks sufficient detail and simply requires plans to be submitted in the future to address a monitoring well network for the Fall River aquifer in the Burdock area for those wellfields in which the Chilson aquifer is the production zone in order to "address uncertainties in confining properties of the Fuson Shale" (OST 2014a at 24).

A.55. This allegation reflects a lack of understanding of the NRC staff response to public comments in the FSEIS at E-135 through E-136. The comment response explains how "mitigation measures will be in place to ensure that drawdown-induced migration of potential contaminants [from the historical mine pits] does not affect aquifer restoration goals." The response goes on to list the extensive mitigation measures that are described in the FSEIS and include: (1) hydrogeological characterization and pumping tests in each wellfield to examine the hydraulic integrity of the Fuson Shale, (2) the license requirement to provide results of hydrogeological characterization and pumping tests to NRC prior to operating each wellfield, (3) Powertech's commitment to locating unplugged or improperly plugged boreholes and wells through pump testing, (4) Powertech's commitment to plugging and abandoning unplugged or improperly plugged boreholes or wells, and (5) NRC's requirement by license condition that Powertech develop a monitoring well network for the Fall River aquifer for those wellfields in which the Chilson aquifer is the production zone. When stating this allegation, there is no mention of the first four of these mitigation measures. Instead the intervenors claim that since the Fall River aquifer monitoring well network is "unsubmitted" and "unreviewed" that the FSEIS conclusion of small impacts is "unsubstantiated."

Q.56. Please elaborate on Powertech's plans to conduct ISR in the vicinity of the historical mine pits.

A.56. Powertech will not be allowed to operate any wellfield without first demonstrating through detailed delineation drilling, potentiometric surface evaluation and pumping tests that the production zone is hydraulically isolated from overlying and underlying aquifers and that an adequate monitoring well network is in place to detect potential horizontal and vertical excursions. Near the historical mine pits, Powertech has committed to only developing ISR wellfields in the Chilson aquifer, which is separated from the overlying Fall River aquifer by the Fuson Shale confining unit. Powertech has committed to monitoring all overlying aquifers for each wellfield, and thus each wellfield near the historical mine pits will include monitor wells in the overlying Fall River aquifer.

Q.57. So the monitor well network for the Fall River aquifer in the vicinity of the mine pits mentioned in this allegation will be in addition to the monitoring that will occur for any wellfield in the Chilson where the Fall River is present as an overlying aquifer?

A.57. Yes. Beyond Powertech's commitment to monitor the Fall River aquifer for every ISR wellfield developed in the Chilson aquifer, NRC will require by LC 12.7 that Powertech provide a more general monitoring well network for the Fall River aquifer in the Burdock area in the vicinity of the historical mine pits.

Q.58. Is the purpose of this monitoring network described in the FSEIS?

A.58. Yes. The purpose of this monitoring network is described in the FSEIS at 4-68:

> "Because leakage may occur through the Fuson Shale, a potential exists for drawdown-induced migration of radiological contaminants from abandoned open pit mines in the Burdock area (e.g., Triangle Pit mine) from the Fall River aquifer into the hydraulically connected Chilson aquifer. To address uncertainties in the confining properties of the Fuson Shale in the Burdock area, the NRC staff will impose by license condition that the applicant design and implement a monitoring well network (NRC, 2013). Specifically, for wellfields in the Burdock area where the production zone is located in the Chilson aquifer, the NRC will require monitoring wells to be placed in the Fall River aquifer to identify any lack of confinement."

Thus the purpose of the Fall River aquifer monitoring network is clearly stated in the FSEIS along with the location (Burdock area) and screened interval (Fall River aquifer) of the monitoring wells. In addition, other mitigation measures are described to ensure that ISR wellfields in the Chilson aquifer are hydrologically isolated from the overlying Fall River aquifer. All of these mitigation measures combined support NRC staff's determination that potential impacts associated with the historical mine pits will be small.

5.3 Powertech's Procedures for Mitigation of Potential Impacts from Exploration Holes are Fully Described and Evaluated in the FSEIS

Q.59. Please respond to the allegation that there is no discussion or analysis in the FSEIS to explain how the applicant will go about identifying abandoned holes or analyzing the effectiveness of plugging and abandonment (OST 2014a at 24).

A.59. Contrary to this allegation, the FSEIS describes the methods that will be used to identify unplugged or improperly plugged boreholes at 4-64:

> "The applicant will use available information and best professional practices—including historical records, color infrared imagery, field investigations, and potentiometric surface evaluation—to locate or detect improperly plugged boreholes or wells in the vicinity of potential wellfield areas. In addition, the applicant will use pumping test results conducted as part of routine wellfield hydrogeologic package development to identify improperly plugged wells and exploration boreholes (Powertech, 2011)."

Further, the procedures Powertech will use to plug boreholes are described in the FSEIS at 2-42, including plugging holes with bentonite or cement grout in accordance with State of South Dakota regulations. NRC staff's evaluation of Powertech's plugging and abandonment (P&A) procedures is documented in the SER (Exhibit NRC-00134 at 201):

> "Based on the information provided in the application, the staff determines that the applicant's proposed P&A are acceptable. Furthermore, the applicant's proposed P&A methods are consistent with Section 6.1.3 of the standard review plan and comply with 10 CFR 40.32(c), 10 CFR 40.42, and 10 CFR Part 40, Appendix A, Criterion 5B."

The FSEIS also evaluates the effectiveness of Powertech's plans to identify and plug unplugged or improperly plugged boreholes at E-150:

> "NRC has determined that the applicant has presented a satisfactory plan for identifying and addressing unplugged borings during operations to avoid potential groundwater migration."

5.4 Powertech's Procedures to Conduct Pumping Tests for Each Wellfield Are Described and Evaluated in the FSEIS

Q.60. Please respond to the allegation that no discussion or analysis is provided in the FSEIS to explain what methodology or effectiveness criteria accompany the pump tests or monitoring well systems (OST 2014a at 24).

A.60. The information that the intervenors allege is missing is clearly provided in the FSEIS. The pumping test methodology and performance criteria are described in Sec. 2.1.1.1.2.3.3 (FSEIS at 2-17 through 2-18) including:

- Testing perimeter production zone monitor wells to confirm hydraulic connection with the production zone; these wells will be located no more than 400 feet from the production area and spaced no more than 400 feet apart.

- Testing monitor wells installed in the immediate overlying and underlying aquifers to confirm hydraulic isolation from the production zone; these wells will be installed at a minimum density of one well per 4 acres of wellfield area.
- Testing monitor wells in subsequent overlying aquifers including alluvium, if present, to confirm hydraulic isolation; these wells will be installed at a minimum density of one well per 8 acres.

As to the precise quantity of drawdown used to confirm hydraulic connection with perimeter monitor wells or hydraulic isolation from overlying and underlying aquifers, this is specific to each wellfield. Powertech has indicated in its license application that a suitable response will typically be at least 1 foot of drawdown in perimeter monitor wells, but that less response may be justified by hydrogeologic conditions (Exhibit APP-016-D at 521). Pumping test results and all raw data will be provided to NRC in hydrogeologic data packages prepared for each wellfield, allowing NRC to review the results and confirm the adequacy of the monitoring network prior to operations.

NRC staff's review of the effectiveness of Powertech's pumping test procedures is documented in the SER (Exhibit NRC-00134 at 183):

> "The staff reviewed the applicant's procedures for conducting post-licensing wellfield aquifer tests and its proposed wellfield hydrologic package content. The staff determines that the aquifer test and analysis procedures are adequate to determine production zone confinement and monitoring network adequacy."

5.5 Powertech's Procedures to Restore Groundwater Are Described and Evaluated in the FSEIS

Q.61. Please respond to the allegation that the DSEIS relies on Powertech's commitment to restore groundwater back to its pre-mining conditions without evaluating how effective restoration efforts will be (OST 2013 at 25).

A.61. The allegations that Powertech has committed to restoring groundwater to "pre-mining conditions" or that "the DSEIS repeatedly refers to Powertech's commitment to restore groundwater back to its pre-mining condition" are not true. Powertech has committed to restoring groundwater to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5), which are Commission-approved background or an MCL, whichever is higher, or an ACL. This commitment is reinforced by LC 10.6, which requires groundwater to be restored "to the numerical groundwater protection standards required by 10 CFR Part 40, Appendix A, Criterion 5B(5)." There does not appear to be any mention in the DSEIS or FSEIS of a commitment to restore groundwater to "pre-mining conditions" (without consideration of MCLs or ACLs). The typical language in the FSEIS is that found at 2-40:

> "Aquifer restoration will be complete when the applicant demonstrates that water quality conditions have been restored in accordance with 10 CFR Part 40, Appendix A, Criterion 5B(5) requirements. These standards are either CAB water quality; water quality

> equivalent to the MCLs provided in the table in 10 CFR Part 40, Appendix A, Criterion 5C; or an ACL NRC established in accordance with Criterion 5B(6)."

Q.62. Are Powertech's proposed groundwater restoration methods described in the FSEIS?
A.62. Yes. The groundwater restoration methods proposed by Powertech are described in detail in FSEIS Sec. 2.1.1.1.4.1 (at 2-37 through 2-39).

Q.63. Did Powertech evaluate the effectiveness of the proposed groundwater restoration methods?
A.63. Yes. Powertech provided examples of the effectiveness of its proposed groundwater restoration methods in the license application (e.g., TR RAI 6.1-6 and 6.1-7 responses in Exhibit APP-016-D at 549-553).

Q.64. Did NRC staff evaluate the effectiveness of the proposed groundwater restoration methods?
A.64. Yes. NRC staff evaluated Powertech's proposed groundwater restoration methods and determined that they will be adequate to meet Criterion 5B(5) standards, as documented in the SER (Exhibit NRC-00134 at 197):

> "Therefore, based on the information provided in the application, the staff determines that the applicant's proposed groundwater restoration methods will effectively restore groundwater to the standards presented in 10 CFR Part 40, Appendix A, Criterion 5B(5). Furthermore, the applicant's proposed restoration methods are consistent with Section 6.1.3 of the standard review plan and comply with 10 CFR 40.32(c), 10 CFR 40.42, and 10 CFR Part 40, Appendix A, Criterion 5B."

It is important to emphasize that the analysis of potential impacts in the FSEIS is not based solely on Powertech's commitment to restore groundwater. Groundwater restoration to Criterion 5B(5) standards will be required by the license. This is documented in the FSEIS at 4-69 through 4-70:

> "[R]restoration to Commission-approved background concentrations (or NRC-approved water quality standards) in accordance with NRC license conditions will ensure that groundwater within the exemption boundary will not threaten surrounding groundwater."

The FSEIS also notes at 4-75 that effectiveness of groundwater restoration will be reviewed and approved by NRC:

> "Before NRC terminates an ISR source material license, the licensee must demonstrate that there will be no long-term impacts to USDWs. NRC review and approval of the wellfield restoration will ensure that the restoration standards are met and that they are protective of public health and the environment."

The general effectiveness of groundwater restoration at NRC-licensed facilities is described in the FSEIS at 4-67 and elsewhere (emphasis added):

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

Further support for the effectiveness of groundwater restoration at ISR facilities is found in IAEA-TECDOC-720 (Exhibit APP-032 at 21, emphasis added):

> "**In most cases today wellfield restoration is routine**. This has helped to assure both federal and state regulators that ISL mining does not significantly impact the environment. As a result, in May 1989, **a representative of the U.S. Nuclear Regulatory Commission (NRC) wrote that "Based upon the accumulation of operational data and information, it has become apparent that ISL operations pose no significant environmental impacts**."

Q.65. Please respond to the allegation that groundwater restoration as a mitigation measure consists only of proposals to make plans to restore groundwater in the future (Moran 2013 at 31, OST 2014a at 21).

A.65. Given the level of detail in the FSEIS on groundwater restoration methods, it is incorrect to state that these methods consist "only of proposals to make plans to restore groundwater in the future." The FSEIS at 2-37 through 2-39 (Sec. 2.1.1.1.4.1) describes the groundwater restoration methods that will be used by Powertech, including groundwater treatment using reverse osmosis with permeate injection into the wellfield if Class V deep disposal wells are used or groundwater sweep with Madison aquifer water injection if land application is used. It describes how additional groundwater sweep may be used if needed to recover flare and states that at least 6 pore volumes will be extracted during groundwater restoration.

5.6 Powertech's Procedures to Conduct Stability Monitoring Are Described and Evaluated in the FSEIS

Q.66. Please respond to the allegation that there is no support for the plan to conduct stabilization monitoring for 12 months (Moran 2013 at 31, OST 2013 at 26).

A.66. This allegation is based on a false premise – that stability monitoring used to determine the effectiveness of groundwater restoration will be conducted "for only 12 months". In fact the FSEIS at 2-40 states that Powertech will be required to implement a groundwater stability monitoring program "for a <u>minimum</u> of 12 months" (emphasis added).

More specifically, LC 10.6 requires Powertech to "continue the stability monitoring until the data show that the **most recent four consecutive quarters** indicate no statistically significant increasing trend for all constituents of concern that would lead to an exceedance above the respective standard in 10 CFR Part 40, Appendix A, Criterion 5B(5)" (Exhibit NRC-0012 at 7, emphasis added)

This determination of the success of groundwater restoration and stability monitoring will be made by NRC based on demonstration that target restoration goals are met and that there are no statistically significant increasing trends (e.g., FSEIS at 2-40). This is summarized in the FSEIS at E-54 of the FSEIS:

> "NRC will review and approve the groundwater restoration data and determine when the production area is restored."

Q.67. Did NRC evaluate Powertech's proposed stability monitoring procedures?

A.67. Yes. NRC staff's evaluation of Powertech's plans for stability monitoring are documented in the SER (Exhibit NRC-00134 at 200):

> "Based on the information provided in the application, the staff determines that the applicant's proposed methods for assessing stability are acceptable. Furthermore, the applicant's proposed stability assessment program is consistent with Section 6.1.3 of the standard review plan and comply with 10 CFR 40.32(c), 10 CFR 40.42, and 10 CFR Part 40, Appendix A, Criterion 5B."

Q.68. Are Powertech's proposed stability monitoring procedures consistent with those at other ISR facilities?

A.68. Yes. Powertech's requirement to conduct stability monitoring for at least four quarters is consistent with recently issued NRC licenses for ISR facilities, including:

- Moore Ranch ISR Project, SUA-1596 requires a minimum 12-month stability monitoring period (Exhibit APP-033 at 134)
- Nichols Ranch ISR Project, SUA-1597 requires a minimum of four quarterly stability monitoring samples (Exhibit APP-034 at 167)
- Lost Creek Project, SUA-1598 requires a minimum of four quarterly stability monitoring samples (Exhibit APP-035 at 207)

- Ross ISR Project, SUA-1601 requires a minimum 12-month stability monitoring period (Exhibit APP-036 at 300)

6. CONTENTION 9

6.1 EPA Regulates Class V UIC Wells in South Dakota and Decides on the Suitability and Appropriate Classification of the Treated Wastewater

Q.69. Please respond to the allegation that disposal of radioactive waste below the lower-most USDW is not a Class V activity, but is a Class I underground disposal well, which is not allowed under South Dakota regulations (OST 2013 at 35-36, OST 2014a at 28).
A.69. This allegation is based on a false premise – that "radioactive waste" will be disposed in the Class V deep disposal wells. In fact, as described throughout the FSEIS, Powertech has committed to treating the wastewater to meet 10 CFR 20, Appendix B, Table 2, Column 2 limits for release of radionuclides to the environment (e.g., FSEIS at 4-34).

Further, the FSEIS at 2-22 confirms that hazardous waste may not be injected into the Class V deep disposal wells:

> "Liquid waste injected into potential Class V injection wells at the proposed Dewey-Burdock ISR Project site must not be hazardous or radioactive, as defined at 40 CFR 144.3."

Q.70. Who will determine whether treated wastewater may be injected in Class V deep disposal wells?
A.70. EPA regulates Class V UIC wells in South Dakota and will make the decision on the suitability and appropriate classification of the waste stream based on Powertech's commitments to treat the wastewater.

Q.71. Do you agree that disposal below the lowermost USDW is limited to Class I UIC wells?
A.71. No. There is no regulatory requirement that Class V wells must be above or below any USDW.

7. REFERENCES

CI (Consolidated Intervenors), 2014a, Statement of Contentions Based on FSEIS, ADAMS Accession No. ML14098A116, March 17, 2014.

_____, 2013, New Contentions Based on DSEIS, ADAMS Accession No. ML13026A010, January 25, 2013.

_____, 2010, Consolidated Request for Hearing and Petition for Leave to Intervene, ADAMS Accession No. ML100680010, March 8, 2010.

Moran, R., 2014, Second Supplemental Declaration of Dr. Robert E. Moran, ADAMS Accession No. ML14077A003, March 17, 2014, attachment to Oglala Sioux Tribe Statement of Contentions Following Issuance of Final Supplemental Environmental Impact Statement.

_____, 2013, Supplemental Declaration of Dr. Robert E. Moran, ADAMS Accession No. ML13029A368, January 24, 2013, Exhibit 2 to Oglala Sioux Tribe List of Contentions Based on the Draft Supplemental Environmental Impact Statement.

_____, 2010, Declaration of Dr. Robert E. Moran, ADAMS Accession No. ML100960635, April 4, 2010, Exhibit 10 to Oglala Sioux Tribe Petition to Intervene and Request Hearing.

OST (Oglala Sioux Tribe), 2014a, Statement of Contentions Following Issuance of Final Supplemental Environmental Impact Statement, ADAMS Accession No. ML14077A004, March 17, 2014.

_____, 2013, List of Contentions Based on the Draft Supplemental Environmental Impact Statement, ADAMS Accession No. ML13026A004, January 25, 2013.

_____, 2010, Petition to Intervene and Request Hearing, ADAMS Accession No. ML100960645, April 6, 2010.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
POWERTECH USA, Inc.	)	Docket No. 40-9075-MLA
	)	ASLBP No. 10-898-02-MLA-BD01
	)	
(Dewey-Burdock Project	)	
In Situ Uranium Recovery Facility)	)	

AFFIDAVIT OF HAL DEMUTH

I declare under penalty of perjury that my statements in prefiled Exhibits APP-013 (Hal Demuth Initial Testimony) and APP-014 (Hal Demuth CV) are true and correct to the best of my knowledge and belief.

Hal Demuth

Executed in Littleton, CO
this 20 day of June, 2014