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 In Situ Uranium Recovery	)	
Facility)	)	

SUPPLEMENTAL DECLARATION OF DR. ROBERT E. MORAN

I, Dr. Robert E. Moran, do hereby swear that the following is true to the best of my knowledge:

Professional Qualifications and Introduction

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1. I am a hydrogeologist and geochemist with more than 40 years of domestic and international experience in conducting and managing water quality, geochemical and hydrogeologic work for private investors, industrial clients, tribal and citizens groups, NGO's, law firms, and governmental agencies at all levels. Much of his technical expertise involves the quality and geochemistry of natural and contaminated waters and sediments as related to mining, nuclear fuel cycle sites, industrial development, geothermal resources, hazardous wastes, and water supply development. In addition, I have significant experience in the application of remote sensing to natural resource issues, development of resource policy, and litigation support. I have often taught courses to technical and general audiences, and has given expert testimony on numerous occasions. Countries worked in include: Australia, Greece, Bulgaria, Mali, Senegal, Guinea, Gambia, Ghana, South Africa, Iraqi Kurdistan, Oman, Pakistan, Kazakhstan, Kyrgyzstan, Mongolia, Romania, Russia (Buryatia), Papua New Guinea, Argentina, Bolivia, Chile, Colombia, Guatemala, Honduras, Mexico, Peru, El Salvador, Belgium, France, Canada, Great Britain, United States.

Literature Reviewed

2. In addition to my professional experience, the opinions and comments that follow are based on review of all, or significant portions of the following documents:

Powertech Application for NRC Uranium Recovery License, Dewey-Burdock Project, Feb. 2009:

- Technical Report (TR)
- Environmental report (ER)
- Supplement to Application, Aug. 2009
- Powertech submittals (2010, 2011, 2012)

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Summary Comments

3. These opinions focus predominantly on the water resources and related impacts within the proposed Dewey-Burdock (D-B) area. These waters are natural resources presently used collectively by numerous parties (ranchers, municipalities, tribal groups, fish and wildlife, mineral and oil and gas developers, etc.). However, the DSEIS must realistically anticipate what will be the true *long-term* uses of these waters---especially when many generations must be considered. Thus, *truly conservative assumptions* should be employed—which is not the case in this DSEIS.

4. Some of these waters are already contaminated by past uranium exploration and mining, with little or no remediation required by any regulatory agency, which suggests a great deal about the future oversight. The D-B site contains numerous old uranium workings (shallow open-pit and underground), accumulations of various contaminated waste materials, 1000s of unplugged

boreholes, which likely provide hydraulic connections between various water-bearing units. To allow for a meaningful review, all available borehole information needs to be assembled and presented in a comprehensive manner.

5. Past exploration and mining activities have exposed the mineralized rocks to reactive surface waters and ground waters and bacteria, increasing the concentrations of numerous contaminating chemical constituents in local waters, soils, etc. *Nevertheless, some of the water-bearing units within and around the DB area will still contain high or relatively-uncontaminated waters, suitable for numerous other uses.* This pattern is the norm at typical metal mine locations worldwide, including uranium sites. The proposed D-B activities will increase the concentrations of such contaminants in some local ground waters, as a minimum. Thus, it is imperative that the specific locations and characteristics of these contaminated and uncontaminated waters be defined in a DSEIS available for public review and comment prior to publication of a FEIS and project approval.

6. The DSEIS gives the impression that all of the D-B-area waters (surface and ground) are already contaminated. However the DSEIS fails to supply the detailed data necessary to support that contention. Experience at similar sedimentary uranium sites indicates that significant quantities of uncontaminated ground water likely exist, and could be used for other livestock, agricultural, domestic, etc. uses. The NRC has failed to require Powertech to provide statistically-adequate, reliable, *preoperational* baseline data, either within the D-B project area, or in surrounding regions. Without adequate baseline data, the presently-uncontaminated waters could be become contaminated through ISL-related activities, but the public would have no way of discovering this impact.

7. The DSEIS fails to provide basic information necessary to reliably evaluate future, LONGTERM impacts. If the D-B-area resources had been evaluated in a truly detailed, interdisciplinary, scientific manner, the DSEIS would have collected and summarized the most fundamental technical information relating to water resources, such as:

- a detailed inventory of all present water users within a radius of at least 2 miles of the proposed D-B boundaries. Such an inventory would include statistically-valid, preoperational data on well yields, water levels, detailed water quality;
- a detailed, statistically-valid summary of BASELINE data for water quality and quantity from the relevant water-bearing units, *based on pre-operational data*. These would already include evaluation of hydrogeologic characteristics for all of the relevant water-bearing units based on actual, long-term aquifer / pump testing data. Such baseline data would also incorporate all relevant data collected prior to Powertech’s involvement, including data collected during the 1950s to the present (including, for example, TVA data).

- detailed data on the presence and condition of all subsurface borings (exploration holes, oil and gas holes, etc.)
- a detailed spring and seep survey, which would have included statistically-reliable (and seasonally-meaningful) measurement of field parameters and yields, detailed water quality---all based on preoperational data.
- all such actual data / information could easily be summarized in the form of maps, tables, and graphs, without resorting to thousands of pages of disorganized text, which has been the approach taken by Powertech and the NRC.

8. In addition, a technically-reliable study of the D-B area would have summarized the detailed data and long-term impacts from the numerous actual, operating and closed ISL sites (throughout the USA and other countries), to gain insight on actual results and impacts obtained from a *population* of sites. It is technically-meaningless to make deterministic predictions about such impacts at a *single* site, especially a site to be operated by a company that has never operated another ISL mine.

9. Impact evaluation (by NRC, PT and consultants) in this DSEIS fails to follow accepted approaches used in the wider scientific community. The DSEIS fails to use reliable scientific investigation to assess or compare known impacts at *populations* of other operating and closed ISL sites. Most importantly, it is not possible to reliably-rank future D-B impacts [SMALL, MODERATE, LARGE] when the NRC and public lack reliable baseline data to use as a measure of change. Such approaches would not be acceptable in most technical, scientific (academic-research) publications.

10. The data and information described above are required for an analysis in a DSEIS prior to FEIS or license approval. Otherwise reliable evaluations of future impacts cannot be made. In addition, without such data, it will be largely impossible to hold the operators responsible for future, unremediated impacts.

Specific Comments

The DSEIS has been publicly-released at a period specifically inconvenient for public review.

11. By releasing the DSEIS over the winter holiday season, NRC has obviously made review and commenting on these documents more difficult and precluded the public from making a useful site visit to verify data and claims made in the DSEIS.

The DSEIS comprises thousands of pages of convoluted, poorly-organized and inadequately-summarized material.

12. The various D-B documents submitted to the NRC encompass more than **14,512 pages**, yet fail to adequately present the most basic data (see below). For example:
--the 2009 Application was almost 6000 pages;
 [Technical Report (TR)-- 3103 pages; Environmental Report (ER)-- 2615 pages;
Supplement to Application-- 66 pages.]
--the 2011 Powertech submittal totaled roughly 5000 pages;
--the present DEIS (Vols. 1 & 2) comprises 858 pg., which is only part of the GEIS;
--the GEIS, to which much of the DSEIS refers comprises 3512 pages.

13. The relevant D-B information, if compiled in a direct, transparent manner using predominantly maps, tables and graphs, could easily have been summarized in 150 pages for the DSEIS. Instead, the DSEIS is so duplicative and poorly-organized that it makes informed review by both the regulators and general public unnecessarily convoluted.

The DSEIS fails to adequately respond to the weaknesses and written criticisms of the Powertech Application.

14. The Powertech Application submittals (2009, 2011) were prepared by Powertech and its consultants, based largely on data collected by these same parties. While the DSEIS states that it was prepared by the NRC [and the CNWRA (Center for Nuclear Waste Regulatory Analyses)], it appears that it is based entirely on these same Powertech data, with no new water-related data added since the application. Clearly most of the DSEIS opinions are also based on the technical opinions of Powertech and their consultants.

15. Also, the DSEIS fails to adequately respond or address most of my written Opinions made regarding the D-B Application, which were submitted to the NRC in April 2010 (Moran Declaration, April 2010).

The DSEIS is Technically-deficient, lacking fundamental data that are needed to reliably evaluate likely impacts to the D-B-area water resources and related environment.

16. The DSEIS admits that important water quality data collection and aquifer testing will only be conducted after license issuance (e.g. DSEIS p. 2-16, 7-8, 7-14, 7-17).

17. Such data are needed *now*, as part of any useful EIS and certainly prior to issuance of an operating permit. These data include: reliable preoperational

baseline data on water quality and quantity / yields of all relevant surface and ground waters; specific data on the total water volumes to be used by all D-B operations; detailed data on hydrogeologic characteristics of all relevant geologic units; detailed evaluations of the hydraulic interconnections between the uranium production zones and the other relevant water-bearing and confining units; data on the detailed chemical compositions of barren and pregnant solutions, evaporation pond waters, etc.; a detailed inventory of all water users within at least a 2 mile distance of the D-B project boundaries.
Details on these categories are discussed below.

Concerns Expressed by Other Federal and State Agencies not Addressed

18. The DSEIS mentions on p. 1-15 and 16 that several other Federal and State agencies have expressed concerns regarding impacts to Water Resources, etc. from the proposed D-B project, but fails to discuss or address in any detail these criticisms. This omission gives the false impression that the present comments (for the Oglala Sioux) are made in isolation from those of these other regulatory agencies.

19. A brief review of the coordination conducted with other agencies reveals the following points of concern with respect to these agencies:

- Coordination with BLM: South Dakota BLM field office:
provided NRC staff with information on **oil and gas leases** in the proposed project area. DSEIS, P1-16. Additionally, BLM staff expressed **concerns related to water quality and hydrology, land use, and cumulative effects.**

-Coordination with U.S. Army Corps of Engineers:
USACE documented the presence of 20 wetlands within the project area and determined that 4 were jurisdictional waters; these are Beaver Creek, an unnamed tributary to Beaver Creek, Pass Creek, and an unnamed tributary to Pass Creek (Powertech, 2009b, Appendix 3.5–H).

-Coordination with USFS:
it expressed concerns that construction and operational activities could impact the nearby Black Hills National Forest and Buffalo Gap National Grasslands. USFS staff noted a concern about the cumulative groundwater effects of the project on the USFS-managed aquatic recreation areas of Cascade Springs and Keith Park Springs. USFS also expressed concerns about potential effects the project could have on Craven Canyon, known to have traditional cultural significance to Native American tribes.

-Coordination with USGS: With respect to the proposed Dewey-Burdock ISR Project, USGS staff expressed a concern that **contaminated groundwater** may travel from the project area and discharge into Beaver Creek within the proposed project area and the Cheyenne River south of the proposed project area [via groundwater or surface water].

-Coordination With South Dakota Department of Environment and Natural Resources expressed concerns regarding:
(i) the adequacy of subsurface characterization, (ii) groundwater flow rates within and in the vicinity of the project area, (iii) potential complications in hydrology caused by past exploratory drill holes, (iv) potential hydrologic connection of production zones and abandoned onsite surface mines, and (v) the effectiveness of confining layers in isolating ore-bearing aquifers. NRC and SDDENR staffs also discussed the applicant's Class III UIC permit application (Powertech, 2010) and the water appropriation and waste management permitting processes for the proposed project. Potential risks to wildlife from wastewater surface impoundments associated with the proposed project were also discussed. SDDENR would coordinate with SDGFP to mitigate the potential effects of surface impoundments on wildlife; mitigation measures discussed included the use of netting and fencing to protect wildlife and implementing protocols to assess the effects of wastewater constituents on wildlife.

-Coordination with S.D. Game, Fish and Parks:
focused primarily on threatened or potentially threatened and endangered species (e.g., the plains topminnow, sage-grouse, and black-footed ferret) and species of local concern (e.g., raptors). SDGFP expressed a **major concern: the potential effects on birds flying through the proposed project area and drinking at exposed wastewater evaporation ponds**. SDGFP suggested two measures to mitigate effects on bird populations: (i) **testing** to determine the **toxicity of constituents in the evaporation ponds** and (ii) using **netting and fencing to restrict wildlife access to exposed ponds**. SDGFP also noted the **need for testing and monitoring of soils** at the proposed site to **identify any buildup of salts and metals** that could result from proposed land application of **treated wastewater**.

Water Use: The D-B Project will use and contaminate tremendous volumes of ground water. How much water will be used throughout the life of the proposed DB operation?

20. The D-B project area is semi-arid, having an average yearly precipitation of about 12.4 inches, and the range of evaporation for the So. Dakota-WY-Nebraska uranium region is between 40 and 50 inches (NRC GEIS 2009). Thus evaporation is roughly 3 to 4 times the yearly precipitation (ER, pg. 3-176 and 177; Fig. 3.6-27). Because the project is presently expected to operate for between 7 and 20 years, it will require the use of tremendous volumes of local ground water, and will result in losses of significantly greater quantities of water via evaporation.

21. Unfortunately, the DSEIS fails to provide reliable estimates for the volumes and sources of water to be used (consumptive and non-consumptive uses) during all stages of the proposed operation. Actual, detailed data on amounts of water required for operations are not presented (e.g. ISL operations, human consumption, dust suppression, evaporation from disposal ponds, waste disposal, etc.). In mining hydrogeologic studies, such data would routinely be included in a detailed Water Balance.

22. No detailed Water Balance is provided in the DSEIS. Instead the DSEIS provides imprecise, conflicting information on the volumes of water to be used throughout the various sections of the DSEIS (e.g. p.2-15, 2-34, 4-57-59, etc.).

23. Powertech calculates that the sustainable pumping rate from the Inyan Kara Group / Aquifer is about 40 gpm for the life of the project (DSEIS p. 4-59). However, the NRC / Powertech state that the operational requirements for the Burdock CPP alone would require a sustained pumping rate of 65 gpm (at DSEIS p. 4-59). Powertech has applied to the SDDENR for permits to extract water from the Madison Aquifer. Thus, it is presently unclear which aquifer will be the source for long-term, operational phase water. If the permits for using Madison Aquifer waters are denied, additional sources (besides Inyan Kara) would be required.

24. The applicant estimates the wellfield production bleed would be approximately **0.5 to 3.0 percent** of the **production flow rate,** yielding a wellfield production bleed rate between 20 gpm and 120 gpm (DSEIS, P. 2-34).

25. Powertech estimates that approximately 52.6 million gallons of ground water would be required for the Construction phase alone (DSEIS p.5-30). **No data are provided for the volumes of ground water required for the other phases, throughout the life of the project.**

26. Clearly, the DSEIS fails to reveal reliable long-term water use data for all phases of the entire project. Greater uncertainty is shown when one reads the water use data originally presented in the 2009 Powertech Application, ER pg. 8-2 (Table 8.1-1), which states that **ground water consumption will be 320 gpm.**

27. Because no Water Balance is presented, it is unclear how much of this volume is recycled, re-injected as waste in other formations, etc. In addition, one must assume that quality of much of the recycled and re-injected water would be degraded as compared to any reliable preoperational baseline data.

28. Aside from the obvious lack of consistency, the estimates (above) translate into massive amounts of ground water when considered over the full life of the project. Using two of the estimated ground water use rates stated above, total water consumption over the life of the project can be estimated as follows:

65 gpm = 34.2 Million gpy (gals / yr).

After 7 yrs = 239,148,000 gallons, or 239.15 Million gallons.
After 17 yrs = 580,788,000 gals or 580.8 Million gallons.

320 gpm = 168.2 Million gpy (gals. / yr).
After 7 yrs = 1,177,344,000 = 1.2 Billion gallons
After 17 years = 2,859,264,000 gallons = 2.86 Billion gallons.

29. Clearly, this range of estimates indicates that vast quantities of ground water will be extracted from these aquifers over the long-term. At a minimum, Powertech should be required to construct a credible project water balance and to more seriously investigate the potential that such large-volume water use might impact local / regional ground water levels and well yields.

30. At present, I see no evidence that the Application contains a reliable compilation of *baseline water level and pumping-rate data for the surrounding domestic and stock wells (see discussion below).* Without such reliable, summarized data, there will be no viable method to demonstrate that ground water levels (and related pumping costs) have not been impacted by project-related activities.

31. The public must assume that Powertech will pay no cost for the actual water (the commodity) used during operations---while numerous other users do. The specifics of this issue should be addressed by Powertech in writing.

32. Despite the central role of water in the operation of the project, water use, availability, depletion, and consumption are not seriously analyzed through a water balance investigation, or other similar technique. This analysis is critical to understanding the anticipated impacts during project review and for monitoring actual water impacts should this project actually begin using and consuming groundwater.

Hydrogeologic Performance of the Water-bearing and Other Geologic Units.

33. The DSEIS fails to provide detailed, site-specific information / data on the hydrogeologic characteristics of the relevant D-B water-bearing and other bounding geologic units, including the mineralized zones. Such data must be obtained by performing and interpreting *long-term*, aquifer test data. The DSEIS admits that such long-term, detailed testing will not be performed until after the NRC license is issued (e.g. DSEIS at 2-17, 7-11).

34. The hydrogeologic data presented in the DSEIS are **inadequate** to reliably portray and predict the following:
-the baseline, detailed directions of ground water flow in the relevant water-bearing units;

-the extent of long-term hydraulic connections between the various geologic units, both within the project area and outside;
-the horizontal / regional extent of water level declines (and impacts on pumping rates) outside the project boundaries;
-the degree to which ground water withdrawals may impact local surface waters;
-the operator's ability to contain the migration of contaminants;
-the operator's ability to restore aquifer water quality to baseline / acceptable conditions.

35. Such inadequate hydrogeologic data also mean that any ground water flow simulations based on these data are likely to provide highly imprecise and unreliable predictions (e.g. SEIS, P.2-16, L 30-37).

36. In addition, such inadequate hydrogeologic data, coupled with the lack of reliable baseline water quality data (see below), render the NRC staff predictions about impacts (both incremental and Cumulative) to water resources *largely meaningless* (e.g. the Executive Summary and Section 5.0). For example, despite failing to define the extent (areal, vertical) and specific, detailed chemical compositions of past contamination, the NRC staff predicts that Cumulative Impacts to *Surface Waters and Wetlands* will be MODERATE TO LARGE (p.5-17), but that the D-B project will have a SMALL incremental impact on surface waters and wetlands when added to all other past and present impacts (p. 5-30). *Given the lack of detailed baseline data (hydrogeologic and water quality) such conclusions sound more like public relations statements than science.*

Impacts from Long-term Pumping of Ground Waters.
Radius of Impacts / Influence. (modified from Moran Declaration, 2010)

37. The DSEIS presents no specific hydrogeologic information on the anticipated declines in water levels at domestic and stock wells outside the D-B project. Despite lacking adequate, long-term aquifer test data, the Powertech ER (2009) presented *predictions* of **water level declines** after 8 years of continuous pumping:
 - **9.9 to 42.8 feet** at the nearest domestic well in the Fall River Aquifer, located 15,075 feet [**about 2.9 mi**.] from the approximate center of pumping (ER pg 4-23);
- 4.9 to 12.6 feet at the nearest domestic well in the **Lakota Aquifer,** located 10,915 feet [**about 2.07 mi.**] from the approximate center of pumping**.**

38. With such uncertainty, it is quite possible that some neighboring wells will be negatively impacted (water level declines / reduced pumping rates). These data interpretations indicate that domestic and stock, etc. wells should be inventoried and monitored out to at least 2 miles from the D-B boundary.

The D-B water-bearing units are hydrogeologically interconnected.

39. The DSEIS avoids discussing definitively the likely hydraulic interconnections between the various D-B water-bearing units. The 2009 Powertech Application does discuss these issues, but presents overly-optimistic conclusions about the isolation of the ore- bearing zones, aquifers, and the lack of fluid excursions that will occur, both vertically and horizontally. Powertech's description and evaluation of possible water-related impacts [2009 Application, ER pg. 8-2 (Table 8.1-1)] are unreasonably optimistic. It is unlikely that the process waters can be contained within the project boundaries given the following pathways that connect the project area with surrounding aquifers: 1) sedimentary formations; 2) geologic fractures, 3) exploration boreholes, 4) mine workings, 5), other anthropogenic fractures and borings.

40. The D-B uranium deposits occur in subsurface, fluvial channel, sandstone deposits in the Lakota and Fall River formations (Smith, 2005). These sandstones *inter-finger* with finer-grained silts and shales, often associated with lignites and coals, which form the typical lithologic sequences often seen in classic sedimentary uranium deposits (Abitz, 2005; Gott, 1974; Henry, 1982; Galloway, 1982; Henry, 1980; Harshman, 1972).

41. Hydraulically, such sedimentary packages typically allow ground waters to flow between the inter-fingering facies, both vertically and horizontally, when the coarser- grained sediments are *stressed by long-term pumping*. The hydraulic inter-connections are verified by conducting ***long-term aquifer tests integrated with sequential water quality sampling and in-situ measurement of field parameters*** (Henry, 1982; Galloway, 1982; Moran, R.E.—hydrogeochemical research activities, U.S.G.S., Water Resources Div., 1973—1978). *The hydraulic interconnections of such inter-fingering facies has been well known for decades within the petroleum industry research groups (e.g. Fisher, et. al.,1969).*

42. Thus, ore-bearing sandstones in typical sedimentary packages associated with roll- front uranium deposits do *not routinely behave as hydraulically-isolated bodies.* Numerous specific lines of evidence from the 2009 D-B Application documents indicate that the project sediments possess various pathways for the migration of water and contaminants from the ore zones into neighboring sediments, both vertically and laterally. For example, thousands of exploration boreholes have been drilled since the 1950's at the D-B site (Smith, 2005; TR, ER), many of which were not correctly plugged and abandoned (TR, Pg. 2-157; Append. 2.7-B, sub-Appendix D, pg. 1484; TR, Append. 2.6- A, pg. 972-1111). In addition, several sources (Smith, 2005, pg. 9; ER, pg. 3-106) report that the area contains historic shallow mine workings, both open pits and short tunnels that would provide additional flow pathways.

43. There are numerous old and existing water wells and old oil test wells in the D-B area, many with rusty and leaky casings, often unplugged or partially-plugged, drilled through several formations which act as potential pathways for

flow between water- bearing units (ER, pg.3-40; TR, Append. 2.2-A, pg. 740-779; 2.2-B, especially pg. 864- 902).

44. The 2009 Application, TR, pg. 2-153-154, states that hydraulic connections between local D-B aquifers often result because confining units are thin or are absent in many areas (ER, pg.3-56-57). In addition, Gott (1974) and others have mentioned the presence of breccia / evaporite pipes (collapse structures), which create vertical permeability pathways between aquifers. Gott (1974, pg. 27-29) and others discuss the common presence of faults and joints throughout the region, which could easily act as flow pathways. The DSEIS states that detailed geologic mapping conducted by Powertech found no indication of such breccia pipes (p. 3-32), but the document fails to state that a detailed examination of all the subsurface data was searched for the presence of such breccia pipes.

45. Vertical and lateral hydraulic connectivity between the ore zones and the neighboring facies / formations are also indicated by the aquifer test results conducted in both 1979 and 2008 (ER, pg.3-56-57; TR, pg. 2-170 & 2-180, for example; TR Append. 2.7-B, Knight-Piesold Pumping Test Report, pg. 1290).

46. The DSEIS fails to assess the forgoing conditions, or likely impacts associated with these conditions in any scientifically meaningful way, nor does it consider that geologic materials with geologic / hydraulic characteristics similar to the D-B target formations frequently yield both water and oil and gas from ***geologic fractures***. A classic example is the Florence oil field in Colorado, which has been producing continuously from fractures in the Cretaceous Pierre Formation since 1862, making it the second oldest producing field in the U.S. [http://ghostdepot.com/rg/library/magazine/florence%20oil.htm].

47. The Pierre Formation exists in the Black Hills region and lies stratigraphically above the Inyan Kara Group, the target formations at D-B (Tourtelot, 1962; DSEIS p.3-14). Thus, it is likely that several of the geologic units in the D-B area can also transmit fluids via fracture pathways. This indicates that future computer simulations of D-B ground water flow and leach field performance should be capable of modeling fracture flow characteristics.

48. The aquifer testing already performed *demonstrates leakage between the various formations / facies bounding the ore zone*. *However, it seems equally likely that longer-duration aquifer tests conducted at even higher pumping rates would demonstrate even more clearly the leaky nature of these site sediments.*

Potential hydrogeologic pathways to nearby wells have not been adequately investigated and documented.

49. The discussion above presents ample evidence that the D-B area sediments contain numerous possible subsurface pathways for project leach fluids to migrate vertically between water-bearing units and outside the project

boundaries. Unfortunately, as noted above, Powertech has not adequately defined the baseline water levels or water quality conditions of neighboring wells within a 2-mile radius of the D-B project. In addition, the 2009 Application, TR pg. 2-180, states that no public data are available on the use of aquifers in Fall River or Custer counties. Such data should have been compiled by Powertech as part of the DSEIS and Application, and should be required before any licenses are given.

Toxic and Hazardous Substances to be Used at D-B.

50. The following chemicals are proposed to be used / stored at D-B (DSEIS, p.4-19):
"The applicant proposes to store, use, and receive shipments of the following chemicals: sodium chloride (NaCl), sodium carbonate ($NaHCO_3$), sodium hydroxide (NaOH), hydrochloric acid (HCl), hydrogen peroxide (H_2O_2), carbon dioxide (CO_2), oxygen (O_2), anhydrous ammonia (NH_3), diesel fuel, gasoline, and bottled gases (Powertech, 2009b)."

51. All these chemicals are likely stored / used in concentrations that would qualify them as toxic or hazardous substances. Releases of such chemicals can contaminate local soils and waters. Despite the proposed use of these chemicals, the proposed water quality (surface and ground waters) and soils monitoring does include constituents adequate to demonstrate the presence of several of these chemicals, especially the fuels / organic compounds (see below).

Chemical Analyses (Detailed) of Ores, Pregnant Leach Solutions, Liquid Wastes are not presented in the DSEIS.

52. The DSEIS fails to provide actual, detailed chemical analyses (numerous) of representative pregnant leach solutions (ore reacted with lixiviant), both before and after undergoing ion exchange treatment. Such data would routinely include both in-situ measurements of fluid temperature, pH, specific conductance, possibly D.O. (dissolved oxygen) and Eh (redox). Similar representative, detailed data should also have been included for the detailed chemical composition of liquid wastes to be disposed of via deep-well injection, land application and evaporation.

53. Because most mining projects at a similar stage of advancement have already conducted extensive laboratory testing and prepared Feasibility Studies to present to potential investors, such detailed chemical composition data would be available. It is not sufficient to present theoretical / expected chemical compositions, as has been done in the 2009 Powertech ER, pg. 4-83. Smith & Assoc. (2005), pg. 5, reports that TVA, one of the previous mineral right holders, had a "pre-mine feasibility study" prepared, probably in the late 1970's or 1980's. If TVA had obtained such detailed data in earlier decades, certainly Powertech would have obtained the older Feasibility information and contracted to have an

updated Feasibility Study performed. Clearly some information in Feasibility Studies is considered proprietary, but detailed chemical composition data on the pregnant solutions and liquids / wastes described above should be analyzed and available to the public and included in any complete DSEIS.

Characterization of Water Resources: Inadequately Described and Characterized.

54. The DSEIS fails to clearly distinguish site surface waters, ground waters (including springs and seeps), wetlands, and waters flowing from boreholes. As all of these waters are ultimately interconnected, hydraulically, this prevents a clear understanding of future impacts to water resources. In several sections, the DSEIS actually confusingly describes ground waters as surface waters. For example, on p. 3-23, it discusses ground waters in abandoned mine pits as though they are surface waters. Page 3-23 states that there are *no known natural springs* within the proposed Dewey-Burdock ISR Project area, which does not mean that a detailed attempt to locate and characterize such springs was ever conducted. On p. 3-27-28, the DSEIS confusingly describes water flowing from an old well as the source of a wetland, when it is obviously not a natural wetland.

55. DSEIS page 3-20 contains a section disingenuously entitled “Artificial Penetrations”, but which is strangely not included in the discussions pertaining to either Surface or Ground Waters. It states: “According to the environmental report, there are 4,000 exploration drill holes representing historic exploration activities (Powertech, 2009a). The applicant has drilled approximately 115 exploration holes, including 20 monitoring wells in the project area. While the applicant cannot confirm that all historic borings were properly plugged and abandoned, the applicant has made commitments to ensure that unplugged drill holes will not impact human health or the environment during operations (Powertech, 2009b, 2011). In the technical report (Powertech, 2009b), the applicant stated that little evidence of unplugged boreholes has been observed given infrared photography data. However, an infrared map of a portion of the Burdock area shows an alkali pond area (Powertech, 2011). The applicant states unplugged borings appear to explain the presence of this pond area. No other pond areas or springs appear in infrared photography data of the Dewey-Burdock site. There is no other evidence indicating that previously unplugged borings are current groundwater flow pathways (Powertech, 2011).”

56. This section makes several half-explained statements as though they are proven facts, and diverts from the likely hydraulic interconnections these boreholes have created between the site surface and ground waters. It implies that a careful study of the site using infra-red photography has been performed, when it is clear that a map of only a portion of the site was available. Despite this tortured language, there is no reason to dismiss the likelihood that many of the old boreholes are acting as conduits between the various water-bearing units, at least below the land surface. Strangely, the DSEIS describes the presence of

several water-filled mine pits (p. 3-23), yet they are not mentioned as being visible on the “infrared photography data of the Dewey-Burdock site”. Clearly a more thorough investigation using infra-red photography and satellite imagery is called for.

Baseline Water Quality

57. The D-B project area has been historically mined and thousands of exploration holes have been drilled within the properties. Hence, it is imperative that high-quality baseline data be supplied to evaluate the actual extent of past impacts to water resources, and the success of future containment or aquifer restoration.

58. The DSEIS, like the Powertech Application, fails to define pre-operational baseline water quality and quantity—both in the ore zones and peripheral zones, both vertically and horizontally. Without adequate baseline water quality data (both ground water and surface water), there is no reasonable method for either the public or the NRC to evaluate the success or failure of either fluid containment or aquifer restoration. The DSEIS and Powertech Application documents repeatedly attempt to convey the impression that the D-B ground water quality is already degraded, rather than compile statistically-defensible data from both the ore zones and non-mineralized zones.

59. This approach contradicts NRC guidance, which requires that pre-mining baseline conditions be defined *before licensing* (NRC, 2003, pg. 2-24). Failing to define specific baseline conditions prior to license approval also contradicts NEPA regulations (Parsons, 2013, p.2).

60. Failing to define and quantify preoperational baseline is also scientifically unsupportable as it allows Powertech and the DSEIS to avoid discussing which specific water sources are contaminated by past uranium mining activities and which represent naturally-contaminated waters.

61. The DSEIS, Table 3.5-4 misleadingly presents what is entitled: Baseline Groundwater Samples with Values Exceeding the MCLs(p. 3-38). Firstly, this table and related discussion fail to make clear that many of these sites are contaminated by past, un-remediated uranium mining and processing. Secondly, the table leaves out most of the important baseline constituents a competent evaluation would have included. Thirdly, the table leaves out any values below the MCLs. Thus, this table does not represent baseline ground water quality. *Most importantly*, *the DSEIS does not contain tables of any of the detailed water quality data, baseline or otherwise.* Further, there is no data or analysis of the hydrogeological mechanisms by which the previous contamination occurred, spread, or was contained.

62. Clearly the DSEIS / Powertech ground water baseline data should include, *as a minimum,* the chemical constituents listed in Table 2.7.3.1 of the NRC's Standard Review Plan (NRC, 2003, pg. 2-25), and Table 7.3-1 of the DSEIS. In addition, baseline water quality monitoring (both ground and surface water) should be expanded to include nitrate, ammonia, aluminum, antimony, strontium, lithium, thallium, turbidity, scans for organic compounds, and / or total organic carbon, and be integrated with *in-situ* field measurements (temperature, pH, S.C. turbidity), water levels and well yields and / or flows.

63. It is only logical that the actual list of baseline constituents should be based on analyses of pregnant solutions resulting from leach testing of the D-B ores and lixiviants—not on theoretical assumptions about what might be the chemical compositions. Such pregnant solution analyses should be made public in the DSEIS prior to Application approval.

64. Frequently, uranium roll-front ores will also mobilize significant concentrations of additional constituents, such as antimony, lithium, and strontium (Moran, 1976). In addition, it is common to detect elevated concentrations of aluminum, sometimes as the result of well-drilling and completion techniques. Thus, it is recommended that these constituents be included in routine determinations of baseline water quality. In fact, standard lab analytical scans, such as ICP (inductively-coupled plasma spectroscopy) routinely report all (or most) of these metals and metalloids at the same cost. It should be noted that almost all of these constituents were included in the data in Appendix 3.4-C of the Powertech ER.

65. I suggest that nitrate and ammonia determinations be included to allow future analysis and determinations regarding impacts from agricultural or industrial sources (ammonia may enter the aquifer via numerous agricultural or industrial activities).

66. Section 2.7 of NRC (2003) is unclear whether applicants shall provide water quality data from unfiltered (Total concentrations) or 0.45-micrometer-filtered ("dissolved") samples. Table 7.3-1 of the DSEIS states that only dissolved constituents will be reported. Much of the D-B data in the Powertech Application Appendices includes both dissolved and Total determinations. It is recommended that unfiltered samples be collected and analyzed, as a minimum, for baseline ground water evaluation. These provide more *conservative* characterization of the ground waters, and waters used in rural areas (human and livestock consumption from wells; other agricultural uses; irrigation; fisheries) are not filtered. Furthermore, contaminants carried in particulate form are ingested by humans and other organisms when consuming unfiltered waters. These particles / colloids are dissolved by the extreme biochemical conditions found in the guts of such organisms, mobilizing the contaminants into the blood and other tissues. In addition, many trace constituents are mobile in ground waters as colloidal

particles (McCarthy, 1989; Ramsey, 2000), which would be removed by filtration, generating unreasonably-low concentrations.

67. Determination of “suspended” fractions is of little utility as there are no regulatory criteria or standards for suspended forms, and such data are subject to much greater error (from the combination of sampling and analytical errors) than are either simple filtered (Dissolved) or unfiltered (Total) determinations.

68. To ensure data quality, the D-B baseline data should include:

- statistical comparisons of the field and lab determinations of pH, and S.C. for the same samples;
- comparisons of Dissolved versus Total determinations from the same samples;
- ion balances, to assist in evaluating the reliability of the analytical data, with comparisons of TDS and S.C. (Hem, 1985).

69. No coordinated, statistically-sound data set for all Baseline Water Quality data (both surface and ground water) is presented in these documents—as is required in NUREG-- 1569. The DSEIS makes clear that baseline water quality will actually be established after operations begin (e.g. DSEIS p.7-13, 14: Projectwide GW monitoring). The DSEIS fails to include reliable baseline water quality data for any of the categories of ground water or surface water.

70. The 2009 Powertech Application, carried forward in the DSEIS, include what it incorrectly calls baseline. For example, on pg. 2-14 and 2-15 of the Technical Report (TR), Sect. 2.2.3.2.2, Powertech states: “At the project site, baseline groundwater sampling was conducted in general (sic) accordance with NRC Regulatory Guide 4.14 (NRC, 1980). ... A summary of the results and methods for the groundwater quality monitoring program, as well as the historical TVA data, is presented in Section 2.7.” However, when the reader goes to TR Section 2.7, there are no tables that actually statistically summarize complete baseline field and lab water quality data for the complete data sets—both historic and recent. Instead, for ground waters, Powertech presents statistics for field data from individual wells or selected aquifers, but fails to statistically-summarize the laboratory data and leaves out the historic TVA data. Powertech then states (TR, pg. 2-203): “Complete groundwater quality data results are available in Appendix 2.7-G.” However, on TR, pg. 2-205 (Sect. 2.7.3.2.2.2, Results for Laboratory Parameters) Powertech then states: “Summary statistics for baseline monitoring program laboratory samples are contained in Appendices 2.7-H and 2.7-I. Appendix 2.7-H gives statistics for all groundwater constituents detected at or above PQL by constituent.” Thus, it appears that Powertech has not included “qualified values,” that is data reported as “less than” some concentration. By deleting the “less than” values, Powertech has severely biased the data set, rendering it useless as a reliable source for evaluating baseline conditions.

71. Furthermore, Powertech states (TR, pg. 2-217-218) that they have arbitrarily selected some analyses from the voluminous historic TVA data, but the reviewer is never allowed to see a statistical summary of the total original data set. This error is carried forward in the DSEIS. Portions of the relevant data are scattered throughout the Appendices of the various documents, and disingenuously organized to leave out all baseline data that had concentrations reported below the detection limits (i.e. "less than" values). Obviously, this approach biases the data. The NRC must require Powertech to statistically summarize all historic water quality data and all recently collected data in separate tables, including all "less than values." Both historic and recent baseline data should be segregated by water-bearing unit. Even should averaging of water quality data over a portion of the aquifer be acceptable, the methodology employed in the Application and DSEIS of discounting relevant data points is untenable.

72. To further confuse the baseline issues, Powertech's Supplement to the Application (August 2009) states on pg. 3-3: "A minimum of eight baseline water quality wells will be installed in the ore zone in the planned well field area." Thus it appears that the Applicant intends that the massive amounts of water quality data (historic and recent) presented in both the TR and ER (Environmental Report) will not actually be used to determine baseline. More importantly, it is unclear whether Powertech has true baseline (pre- operational) ground water quality data that describe the **non-ore zone regions of the relevant aquifers.** It is imperative that baseline data for the non-ore zone ground waters be collected and summarized separate from those of the ore zones – a review the DSEIS fails to conduct.

73. Any revision of the DSEIS should incorporate the comments made in Abitz (2009) regarding baseline characterization and data interpretation.

74. Lastly, the DSEIS should already contain a statistically-reliable database of baseline ground water quality data from all known wells within at least 2 miles of the DB boundary

Confusion of Baseline and Background

75. Table 7.3-1 of the DSEIS (p. 7-8 to 7-11), and the accompanying text confusingly and incorrectly use the terms "Background" and "Baseline" as having the same meaning. For many decades, "background" in geochemical / water quality literature has been defined as: "The normal abundance of an element in unmineralized earth materials is commonly referred to as background." (Rose, Hawkes & Webb, 1979, p. 30). Baseline in environmental studies has routinely been used to define a starting criterion, or yardstick, against which subsequent data are to be compared. Baseline has been used in this sense for many decades. In mining-related studies, the most common "baseline" is either pre-mining or preoperational conditions.

The DSEIS fails to clearly and adequately describe the detailed methods employed for collecting water quality and water quantity data, for both surface and ground waters.

76. Because the specific sampling and handling procedures can drastically change the results obtained when collecting water quality samples (both surface and ground water), it is imperative that the DSEIS include detailed descriptions of the various sampling, sample handling, preservation and shipment methods employed. Likewise, the DSEIS contains inadequate detail concerning the specific methods employed in collecting field water quality measurements and measurements of well yield, stream flow, etc.

77. For example, such details should provide information similar to those contained in the U.S.G.S. methods documents cited below:

[USGS] United States Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, available online at: http://pubs.water.usgs.gov/twri9A.

Surface Water Quality Baseline Data: The DSEIS fails to adequately characterize these resources, or to include statistically- reliable summaries of detailed surface water data.

78. Tables 3.5-1 and 3.5-2 (p.3-25-26) present totally incomplete and inadequate summaries of surface water quality. Most hydrogeologically-important chemical constituents are missing from these tables and they contain no indication of whether samples were field-filtered, or if the data are Total concentrations. (unfiltered samples).

79. The DSEIS contains no substantive discussion of the interactions between ground and surface waters, especially when the hydrogeologic system would be under pumping stress---as would be expected during the operating life of the D-B project. The DSEIS contains no detailed analysis or discussion of potential impacts to site surface waters due to ground water pumping, or potential spills and permitted discharges to surface waters. All such operations generate short-term impacts to surface waters, as a minimum.

80. The DSEIS no longer contains the questionable statements included in the 2009 application at ER pg. 4-16, which state: "Most ISL operations extract slightly more groundwater than they re-inject into the uranium bearing formation. ***The groundwater extracted from the formation could result in a depletion of flow in nearby streams and springs if the ore-bearing aquifer is hydraulically connected to such features.*** However, because most, if not all ISL operations are expected to occur where the ore- bearing aquifers are

confined, local depletion of streams and springs is unlikely, and potential impacts would be anticipated to be SMALL (NUREG-1910, 2008).” However, the DSEIS provides no detailed technical analysis to support the contention that surface waters will not be impacted because water-bearing units having confined aquifer conditions underlie much of the D-B site.

81. More importantly, the DSEIS and Application fail to provide a summarized, statistically-reliable surface water quality baseline database. As such, there will be no defensible method for verifying whether impacts to surface water quality have or have not occurred.

A Baseline Spring and Seep Survey is not presented in the DSEIS.

82. Disingenuously the DSEIS states that: “There are **no known natural springs** within the proposed Dewey-Burdock ISR Project area (Powertech, 2011). There is one area in the southwest corner of the Burdock area, known as the “alkali flats” or the “alkali area,” where **groundwater is discharging** to the ground surface from the Fall River aquifer and Chilson aquifer (Chilson Member of the Lakota Formation) **through improperly plugged exploratory boreholes** (Powertech, 2011). Two springs are present along the Dewey Fault near the town of Dewey approximately 2 km [1.2 mi] northwest of the proposed project boundary (DSEIS p. 3-23).”

83. The DSEIS presents no information to indicate that either the NRC or Powertech have conducted an actual spring and seep survey. Such a survey would have included and characterized the springs along the Dewey Fault, and any others located within the D-B area and a reasonable perimeter, which should be at least 2-miles from the project boundary—given the results of the short-term pump test data in the 2009 Application.

84. The region surrounding the D-B project contains numerous springs in both the Madison and Minnelusa formations (DEIS p.3-32; Driscoll, et al., 2002). Baseline surveys of springs and seeps are crucial in studies where large volumes of ground water are to be extracted. The flows of such seeps and springs often decline or stop after large-scale, long-term ground water extraction begins, especially in arid or semi-arid regions, such as the D-B area. If such impacts begin to occur, disputes will arise as to the possible roles of the project water extraction and overall climate change, for example. Hence, it is imperative that such a survey be performed prior to issuance of any licenses, and such a survey should include, as a minimum:
-locate and survey all springs and seeps within some reasonable radius of the project boundary;
-measure and record flow / discharge quarterly for at least one year prior to issuance of any licenses;
-during all field episodes, make field measurements of in-situ pH, water temperature,

and S.C.(specific conductance) and collect samples for laboratory analysis.

Samples should be analyzed for the same list of constituents noted in the Baseline water Quality comments above. Spring and seep water quality data should be interpreted as representative of local ground water quality (Freeze and Cherry, 1979; Hem, 1985).

The presence of high quality ground waters within the D-B Project boundary have not been adequately defined.

85. Much of the DSEIS discussion concerning ground water quality seems focused on showing that the site waters are already contaminated. This would not be surprising given the presence of the uranium mineralization and the past mining and exploration activities---all of which would have caused increased concentrations of numerous chemical constituents above true pre-mining baseline. However, based on statements and data presented in the DSEIS, Powertech has not adequately defined whether zones peripheral to the D-B ore-bearing geologic formations and bounding formations (above and below) also contain zones of high-quality, possibly potable ground water. Such zones should already have been defined as part of the DSEIS and Application documents.

Potential impacts to ground waters have been unrealistically minimized and inadequately characterized.

86. The DSEIS fails to provide adequate baseline data to demonstrate that portions of the ore-bearing zones do not contain high quality ground water. In fact, it is clear that the NRC has relied on Powertech data that clearly are biased against revealing the extent of high quality ground waters. For example, Table 3.5-4 includes only water quality concentrations that exceed the MCLs (maximum contaminant levels), and discards all data having lower concentrations (p. 3-38). The discussion on p. 3-37 also is clearly intended to convey the message that most of the D-B area waters are already contaminated. A similar bias is presented in the DSEIS discussions of D-B area surface water quality (p.3-23, 25, 26, 27).

87. The DSEIS continues the unbalanced discussion of contaminated “baseline” that was presented in the 2009 Application. The ER (pg. 4-18) states that all D-B ore zone ground water quality is degraded by natural mineralization processes, but there are no data provided to support this allegation and in many similar situations it is simply not true. Furthermore, many ground water- bearing zones in mineralized areas do not contain elevated concentrations of metals, non- metals, etc. until they have been exposed to air and bacteria---often as the result of previous mining or exploration drilling—as has occurred here. Even following exploration and mining activities, some portions of ore-bearing formations continue to contain high-quality ground water.

88. Hence, it is not defensible for NRC and Powertech to state, as the company does in ER Sect. 4.6.2.2 (Potential Impacts of Production on Ore Zone Groundwater Quality) that: “Potential environmental impacts to groundwater are changes to water quality in well fields within the exempted aquifer. The impact, in and of itself, is of limited significance, due to the fact that the groundwater quality is very poor prior to ISL operations; due to the presence naturally occurring radionuclides, heavy metals, and other constituents that exceed EPA and/or state drinking water limits. Accordingly, the exempted aquifer is not and can never serve as a USDW (HRI, 1997; NMA, 2007).” The citations provided here by Powertech do not pertain to the specific D-B situation and one, the NMA citation, is simply a routine public relations statement made by the industry’s lobbying group. The DSEIS inadequately addresses these issues.

89. The public relations statements continue on ER, pg 4-18, where they state: “Powertech (USA) has proposed to use gaseous oxygen and carbon dioxide lixiviant. The interaction of the lixiviant with the mineral constituents of the exempted ore zone results in a slight increase in trace elements and primary constituents of sulfate, chloride, cations and TDS above pre production levels. There is no introduction of non-naturally occurring constituents from the leach fluids into the ore body.”

90. To support these unsubstantiated statements, Powertech needs to supply actual, detailed chemical analyses of the pregnant leach solutions (multiple analyses)--solutions resulting from the chemical interaction of the proposed lixiviant and the ore zone rocks. It is a basic purpose of an ISL operation to introduce these lixiviants to drastically change the local ground water chemistry, routinely producing significantly-elevated concentrations of many major and trace metals and metalloids, plus other constituents: i.e. arsenic, antimony, molybdenum, selenium, vanadium, uranium, strontium, iron, manganese, lead, lithium, nickel, chromium, sulfate, chloride, etc. It is a total “red-herring” to claim that: “There is no introduction of non- naturally occurring constituents.....”

91. *In addition, there is ample evidence in the technical and regulatory literature to show that the leached aquifers at most, if not all ISL operations, have never truly been restored to their pre-operational, baseline water quality.*

Ground Water Monitoring Methods are Inadequate to Reliably Define Past or Future Impacts. Domestic and Stock Wells.

92. DSEIS p.7-13 and 14 (Project-wide GW monitoring), states that all domestic and stock wells within **2km** (1.2 mi.) of the project area will be sampled quarterly for a year to establish baseline water quality after operations begin [based on NRC, 1980, Regulatory Guide 4.14]. “All the preoperational groundwater samples will be analyzed for the constituents listed in Table 7.3-1.”

93. The stated approach presents several *serious flaws*:

- if the samples are collected after operations begin, they cannot be considered true baseline;
- the list of constituents to be monitored is inadequate;
- The NRC Guidance Document cited is inappropriate: it refers only to uranium mills, not ISL operations, and deals only with radiological effluent.
- This Guidance Document does not define the radius to which domestic and stock, etc. wells should be monitored, for any type of uranium operation--ISL or mill. The authors have incorrectly applied the 2-Km distance as the Guidance speaks only with regard to tailings impoundments at conventional mills (section 2.13; p. 4.14-4).
- sampling of these wells *during operations* is proposed to be done *once per year*, which is totally inadequate to note changes in water quality or water level.

94. The definition of the area containing domestic and stock wells to be monitored needs to be expanded and defined more precisely. Because the DSEIS fails to show that Powertech has ever performed a detailed well inventory of all wells outside the proposed DB boundary, such an inventory is needed to evaluate present and future impacts as part of any acceptable EIS. A preliminary inventory should investigate and summarize the characteristics of all wells within at least 2 miles of the DB boundary. The inventory should plot the locations of all such wells on appropriate maps and summarize their uses; date drilled; completion characteristics, including depths; well yields; availability of water quality data. Once such an inventory is completed, all of these wells should be monitored for detailed water quality and water levels quarterly for a year, with all data summarized in a revised EIS.

Baseline Water Quality Within Proposed Operation Areas.

95. The DSEIS states (p. 7-8) that selected wells completed within the mineralized zones will be used to evaluate "baseline" water quality and they will then be converted into injection or production wells. Clearly the water quality in many of these zones is no longer true baseline due to all of the historical drilling / mining in many of these areas. These activities would have altered the original geochemical and bacteriological conditions, leading to significant changes in the water quality. In addition, if the "baseline" wells are converted to injection or production uses, these wells must be maintained, post-closure, to allow for long-term monitoring to evaluate the success or failure of aquifer restoration.

Land application is not an approved method of radioactive liquid waste disposal.

96. The DSEIS proposes that various liquid wastes may be disposed via land application. However, US EPA (2008) guidance states that land application is not an approved method for disposal of such wastes. Equally importantly, the DSEIS has failed to supply detailed chemical analyses of these proposed wastes (see discussion below) to clarify the chemical nature of the materials being disposed.

97. Such detailed chemical composition data should be included in the DSEIS available for public comment and technical review prior to FEIS and license approval.

98. It is ironic that the Supplement to the 2009 Application erroneously states on pg. 4-7 that irrigation pivots have been used to dispose of non-hazardous wastes via surface application " with no deleterious effect on the environment" at Hobson, Mount Lucas, and Highland. In 2008, the operators of the Highland and Smith ISL mines in Wyoming were forced into a settlement agreement with the WY Dept. of Environ. Quality, because land application of liquid wastes containing elevated concentrations of selenium had contaminated soils. Part of the settlement agreement required the operators of Highland to immediately pay $8 million to accelerate reclamation activities and to increase their financial assurance bonds for these two sites to $80 million (WY DEQ, 2008). Furthermore, Faillace and others (1997) report that release of such waters will contaminate the soil at the land application areas. Radionuclides adsorbed by the soil will become a source term for radioactive release through wind erosion processes.

Deep Well Injection of Liquid Wastes. The DSEIS fails to provide necessary details on the chemical composition of the wastes and water treatment specifics.

99. At present, the public has not been told what specific measures will be used to dispose of D-B liquid wastes. One option mentioned is to dispose of such wastes via deep wells completed into the Minnelusa and / or Deadwood Formations (DSEIS p. 2-22). However, the public has no idea of the detailed chemical compositions of these liquid wastes. Detailed chemical analyses of these liquids should have been included in the DSEIS, including, as a minimum, all chemical constituents for which any category of environmental standard or criterion exists. These should include determinations of S.C., TDS, pH, all commonly-reported inorganics, trace elements, radiochemicals, and a detailed organic-constituent scan. Such data should be provided in the EIS for both treated and untreated liquid wastes.

100. While both the Minnelusa and Deadwood Formations are deep below the land surface, it is quite short-sighted to assume that these waters, once contaminated by the process wastes, could never generate negative impacts—especially if one considers the cumulative impact of the other industrial wastes that are or will be injected into these formations, long-term. Long-term scenarios should consider timeframes of at least 100s to 1000s of years in the future, when these deep waters may be required for other foreseeable domestic, agricultural, or industrial uses, and the economics of water are likely to be quite different than has been assumed in the GEIS (DSEIS p. 5-31). Thus, detailed water quality

analyses should be performed on these deep aquifer waters, both pre-injection and at various periods after injection is initiated.

The technical and regulatory literature amply documents the numerous failures to restore aquifer water quality at other ISL sites. Thus, it is reasonable to assume that portions of the D-B ground water surrounding the leached zones will have degraded water quality and may be unfit for future uses.

101. GEIS Section 2.5 described aquifer restoration activities within wellfields that *ensure water quality in surrounding aquifers would not be adversely affected by the uranium recovery operations* (DSEIS p. 2-35; NRC, 2009a). However, neither the DSEIS or the GEIS contain detailed discussions to demonstrate that the population of other in-situ operations have been able to do so. Indeed, the historical reality from other operating or closed ISL sites demonstrates an inability to restore to pre-operational or baseline WQ conditions for all constituents. (Otton, 2009; Hall, 2009).

The public has no detailed information concerning the specific aquifer restoration standards / criteria that will actually be employed. The DSEIS presents no such specific aquifer clean-up standards / criteria.

102. Because the DSEIS does not contain actual baseline data for D-B water resources, the DSEIS does not contain any such specific aquifer restoration standards / criteria. Instead, the DSEIS has the following convoluted, bureaucratic language (p.2-35):
"The primary goal of aquifer restoration is to return groundwater quality within the production zone of wellfields to the preoperational water quality conditions or to standards consistent with NRC requirements at 10 CFR Part 40, Appendix A, Criterion 5B(5) (Powertech, 2009b, 2011)."

103. The subsequent language makes clear to the reader that the public will not be told what the specific aquifer clean-up criteria will be until long after aquifer restoration has begun, and that the criteria are totally flexible.

"10 CFR Part 40, Appendix A, Criterion 5B(5) requires that groundwater quality in the exempted ore-bearing aquifer be restored to (i) a Commission-approved background (CAB) concentration; (ii) the maximum contaminant levels (MCLs) listed in 10 CFR Part 40, Appendix A, Table 5C, for constituents listed in Table 5C and if the background level of the constituents fall below the listed value; or (iii) an alternate concentration limit (ACL) established by the Commission, if the constituent background level and the values listed in Table 5C are not reasonably achievable. The ACL development is described in SEIS Appendix B. These groundwater quality standards would be implemented, as part of the aquifer restoration phase, to ensure public health and safety."

Target Restoration Goals and UCL Parameters and standards should all be selected by the NRC and presented publicly in the EIS, prior to license approval.

104. The DSEIS uses unnecessarily convoluted and inconsistent terms to describe aquifer restoration standards / criteria. Various parts of the DSEIS use the following terms (DSEIS p. 2-35):
Commission-approved background (CAB)
Maximum contaminant levels (MCLs)
Alternate concentration limit (ACL)
target restoration goals
lixiviant migration indicators (DSEIS p. 7-11)

105. It is impossible to discern whether or not the target restoration goals are the same as lixiviant migration indicators.

106. DSEIS p. 7-11 states: "The constituents and parameters selected as lixiviant migration indicators and for which UCLs will be set at the proposed Dewey-Burdock ISR Project are **chloride, conductivity, and total alkalinity** (Powertech, 2011)."

107. The 2009 Powertech Application Supplement, pg. 5-6, Sect. 5.2.7, states: "Powertech management has always used **Chlorides, Sulfate, and Uranium** as Upper Control Limit (UCL) Parameters. **Sometimes Total dissolved Solids** is used." This statement fails to provide necessary clarity, as Powertech has never operated an ISL mine.

108. The descriptions of proposed water quality monitoring (surface and ground waters) on pages DSEIS 7-4 through 7-15 are unclear and unnecessarily convoluted. Instead of the pages of unclear wording presented here, these details should have been summarized using tables to show: the specific sites / wells to be sampled; specific constituents & parameters; sampling frequency, reporting protocol and frequency.

109. The procedures describing how UCLs will be determined are inconsistent (p. 7-11, L 24-38). The UCLs named in the 2009 Application supplement and the DSEIS (2012) are different. How could the procedures used in both cases comply with NUREG-1569 (NRC 2003)? Furthermore, setting the UCLs at the mean concentration plus 5 standard deviations is excessively lax. It would be much more meaningful to present means plus the 95 percent confidence intervals.

110. Apparently only water level and UCL data (chloride, conductivity, and total alkalinity) will be reported to EPA, and only quarterly (DSEIS p. 7-11). Such reporting is totally inadequate in both frequency and constituents. In essence it

prevents the public and the EPA from understanding what is happening at the site.

111. The NRC has considerable experience with numerous operating and closed ISL / ISR operations. Clearly NRC, not the operator, should select the appropriate "target restoration goals". Yet, the DSEIS p. 2-35, L 37-38, states: "The applicant would establish target restoration goals [CAB concentrations per…….]." Selection of such target restoration goals and UCL parameters and standards should be done by the regulatory agency in the DSEIS to avoid possible conflicts of interest and reveal these foreseeable impacts at the earliest possible stages of project analysis.

112. *Such specific restoration goals and standards should be presented in the DSEIS for public review and comment prior to FEIS or license approval*.

The SDEIS does not clearly define the various zones that are contemplated to contain, monitor, and control migration of lixiviant-mobilized groundwater and chemical constituents.

113. D-B Application Supplement, pg. 5-5 describes an aquifer exemption boundary, which acts as an additional buffer zone outside the monitor well rings **"to provide protection to adjacent water from the excursions that occur in the normal course of operations."** Page 5-6 of the Supplement further states that the aquifer exemption boundary is proposed to be up to 1200 ft. outside the monitor well ring, and **would be considered the point of regulatory compliance. Apparently simply pumping to create an inward flow direction is not adequate to control "excursions."** It appears this aquifer exemption boundary is actually an expanded ground water sacrifice zone.

Mitigation is Not Detailed In a Manner That Allows Any Meaningful Review

114. The DSEIS portrays mitigation to account for impacts, but the mitigation consists only of proposals to make plans to restore groundwater in the future. There is no detail as to the effectiveness of these proposed mitigation measures, nor any analysis of whether any such plans have succeeded in the past.

115. The DSEIS provides for monitoring of restored groundwater aquifers for only 12 months. DSEIS, P. 2-37. However, there is no assessment as to whether 12 months is adequate. Aquifer restoration activities at numerous other ISL sites have failed to return aquifer water quality to baseline conditions following years of attempts at clean-up. Hence, at minimum, the NRC should conduct these effectiveness reviews and require that post-operational monitoring of D-B aquifer water quality continue until baseline conditions are attained.

Financial Assurance

116. DSEIS, p. 2-35 states that: “The applicant would also be required to provide financial sureties to cover the costs of both planned and delayed restoration programs, in accordance with 10 CFR Part 40, Appendix A, Criterion 9. NRC reviews financial sureties annually.” Although a final decision on surety amounts will come at a later date, the revelation and analysis of the likely amount of surety must be revealed and analyzed in the DSEIS.

117. The NRC and the public know several general facts about the usefulness of most company-generated financial assurance estimates:

1-They generally are based on overly-optimistic assumptions about future water quality, thereby under-estimating costs. Kuipers (2000) conducted a survey of bonding practices at metal mines throughout the western U.S. and found that the bond amounts available were hundreds of millions of dollars below that necessary to conduct actual clean-ups. Many of the “problem” sites have been foreign-owned entities, especially those with their corporate headquarters and assets based in Canada.
2-Aquifer restoration at most, if not all previously-licensed and operated ISL sites has failed to actually return ground water quality to baseline conditions [Hall (2009); Otton and Hall (2009);
3-Predictions of future aquifer restoration success made by the project proponents seldom use truly conservative assumptions. Calculation of financial assurance amounts made by representatives of the party that stands to profit from project licensing represents an extreme conflict of interest.
4-The technical literature is filled with documentation that quantitative predictions of future water quality at *specific* sites cannot be done reliably [Sarewitz, et. al. (2000); Moran (2000); Pilkey & Pilkey-Jarvis(2007); Kuipers & Maest (2006)], and the general failure to restore aquifers back to pre-operational baseline concentrations supports this. This approach must be totally rejected because it assumes one can make accurate and precise *deterministic* predictions.

118. For these reasons, at least preliminary financial assurance calculations should be included in the DSEIS, preferably made by some independent party, not paid or directed by the project proponents. These calculations should also consider the actual reclamation and restoration costs incurred, long-term, from a statistical sampling of the previously-licensed ISL sites. Furthermore, these financial assurance amounts and mechanisms should be made public prior to award of any licenses.

119. To ensure protection of the general public, such financial assurance agreements (bonds, etc.) should be made with the parent corporation, not simply the local operating entity.

Pursuant to 10 C.R.F. § 2.304(d) and 28 U.S.C. § 1746, I declare under penalty of perjury, that the foregoing is true and correct to the best of my knowledge and belief.

Signed on the 24th day of January, 2013,

Robert E. Moran, PhD.