**NRC-158**
**Submitted: October 14, 2014**

October 14, 2014

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

**SUPPLEMENTAL TESTIMONY REGARDING NRC STAFF'S ANALYIS OF TVA WELL LOG DATA**

**Q1: Please state your name, position, and employer.**

A1a: My name is Thomas Lancaster. I am a Hydrogeologist with the Uranium Recovery Licensing Branch in the NRC's Office of Nuclear Materials Safety and Safeguards (NMSS). My job duties are described in my initial written testimony at Exhibit NRC-001, answer A1.c. I am submitting a revised statement of professional qualifications to reflect that, since I last testified in this hearing, my former office, the Office Federal and State Materials and Environmental Management Programs (FSME), became part of NMSS. Except for that change, my job duties remain largely the same. My revised statement of professional qualifications is Exhibit NRC-005-R.

A1b: My name is James Prikryl. I am a Senior Research Scientist in the Geosciences and Engineering Division of the Southwest Research Institute. My job duties are described in Exhibit NRC-001 at A1.d. My statement of professional qualifications is found at Exhibit NRC-006.

A1c: My name is Paul Bertetti. I am a Principal Scientist in the Geology and Geochemistry Group of the Center for Nuclear Waste Regulatory Analyses, Geosciences and

Engineering Division. My statement of professional qualifications is found at Exhibit NRC-159.

A1d: My name is Ronald McGinnis. I am a Senior Research Scientist at the Center for Nuclear Waste Regulatory Analyses. I work in the Geosciences and Engineering Division of the Department of Earth, Material, and Planetary Sciences. My statement of professional qualifications is found at Exhibit NRC-160.

**Q2: Have you previously testified in this hearing?**

A2a: (T. Lancaster, J. Prikryl) Yes. We have both provided written initial and rebuttal testimony in this hearing. We also testified during the oral portion of the hearing that the Board held August 19–21, 2014 in Rapid City, South Dakota.

A2b: (P. Bertetti, R. McGinnis) We have not testified previously in this hearing.

**Q3: Why are you testifying?**

A3: (T. Lancaster, J. Prikryl, P. Bertetti, R. McGinnis) We are testifying in order to address our review of historic Tennessee Valley Authority (TVA) drill hole logs that Powertech disclosed on September 14, 2014. We reviewed these logs to determine if information from drill hole logs that were recently acquired by Powertech from Energy Fuels Nuclear could affect interpretations of site hydrogeological characteristics presented in the FSEIS (Ex. NRC-008).

**Q4: How did this issue arise?**

A4: (T. Lancaster, J. Prikryl) During the evidentiary hearing conducted in Rapid City, South Dakota on August 20, 2014, the Oglala Sioux Tribe (OST) and the Consolidated Intervenors (CI) argued that recently acquired drill hole logs referenced in a Powertech press release dated July 14, 2014 (Ex. OST-019) are relevant to Contention 3 (the adequacy of hydrogeological analyses to assess potential impacts to groundwater).

They argued that a review of the drill hole logs could affect the conclusions reached by the NRC Staff in the FSEIS. Specifically, experts for the OST and CI argued that the additional well logs acquired by Powertech could reveal the presence of structural features, primarily faults or fractures, which could potentially impact the containment of fluids during ISR operations.

**Q5: What did you review?**

A5: (T. Lancaster, J. Prikryl, P. Bertetti, R. McGinnis) We evaluated the historic TVA drill hole logs in both digital and paper form. The drill hole logs were generated in the 1970s and 1980s during exploration activities to define the Dewey-Burdock uranium deposit. The logs typically consist of gamma, self- or spontaneous-potential, and resistivity readings. The gamma readings measure natural radioactivity and are used primarily to determine the location and depth of uranium ore bodies at the Dewey-Burdock site. The spontaneous potential readings provide information on differences in solution concentration or the movement of fluids through porous media. The resistivity readings provide information on the rock types encountered in the subsurface (e.g., sandstone, shale) and are used to determine the depth and thickness of sand and shale units at the Dewey-Burdock site.

On September 15, NRC staff received a compact disc (CD) containing 3,076 historic drill hole logs in digital form. The 3,076 drill hole logs on the CD are a subset of approximately 6,000 TVA drill hole logs that were generated during exploration activities at the site. The CD contains approximately 1,400 TVA drill hole logs that were recently acquired by Powertech from Energy Fuels. However, Powertech has not yet cataloged the drill hole logs on the CD, and therefore it is unknown which of the 3,076 drill hole logs on the CD are the approximately 1,400 logs recently acquired by Powertech.

On September 23, Staff from the Center for Nuclear Waste Regulatory Analyses (CNWRA) (contractors for the NRC working on the Dewey-Burdock SEIS) visited Powertech's office in Edgemont, South Dakota to review paper logs of TVA exploration holes drilled at the Dewey-Burdock site. The site visit focused on inspecting drill hole paper logs, deviation logs, lithological description logs, and borehole plugging reports. Powertech provided access to all of the approximately 6,000 TVA drill hole logs in paper form generated during exploration activities at the site, which include the approximately 1,400 recently acquired drill hole logs.

Exhibit NRC-161 is a map showing the locations of drill holes (drill holes identified by digital logs on the CD provided by Powertech) in relation to the Dewey-Burdock project permit boundary. To map the locations of the digital drill hole logs, we cross-referenced the drill hole ID of each digital log on the CD provided by Powertech with the list of historic TVA drill holes in Appendix 2.6-A of Powertech's revised TR (Ex. APP-015-J). Appendix 2.6-A is a listing of historic TVA drill holes within a one-mile perimeter of the Dewey-Burdock permit boundary, with the South Dakota State Plane coordinates and surface elevation of each drill hole. Exhibit NRC-161 also shows the locations of all the drill holes listed in Appendix 2.6-A of the revised TR.

Of the 3,076 historic digital drill hole logs on the CD provided by Powertech, approximately 2,780 were located by cross-referencing with Appendix 2.6-A. The locations of the approximately 300 remaining digital drill holes logs could not be determined (i.e., the drill hole IDs were not listed in Appendix 2.6-A of the revised TR).

**Q6: What was the NRC Staff's approach to reviewing the data?**

A6: (T. Lancaster, J. Prikryl, P. Bertetti, R. McGinnis) We focused our review of the historic drill hole logs on the Fuson Shale. The Fuson Shale is a confining unit that separates

the Fall River and Chilson uranium production zone aquifers at the Dewey-Burdock Project site (see FSEIS Section 3.5.3.2). As explained in the FSEIS Section 3.5.3.2, pumping tests conducted at the Dewey-Burdock site have demonstrated a hydraulic connection between the Fall River and Chilson aquifers through the intervening Fuson Shale. During the evidentiary hearing, experts for the OST and CI argued that hydraulic communication between the Fall River and Chilson aquifers through the Fuson Shale may be the result of structural features, such as faulting and fracturing (Hearing Transcript (ADAMS Accession No. ML14237A336) at pages 145–160). Experts for the OST and CI also argued that faulting and fracturing is ubiquitous within the Dewey-Burdock Project area and that drill hole logs used to create cross-sections of subsurface geology at the site are spaced too far apart to reveal faulting. Therefore, we analyzed the historic drill hole logs to evaluate whether displacement of the Fuson Shale due to faulting could be revealed. As previously explained in A.5, because Powertech has not yet cataloged the drill hole logs on the CD, it is unknown which of the drill hole logs on the CD are the approximately 1,400 that were recently acquired by Powertech and referenced in Exhibit OST-019. Therefore, we conducted a comprehensive spot-check analysis that included reviewing digital logs contained on the CD and paper logs kept at Powertech's office in Edgemont, South Dakota.

We used the type log information provided in Powertech's revised TR to identify the relative position of the Fuson Shale in the digital and paper drill hole logs (Ex. APP-015-B, Figures 2.6-2a, 2.6-3e, and 2.6-3f). Exhibit NRC-162 is a type log from Powertech's revised TR depicting the Fuson Shale and its relationship to the host sands (Fall River Formation and Chilson Member of the Lakota Formation) at the Dewey-Burdock site (Ex. APP-015-B, Figure 2.6-2a).

To facilitate inspection of the data and mapping of the geophysical log locations, we downloaded digitized geographic information from the South Dakota Department of Environmental and Natural Resources (SD DENR). The downloaded data files included (i) a U.S. Geological Survey topographic map (24K scale in DRG format) for the area (Ex. NRC-163), (ii) U.S. Geological Survey digital elevation model (30-m grid) data for the Dewey-Burdock region (Ex. NRC-164), and (iii) composite USDA NAIP orthographic imagery (2012) for Fall River County (Ex. NRC-165). We used the digital data sets to generate maps to evaluate geophysical data and compare information presented by experts from the OST and CI during the recent oral hearing.

Our approach to reviewing the drill hole log information consisted of:

1. Spot checking the locations of drill holes to verify that drill hole position information in Powertech's revised TR is accurate.
2. Spot checking paper drill hole logs to evaluate whether structure and isopach maps of the Fusion Shale in Powertech's ER, TR, and revised TR accurately depict the structure of the Fuson Shale at the Dewey-Burdock site.
3. Analyzing closely spaced drill hole logs across selected portions of the Dewey-Burdock site to evaluate whether displacement of the Fuson Shale (the confining unit between the Fall River and Chilson aquifers) due to structural features (e.g., faulting or fracturing) is present.

**Q7: What did you find?**

A7: (T. Lancaster, J. Prikryl, P. Bertetti, R. McGinnis) We present the results of our review in the following sections.

***Spot Check of Drill Hole Locations***

A review of some maps in Powertech's revised TR (Ex. APP-015) indicates slight differences in the plotted locations of drill holes relative to the Township and Range grids. These differences can be seen by comparing Plates 2.6-7 (Chilson Isopach) and 2.6-8 (Fuson Isopach) in the revised TR (Ex. APP-15-D). Drill holes on the eastern edge of the proposed initial Burdock wellfield for the most part do not extend beyond the boundary between sections 11 and 12 in Plate 2.6-7, while several drill holes are located in section 12 in Plate 2.6-8.

Because the original locations of the TVA drill holes were recorded and mapped using a local coordinate system that is not associated with currently used coordinate systems or projections, conversion to South Dakota State Plane coordinates is cumbersome. Additionally, inspection of the data suggests that there were several independent sequences of conversions and coordinate changes during the project's history. Thus, the cause of the discrepancies is likely due to an erroneous assumption of the original datum used for conversion of some of the location data to South Dakota State Plane coordinates.

It is important to note that the geological interpretations and conclusions of the FSEIS (Ex. NRC-008) and NRC's Safety Evaluation Report (SER) (Ex. NRC-134) are not significantly affected by this discrepancy in plotting. The relative positions of the drill holes are not different, and the resulting isopach maps, structure maps, cross-sections, and associated interpretations in Powertech's ER and revised TR remain the same.

To facilitate the independent check, we also reviewed selected drill hole plugging reports associated with more recent holes drilled by Powertech. These drill hole plugging reports contain independent drill hole location information collected by the plugging

contractor. Table 1 lists drill holes in the Burdock and Dewey areas that were included in the location spot check. The location data from the drill hole records were used to compare previously mapped locations of the same drill holes. Results of the independent check indicate the drill hole position information presented in Plate 2.6-8 of the revised TR is accurate, and, importantly, this drill hole position information is the same as that presented in tabular form in Appendix 2.6-A of the revised TR (Ex. APP-015-J). Thus, maps generated using the location data presented in Appendix 2.6-A of the revised TR are reasonably accurate.

**Table 1. Drill Holes Included in Location Spot Check**

| Drill Hole | Latitude Decimal Degrees NAD 1983 | Longitude Decimal Degrees NAD 1983 |
|---|---|---|
| DB-07-11-8 | 43.462622 | -103.967463 |
| DB-07-11-9 | 43.462620 | -103.967068 |
| DB-07-11-10 | 43.462619 | -103.966609 |
| DB-07-11-13 | 43.456491 | -103.959167 |
| DB-07-15-1 | 43.448719 | -103.981353 |
| DB-07-29-4 | 43.497882 | -104.028203 |
| DB-07-29-5 | 43.498242 | -104.028600 |
| DB-08-15-2 | 43.446789 | -103.993325 |
| DB-08-15-3 | 43.446552 | -103.993168 |
| DB-08-32-10 | 43.491152 | -104.029080 |
| DB-08-32-11 | 43.490827 | -104.026822 |

***Spot-Checking Digital and Paper Drill Hole Logs***

We conducted a spot check and analysis of randomly selected digital and paper drill hole logs to evaluate the validity of the structure map of the top of the Fuson Shale in Powertech's revised TR (Ex. APP-015-D, Plate 2.6-4). We would note that the structure map of the Fuson Shale in Powertech's revised TR was constructed from a subset of paper drill hole log information in Powertech's possession before it received its NRC source material license (Ex. NRC-012). Therefore, Powertech's recently acquired drill

hole log information (referenced in Exhibit OST-019 and consisting of approximately 1,400 drill hole logs) was not used to construct the structure map of the top of the Fuson Shale in the revised TR. However, NRC staff included both digital and paper drill hole logs in its spot check analysis to ensure that some of the recently acquired drill hole logs (which are contained on the CD as digital files) are included in the drill hole log spot check analysis.

Exhibit NRC-173 lists the drill hole logs used in the spot check analysis. For each drill hole listed in Exhibit NRC-173, NRC staff examined either the digital or paper log for the drill hole to determine the top and bottom elevations of the Fuson, which are recorded in Exhibit NRC-173. Again, NRC staff used type log information provided in Powertech's revised TR to identity the relative position of the top and bottom of the Fuson in the drill hole logs based on resistivity readings (see Exhibit NRC-162).

Exhibit NRC-166 is the structure map of the top of the Fuson Shale from Powertech's revised TR (Ex. APP-015-D, Plate 2.6-4). The elevation of the top of the Fuson Shale for each drill hole listed in Exhibit NRC-173 is plotted in Exhibit NRC-166. Examination of Exhibit NRC-166 indicates that the plotted data from Exhibit NRC-173 for the top of the Fuson Shale is in very good agreement with the elevation contours for the top of the Fuson presented in Plate 2.6-4 of Powertech's revised TR.

***Analysis of Closely-Spaced Drill Hole Logs***

Using digital drill hole log data, we analyzed and correlated drill hole log information along transects of closely spaced drill holes across selected portions of the Dewey-Burdock site. We did this to evaluate potential displacement and thickness variations in the Fuson Shale that could be indicative of structural features, such as faulting and fracturing. Exhibit NRC-167 shows the locations of four drill hole transects selected for

analysis (Transect 1 through Transect 4). The transects are oriented in a northwest to southeast direction, which is perpendicular to the orientation of regional faulting outside of Dewey-Burdock (e.g., the orientation of faults in the Dewey Fault Zone located northwest of the project area and in the Long Mountain Structural Zone south of the project area are oriented southwest to northeast). The northwest to southeast orientation of the transects was selected because it is more likely to capture the displacement of beds due to faulting within the project boundary.

The locations of Transect-1 and Transect-2 were selected to bisect the location of a potential fault identified by Dr. Moran, an expert witness of the OST, based on the analysis of satellite imagery (Ex. OST-005, pages 29 and 30). The positions of potential faults identified by Dr. Moran are illustrated in Exhibit OST-005 at pages 29 and 30 and are plotted on Exhibit NRC-167. The locations of Transect-3 and Transect-4 were selected to cross the initial wellfields in the Burdock and Dewey areas, respectively. The locations of the initial Burdock and Dewey wellfields are also shown on Exhibit NRC-167.

We utilized digital data on the CD provided by Powertech to construct fence diagrams along the transects to evaluate the structure/stratigraphy of the Fuson Shale. This transect fence diagram construction process was combined with site visit spot checks to confirm that paper drill hole logs were consistent with the digital data on the CD. We independently identified the elevation for each selected borehole used in the transects by referring to the USGS topographic map of the area (Ex. NRC-163). The elevations were generally consistent with values previously reported in Appendix 2.6-A of Powertech's revised TR (Ex. APP-015-J). We then used these elevation data to convert the depth data in the drill hole logs to elevation values in feet above mean sea level (ft above m.s.l.) to facilitate inter-log comparisons. We used the type log information

provided in Powertech's revised TR to delineate the position of the top and bottom of the Fuson in the drill hole logs based on resistivity readings (Ex. NRC-162).

The results of our analysis of closely spaced drill hole logs did not reveal significant displacement or thickness variations that would confirm the presence of faulting or fracturing of the Fuson Shale. For example, resistivity profiles and locations of the land surface elevation and top and bottom of the Fuson Shale are presented as fence diagrams for Transects 1 and 2 in Exhibits NRC-168 and NRC-169, respectively. The locations of drill holes used to construct fence diagrams along Transects 1 and 2 are shown in Exhibit NRC-170. The red lines in Exhibit NRC-170 indicate the approximate location of a fault/fracture zone identified by Dr. Moran in his written testimony (Ex. OST-005, pages 29 and 30).

A review of Exhibit NRC-168 indicates a small change in both land surface elevation and elevation of the Fuson Shale over the length of Transect 1. The thickness of the Fuson Shale remains constant along the transect. In particular, there is no significant thinning or thickening of the Fuson Shale associated with the slight change in elevation. We note that shales are commonly thinned to accommodate extension or thickened to accommodate compression near faults or folds. Considering the continuity of the Fuson Shale seen in the fence diagram, the change in elevation (slight monocline) is likely due to a depositional feature and not due to fault displacement.

A review of Exhibit NRC-169 indicates relatively little or no change in land surface or Fuson Shale elevation along Transect 2. The small "uptick" in elevation at drill hole MST015 is a result of the need to locate that drill hole up dip from the rest of the transect line. Originally drill hole MST008 was selected for inclusion in the transect, but inspection of the drill hole log indicated that drill hole MST008 was logged through the

casing. Resistivity was omitted in favor of a neutron log for that drill hole. Thus, drill hole MST015 was used to fill the data gap at this location. Inspection of Exhibit NRC-168 also indicates a constant thickness for the Fuson Shale along the transect. The absence of bed thinning or thickening, and the absence of any vertical stratigraphic offset or elevation change, suggest there is no impact in this area from faulting or folding.

**Q8: How do your findings affect the analysis in the FSEIS?**

A8: (T. Lancaster, J. Prikryl, P. Bertetti, R. McGinnis) As documented in FSEIS Sections 3.4 and 3.5, based on our independent review of the geology and hydrology in the Dewey-Burdock area, we did not find any evidence of faulting within the proposed project area. As we explain in A3.25 of our initial testimony (Ex. NRC-001) and A3.6 of our rebuttal testimony (Ex. NRC-151), we based our findings on a review of the USGS Quaternary Fault and Fold Database (Ex. NRC-139) to evaluate active faults with surface expression within and surrounding the Dewey-Burdock site. In addition, our evaluation of cross-sections and structure maps representing both the Dewey and Burdock areas that depict subsurface geologic strata did not show evidence of faulting at a scale that might offset or substantially thin the Fuson Shale (Ex. NRC-134). These cross-sections and structure maps are depicted in Plates 2.6-3 to 2.6-5 of Exhibit APP-015-D and Plates 2.6-12a to 2.6-12j of Exhibit APP-015-E.

Our analysis of the TVA drill hole log information supports the findings in the FSEIS. As described previously in A.7, we conducted a spot check and analysis of randomly selected digital and paper drill hole logs to evaluate the validity of the structure map of the top of the Fuson Shale in Powertech's revised TR (Ex. APP-015-D, Plate 2.6-4). The results of the spot check are illustrated in Exhibit NRC-166 and indicate that plotted data for the top of the Fuson Shale from randomly selected digital and paper logs is in

very good agreement with elevation contours for the top of the Fuson presented in Powertech's revised TR (Ex. APP-015-D, Plate 2.6-4). The results of the spot check confirm that structure maps representing geologic strata at the Dewey-Burdock site, in this case the top of the Fusion Shale, do not indicate the presence of faults, fractures, and geologic bed displacements within the site boundary.

We also analyzed and correlated drill hole log information along transects of closely spaced drill holes across selected portions of the Dewey-Burdock site. We did this to evaluate potential displacement and thickness variations in the Fuson Shale that could be indicative of structural features, such as faulting and fracturing (see Exhibits NRC-168 and NRC-169). The information clearly indicates that the Fuson Shale does not undergo significant thickening or thinning and does not exhibit significant vertical offset, both of which would be indications of possible faulting. Finally, a comparison of the thickness of the Fuson Shale along each transect is consistent with the thickness of the Fuson Shale in the same areas as presented in the Fuson isopach map depicted in Plate 2.6-8 of Powertech's revised TR (Ex. APP-015-D) and in cross-sections depicted in Plates 2.6-12a to 2.6-12j of Powertech's revised TR (Ex. APP-015-E).

In summary, our analysis of TVA drill hole log information confirms the validity of the structure and isopach maps and cross-sections presented in Powertech's revised TR. Accordingly, our analysis supports the findings in the FSEIS with respect to the Fuson Shale's ability to function as a hydraulic barrier.

**Q9: What do your findings say about the arguments of Dr. Moran and Dr. LaGarry?**

A9: (T. Lancaster, J. Prikryl, P. Bertetti, R. McGinnis) Dr. Moran and Dr. LaGarry argue that the hydrogeological characterization of the site presented in the FSEIS is inadequate to show the presence of faults within the Dewey-Burdock project boundary. For example,

in his written testimony, Dr. Moran claims that a review of several forms of Dewey-Burdock area satellite imagery by himself and senior remote-sensing experts at Front Range Natural Resources shows the Dewey-Burdock area is intersected by numerous faults and fractures (Ex. OST-001 at p. 21). Exhibit OST-005 at pages 29 and 30 shows the locations of suspected faults within the Dewey-Burdock project boundary that Dr. Moran identified based on an analysis of satellite imagery. In his written testimony, Dr. LaGarry argues that the aquifers in the Dewey-Burdock area are poorly confined due to secondary porosity associated with faults and joints and that the absence of faults within the Dewey-Burdock site is a false perception because faults are ubiquitous in the region (Ex. INT-013 at p. 3-5). During the evidentiary hearing, Dr. LaGarry reiterated his argument that faults are ubiquitous in the region and also argued that drill hole logs used to create cross-sections of subsurface geology at the site are spaced too far apart to reveal displacement of beds due to faulting (Hearing Transcript at pages 145–160).

In fact, the TVA drill hole log information does not support the arguments of Dr. Moran and Dr. LaGarry. As we state above in A.7, plotted data for the top of the Fuson Shale from randomly selected digital and paper logs is in very good agreement with elevation contours for the top of the Fuson depicted in Plate 2.6-4 of Powertech's revised TR (Ex. APP-015-D) (see Exhibit NRC-166). The results of the spot check of the randomly selected digital and paper logs confirms that structure maps representing geologic strata—in this case the top of the Fusion Shale—do not show the presence of faults, fractures, and geologic bed displacements within the site boundary.

To further investigate the claims of Dr. LaGarry and Dr. Moran, we analyzed and correlated drill hole log information along transects of closely spaced drill holes across selected portions of the Dewey-Burdock site, as described previously in A.7. We conducted our analysis using information from the digital logs to evaluate potential

displacement and thickness variations in the Fuson Shale that could be indicative of structural features, such as faulting and fracturing. The locations of Transect-1 and Transect-2 were selected to bisect the location of a suspected fault identified by Dr. Moran based on the analysis of satellite imagery (Ex. OST-005, pages 29 and 30). The position of potential faults identified by Dr. Moran is shown in Exhibits NRC-167 and NRC-170. As explained previously in A.7, the results of our analysis of closely-spaced drill hole logs, including the drill hole logs along Transects 1 and 2 that bisect suspected faults identified by Dr. Moran, did not reveal significant displacement or thickness variations that would indicate the presence of faulting or fracturing of the Fuson Shale.

In summary, based on our analysis of randomly selected digital and paper logs and closely-spaced drill hole logs, we find that the arguments of Dr. Moran and Dr. LaGarry are not supported. The results of a spot check of randomly selected digital and paper logs confirms that structure maps representing geologic strata, in this case the top of the Fusion Shale, do not show the presence of faults, fractures, and geologic bed displacements within the site Dewey-Burdock boundary. The information clearly indicates that the Fuson Shale does not undergo significant thickening or thinning and does not exhibit significant vertical offset, both of which would be indications of possible faulting.

**Q10: What do the TVA drill hole logs say about breccia pipes within the Dewey-Burdock project boundary?**

A10: (T. Lancaster, J. Prikryl, P. Bertetti, R. McGinnis) In his written testimony, Dr. Moran claims that breccia pipes or collapse features are present in the Dewey-Burdock project area (Ex. OST-001 at pp. 21-22). To support this claim, Dr. Moran argues that circular, topographic features can be seen on modern satellite imagery of the Dewey-Burdock site and surrounding areas and that these features likely represent solution/collapse

features (Ex. OST-001 at p. 22). Exhibit OST-005 at pages 13 and 30 shows the location of a suspected sinkhole within the Dewey-Burdock project boundary that Dr. Moran identified based on an analysis of satellite imagery. During the evidentiary hearings, Dr. Moran reiterated his claim that satellite imagery (specifically Exhibit OST-005 at page 13) shows the location of a sinkhole (Hearing Transcript at pages 180–188).

To investigate the claims of Dr. Moran, we reviewed the TVA drill hole log information that Powertech recently disclosed and considered this information in connection with available literature and reports on the structure and stratigraphy of the Dewey-Burdock region (Exs. NRC-081, NRC-082, NRC-086, OST-007, OST-008, and OST-009). We found no documented evidence that any of the historic TVA boreholes (boreholes drilled within or in the vicinity of the Dewey-Burdock site during exploration activities in the 1970s and 1980s) encountered subsurface voids or disturbed geologic strata that would be associated with breccia pipes or collapse features.

Exhibit NRC-171 shows the location of the alleged sinkhole identified by Dr. Moran (Ex. OST-005 at pages 13 and 30), which he identified based on satellite imagery and TVA drill holes in close proximity to the alleged sinkhole. We analyzed the log information from several drill holes labeled in Exhibit NRC-171 (i.e., drill holes MST022, KLT076, KLT023, KLT068, and KLJ008). We conducted our analysis using information from digital logs on the CD provided by Powertech, and we evaluated potential displacement and thickness variations that could be indicative of collapse or disruption of subsurface geologic strata.

In Exhibit NRC-172, we present a fence diagram of the labeled drill holes in Exhibit NRC-171 and show the approximate location of the alleged sinkhole relative to the drill hole locations (as viewed perpendicular to the line of drill holes). The land surface

profile and stratigraphic profiles illustrated in Exhibit NRC-172 show no evidence of a sinkhole-like structure or any discontinuity that might result from brecciation. The stratigraphic elevation changes are consistent with the dip of the Inyan Kara Formation in this area. We would also note that, based on the information from the topographic map shown in Exhibit NRC-171, the alleged sinkhole is actually located on or near a topographic high on the landscape.

To summarize, the results of the drill hole log analysis did not reveal stratigraphic anomalies that would indicate the presence of a sinkhole or breccia pipe. Resistivity profiles from drill hole logs in close proximity to the alleged sinkhole identified by Dr. Moran in Exhibit OST-005 do not show structural or stratigraphic features, such as thickness variations or elevation changes, that could be interpreted as being caused by solution or collapse features.

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**AFFIDAVIT OF THOMAS LANCASTER**

I declare under penalty of perjury that my statements in prefiled Exhibits NRC-158 (NRC Staff's Supplemental Testimony) and NRC-005-R (Revised Statement of Professional Qualifications for Thomas Lancaster) are true and correct to the best of my knowledge and belief.

***/Executed in accordance with 10 C.F.R. § 2.304(d)/***

_____
Thomas Lancaster

Executed in Rockville, Maryland

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**AFFIDAVIT OF JAMES PRIKRYL**

I declare under penalty of perjury that my statements in prefiled Exhibits NRC-158 (NRC Staff's Supplemental Testimony) and NRC-006 (Statement of Professional Qualifications for James Prikryl) are true and correct to the best of my knowledge and belief.

James Prikryl

San Antonio, Texas
October 14, 2014

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| (Dewey-Burdock In Situ Uranium Recovery Facility) | ) | |

**AFFIDAVIT OF F. PAUL BERTETTI**

I declare under penalty of perjury that my statements in prefiled Exhibits NRC-158 (NRC Staff's Supplemental Testimony) and NRC-159 (Statement of Professional Qualifications for F. Paul Bertetti) are true and correct to the best of my knowledge and belief.

F. Paul Bertetti

San Antonio, Texas

October 14, 2014

October 14, 2014

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

**AFFIDAVIT OF RONALD N. MCGINNIS, JR.**

I declare under penalty of perjury that my statements in prefiled Exhibits NRC-158 (NRC Staff's Supplemental Testimony) and NRC-160 (Statement of Professional Qualifications for Ronald N. McGinnis, Jr.) are true and correct to the best of my knowledge and belief.

Ronald N. McGinnis, Jr.

San Antonio, Texas
October 14, 2014