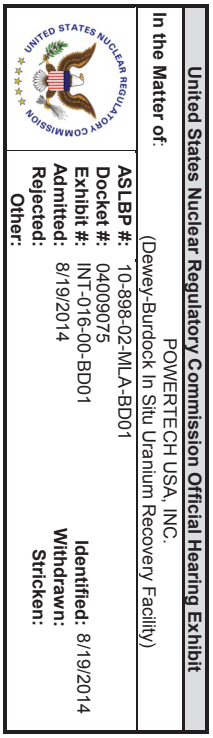
UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION



In the Matter of POWERTECH USA (In Situ Leach, Dewey Burdock, SD)	Docket No. 40-9075-MLA March 8, 2010

CONSOLIDATED REQUEST FOR HEARING AND PETITION FOR LEAVE TO INTERVENE

Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Sir or Madam:

Pursuant to 10 CFR Section 2.309, each of the following requestor/petitioners states that he, she or it has an affected interest in this matter and desires to participate as a party and files this request for hearing and petition for leave to intervene and a specification of the contentions which should be litigated: Theodore P. Ebert, David Frankel, Gary Heckenlaible, Susan Henderson, Dayton Hyde, Lilias C. Jones Jarding, Clean Water Alliance ("CWA"), and Aligning for Responsible Mining ("ARM").

A hearing should be granted and the requestor/petitioners are entitled to participate in it if he, she or it shows standing and has proposed at least one admissible contention that meets the requirements of Section 2.309(f).

This request/petition is timely filed on March 8, 2008 based on the FRN published at 75 Fed. Reg. 467 (January 5, 2010) (the "FRN"). Capitalized terms that are not defined herein have the meanings assigned to them in the Application for a combined

source material/11e.(2) byproduct material license (the "License"), which contains the Technical Report (February 2009) ("TR") and Environmental Report (February 2009) ("ER") filed by Applicant Powertech (USA), a wholly owned subsidiary of Canadian corporation Powertech Uranium Corp. ("Applicant"), and the Supplemental Application (August 2009) ("App. Supp.") filed by Applicant after the NRC Staff's initial rejection of the February 2009 Application.

Each requestor/petitioner notes that Section 2239(a)(1)(A) of the Atomic Energy Act, as amended, provides that in any proceeding for the amending of any license, the Commission shall grant a hearing upon the request of any person whose interest may be affected by the proceeding, and shall admit any such person as a party to such proceeding.

Background:

The Black Hills of South Dakota has been known for many decades to be a uranium-rich region.[1] Open pit uranium mining from the 1970s and 1980s, has left a legacy of contamination and cancer, death and destruction, in large part due to negligent and reckless failures on the part of state and federal regulators which allowed uranium companies to 'cut-and-run', leaving thousands of radioactive tailings piles for future generations to clean up. Figure 2.9-3 shows Gamma-Ray Count Rates at the Dewey-Burdock Site with several large red spots showing >50,000 counts per minute (CPM), demonstrating that substantial radioactive contamination still exists at the proposed mine site from the last era of Uranium mining which has yet to be cleaned up.

Now, the NRC eagerly desires to allow more uranium mining, this time from the

[1] TR §1.2.

aquifers of drinking water that lie beneath the Black Hills. The negligence of past regulators and the pollution caused by past uranium mining has highly sensitized this local population to the potential catastrophic damage and deadly consequences they are facing. Yet, the NRC did not find it necessary to distribute paper copies of the 6,000 page Application in the affected communities. Accordingly, a hearing is required in order to shed the light of day on this Proposed Action near Edgemont, in Custer County and Fall River County, South Dakota. All of the requestor/petitioners live in the affected area and use water that is affected by the mining directly or through inter-connections among the underground water.

The Proposed Action uranium deposit occurs in both the Fall River and Lakota formations of the lower Cretaceous age that make up the Inyan Kara Group. The Fall River and Lakota formations consist of permeable sandstones deposited in a major sand channel system that makes up a groundwater aquifer.[2] Uranium mineralization has occurred in more than one horizon within the Inyan Kara Group resulting in multiple roll fronts.[3] The estimated mineable resource within the project boundary is 7.6 million pounds of U_3O_8 with an average grade of 0.21 percent.[4]

At the PAA, Powertech (USA) will add gaseous oxygen and gaseous carbon dioxide to the recirculated native ground water from the ore zone aquifer to solubilize and mobilize radioactive Uranium.[5] Once solubilized, the uranium bearing ground water will be pumped by submersible pumps via well field production wells to the surface where it is bonded by IX forces onto IX resins.[6] After the uranium is removed, the radioactive 'development'

[2] TR §1.6.
[3] Id.
[4] Id.
[5] TR §1.7.
[6] Id.

groundwater will be recirculated and reinjected into the aquifer via well field injection wells.[7]

Applicant intends to maintain a constant "bleed" of water from the mined aquifer which permanently removes that amount of "bleed" water from the natural hydrological cycle.[8] The (bleed) is intended to create and maintain a cone of depression in the pressure surface of the aquifer so that the new ground water is continually flowing to the center of the production zone in the hopes of avoiding leakage of radioactive fluids outside the mining area into pathways for human ingestion.[9] Applicant does not know the amount of water that will be irretrievably removed from the hydrological cycle but estimates that it will be between a low of 0.5% and a high of 3.0% which is a range with a factor of 600% between the estimated low and estimated high.[10] Applicant expects total production under the License to be approximately 1,000,000 pounds of U_3O_8 per year.[11]

Radioactive wastewater from the Proposed Action ISL operations will consist primarily of spent CPP elution brines, production well field bleed, and restoration flows; these wastewaters will be disposed of by injection in Class I or V injection wells, or by treatment and subsequent land application.[12] As part of the wastewater management plan, there may be periodic releases of water from storage ponds for the beneficial use of crop irrigation.[13]

Land use within the proposed project boundary primarily consists of residential, agriculture related to grazing, as well as hunting and historical mining.[14] The majority of agricultural production is related to grazing.[15] Most land serves as grazing land for cattle

[7] Id.
[8] See TR §1.7.
[9] Id.
[10] See TR §1.7.
[11] TR §1.8.
[12] TR §1.10.
[13] Id.
[14] TR §2.2.2.
[15] Id.

that are sold as food, as well as a number of horses.[16] Major attractions near the PAA include Mount Rushmore National Memorial, Wind Cave National Park, Jewel Cave National Monument, Buffalo Gap National Grassland, Custer State Park, Black Hills National Forest, Angostura State Recreation Park, Gov. George S. Mickelson Trail,[17] Crazy Horse National Monument, and the Black Hills Wild Horse Sanctuary.[18]

The nearest resident is 0.9 miles to the west south-west of the PAA. [19]

Prior to the intended operations of Applicant at the PAA, the human influence on the area has been minor with most of the area being used for grazing activities and associated facilities (e.g., fences and stock wells), recreation, and tourism.[20]

The PAA drains into the Upper Cheyenne River basin, which extends through three states - Wyoming, Nebraska, and southwestern South Dakota.[21] The PAA is drained by the Cheyenne River (Figure 2.2-1).[22] Beaver Creek and Pass Creek pass through the proposed permit area and empty into the Cheyenne River downstream of the proposed permit boundary.[23] Beaver Creek drains the southeastern portion of Weston County in Wyoming before entering Custer County in South Dakota and discharging to the Cheyenne River south of Burdock in Fall River County.[24] The Pass Creek watershed is located in Custer, Fall River, and Pennington Counties in South Dakota and a very small portion of Weston County in Wyoming.[25] The remaining surface water resources in the PAA are small intermittent stream channels and small ponds which, are used by livestock when water

[16] Id.
[17] See TR §2.2.2.
[18] Declaration of Dayton Hyde.
[19] Id.
[20] TR §2.2.2.1.
[21] TR §2.2.3.1.
[22] Id.
[23] Id.
[24] Id.
[25] Id.

exists.[26] Applicant's testing shows that Uranium was detected in all of the fish collected at Beaver Creek from pre-existing contamination (see TR §2.8.5.6.1.2.4) and that tests also showed Polonium-210, Thorium-230, Radium-226 and Lead-210 in fish from Beaver Creek.

Four major aquifers are utilized as groundwater resources in the Black Hills.[27] These main aquifers are the, Inyan Kara, Minnelusa, Madison, and Deadwood.[28] The groundwater hydrology is influenced by distribution and variation in recharge, leakage between overlying and underlying hydrogeologic units, lateral flow within the aquifers, and discharge to pumping wells, artesian wells, and springs.[29] In the PAA, the Fall River and Lakota Formations, together forming the Inyan Kara aquifer, are the principal sources of water.[30]

Applicant has identified the two 'host' counties, Custer County and Fall River County, and the major towns within these two counties to include: in Custer County: - Buffalo Gap, Custer City, Fairburn, Hermosa, and Pringle; and in Fall River County: - Edgemont, Hot Springs, and Oelrichs; and in Pennington County: Rapid City which is the closest urban area to the project, is approximately 100 miles via road northeast of the PAA.[31] Rapid City gets its water from the Madison and Minnelusa aquifers.[32]

The PAA contains substantial cultural resources.[33] The Archaeology Laboratory, Augustana College (Augustana), Sioux Falls, South Dakota, conducted on-the-ground field

[26] Id.
[27] TR §2.2.3.2.1.
[28] Id.
[29] Id.
[30] TR §2.2.3.2.3.
[31] TR §2.3.
[32] Declaration of Lillias Jones Jarding.
[33] See TR §2.4.1 and expert letter dated January 14 2010, from Red Feather Archaeology which was submitted with the undersigned's SUNSI request in the proceeding and is filed herewith and incorporated herein by this reference.

investigations between April 17 and August 3, 2007.[34] Augustana documented 161 previously unrecorded archaeological sites and revisited 29 previously recorded sites within the PAA during the current investigation.[35] Prehistoric sites account for approximately 87 percent of the total number of sites recorded.[36] Historic sites comprise approximately five percent of total sites recorded, while multi-component sites (pre-historic/historic) comprise the remaining eight percent.[37] The land in the PAA has a very high density of sites, specifically those of prehistoric affiliation, and strongly indicative of the intense degree to which this landscape was being exploited during prehistoric times by tribal people.[38]

All of the uranium expected to be mined by Applicant under the License is located within the Inyan Kara Group which Applicant states is 350 feet thick.[39] The Inyan Kara Group consists of the Lakota Formation underlying the Fall River Formation.[40]

The Lakota Formation consists of three (3) members (from lower to upper): Chilson Member (also known as the "Lakota Sandstone") (100 to 240 feet thick), Minnewasta Limestone Member (not in PAA) and Fuson Member (30 to 80 feet thick).[41] The overlying unit, the Fall River Formation, is between 120 and 160 feet thick and consists of dark carbonaceous siltstone interbedded with thin laminations of sandstone, at the bottom, with channel sandstones over that, and a sequence of alternating sandstone and shales over that.[42] Applicant states that the Chilson Member showed high horizontal

[34] TR §2.4.1.
[35] Id.
[36] Id.
[37] Id.
[38] Id.
[39] TR §2.6.2.2 and TR §2.7.2.2.5.
[40] Id.
[41] Id.
[42] Id.

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permeabilities.[43]

The oldest rocks in the region are Precambrian metamorphic rocks and granites. These form the core of the Black Hills Uplift and are exposed at the surfaced of this structural feature.[44] Overlying these crystalline rocks are 2000-3000 feet of Paleozoic sediments.[45] This sedimentary sequence contains several regional aquifers, to include the Deadwood Formation of Cambrian age, the Mississippian Madison Limestone and the Pennsylvanian/Permian-age Minnelusa Formation.[46] Mesozoic sediments include the Triassic age Spearfish Formation and the Sundance, Unkpapa and Morrison Formations of Jurassic age.[47]

The Early Cretaceous sediments of the Inyan Kara Group consist of the Lakota Formation and the Fall River Formation and is a transitional unit, exhibiting a change from terrestrial to marine deposition.[48] The basal Lakota Formation (Chilson Member) is a fluvial sequence, which grades upward into marginal marine sediments as the Cretaceous Seaway inundated a stable land surface.[49] Basal units of the Lakota Formation scour into clays of the underlying Morrison Formation and display the depositional nature of a large braided stream system, crossing a broad, flat coastal plain and flowing toward the northwest.[50] Younger fluvial sand units of the Lakota become progressively thinner and less continuous and are separated by thin deposits of overbank

[43] TR §2.6.2.2.
[44] TR §2.6.1.2.
[45] Id.
[46] Id.
[47] Id.
[48] Id.
[49] Id.
[50] Id.

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and flood plain silts and clays.[51]

At the top of the Lakota is the Fuson Member.[52] The Fuson consists of shale with minor beds of fine grained sandstone and siltstone.[53] The Fuson separates the underlying Lakota Formation from the overlying Fall River Formation.[54]

The Fall River consists of thick, widespread fluvial sands in the lower portion, grading to thinner, less continuous, marginal sands in the upper part.[55] The Cretaceous Lakota and Fall River Formations are the hosts of the roll front uranium mineralization in the Black Hills region and the focus of Applicant's proposed project.[56]

Mineralized sands within the project occur at depths of less than 100 feet in the outcrop area of Fall River Formation and at depths of up to 800 feet in the Lakota in the northwest part of the project.[57] This mineralization occurs in three sandstones in the Fall River Formation and within six sandstones of the Lakota Formation. The uranium mineralization occurs along a large "U" shaped trend that is five miles long and three to four miles wide. The average thickness of this mineralization has been calculated to be 6.1 feet and the average grade is 0.21 percent U308.

The PAA is in the Southern Black Hills, which includes two physiographic divisions that are characterized as the Black Hills and the Great Plains Divisions.[58] The Black Hills Division generally consists of steep formations of metamorphosed and intensely compacted sedimentary rocks, which form a perimeter around an intrusion of Precambrian igneous and

[51] Id.
[52] Id.
[53] Id.
[54] Id.
[55] Id.
[56] Id.
[57] TR §2.6.3.
[58] TR §2.7.1.1.

crystalline rocks.[59] The sedimentary layers consist of aquifer formations that typically have high permeability, which allows for the transportation and storage of water.[60] Aquifers are usually separated by an aquitard layer that restricts the vertical transport of water from one aquifer to the next.[61] The aquifers generally receive a large amount of recharge from stream losses and infiltration.[62] The infiltration rates can vary greatly due to variations in slope and soil and can have a significant impact on the base flow of natural streams (Driscoll and others, 2002).[63] The streams generally have well-developed natural drainage areas that primarily flow from west to east (Driscoll and others, 2002).[64]

The PAA lies primarily within the Beaver Creek Basin and is drained by both Beaver Creek and Pass Creek.[65] The Pass Creek watershed is a sub-basin within the Beaver Creek basin, but the two watersheds were characterized as separate basins.[66] The Beaver Creek system flows through the northwestern section of the PAA from the northwest to the southeast.[67] The Pass Creek system flows south through the central portion of the PAA and joins Beaver Creek southwest of the PAA.[68] Three miles south of this confluence, Beaver Creek converges with the Cheyenne River (Figure 2.2-2) which eventually flows into the Missouri River.[69]

The Beaver Creek Basin is 1360 mi2, excluding the Pass Creek sub-basin.[70] It extends from a few miles northwest of Upton, WY to about eight miles southeast of

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[59] Id.
[60] Id.
[61] Id.
[62] Id.
[63] Id.
[64] Id.
[65] TR §2.7.1.3.
[66] Id.
[67] Id.
[68] Id.
[69] Id.
[70] TR §2.7.1.3.1.

Dewey, SD and lies within Weston, Niobrara and Crook Counties in Wyoming, and within Pennington, Custer and Fall River Counties in South Dakota. Beaver Creek is a perennial stream with ephemeral tributaries.[71]

The Pass Creek watershed, characterized as a subbasin of the larger Beaver Creek Basin, comprises most of the east-southeast portion of the Beaver Creek Basin and is almost fully contained in South Dakota.[72] The Pass Creek watershed is 230 mi2 and is located in Custer, Fall River, and Pennington Counties in South Dakota and a very small portion of Weston County in Wyoming. Pass Creek is dry except for brief periods of runoff following major storms.[73]

The northwestern section of the PAA drains to Beaver Creek via an intermittent tributary.[74] The north-central and east-central section of the PAA is drained via Pass Creek and smaller, ephemeral tributaries.[75] The southeast portion of the PAA is also part of the Cheyenne River Basin that drains into the Cheyenne River through East Bennett Canyon.[76] The PAA contains many intermittent streams and drainage channels, particularly in the eastern extent, that are consistently dry throughout the year.[77] Stream flow only occurs in these channels after significant precipitation or snowmelt events and even then may not be of considerable amounts.[78] Three small ephemeral stream channels cut through the primary facility zone in the eastern section of the PAA.[79] Most of the

[71] Id.
[72] TR §2.7.1.3.2.
[73] Id.
[74] TR §2.7.1.3.3.
[75] Id.
[76] Id.
[77] Id.
[78] Id.
[79] Id.

small impoundments that exist within the PAA are dry during most of the year (Plate 2.5-1).[80] Many of these existing impoundments are found along ephemeral streams and tributaries, particularly in the eastern section of the PAA.[81]

Beaver Creek is the primary surface water resource in the PAA.[82] Applicant states that there will be no ISL operations within 0.4 miles of the Beaver Creek channel, with the exception of two very small areas of known ore bodies that may involve in situ leach well installations and associated piping (Figure 2.7-1).[83] Pass Creek is a secondary surface water resource in the PAA, although the channel is almost always dry.[84] There will be no in situ leach operations within 0.5 miles of the Pass Creek channel, with the exception of one small orebody that may involve in situ leach well installations and associated piping.[85] The remaining surface water resources in the PAA are small intermittent stream channels and small ponds which are used by livestock when water exists.[86]

The groundwater hydrology is influenced by distribution and variation in recharge, leakage between overlying and underlying hydrogeologic units, lateral flow within the aquifers, and discharge to pumping wells, artesian wells, and springs.[87] Regionally, the general direction of groundwater flow is downdip or radially away from the central part of the Black Hills where the aquifers are recharged via infiltration from local rainfall.[88] The aquifers transition from unconfined at the outcrop areas to confined away from the central highlands.[89] At some distance away from the highlands the groundwater often is under

[80] Id.
[81] Id.
[82] TR §2.7.1.3.4.
[83] Id.
[84] Id.
[85] Id.
[86] Id.
[87] TR §2.7.2.1.
[88] Id.
[89] Id.

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sufficient pressures for artesian conditions and flowing artesian wells to exist.[90] Table 2.7-13 shows hydraulic conductivity, transmissivity, and porosity between the affected aquifers.

The Inyan Kara Group is a very heterogeneous formation, which results in the two (2) aquifers exhibiting a large variation in local characteristics.[91] Regionally, the Inyan Kara exhibits a large effective porosity (0.17) and the aquifer can yield considerable water from storage (Driscoll et al., 2002).[92] Within the Black Hills, transmissivity of the Inyan Kara ranges from 1 to 6,000 ft2/day.[93] This high variability is an indication of the complex heterogeneity of the Inyan Kara formation.[94] The Inyan Kara is confined below by the Morrison Formation (50-100 ft thick) and above by Cretaceous Graneros Group shale.[95]

Because of the geologic variability across the Black Hills, it is extremely difficult to ascertain hydraulic connection between aquifers.[96] Interconnection between aquifers results from the thinning or absence of confining units between aquifers, which has been documented in local and regional geologic studies (Miller, 2005).[97] Analyses of regional aquifer tests conducted around the Black Hills provide direct evidence of aquifer interconnection.[98]

Applicant admits that breccia pipes serve as a path between the Minnelusa

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[90] Id.
[91] TR §2.7.2.1.2.
[92] Id.
[93] Id.
[94] Id.
[95] Id.
[96] See TR §2.7.2.1.7.
[97] TR §2.7.2.1.7.
[98] Id.

Formation and the Inyan Kara Group.[99] These breccia pipes are the result of dissolution of significant thicknesses of anhydrite from the upper Minnelusa and subsequent collapse.[100] The greatest concentration of these breccia pipes has been noted within a few miles of the outcrop, although groups of pipes can be concentrated along joints and may extend as "high in the stratigraphic section as the Lakota Formation" (Braddock, 1963).[101] Applicant states that researchers Gott, Wolcott, and Bowles (1974) believed that these breccia pipes allowed large quantities of water to migrate between the Minnelusa and Inyan Kara.[102] Applicant further states that it knows that the aquifers are unconfined near outcrops and that groundwater flow is radially outward from the central highlands towards the plains.[103]

The Black Hills are relatively arid with rainfall ranging from 12 to 28 inches per year in the area. Most precipitation can be accounted for as surface runoff or evapotranspiration.[104] Regionally, the percentage of precipitation that recharges the aquifers varies from 30 percent in the northwestern Black Hills to approximately 2 percent in the drier southwestern Black Hills.[105] Streamflow losses can contribute to aquifer recharge if connection between the stream and underlying aquifer exists.[106] Generally, surface water recharge to groundwater is limited to relatively shallow alluvial aquifers in relatively close proximity to the streams.[107] The exception to this rule occurs

[99] Id.
[100] Id.
[101] Id.
[102] Id.
[103] TR §2.7.2.1.8.
[104] TR §2.7.2.1.9.
[105] Id.
[106] Id.
[107] Id.

in areas where karstic features provide preferential pathways for recharge into the subsurface.[108] Other sources of recharge to individual units can occur from leakage between units. Regionally, water elevations increase with depth, which provides an upward potential for ground-water flow.[109] This limits the potential for downward recharge.[110] Locally these flow head relationships can be reversed due to pumping of wells, thus creating localized zones where the potential for downward leakage exists.[111]

There are numerous springs throughout the Black Hills, including in the Madison and Minnelusa formations.[112] Where these streams cross aquifer outcrops along the eastern Black Hills they lose flow into the subsurface through sinkholes and re-emerge downstream in springs and wells (Rahn, 1971 and Long and Putnam, 2002).[113] In alluvial aquifers, flow is often exchanged between subsurface and surface water.[114] Many of the streams in the Black Hills are losing streams from which stream water infiltrates into the alluvial aquifers.[115] Streams also can be gaining streams, in which they have increased discharge due to inflow from an alluvial aquifer.[116]

In general, the Inyan Kara consists of interbedded sandstone, siltstone, and shale.[117] Applicant states that the Inyan Kara Group averages 350 feet thick.[118] The Fuson member of the Lakota, underlying the Fall River, varies in thickness from 40 to 70 feet.[119] Applicant expects (without reliable evidence) that the Fuson will be an effective interaquifer confining

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[108] Id.
[109] Id.
[110] Id.
[111] Id.
[112] TR §2.7.2.1.10.
[113] Id.
[114] Id.
[115] Id.
[116] Id.
[117] TR §2.7.2.2.5.
[118] Id.
[119] Id.

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unit.[120] Applicant admits that results of aquifer tests at the PAA indicate that the Fuson Shale is not an effective barrier in some locations.[121] Applicant admits that it is possible that, "interaquifer connection here could result from as-yet-unidentified structural features or old open exploration holes".[122] Applicant states that the Inyan Kara is confined above by the Graneros Group, a thick sequence of dark shale that varies in thickness from zero (0) feet where the Inyan Kara crops out to more than 500 feet thick in the plains.[123] Applicant expects that the Graneros Group confining unit will prevent the vertical migration of water between the Inyan Kara and alluvial aquifers.[124] Applicant states that the Graneros Group is composed of several geologic formations including the Skull Creek, Newcastle, Mowry, and Belle Fourche but that Applicant expects the group acts as a single unit that confines the Inyan Kara aquifer.[125] In the PAA, the thickness of the Graneros is zero (0) at the outcrop but increases westward to more than 500 feet thick.[126]

Applicant states that alluvial aquifers in the vicinity of the project site consist of any saturated alluvial material along Pass Creek, Beaver Creek, and the Cheyenne River.[127] In general, the thickness of the alluvial material varies from zero (0) to 25 feet, although it can reach 40 feet.[128] The alluvial material is typically unconfined although localized areas of confinement may exist where weathered shale and other material has slumped on top of the alluvium.[129] Applicant states that the general pattern of groundwater flow is away from the highlands generally, but not exclusively,

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[120] See TR §2.7.2.2.5.
[121] Id.
[122] TR §2.7.2.2.5.
[123] Id.
[124] Id.
[125] TR §2.7.2.2.6.
[126] Id.
[127] TR §2.7.2.2.7.
[128] Id.
[129] Id.

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southwestward.[130]

A major avenue for interchange is along the alluvium where Pass Creek crosses the Inyan Kara outcrop.[131] It is unknown to Applicant whether the alluvium may gain or lose flow to the underlying aquifer.[132] Applicant admits that there is currently no stream loss data for Pass Creek to quantify this interaction so it remains an unknown.[133]

Applicant also admits that it is unknown the extent and continuity of the shale interbeds in the Fall River Aquifer or whether they are sufficiently thick and continuous to serve as vertical confinement for ISL operations will need to be evaluated by analyzing cores from borings as well fields are drilled.[134]

Although the exact relationships between the breccia pipes and the Inyan Kara remains unknown, Applicant has stated that a a minor amount of communication between the Inyan Kara and underlying aquifers (including the Unkpapa, Sundance, and Minnelusa) may occur in yet undiscovered areas where the Morrison is thin or absent or along undiscovered breccia pipes.[135]

Applicant assumes that the Fuson member of the Lakota Formation will act as an effective interaquifer confining unit for the mined Inyan Kara Group.[136] Results of aquifer tests at the PAA indicate that the Fuson Shale is not an effective barrier in some locations (Boggs and Jenkins, 1980).[137] Locally unidentified structural features and/or old, unplugged exploration holes exacerbate this interaquifer connection.[138] The exact location

[130] TR §2.7.2.2.8.
[131] TR §2.7.2.2.10.
[132] Id.
[133] Id.
[134] TR §2.7.2.2.15.2.
[135] TR §2.7.2.2.16.
[136] Id.
[137] Id.
[138] Id.

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of these potentially unplugged holes is undeterminable.[139] Applicant states that flow from these open holes could potentially reach the ground surface.[140]

Applicant proposes to take its large requirement of water for its operations from a water supply well in the Madison formation.[141] Applicant states that it may need up to 500 gallons per minute (gpm) from the Madison Aquifer (500 x 60 x 24 x 365 = 262 million gallons drinking water per year).[142]

Applicant states that the PAA is within the Cheyenne River watershed.[143] Two main stream channels pass through the PAA: Beaver Creek (perennial) and Pass Creek (intermittent).[144] Both flow south into the Cheyenne River, which runs from west to east approximately 2.5 miles south of the PAA boundary.[145]

Pronghorn *(Antilocapra americana)* and mule deer *(Odocoileus hemionus)* are the only two big game species that regularly occur in the PAA, and both are considered year-round residents.[146] Elk *(Cervus elaphus)* and white-tailed deer ***(0. virginianus)*** are also present in the survey area, but only in small herds.[147] The latter two species can also be seen in the survey area year-round, but may be more common during different times of the year.[148] The pronghorn is the most common big game species in the project survey area, though no species is prevalent.[149] The pronghorn is a browse species and

[139] Id.
[140] Id.
[141] TR §2.7.2.2.20.
[142] TR §2.7.2.2.21.
[143] TR §2.8.2.
[144] Id.
[145] Id.
[146] TR §2.8.5.4.2.
[147] Id.
[148] Id.
[149] Id.

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sagebrush-obligate, using shrubs for both forage and cover (Fitzgerald et al. 1994).[150] Pronghorn herds were most often observed in sagebrush stands just beyond the north-central boundary of the PAA during winter 2007-2008.[151] Conversely, herds were widely distributed throughout grassland habitats in the northwestern and southeastern portions of the survey area during spring, summer, and early fall 2008.[152] In June, after the ground and water pools had dried up, water availability became a limiting factor and pronghorn began to move to, and concentrate around, more dependable water sources such as Beaver Creek and livestock tanks, and to draws with more succulent forage.[153]

Applicant states that radionuclide concentrations in sediment at downstream locations of Pass Creek (PSC02) and the Cheyenne River (CHR05) are elevated compared to upstream locations for the same surface water bodies indicating potential impacts from mineralized areas of the on and adjacent to the site.[154] Applicant also states that the measured values of Radon-222 at the PAA exceed the limits set in 10 CFR 20 for Radon-222 with daughters present.[155]

Applicant states that the groundwater contained within the ore zones of the Inyan Kara Group has concentrations of radionuclides that exceed EPA MCL concentrations.[156] Applicant also states that the aquifer does not presently and will not in the future serve as a source of drinking water.[157]

The License Application includes a byproduct 11e.(2) license for liquid process

[150] Id.
[151] Id.
[152] Id.
[153] Id.
[154] TR §2.9.4.3.
[155] TR §2.9.5.3.
[156] TR §2.9.8.3.
[157] Id.

wastes, groundwater generated during aquifer restoration and affected groundwater generated during well development.[158]

Applicant states that consumption of groundwater and short-and long-term changes to groundwater are some of the groundwater impacts related to proposed project.[159] As for consumption, Applicant estimates that the drawdown of the Fall River Aquifer at the nearest domestic well will be between a low of 9.9 feet and a high of 42.8 feet during the first eight years under the ten-year License (if it is granted).[160] Applicant further estimates that the drawdown of the Lakota Formation at the nearest domestic well will be between a low of 4.9 feet and a high of 12.6 feet during such eight year period.[161] Applicant states in ER §7.4.3 that the use of groundwater supply for operations will be a temporary commitment of water resources.

Applicant has stated that it expects that the groundwater will be degraded in the Inyan Kara.[162] Applciant proposes to use gaseous oxygen and carbon dioxide lixiviant.[163] The interaction of the lixiviant with the mineral and chemical constituents of the aquifer results in an increase in trace elements (including toxic elements).[164] There is no conveyance of new constituent species from the recovery process into the groundwater.[165] The recovery process may however raise levels of specific constituents that are present within the ore bearing zone and host aquifer pre-operations.[166] The reduced, insoluble form of uranium present in the ore zone pre-operations is solubilized as a direct result of

[158] TR §4.2.1.
[159] TR §7.2.5.
[160] TR §7.2.5.1.1.
[161] TR §7.2.5.1.2.
[162] TR §7.2.5.2.
[163] Id.
[164] See §7.2.5.2.
[165] Id.
[166] Id.

oxidation via the ISL process when oxidized uranium is introduced to bicarbonate anions and become mobile for extraction.[167] This is the most noticeable impact to the groundwater as a direct result of the ISL process.[168] Although other trace constituents are mobilized during the ISL process, the concentrations of these constituents are dependent upon the specific mineralogy.[169] Applicant states at ER §4.6.2.2 that the interaction of the lixiviant with the mineral constituents of the ore zone results in an a measurable increase in trace elements and primary constituents of sulfate, chloride, cations and TDS above pre production levels.

Leach fluid excursions have the potential to contaminate adjacent aquifers with radioactive and trace elements that have been mobilized during the ISL process.[170] There are two types of excursions: vertical and horizontal.[171] A vertical excursion is movement of solution into overlying or underlying aquifers.[172] A horizontal excursion is a lateral movement of leach fluids outside the production zone of the orebody aquifer.[173] Horizontal and vertical lixiviant excursions have the potential to contaminate the groundwater in the production aquifer or the overlying or underlying aquifers.[174] Applicant admits that the potential impacts of horizontal and vertical excursion could be significant.[175]

Applicant states in the Environmental Report that it is aware of at least 73 private wells near the PAA.[176] Wells within 2 km of the PAA include 24 wells known to obtain water from the Fall River Formation (part of the host Inyan Kara), with 12 of these wells

[167] Id.
[168] Id.
[169] Id.
[170] TR §7.2.5.3.
[171] Id.
[172] Id.
[173] Id.
[174] TR §7.5.2.
[175] Id.
[176] See ER §3.4.1.2.

being flowing artesian wells.[177] Within this same 2 km radius, there are 39 wells currently obtaining water from the Lakota Formation (part of the host Inyan Kara), 14 of which are flowing artesian.[178] Additionally, 10 wells are completed within an unknown formation of the Inyan Kara aquifer (Fall River, Lakota, or both).[179] The total estimated flow from the Inyan Kara (including wells screened within the Fall River, Lakota, or both) within 2 km of the PAA is approximately 70 gpm.[180]

Applicant is aware of the cumulative impacts of other uranium projects in the same area.[181] Applicant states that uranium was first discovered near Edgemont in 1951 and subsequently was mined for a number of years using conventional surface mining methods.[182] ER Figure 6.1-4 shows Gamma-Ray Count Rates for the PAA including very high rates of more than 50,000 CPM in areas of old open pit uranium mining.[183] Applicant states that gamma-ray count rates reached a high of 460,485 CPM in un-reclaimed open pit uranium mines in the PAA.[184] Applicant further states that it is clear that the surface mine area in the eastern quarter of the site exhibits radiological impacts from historic and/or current anthropogenic activities within the area.[185] Applicant states that the potential radiological impacts due to the project during operation are small.[186]

Applicants states that the project should present Custer and Fall River counties with

[177] ER §3.4.1.2.
[178] Id.
[179] Id.
[180] Id.
[181] See ER §4.16.1.
[182] Id.
[183] ER §6.1.2.2.1
[184] Id.
[185] Id.
[186] ER §7.4.4.

net positive gain when compared to the no action alternative.[187] Applicant estimates $186 million in value added and states but does not quantify in dollar terms the estimated costs.[188] ER Table 8.1-1 describes the impact to groundwater due to degradation as a "slight alteration of ore zone groundwater" and estimates net consumption of 320 gpm (320 x 60 x 24 x 365 = 168 million gallons per year) without counting the 500 gpm that might be taken from the Madison Aquifer as discussed above.

Intervention Requested

Intervention is requested in addition to a request for a hearing. If the petition for leave to intervene as a matter of right is denied, then this request includes a request to be allowed discretionary intervention under Section 2.309(d).

Description of Each Requestor/Petitioner[189]

A. Individuals

Theodore P. Ebert: Hot Springs, South Dakota. Mr. Ebert is a member of Aligning for Responsible Mining. He uses water for personal, household, domestic purposes, including gardening, bathing, and drinking. His water is Hot Springs tap water which comes from the Madison Aquifer. He has lived in Fall River County for nine years and during that time, the water in Edgemont has worsened in terms of cloudiness and order. Mr. Ebert's Declaration states his address and is filed herewith.

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[187] ER §7.5.
[188] ER Table 7.5-1.
[189] The address and phone number of each requestor/petitioner is set forth on his, her or its Declaration, filed with this Petition, and incorporated herein by this reference as if fully set forth at length herein.

David Frankel: Buffalo Gap, South Dakota. Mr. Frankel is a member of Aligning for Responsible Mining. He uses water for personal, household, domestic purposes, including gardening, bathing, and drinking. He uses water from the well at his residence at 101 Walnut Street, Buffalo Gap, SD, for gardening. He also uses tap water which comes from the Fall River Water District and which comes from the Madison Aquifer. He has lived in Custer County for two years. Mr. Frankel's Declaration states his address and is filed herewith.

Gary Heckenlaible: Rapid City, South Dakota. Mr. Heckenlaible is a member of Aligning for Responsible Mining. He uses water for personal, household, domestic purposes, including gardening, bathing, and drinking. His water is Rapid City tap water which comes from the Madison Aquifer. Mr. Heckenlaible's Declaration states his address and is filed herewith.

Susan Henderson: Edgemont, South Dakota. Ms. Henderson is a member of the Clean Water Alliance. Ms. Henderson owns and operates a 8,160 acre deeded Dora R. Henderson Ranch (Estate) in the western part of Fall River County, South Dakota. Ms. Henderson uses well water from the Lakota Sandstone aquifer for her residence and her cattle operation. Ms. Henderson also buys water for livestock use which comes from the Madison Aquifer. Ms. Henderson also has a deep-sourced spring on her Ranch. Ms. Henderson states that she will be put out of business and deprived of her livelihood in the event that any of the above-referenced water resources on which she and her Ranch rely were to become contaminated due to Applicant's proposed

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operations. Ms. Henderson states that a portion of the Inyan Kara formation proposed to be mined flows first southwest from the PAA and then flows eastward around the southern boundary of the Black Hills which would include her residence and her Ranch. Ms. Henderson is also concerned about potential natural inter-mixing of aquifers from the minding areas due to fracturing in the rock as well as potential contamination from old abandoned uranium mines that might be mobilized by Applicant's proposed mining. Ms. Henderson is concerned that the older uranium mining projects and open pits together with the fractured nature of the rock in the area are causing intermixing and contamination of the aquifers. Ms. Henderson states that the harm to the communities surrounding the PAA would be catastrophic if the water supplies are contaminated which would include harms to tourism and ranching businesses. Ms. Henderson's Declaration states her address and is filed herewith.

Dayton Hyde: Hot Springs, South Dakota. Mr. Hyde is a member of the Clean Water Alliance. Mr. Hyde is a cowboy author, World War II combat veteran and founder of the Black Hills Wild Horse Sanctuary which consists of several thousand acres and is home to America's largest wild horse herd with over 500 wild horses including American Spanish Mustangs, Sulphur and Kiger Mustangs, herds from State Governments, Bureau of Land Management, and the US Forest Service. Mr. Hyde's personal website is: www.daytonohyde.com and the Black Hills Wild Horse Sanctuary website is www.wildmustangs.com. Mr. Hyde has lived on the Sanctuary property for 22 years and uses water for personal, household, irrigation, ranching and gardening purposes. At that time, Mr. Hyde was recruited by then Governor George Mickelson to

take over stewardship of the land and create the Wild Horse Sanctuary. The Sanctuary is a major tourist attraction and Hollywood movie set (used for *Hidalgo* which brought over $2,000,000 to the community). The Sanctuary land is protected by a Conservation Easement (in favor of The Nature Conservancy) which forbids environmentally harmful activities on the land. The Cheyenne River flows through the Sanctuary and is the primary water source for the wild horses, domestic horses, cattle and wildlife on the Sanctuary's land. The Sanctuary's 11,000 acres are also watered by five (5) wells in the Inyan Kara aquifer. If the water becomes contaminated, the Sanctuary will have no way of watering the horses. The Sanctuary land is downstream from Beaver Creek and Pass Creek; therefore it is subject to contamination in the event of any spills, leaks or excursions. Mr. Hyde's Declaration states his address and is filed herewith.

Lilias C. Jones Jarding, Ph.D.: Rapid City, South Dakota. Ms. Jarding is a member of the Clean Water Alliance. She uses water for personal, household, domestic purposes, including gardening, bathing, and drinking. Her water is Rapid City tap water which comes from the Madison Aquifer. Ms. Jarding is concerned that Applicant will consume 2,243 million gallons of water from the Madison Aquifer which represents a substantial withdrawal from the aquifer upon which she relies. She also notes that her water also comes from the Mennelusa which is hydrologically connected to the Madison. Ms. Jarding is concerned that a drawdown on the Madison would also lead to a drawdown on the Minnelusa. She is concerned that the well-being of her family, property, animals and herself would be negatively impacted by Applicant's proposed operation. Ms. Jarding also submits the summary "Geology and Hydrology in Uranium

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Areas in the Southern Black Hills" (January 2010) ("Black Hills Geology Summary"), which is filed herewith and incorporated herein by this reference as if fully set forth at length. Ms. Jarding's Declaration states her address and is filed herewith.

B. Organizations

Aligning for Responsible Mining ("ARM"), by David Frankel, Legal Director: Aligning for Responsible Mining is an NGO based at Pine Ridge Indian Reservation founded to prevent abusive mining which is mining that does not comply with the International Precautionary Principle. ARM members Mr. Ebert, Mr. Frankel and Mr. Heckenlaible are individual petitioners in this proceeding. Mr. Frankel's Declaration on behalf of ARM states ARM's address and is filed herewith.

Clean Water Alliance, by Lilias Jarding, Ph.D, Executive Director: Clean Water Alliance ("CWA"), is a South Dakota nonprofit which was formed in 2009 to protect the natural resources of the Black Hills of South Dakota with a focus on groundwater contamination from uranium mining. CWA members Dayton Hyde and Susan Henderson live very close to the proposed mine operations and CWA member Lilias Jarding each expect direct negative impacts on their respective water supplies from the proposed operation. Ms. Jarding's Declaration on behalf of CWA states its address and is filed herewith.

EXPERTS, SUPPORTING DOCUMENTS AND REFERENCES

The following documents, articles and information are hereby incorporated by reference as if set forth at length herein:

1. Expert Opinions.

(a) Opinion of Dr. Hannan LaGarry, March 8, 2010 ("LaGarry Opinion"), which is incorporated herein by this reference as if fully set forth at length

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herein.

(b) Opinion of Dr. Robert Moran, February 23, 2010 ("Moran Opinion"), which is incorporated herein by this reference as if fully set forth at length herein.

2. References.

Torrell, L., et. al., The Market Value of Water in the Ogallala Aquifer, 66 Land Economics 2d 163 (1990) ADAMS ML080080390, incorporated herein by this reference as if fully set forth at length hereat.

APPLICABLE LAW

The Atomic Energy Act of 1954, as amended ("AEA") expressly provides that "the Congress of the United States hereby makes the following findings concerning the development, use and control of atomic energy:….[t]he development, utilization, and control of atomic energy for military and for all other purposes are vital to the common defense and security, [t]he processing and utilization of source material must be regulated in the national interest and in order to provide for the common defense and security and to protect the health and safety of the public, and [s]ource and special nuclear material, production facilities, and utilization facilities are affected with the public interest, and regulation by the United States of the production and utilization of atomic energy and of the facilities used in connection therewith is necessary in the national interest to assure the common defense and security and to protect the health and safety of the public. AEA Section 2012(a), (c)(d)(e); 42 USC §2012.

Significantly, the national interest and common defense aspects include protecting the health and safety of the public, including the environment and water resources. "The Atomic Energy Act was passed years before broader environmental concerns prompted

enactment of the National Environmental Protection Act ("NEPA"). Yet many of those same concerns permeated provisions of the first-mentioned legislation and the regulations promulgated in accordance with its mandate. To say that these must be regarded independently of the constantly increasing consciousness of environmental risks reflected in proceedings with reference to NEPA, would make for neither practicality nor sense. Nor can AEA requirements be viewed separate and apart from NEPA considerations. Especially in view of NEPA, it also is unreasonable to suppose that risks are automatically acceptable, and may be imposed upon the public by virtue of AEA, merely because operation of a facility will conform to the Commission's basic health and safety standards. The weighing of risks against benefits in view of the circumstances of particular projects is required by NEPA in view of AEA. The two statutes and the regulations promulgated under each must be viewed in *para material.* Citizens for Safe Power, Inc. v. NRC, 524 F.2d 1291, 1299 (DC Cir. 1975).

AEA Section 61 provides that the Commission may make certain determinations concerning source material provided that before making such determination, the Commission must "find that the determination that such material is source material is in the interest of the common defense and security. 42 USC 2091. AEA Section 62 provides that "no person may transfer or receive in interstate commerce, transfer, deliver, receive possession of or title to, or import into or export from the United States any source material after removal from its place of deposit in nature. 42 USC 2092. AEA Section 69 provides that **"[t]he Commission shall not license any person to transfer or deliver, receive possession of or title to, or import into or export from the United**

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States any source material if, in the opinion of the Commission, the issuance of a license to such person for such purpose would be inimical to the common defense and security or the health and safety of the public. 42 USC 2099 (emphasis added).

In order to obtain a source materials license from the NRC, an applicant must file a license application under AEA Section 182. 42 USC 2232. Each application shall be in writing and "shall specifically state such information as the Commission, by rule or regulation, may determine to be necessary to decide such of the technical and financial qualifications of the applicant, the character of the applicant, **the citizenship of the applicant**, or any other qualifications of the applicant as the Commission may deem appropriate for the license. Id. (emphasis added.)

NRC Regulation Section 40.9 provides that all information provided to the Commission by Applicant shall be complete and accurate in "all material respects" which can be read to mean that the Applicant has disclosed all information that a reasonably prudent regulator would consider important in making a licensing decision.[190] Further, Section 40.9(b) requires Applicant to notify the Commission if Applicant has identified information having a significant implication for public health and safety or common defense and security.

[190] Rules for establishing materiality under federal law are well-established by the Supreme Court under the securities laws, see TSC Industries, Inc. v. Northway, Inc., 426 U.S. 438 (1976), concluding in the proxy-solicitation context that "[a]n omitted fact is material if there is a substantial likelihood that a reasonable shareholder would consider it important in deciding how to vote." Id., at 449. Acknowledging that certain information concerning corporate developments could well be of "dubious significance," id., at 448, 96, the Court was careful not to set too low a standard of materiality; it was concerned that a minimal standard might bring an overabundance of information within its reach, and lead management "simply to bury the shareholders in an avalanche of trivial information-a result that is hardly conducive to informed decisionmaking." Id., at 448-449. It further explained that to fulfill the materiality requirement "there must be a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the 'total mix' of information made available." *Id.*, at 449. We now expressly adopt the TSC Industries standard of materiality for the § 10(b) and Rule 10b-5 context. Basic Inc. v. Levinson, 485 US 224, 231-232 (1988).

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Once the Commission has received full disclosure in an application, it may approve the sought after source materials license in accordance with Section 40.32 if: (a) The application is for a purpose authorized by the Act; (b) The applicant is qualified by reason of training and experience to use the source material for the purpose requested in such manner as to protect health and minimize danger to life or property; (c) The applicant's proposed equipment, facilities and procedures are adequate to protect health and minimize danger to life or property; and (d) **The issuance of the license will not be inimical to the common defense and security or to the health and safety of the public.** 10 CFR 40.32 (emphasis added.)

NRC Regulations Section 51.60 requires that Applicant prepare and submit an environmental report which contains the information specified in NRC Regulations Section 51.45:

> 51.45 – (b) *Environmental considerations.* The environmental report shall contain a description of the proposed action, a statement of its purposes, a description of the environment affected, and discuss the following considerations:
>
> (1) The impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance;
>
> (2) Any adverse environmental effects which cannot be avoided should the proposal be implemented;
>
> (3) Alternatives to the proposed action. The discussion of alternatives shall be sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102(2)(E) of NEPA, "appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form;
>
> (4) The relationship between local short-term uses of man's environment

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and the maintenance and enhancement of long-term productivity; and

(5) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

(c) *Analysis.* The environmental report must include an analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects…. The analyses for environmental reports shall, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, those considerations or factors shall be discussed in qualitative terms. The environmental report should contain sufficient data to aid the Commission in its development of an independent analysis.

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(e) *Adverse information.* The information submitted pursuant to paragraphs (b) through (d) of this section should not be confined to information supporting the proposed action but should also include adverse information.

Further, in order for the Application to be complete, it must comply with Part 40, Appendix A which provides, among other things, that:

10 CFR Part 40 Appendix A, Criterion 5(B)(3)(a)(iii) – quantity of ground water and direction of ground-water flow; (iv) proximity and withdrawal rates of ground-water users; (vi) existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality; and (ix) The persistence and permanence of the potential adverse effects.

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Criterion 5(B)(3)(b)(iii) The quantity and quality of ground water, and the direction of ground-water flow;

(iv) The patterns of rainfall in the region;

(v) The proximity of the licensed site to surface waters;

(vi) The current and future uses of surface waters in the area and any water

quality standards established for those surface waters;

(vii) The existing quality of surface water, including other sources of contamination and the cumulative impact on surface-water quality;

(viii) The potential for health risks caused by human exposure to waste constituents;

(ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and

(x) The persistence and permanence of the potential adverse effects.

Criterion 5B(6)(a) Potential adverse effects on ground-water quality, considering--

(i) The physical and chemical characteristics of the waste in the licensed site including its potential for migration;

(ii) The hydrogeological characteristics of the facility and surrounding land;

(iii) The quantity of ground water and the direction of ground-water flow;

(iv) The proximity and withdrawal rates of ground-water users;

(v) The current and future uses of ground water in the area;

(vi) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality;

(vii) The potential for health risks caused by human exposure to waste constituents;

(viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;

(ix) The persistence and permanence of the potential adverse effects.

(b) Potential adverse effects on hydraulically-connected surface water quality, considering--

(i) The volume and physical and chemical characteristics of the waste in the licensed site;

(ii) The hydrogeological characteristics of the facility and surrounding land;

(iii) The quantity and quality of ground water, and the direction of ground-water flow;

(iv) The patterns of rainfall in the region;

(v) The proximity of the licensed site to surface waters; (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;

(vii) The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality;

(viii) The potential for health risks caused by human exposure to waste constituents;

(ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and

(x) The persistence and permanence of the potential adverse effects.

CONTENTIONS

Contention A: The Application does not accurately describe the environment affected by its proposed mining operations or the extent of its impact on the environment as a result of its use and potential contamination of water resources, through mixing of contaminated groundwater in the mined aquifer with water in surrounding aquifers and drainage of contaminated water into the Cheyenne River.

Contention B: Applicant's proposed mining operations will use and contaminate water resources, resulting in harm to public health and safety, through mixing of contaminated groundwater in the mined aquifer with water in surrounding aquifers and drainage of contaminated water into the Cheyenne River.

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Contention C: Cost Benefits as discussed in the Application fail to include economic value of environmental benefits. Section 51.45(c) requires "to the extent that there are important qualitative considerations or factors that cannot be quantified, those considerations or factors shall be discussed in qualitative terms." The Application does not contain any quantification of the negative impacts predicted and estimated by Applicant and mentioned in the Application such as the value of the millions of gallons of water that will be taken from the Inyan Kara and Madison Aquifers; and the loss in real property values from aquifer drawdowns (see Torrell, infra). A University of Adelaide study has put an economic value on the wetlands of the River Murray, highlighting the ramifications of cutting off water flows in times of drought. The study has concluded that every hectare of permanent wetland provides more than $7,000 worth of water purification each year.

http://www.adelaide.edu.au/adelaidean/issues/23221/news23241.html

According to one assessment of natural ecosystems, the dollar value of wetlands worldwide was estimated to be $14.9 trillion. (Source: Costanza et al. 1997). See also Economic Benefits of Wetlands, EPA 843-F-06-004, Office of Water (May 2006), and Economic Reasons for Conserving Wild Nature, Science Vol. 297 (August 9, 2002), www.sciencemag.org. Therefore, it is possible to quantify the qualitative considerations involved with negative impacts to the groundwater, surface water, Beaver Creek, Pass Creek and Cheyenne River and the Application fails to conform to that requirement of Section 51.45(c).

Contention D: Section 51.45(e) requires disclosure of adverse information.

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Section 40.9 requires disclosure of all material facts and that the Application be complete. As described in the LaGarry Opinion and the Moran Opinion, the Application fails to disclose all required information in a comprehensible manner.

As the Moran Opinion states:

> After reviewing a large portion of the approximately 6000 pages of relevant documents [Technical Report is 3103 pg.; Environmental Report is 2615 pg.; Supplement is 66 pg.], ***I find it is not possible to provide a meaningful expert review and technical comment on the adequacy of the documents within the time provided because they are quite disorganized, often with little consistency between the various documents, and frequently presenting information and interpretations in a technically inadequate manner.*** More importantly, the reports fail to provide the most important information necessary to commenting intelligently on these matters. Further details are presented below.

Therefore, the Application violates Section 40.9 by being disorganized, and violates Section 51.45(c)'s requirement concerning analytical content as Dr. Moran opines that the Application presents information and interpretations in a technically inadequate manner. Dr. Moran continues in his Opinion that:

> With respect to details as to the difficulty in review caused by the manner in which the application materials have been prepared, Tables 2.7-27, 28 and 29 of TR (pg. 2-198-199) serve as representative examples of the poorly-written, confusing nature of these documents. Because their titles are so inadequate, [i.e.,Table 2.7-27: Quarterly Sampled Groundwater Quality Well Data; Table 2.7-29: Additional Well Data] the reader has no way of knowing what sampling dates are represented. The total depths and screened intervals for many of the wells listed in Table 2.7-27 are not known. Hence, how can the reader reasonably interpret their usefulness?
>
> Frequently the text will refer to a specific table or figure, but when the reader goes to that table or figure, it is not the one referred to. A typical example can be found on pg. 2-199 of the TR, where the text refers to Table 2.7-29, when in fact it is discussing Table 2.7-30. Such mistakes are common in these Application documents and are quite confusing to the reader.

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No coordinated, statistically-sound data set for **all** Baseline Water Quality (both surface and ground water) is presented in these documents—as is required in NURGEG--1569. 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 Section 2.7, there are no tables that actually summarize, statistically, 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 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.

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. 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. Powertech must 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.

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 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

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whether Powertech has baseline (pre-operational) ground water quality data that describes the **non-ore zone regions of the relevant aquifers.**

Dr. LaGarry's Opinion indicates a violation of Section 51.45 and also of Criterion 5B of Appendix A of Part 40 by failing to adequately describe confinement of the host aquifer, fails to analyze properly secondary porosity in the form of faults and joints, artesian flow, and horizontal flow of water within the uranium-bearing strata. Dr. LaGarry found the Environmental Report to be poorly referenced, especially concerning the geology – in violation of Appendix A. Dr. LaGarry opines:

The problem of artesian flow

Artesian flow occurs when there is a hydrologic connection, through faults or highly permeable strata, between groundwater sources and the land surface. The weight of water in overlying strata exerts pressure downward into water within the uranium-bearing strata, which can then be released as artesian water flow where the topographically lower uranium-bearing strata is exposed at the surface, or where it is punctured by drilling. Artesian flow was observed or predicted by Powertech in their Dewey-Burdock Project proposal (sections 3.4.1.2, 3.4.3.1, and 3.4.3.1.7). Artesian flow is most likely where the upper confining layer is perforated by secondary porosity (section 3.3.2.1), poorly constructed or improperly sealed exploration wells (sections 3.3.2 and 3.4.1.2), or thinning or absence of upper confining layers (section 3.4.3.1.7). Artesian flow could transmit lixiviant, the most toxic mineral-laden of waters, onto the land surface (and into Cheyenne River, White River, or Hat Creek alluvium) and discharge large amounts of contaminants into aquifers or faults in a very short time.

The problem of horizontal flow

Confining layers adjacent to uranium-bearing strata limit the unwanted spread of contaminants from an ISL site. However, horizontal flows within the uranium-bearing strata are also of concern. Such flow can rapidly redirect lixiviant or mine waste away from the mine site and into unexpected breaches in the confining layers. In their application to the NRC, Powertech reports horizontal flows within the uranium-bearing strata (the Inyan Kara Group) of up to 35.5 meters/day (Chilson Member, section 3.3.2.2) based on local conditions, and of up to 6,000 ft^2/day (section 3.4.3.1.2) elsewhere in the Black Hills region. Even if secondary

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> porosity, artesian flow, or lack of confinement did not contaminate nearby water supplies, down gradient flow along the Cascade and Chilson anticlines (Rothrock 1931a, 1931b, 1948) would transmit contaminants to the major, mapped faults north of the Pine Ridge in Nebraska in less than 5 years (using the smaller value).

Failure to include these analyses violates Section 51.45, especially subsection (c) and (e) thereof.

Contention E: The License may not be granted because it would violate Section 40.32(d) because of lack of adequate confinement of the host Inyan Kara aquifer, the proposed operation would be inimical to public health and safety in violation of the AEA and NRC Regulations cited above in the "Applicable Law" section. Dr. LaGarry opnions that:

> **The problem of lack of confinement**
>
> In order for ISL mining to be considered safe, the uranium-bearing, mined strata must be isolated from rocks above and below by confining layers. There are three principal pathways through which contaminated water could migrate away from the uranium-bearing strata through adjacent confining layers. The first, and most common, are along joints and faults (see above). Where present, joints and faults penetrate confining layers above and below. The second is through thinning or pinching out of confining layers. In their application to the NRC, Powertech concedes that the upper confining layers thin and there are breaches in the upper confining layers (sections 3.3.2.2, 3.4.3.1.7, 3.4.3.1.10, and 3.4.3.2). The third pathway for mine fluids to breach containment is through perforations made by wells. In Powertech's application, they repeatedly mention "thousands of exploratory wells," along with wells that supply drinking water (the uranium-bearing strata are a local drinking water supply) and water for livestock. In addition, many of these wells are abandoned and most likely improperly plugged (section 3.4.1.2). Once mining begins, and minerals are being extracted, flow pathways within the uranium-bearing rocks will change, potentially creating circumstances in which any one of these wells could allow lixiviant to breach confinement. Once into adjacent water-bearing strata or the land surface, contaminants can enter rivers and flow downstream with each successive rain event, or flow downgradient into other water supplies.

As described in the LaGarry Opinion, the Application states that the upper confining layers are thin and there are breaches in the upper confining layers. Also, the Application states that so much is unknown about the area and its hydrology, and the inter-connection between the aquifers that it is not possible to provide assurance that the confinement will be adequate to protect public health and safety. Therefore, the License may not be issued and must be denied under Section 40.32(d).

Contention F: The Application violates Section 51.45(c), (e) and 51.45(b)(5) by failure to describe irretrievable commitment of resources in the form of water resources taken from the Inyan Kara and Madison Aquifers in the form of the 'bleed' and in connection with restoration which involves 320 gpm from the Inyan Kara and up to 500 gpm from the Madison, as described in the Application and referenced in this Petition above.

Contention G: The Application violates Section 51.45(c) and (e) by failing in ER Section 1.3 to explain the details involved and exposures related to Applicant's proposal to "receive and process uranium loaded resins from other Proposed Projects such as Powertech's nearby Aladdin and Dewey Terrace Proposed Satellite Facility Projects planned in Wyoming or from other licensed ISL operators or other licensed facilities generating uranium-loaded resins." This has obvious ramifications for the entire proposal. The rest of the ER and Supplement talk only about the impacts of transporting and processing uranium from the Dewey-Burdock sites. If resins are to be accepted from an unknown number of other mines, then Applicant must provide all plans and information for those ores and for their processing before a permit is issued. How

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much nuclear material will be handled at the Dewey-Burdock site? How much water will be used? How will wastes be disposed – apparently wastes many times larger than those considered in the Application? Will additional ponds, wells, land for application, or processing facilities be needed? What will be the impacts of the additional traffic? And so forth. Clearly, new Technical and Environmental Applications are needed. Regulators must address these questions before any further action is taken on this Application.

Contention H: Section 51.45(c) and (e) is violated because in the Application Section 3.4.3.1.7 ER on hydraulic connection of aquifers, the Applicant provides information that is not local and fails to include studies that are closer to the proposed project area.

Contention I: Section 51.45(c) and (e), Appendix A of Part 40 are violated because Applicant failed to provide:

(1) a coordinated, statistically-sound data set for **all** Baseline Water Quality (both surface and ground water) is presented in these documents—as is required in NURGEG--1569. Powertech states 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. 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. *Powertech must statistically summarize*

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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. Failure to do so violates the above-referenced NRC Regulations. The Dewey-Burdock 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 impacts to water resources, and the success of containment or aquifer restoration.

(2) detailed data on the chemical composition of pregnant solutions (ore reacted with lixiviant) and detailed analyses of these waters following ion exchange. Mining projects that have progressed to this stage routinely conduct Feasibility Studies and release Feasibility Reports that contain such chemical data. For example, a review of the D-B properties by Smith & Assoc. (2005) mentions that such a Feasibility study was performed for TVA. Leaching of such ores traditionally mobilizes elevated concentrations of many metals and metalloids, plus other constituents: i.e. arsenic, antimony, molybdenum, vanadium, uranium, strontium, iron, manganese, lead, lithium, nickel, chromium, sulfate, chloride, etc. Reliable, complete baseline data are crucial for understanding the chemistry of potential releases to the environment.

(3) detailed data on the chemical composition of liquid wastes that may undergo deep well injection and / or land application. Such data should also be available in Feasibility

Studies.

(4) a realistic description and evaluation of possible water-related impacts, as contemplated by Criterion 5B of Appendix A of Part 40. It is unlikely that the process waters can be contained within the project boundaries given all of the evidence of:

-- thousands of exploration boreholes drilled since the 1950's, many of which were not correctly abandoned;

--hydrogeologic leakage between the ore-bearing formations;

--faults / fractures acting as potential pathways;

--geologic facies inter-connections;

--vertical "breccia pipes" and collapse structures;

--diapir structures?

--historic mine workings as flow pathways.

(5) a rational and analytic discussion of site fluid containment using current research literature.

(6) realistic estimates of water resources to be irretrievably committed as required by Section 51.45(b)(5); rather, the Environmental Report unreasonably minimizes the potential project water impacts [p.8-2], where they estimate that net ground water consumption will be 320 gpm, which is **168.2 gals. per year**. After the anticipated life-of-mine, 17 years, net ground water consumption would equal roughly **2.86 Billion gallons**. (Emphasis added.)

(7) The discussion of geological "formations of interest" at the Dewey-Burdock site

excludes the Madison and Minnelusa Aquifers, which would be used for large amounts of project water (Section 3.3.2.2 ER).

(8) The potential impacts of the presence of 26 flowing artesian wells on the proposed project or the environment are not discussed (Section 3.4.1.2 ER).

(9) In Section 3.4.2.2 ER, the applicant discusses surface water quality. This discussion includes only the State of South Dakota's Beneficial Use Numeric Criteria. It neglects to discuss known contamination from past uranium activities in the area, including radioactive contamination of the Cheyenne River.

(10) Section 3.4.3.1.3 ER provides a limited discussion of porosity in the Minnelusa Aquifer. The sources provided in Table 3.4-3 include only one local piece of research. Sources are available that discuss this issue closer to the project area.

(11) In Section 3.4.3.1.7 ER on hydraulic connection of aquifers, the Applicant provides information that is not local and fails to include studies that are closer to the proposed project area.

(12) The Applicant assumes that its workforce will be local, thus minimizing housing impacts (Section 4.12.3 ER). To be valid, this assumption should be tied to some sort of research. Is a population that is generally older, majority 12^{th} grade education, and characterized by government employment suited to mining?

(13) The Applicant ignores critical environmental justice issues in Section 4.13 ER. The Black Hills region is home to the Lakota (western Sioux) people, who have ongoing treaty rights and cultural/historical interests in the area. To the Lakota, the Black Hills are sacred, and mining activity a sacrilege. Mining in the Hills is tantamount to digging

up the Vatican or Jerusalem. The Pine Ridge Reservation, home to the Oglala Lakota, is downstream along the Cheyenne River and is already plagued by radioactive water. This is one of the largest reservation populations within the United States. These factors need to be carefully researched and made a critical aspect of the consideration of mining impacts.

(14) Mitigation of damage to historical and cultural impacts is not discussed in Section 5.8 ER.

(15) Section 5.8 ER mentions a Memorandum of Agreement with the State of South Dakota. Agreements should also be completed with the seven bands of the Lakota people.

(16) Section 5.6 ER, which discusses potential air quality impacts, mentions only non-radioactive particulate emissions and fugitive dust. These emissions and dust may also carry radioactivity.

(17) The Applicant does not mention local first responders in its emergency training plans (Section 5.12 ER).

(18) Applicant discusses weather without mentioning the presence of dust devils and tornados in the area, which could cause the release of radioactive materials and heavy metals into the environment (Sections 3.5.2 and 3.5.3. ER, which repeat information, and Section 3.6.2.4 ER). The company also fails to mention heavy snow events, which can impact building integrity.

(19) Discussion of precipitation does not include a 100- or 500-year rain event (Section 3.6.2.3 ER). A single rain event in one of the study years is used to characterize

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a heavy rainfall, and the Applicant does not discuss what the impacts of such a storm would be on its operations (Section 3.6.3.4 ER). In the Black Hills area, rain often comes in heavy downpours. As an example, in 1972 a flash flood killed more than 200 people on the eastern side of the Black Hills. The Applicant should discuss the impacts of flash flooding and what would be done if a flood moves radioactive and/or toxic materials off the proposed project site or overtops ponds.

(20) There is a similar problem with the discussion of land application in Section 4.4.2 Supplement. Applicant says that precipitation will not wash materials off those areas, but gives no back-up information.

(21) Oglala Lakota College, which has a campus in Rapid City and 10 other campuses on the Pine Ridge Reservation, is not mentioned in the discussion of post-secondary schools (Section 3.10.2.2 ER).

(22) The Applicant's discussion of the area labor force is incomplete. The implications of an older population, the majority of whom have 12 years of education, is not discussed as far as how it relates to the company's labor needs (Section 3.10.3.1).

(23) There is no consideration of the impacts of wildfire or how this danger will be mitigated. A wildfire threatened the Crow Butte ISL facility, and these fires are common in the area.

(24) Food sampling was done on one cow on one date. It is not clear if that "locally grazing cow" was anywhere near the proposed mine site (Section 6.1.11 ER).

(25) The Applicant appears to suggest that it might do deep well disposal into the Minnelusa Aquifer, an important aquifer that is hydrologically linked to the Madison

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Aquifer, which is the most important aquifer in the region (Section 4.2 Supplement). This information and its ramifications are not included in the Application.

(26) The wastewater to be land applied is characterized as “non hazardous” in Section 4.3 Supplement. This is contrary to research that indicates that land application of uranium mine wastewater may create zones that are highly toxic.

(27) In its supposed discussion of nonradiological impacts (Section 4.14.1 ER), the Applicant doesn’t talk about nonradiological impacts. As arsenic and selenium are typically found with uranium in this region, these impacts need to be discussed.

(28) The Applicant repeatedly refers to “standard operating procedures” or “best management practices” in a safety context (Sections 4.14.11, 5.2.2, 5.12 ER). Critical protections to the public and the environment should not be glossed over in this manner and need to be detailed.

(29) Applicant says that it will keep runoff from disturbed areas from entering local waterways. It refers to documents that “provide confidence” that this will be the case, as well as to unspecified Best Management Practices (Section 4.15.2.3 ER). Given the importance of preventing deterioration of surface water resources in the area, this information should be presented in detail.

(30) The information provided gives no reason to expect that the proposed land application areas are adequate to the proposed rate of application (Section 4.15.2.4.2 ER).

(31) Estimated land application water quality (Table 4.15-1) is based, among other things, on unspecified, undated historical data from Wyoming and Nebraska. This is vague. It is also unclear whether conditions at the other sites are comparable to

conditions at the Dewey-Burdock site.

(32) The Applicant repeatedly omits or underestimates the impacts of the approximately 4000 old exploration drill holes located in the proposed mining area. This goes to a basic issue, the ability of surrounding rock layers to contain the in situ leach mining operation. Examples include:

a. Section 3.3.2.2 ER on the Fuson Member, characterizing it as having "low vertical permeability."
b. In the same section, the Skull Creek Shale is similarly characterized.
c. In its characterization of regional hydrostratigraphic units (Section 3.4.3.1.1 ER et seq.), the Applicant fails to mention the drill holes.
d. The Applicant fails to mention old drill holes in its discussion of regional hydraulic connection of aquifers (Section 3.4.3.1.7 ER).
e. In its discussion of the Morrison formation as a confining unit in Section 3.4.3.2 ER, the Applicant states that the formation is a barrier to all deeper aquifers.
f. The Applicant concludes that the impacts of deep well injection will be "SMALL" [*sic*] "if" aquifers are confined (Section 4.6.2.4 ER). This is a very broad assumption.
g. In Section 6.2.2.4.1 ER, the Applicant says "vertical excursions are not a primary concern."
h. Section 5.2.4 suggests that overlying monitor wells "may be installed." In Section 5.2.5, it says it "prefers not to use underlying aquifer monitor wells." The number of old drill holes suggests that monitor wells must be installed in both overlying and underlying aquifers.

(33) The Applicant minimizes the disturbance to land at all stages of the analysis. The applicant states that only 108 acres out of a total proposed action area (PAA) of 10,580 acres would be impacted by mining, facilities, and roads (1.2.3 ER; see also Table 2.11-1 and Section 4.3.1 ER). Their basis for this number is not provided, but it apparently includes only part of the *initial* mine units, which appear to take up most of a section, or 640 acres (Supplemental Exhibit 3.2-1).

(34) The Applicant also minimizes the disturbance created by its proposed land application of wastewater. It states that a maximum of 355 acres would be used for this purpose (Section 1.2.3 ER). However, maps of the proposed land application area show that application would be done over most of two sections (1,280 acres). This does not include the additional storage, settling, or spare ponds required by this process (Supplemental "Land Application and Irrigation Site Investigation-Test Pit Locations" Map).

(35) In section 3.1.1 ER, the Applicant says both that "there are no recreational

lands present" in or within 2 km of the proposed project site *and* that a "recreational use" of the proposed project area is large game hunting – in contiguous sentences.

(36) Table 3.4-3 ER and Section 3.4.3.1.4 ER provide information on the Madison Aquifer that is not site-specific. There is a lot of research on the aquifer that provides relevant information. This is not corrected in the Supplement.

(37) The Applicant mentions exchange between subsurface and surface water in Section 3.4.3.1.10 ER. This is not discussed in the rest of the Application, despite high uranium readings in alluvial aquifers (Section 3.4.3.3.3.2 ER), and it is unclear whether this type of exchange occurs in the relevant alluvial aquifers. This is important information.

(38) The Applicant took water quality samples directly from uranium ore bodies (Sections 3.4.3.3.2.2 and 3.4.3.3.3.3 ER). This does not provide representative information on water quality in the proposed project area. We are also asked to accept the Applicant's word that sampling results are representative in Section 6.1.8.4 ER.

(39) Information on area vegetation and stream flows was gathered soon after an extended period of drought. While this is mentioned (Section 3.5.5.1.1 ER, quoting Powertech's Project Manager), the implications are not considered in the ER.

(40) The applicant relies on a survey for black-footed ferrets that was completed in 1977. This was during a period of time when the ferret was believed to be extinct in South Dakota (Section 3.5.5.4.1 ER). Since that time, populations have rebounded.

(41) The representativeness of meteorological information taken on the site was determined using data from Chadron, NE, a site that is 53 miles away and has very different topography (Section 3.6.1 ER).

(42) The Applicant also uses information from Oral, SD, in its weather analysis. Predominant wind directions on the Oral site are different from the directions measured on the proposed project site (Sections 3.6.3.2 and 3.6.2.4 ER).

(43) It is unclear how a continental measure of the radiation impacts is relevant to a local measure of radiation exposure. The numbers shown in Table 3.11-1 ER are suspect, as the project area is higher altitude than where most of the continent's population is located and contains over 100 old uranium mines.

(44) In Section 4.4.3.3 ER, the Applicant notes that the Nuclear Regulatory Commission concludes that a transportation accident involving a truck carrying yellowcake is 11% per year per uranium extraction facility. This means that the probability is 100% over ten years. The Applicant fails to discuss the implications of this probable accident.

(45) The Applicant uses the National Mining Association, a trade group that promotes mining, as the source for sections of its ER. These include Sections 4.5.2 – 4.5.5, 4.6.2.2, and 4.6.2.8.1 ER, which include the applicant's discussion of excursions, a critical risk factor from ISL mines. These sections are overly vague, as they are designed as a general description of a mining operation.

(46) The Applicant analyzes (vaguely) the potential impacts of sedimentation from its proposed project in the context of the watershed of the Angostura Reservoir (Section 4.6.1.1 ER). This is not the appropriate unit of analysis. The analysis needs to be specific to the area of its project.

(47) Because the Applicant says that its tests showed no percolation beyond the base of the soil profile, it "assumes" that there will be no lateral or vertical movement of water that could impact groundwater under the land application sites (Section 4.6.2.3 ER). This ignores the presence of alluvial aquifers, as well as being poor science.

(48) It is unclear how a phased approach to well field construction will minimize groundwater impacts, as the company states in Section 4.6.2.5 ER.

(49) In Section 4.6.2.6.1 ER, which discusses drawdown, the Applicant makes at least three assumptions that are not appropriate for the proposed project area: that the aquifer is homogeneous, that the aquifer is confined; and that there is no recharge (Section 4.6.2.6.1 ER).

(50) The Applicant opines that the Dewey Fault Zone contains the project area's aquifers (Section 4.6.2.6.1 ER). Fault Zones are fractures in the earth that may conduct fluids among aquifers or may move either horizontally or vertically.

(51) Drawdown impact estimates are based on only a few test wells (Sections 4.6.2.6.2 and 4.6.2.6.3 ER). It is unclear whether these tests are representative of the entire proposed project area.

(52) The Applicant assumes that there will no physical impacts on Cottonwood Gallery and Ponderosa Pine vegetative communities (Section 4.7 ER). This is impossible, given the extensive disturbance of project operations, as well as the certainty of above-ground spills and leaks.

(53) The Applicant speculates that land application will actually "enhance" habitat (Section 4.7 ER). This contradicts research indicating that land application from in situ mines can concentrate contaminants to toxic levels.

(54) In Section 4.12, the Applicant makes a number of assumptions about local socioeconomic impacts of the project that are not supported by any evidence, and that there is reason to believe are untrue. Its data about local socioeconomic impacts should be calculated to reflect the situation on the ground. These include: (a) "[N]ew workers living within Custer and Fall River Counties would spend their income locally." People from rural counties in the area do substantial shopping and other economic activity in Rapid City. (b) There would be $45.8 million in non-payroll capital expenditures. The nature of these expenditures is unclear. For example, contractors Knight Piésold are from Denver. Most equipment, including expensive items like drill rigs and mining and transportation equipment, are not manufactured locally, so the financial benefits of these purchases would not be local.

(55) In calculating production releases of radon, the Applicant includes "small unavoidable leaks in well field and ion exchange equipment" (Section 4.14.2.3.4 ER). The definition of "small" is open to interpretation. However, most in situ operations include larger spills. This is well-known and should be

included in this analysis.

(56) Atmospheric releases of radon are calculated using 1978 data from Casper, WY, which may not be representative of current or local conditions (Section 4.14.2.3.12 ER).

(57) The Applicant assumes that radionuclide concentrations in *soil* will be "the most important pathways to flora and fauna exposure" (Section 4.14.2.4 ER). It is not clear whether this includes land application, which can concentrate contaminants in both flora and fauna.

(58) There is contradictory information on the Applicant's plan for deep well disposal. It both shows on-site options and says that there are suitable zones for disposal in Wyoming and Nebraska. This section is also very vague in its discussion of impacts from deep well disposal (Section 4.15.2.4.1 ER),

(59) The Applicant states "Considering the distance between the existing projects and the proposed project and the almost half a century since the previous uranium development in the area, cumulative environmental impacts are considered to be small to negligible" (Section 4.16.1 ER). This statement fails to consider the 169 known old uranium mines and prospects in the southern Black Hills. There are also old surface and underground mines directly on the proposed project area.

(60) In its calculations of existing gamma count rates in the proposed mining area, the Applicant removes what it determines to be "outliers," including 9% of the readings in the old surface mine areas (Section 6.1.2.2.1 ER). Similarly, 16% of the first 80 readings on Radium-226 and 20% of those done in the surface mine area were rejected as "outliers." This depresses the area's readings and minimizes the existing disturbance. If all readings were included, it might become clear that the area should not be disturbed further.

(61) The applicant sampled stream sediments in the upstream side of dry surface impoundments (Section 6.1.4.1.2 ER). Stream sediments normally collect at the downstream side of an impoundment and should also be sampled there.

(62) The criteria for selection of groundwater wells for water sampling are listed, but not operationalized. The Applicant says the sites were "representative" (Section 6.1.8 ER), but that cannot be determined without further information.

(63) The comparison of historic and recent groundwater quality does not include radionuclides (Section 6.1.8.3 ER). This is important, given the fact that these are major criteria of concern. Increased radionuclide contamination in wells could indicate vertical contamination through old drill holes. The Applicant then extends these few samples (that do not include criteria of concern) to say that the water parameters in the tested wells have been consistent over time. And then it goes farther to say that the area's water chemistry is stable (Page 6-82 ER). There are a lot of assumptions in these leaps of faith. This research should be re-done before a permit is considered further.

(64) Many aspects of the geology of the proposed project area are stated by Applicant to be UNKNOWNs. Their discussion on this topic repeatedly slants the information in the direction of simplicity and safety, while a number of authors point out the complexity of the geology of the Black Hills. As

noted above, the presence of over 4,000 old drill holes is often ignored. The discussion of breccia pipes talks about the unlikely development of "caverns" – which are different from "breccia pipes" (Section 2.3.1 Supplement).

(65) Breccia pipes in this region are known to be as much as 1300 feet high and several hundred feet across. If they are associated with the Dewey Fault Zone, as the Applicant states (Section 2.3.1 Supplement), then they are very close to the proposed project area. The maps submitted with the Application do not show any drilling that may have identified (or created) problems in the area between the proposed project and the Dewey Fault Zone.

(66) Section 3.2 Supplement raises a new issue that is not analyzed in other parts of the Application. This is the Applicant's intention to disturb the old open pit uranium mines on its proposed mining site. It first says that it doesn't plan to operate through the mine wastes, then says that it plans to place well fields in that area. The full implications of mining in the same location as the old uranium mines need to be discussed, including air and water quality, human exposure, waste issues, cumulative impacts, and so forth.

(67) In Section 6.2 Supplement, the company begins by saying that vehicular traffic is a "potential source of dust." This reflects ignorance, a failure to analyze and describe the nature of Western South Dakota's unpaved roads or unimproved tracks in the summer. There will be dust.

(68) The "potential source[s] of dust" include 107 vehicles during initial construction, 109 during operations, and 41 during decommissioning. Clearly, there will be a lot of dust. A photo of another ISL mine in the area shows barren ground, stripped of vegetation. This suggests that there will be a lot of dust from operating areas. Due to the spacing of wellheads, it is questionable whether "heavy duty watering trucks" will be able to adequately wet down well fields.

<u>MISREPRESENTATION in violation of Section 40.9(a),(b)</u>

The following are examples of misrepresentation of information:

(69) In Section 1.1 ER, the Applicant provides misleading information by focusing on the greenhouse gases emitted by nuclear power plants, without considering the entire nuclear chain. All stages of that chain *other than* power plants emit greenhouses gases, including exploration, mining, milling, enrichment, construction, decommissioning, transportation, and waste disposal. The failure to clearly enunciate the full impact of nuclear activities in this context is misleading.

(70) Table 2.11-1 purports to compare project alternatives. It states that the proposed action would have no surface water impacts and "slight consumption of ore zone groundwater." Thousands of millions of gallons of ground water would not be considered "slight consumption" by most people. Saying there will be no surface water impacts ignores construction and transportation impacts, as well as the history of above-ground spills and leaks from in situ

leach operations.

(71) Table 2.11-1 says that there will be no historical and cultural impacts. Section 5.8 says that there "may be" archeological sites present. These statements are contradicted by the company's statement that there are at least 190 archeological sites in the proposed project area, or one site per 8.1 acres – and that Applicant notes that "the sheer volume of sites documented in the area is noteworthy" (Sections 3.8.1 and 4.10 ER). This implies that the Applicant is not adequately prepared to deal with these sites, as it is apparently not fully in a mindset that accepts and expects their presence.

(72) Under "Socioeconomic Impacts," Table 2.11-1 lists only positive impacts – and only economic impacts – for the proposed project. It lists only negative – and only economic impacts for the no-action alternative. There is a similar problem in Section 4.1. *Socio*economic impacts are not just economic. Mining projects have a history of both positive and negative social and economic impacts, known as the boom-and-bust cycle.

(73) In section 3.1.1.1 ER, the Applicant says, "The human influence on the area is minor." Some would consider the presence of 340 acres of unreclaimed open pit uranium mines (Table 3.3-1) to be more than a "minor" influence. The presence of grazing, wells, roads, and a railroad are also a result of human activity and changed the character of the area.

(74) In Section 3.6.4 ER, the Applicant asserts "ISL facilities do not significantly affect air quality." It provides no support for this assertion. In fact, in the Supplement (Section 6.2), it says that 107 vehicles will be involved in initial construction (not counting ongoing construction), 109 will be involved in operations, and 41 will be involved in decommissioning. It does not mention the air quality impacts of blowing dust that may be contaminated with materials generated by the mining.

(75) The Applicant says that large mammals will be disturbed by in situ leach mining in a manner "similar" to that already existing in the area (Section 4.7.2.1 ER). This minimizes the fact that the proposed operation is a major industrial operation that would be added to a relatively quiet and open landscape.

(76) In Section 4.7.5.2 ER, the Applicant suggests that the intrusion of an industrial operation about half a mile from an active bald eagle nest will not disturb the nest. It implies that burying pipelines, which involves heavy equipment operation, will minimize impacts to the birds. It says that center-pivot irrigation -- which disturbs the landscape, involves human activity and noise, and may contaminate eagles' food sources -- can be minimized so as to not disturb nesting birds. These statements are not credible.

(77) The Applicant also states that the bald eagle nest site is "at least 1.0 mile from the nearest planned facility" (Section 4.7.3.2 ER). This is contradicted by Plate 2.8-3.

(78) In its discussion of the cumulative impacts of other uranium projects, the Applicant mentions only surface mining (Section 4.16.1 ER). The immediate area of the proposed mine also has a history of underground mining. The

discussion mentions Wyoming and Nebraska, which have a history of in situ leach mining. The company's principals are clearly familiar with this due to other mentions of the Crow Butte Mine in Nebraska and due to their employment at ISL mines in Wyoming. The failure to provide this information minimizes the cumulative impacts of uranium activities in the region, which are substantial.

(79) In Section 5.1.1 Supplement, the company begins by stating that it will replace existing water wells or secure other water if a well's use is diminished. As proof, it provides a copy of its lease. This lease only protects lessors from problems with water quality and availability, not others who might be impacted.

(80) The failure to fully consider the No Action Alternative is part of a larger pattern. This pattern begins when the Applicant states that this Alternative is simply "a baseline from which to compare the potential impacts of the other action alternatives." (Section 2.1 ER). It is, in other words, given no real consideration. Real consideration is required.

(81) Other problems with the Cost-Benefit Analysis include that the Applicant assumes that the project will include "limited surface disturbance, negligible radiological impacts" and "insignificant changes in the overall groundwater quality" *before* it begins its cost-benefit analysis (Section 7.2.1.2 ER). This is contrary to proper analytical methods, in which one begins without major assumptions that bias the analysis.

(82) The project is considered as one unit of analysis (Section 7.2.2.1 ER). This is inappropriate. There will be distinct costs and benefits from each aspect of the project. A processing facility has different impacts than a well field. A road has different impacts than a pipeline. Center-pivot irrigation has different costs and benefits than deep well disposal. And so forth.

(83) In the Cost-Benefit Analysis Section, the Applicant states that the project will last 7 years, rather than the 8 years used elsewhere. And, of course, restoration times have been under-estimated at other ISL mines. So, based on that experience, it is optimistic to expect project completion in either 7 or 8 years. A longer project lifetime would expand both the costs and the benefits of the proposed project.

(84) In the consideration of potential socioeconomic impacts (Section 4.12 ER), the Applicant says that its project will employ as many as 200 people in one year. In the Cost-Benefit Analysis, this number is 86 (Section 7.3.2 ER). There is a substantial difference in both the costs and benefits of 200 employees and 86 employees. The analysis should provide a realistic number based on solid data, rather than wildly different numbers.

(85) The Applicant excludes federal taxes from its consideration of costs and benefits (Section 7.3.3 ER). It does not explain how it calculates the figures for its tax contributions in Table 7.3-3. Given the fact that the Applicant reports only the economic benefits of the proposed project, it is possible that the tax contribution numbers are inflated.

(86) The consideration of potential value-added benefits does not tell what those

benefits might be – or what the *costs* of achieving them might be (Section 7.3.4 ER). It is likely that most value-added benefits of operation will accrue to the Applicant in the form of revenue from yellowcake production. This should be clarified.

(87) The section on housing shortages does not discuss housing shortages (Section 7.4.1 ER). Housing shortages have been a critical problem in boom-and-bust economies.

(88) The information on school impacts shows no understanding of the impacts of an increased number of students on a school district (Section 7.4.1.2 ER). While student-teacher ratios may be low in area schools, that does not mean that classrooms have excess capacity, administrators are under-worked, there is excess water and sewer capacity, gyms are large enough, or there are enough janitors or buses. The Applicant should research and consider all factors related to school growth.

(89) In the groundwater impacts section, the Applicant states that its mining would represent a "temporary commitment of water resources." This could not be further from the truth. The applicant says that its operations will consume (i.e., use up) as many as 4,654 Million gallons of water (Table 4.6-2 and Section 4.2.1.1 Supplement). The benefits of this water to the Applicant should be monetized. Water for the proposed project should also be monetized not only in terms of current use, but also of opportunity costs.

(90) Table 7.5-1 does not reflect a realistic Cost-Benefit Analysis, all likely variables related to all alternatives must be considered. To the extent possible, they must be monetized to allow direct comparison of costs and benefits.

<u>UNACCEPTABLE ENVIRONMENTAL IMPACTS which make issuance of the Licence inimical under Section 40.32(d):</u>

The Applicant's plans do not acknowledge many of the known impacts of the in situ leach mining process and present unacceptable environmental risks. These include:

(91) The Applicant states that placing monitoring wells no more than 400 feet from the production zone and no more than 400 feet apart "will ensure that no leach fluids will pass between the adjacent monitor wells undetected…" (Page 1-19 ER). This makes no sense, as it would be possible for an excursion to pass through an opening at least 300 feet wide without necessarily being detected. Excursions are, of course, common at in situ leach uranium operations. If the Applicant is in denial, rather than in a mindset that expects excursions, it is likely to be less vigilant. Obviously, this increases the risk of major excursions, which is not acceptable.

(92) Multiple spills and leaks involving liquids that are contaminated with radiation and/or heavy metals occur at in situ leach uranium mines. This lack of control and the resulting contamination are not acceptable.

(93) The evidence indicates that the proposed project would have unacceptable impacts on a bald eagle nesting site and on species living on or near land

application sites.

(94) This type of project, which would involve large land disturbance in an area with a lot of cultural resources, cannot avoid unacceptable impacts on cultural and historical sites.

(95) Ownership and treaty rights of the Lakota people are not considered in the Application, and the cumulative impacts of uranium mining on those rights are unacceptable.

(96) Use of 2,423 Million gallons of water from the Madison Aquifer and 2,231 Million gallons of water from the Inyan Kara formation is unacceptable, particularly given the semi-arid nature of the region and the reliance on groundwater.

(97) Creation of settling and storage ponds to hold 308,907,127 gallons of toxic liquids is a threat to public health and the environment, given a history of leaks and spills from impoundments at uranium operations.

(98) Water movement in the aquifers that would be impacted is over 1 mile per year. As excursions are common and not always quickly controlled, this presents risks to wells and surface water users within a short time frame.

(99) Existing negative impacts from historical uranium operations, including existing pits and tunnels, air quality, water quality, and stream sediments, argue against further disturbance of the area.

(100) As the Applicant states, "no operations can occur where mine solutions could contaminate [existing] wells" (Section 5.1 Supplement). The reality is that water in the impacted aquifers moves over a mile a year, excursions are predictable, the area is geologically complex, and the nearest wells could become contaminated within the life of the project. Since these factors clearly create a situation in which "mine solutions could contaminate" wells, I am pleased that the Applicant agrees that the Dewey-Burdock project should not occur. I am firmly in favor of the No Action Alternative.

Contention J: Section 51.45(c), (e) are violated because: the Application fails to describe the extent to which the affected area contains faults and fractures horizontally and vertically between aquifers, through which the groundwater can spread thorium, radium 226 & 288, arsenic and other heavy metals disturbed through the ISL mining process. These metals can travel to contaminate clean drinking water and surface water. The contaminated water can eventually find its way to the pipe that brings drinking water into our homes, or the garden hose that waters our family gardens. Arsenic

and alpha emitters make people sick.

CONCLUSION

For the foregoing reasons, the undersigned respectfully requests a hearing, intervention and asserts standing and admissible contentions as set forth above.

Dated this 8th day of March, 2010.

Respectfully submitted,

/s/ - electronically signed by

David Frankel, on his own behalf and as
Attorney for Above-Referenced Requestor/Petitioners[191]

Aligning for Responsible Mining
POB 3014
Pine Ridge, SD 57770
308-430-8160
arm.legal@gmail.com

[191] Notice of Appearance for such Requestor/Petitioners is being filed herewith.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of	)	
POWERTECH, INC.	)	Docket No. _____
(In Situ Leach Facility, Dewey-Burdock, SD	)	License SUA-_____

STATE OF SOUTH DAKOTA)
) SS:
COUNTY OF FALL RIVER)

AFFIDAVIT OF DAYTON HYDE

I, Dayton Hyde, hereby state as follows:

1. I make this affidavit in connection with a Petition to in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine near Edgemont, South Dakota (the "Mine"). My physical address is 12165 Highland Road Hot Springs, South Dakota 57747. The mailing address for me is Box 932, Hot Springs, SD 57747.

2. I have authorized attorneys Bruce Ellison, David Frankel, and other attorneys working with the Clean Water Alliance to represent me in this matter. I am fully familiar with the facts stated in this affidavit, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents of this affidavit.

3. My home address is The Black Hills Wild Horse Sanctuary, 12165 Highland Road, Hot Springs, SD 57747 which is also the place of my business.

4. I have lived on the Sanctuary property for twenty-two years. My assistant Susan Watt moved to South Dakota in 1996 and also resides on the Sanctuary. The Black Hills Wild Horse Sanctuary consists of several thousand acres of privately owned land and another large acreage leased from the Oglala Sioux Tribe.

5. Twenty two years ago I left my Oregon ranch with a dream to seek a large acreage where I could give freedom to captured wild horses. The late governor of South Dakota, George Mickelson flew me over a fascinating wilderness area which had been donated to the South Dakota Community Foundation by Honeywell Corporation, which had intended the land for a weapons testing area. The Governor feared that the land might fall into the wrong hands, and this unique wilderness with spectacular scenery and great religious significance to the Native Americans be lost to the wrong kind of development. As I promised Governor Mickelson, I formed the Institute of Range and the American Mustang (IRAM) a 501 c 3 non profit registered in the state of South Dakota. I bought land and set up what is known now as The Black Hills Wild Horse Sanctuary. Several hundred captured wild horses were shipped in by the Bureau of Land Management.

6. The early years were a financial struggle, but eventually, by giving tours and by donations from caring individuals who believed in my dream, the project was successful. Recently, the Black Hills, Badlands, and Lakes Association awarded me their Lifetime Achievement Award, for creating a major tourist attraction which attracts people from all over the world. The movie *Hidalgo* which was filmed here brought in over two million dollars to the community. Each year the Sanctuary visitors spend thousands of dollars through out the state and local area. Just like other ranches, IRAM pays property taxes.

7. The land is protected by a Conservation Easement which forbids development, and visitation to this irreplaceable wild land is only by guided tours, ensuring good behavior by thoughtless individuals. Movie and television crews love not only the spectacular beauty of the land but the fact that the area is essentially road less and looks the way it did thousands of years ago.

8. The Cheyenne River, which flows through the Wild Horse Sanctuary, is the primary water source for the wild horses, domestic horses, cattle and wildlife protected on our land. The Sanctuary is currently home to over 500 wild horses, 150 domestic horses and 80 head of cattle. If this water becomes contaminated, we will have no way to water the horses and the land will become useless as one of America's greatest private wilderness areas and wild horse sanctuaries.

9. The Cheyenne River flows through our land downstream from where the Beaver and Pass Creeks flow through the Dewey-Burdock project area and into the Cheyenne River. It is thus down stream from any surface or surface impacting spills or leaks of mine waste or other contaminates containing toxic and/or carcinogenic heavy metals and arsenic by the proposed Powertech mining operation;

10. Now the dream of providing a Sanctuary for unadoptable wild horses, preserving

the undomesticated land and holding sacred the Native American Ceremonial Sites may become a nightmare due to the attempt by certain companies to revive uranium mining in neighboring areas and even on the Sanctuary itself. Water is a precious commodity in this area. Our eleven thousand acres are watered by five wells and several miles of the Cheyenne River. Part of the Inyan Kara aquifer flows through the Sanctuary and beyond. The mining companies propose to drill a series of wells into the uranium deposits located in the underground aquifers, pump down thousands of gallons of water, and pump up uranium water to be processed for mineral content, then flush the resulting water back down into the wells.

11. The land here is highly fractured and there is no way the mining companies can guarantee that the Inyan Kara, the Madison, and the other major aquifers will not become polluted and unusable to Man and animals. Our horses and cattle can sicken and die, along with the people. This whole area could become a cancer ridden death zone.

12. There is no way the uranium can be extracted safely. Present mining operations have a history of accidents and spillages. In the early fifties, Edgemont was severely contaminated and required millions of tax payer dollars for clean up. It will be impossible to clean up our wells and aquifers once they are contaminated. There will be no one living in the area once our water is polluted. The two million year old Cheyenne River itself stands to be polluted.

13. The companies are cultivating the locals, talking about the supposed millions they will bring into the area and the jobs they will create. It is the same old story and people have short memories. Bear in mind, these are largely Canadian companies and the market for uranium yellowcake would be China and India. In the US the bonds for clean up are notoriously low. Too often the operators take their profits and skip out, leaving cleanup cost to the public. All the money in the world and the best of intentions won't clean up a poisoned aquifer, and such pollution can travel far from the mining areas. It is far better leave uranium and the other poisons locked up where Nature put them.

14. I have worked hard and long to create the Black Hills Wild Horse Sanctuary. Daily flights of helicopters hunting for minerals drive our wild horse herds back and forth in panic. The sight of survey stakes driven into our private land is a grim reminder that we face troubled times. Uranium deposits ring the Black Hills up thrust. We should not let Uranium Mining to get a foothold. I happen to love South Dakota. I don't want it to become the Leukemia capitol of the world.

15. Future generations will only see a deathscape instead of a place that has kept its beauty since the last ice age. Land that represents what the West was in the times of

Native dominance, trappers and mountain men and when wild horses thundered in freedom across the plains.

This Affidavit is submitted in accordance with 10 C.F.R. Section 2.304(d) and 28 U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

Dayton O. Hyde

Dayton O Hyde
President and Founder
Institute of Range and American Mustang
Black Hills Wild Horse Sanctuary
P.O. Box 932
Hot Springs, South Dakota 57747

Sworn and subscribed to this 26 day of February 2010.

Cheryl Ann McClain
Notary Public

My Commission Expires: My commission expires: September 8, 2012
(SEAL)

CHERYL ANN McCLAIN
SEAL NOTARY PUBLIC SEAL
SOUTH DAKOTA

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of
POWERTECH, INC.
(In Situ Leach Facility, Dewey-Burdock, SD)

Docket No. _____
License SUA-_____

STATE OF SOUTH DAKOTA)
) SS:
COUNTY OF FALL RIVER)

AFFIDAVIT OF SUSAN HENDERSON

I, Susan Henderson, hereby state as follows:

1. I make this affidavit in connection with a Petition to Intervene in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine near Edgemont, South Dakota (the "Mine").

2. I have authorized attorneys Bruce Ellison and David Frankel and the other attorneys working with the Clean Water Alliance to represent me in this matter. I am fully familiar with the facts stated in this affidavit, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents of this affidavit.

3. My address is 11507 Hwy 471, Edgemont, SD 57735, which is also the place of my ranching business, in the western part of Fall River County.

4. I am the sole heiress to and owner of the 8,160 acre deed of Dora R. Henderson Ranch (Estate) operator of a substantial scale cattle business run on that land. I primarily use well water from the Lakota Sandstone aquifer for my residence and for my cattle operation. I also buy water for livestock use which comes from the Madison aquifer.

5. There is further a deep-sourced spring on my ranch from which I also draw water. It is from my years of experience with utilizing this water source that I understand it to be affected by local and other underground water sources in the area.

6. If any of these water sources becomes contaminated from Powertech's proposed mining operation in the Dewey-Burdock area of Fall River County, due to underground excursions or other means of contaminating the aquifers of the Inyan Kara formation, if not the Madison, it will put me out of business and therefore my livelihood;

7. I served for 10 years as the Chairwoman of the Restoration Advisory Board for the Black Hills Army Depot cleanup (located at Igloo, SD). I also have served for 15 years as the Chair of the Igloo-Provo Water Project District. In these two capacities I have studied all sorts of government and corporate documents involving water quality, movement, toxicity, and the like. One of our issues has been whether the Army project has contaminated our local water supplies. There is no question that the activities of the Army contaminated the Cheyenne R. basin, Cottonwood Creek and the surrounding aquifers. Thus we already have a severely damaged watershed.

8. It is my understanding from published scientific research studies that a portion of the Inyan Kara formation, the formation proposed to be mined by Powertech, like the Minnelusa below it and the Madison below that, flows first southwest from the proposed mining area and then flows eastward around the southern boundary of the Black Hills. This would include the area where I live and operate my ranching business in western Fall River County.

9. I am also aware of studies indicating potential natural inter-mixing of aquifers from the mining areas due to fracturing in the rock, as well as fracturing causing such intermixing from the old and abandoned uranium mines in the same general area Powertech wants to do a massive in-situ mine.

10. The 4,000 foot Madison well at Igloo is already showing increased levels of arsenic, radioactivity and other heavy metals. Since the U.S. Army insists that the Black Hills Army Depot was not a nuclear or atomic site, I feel that the increased levels of heavy radioactive metals and arsenic are from the older uranium mines in the area ~~form~~ from the 1950s has begun to enter the aquifer.

11. It is my understanding that there are 5,000 or so abandoned and improperly plugged exploration holes in the proposed mining area, as well as abandoned old uranium mines in the area. I am concerned that these older uranium mining and exploration projects, together with the fractured nature of the rock in the area are causing intermixing

and contamination of aquifer. I don't want this problem made worse by the huge mining operation proposed by Powertech.

12. I expect the United States government and its agencies such as the Nuclear Regulatory Commission to protect my air, and certainly my surface and ground water upon which I depend on for domestic and agrarian use of my land, from mining operations which may potentially pollute them.

13. I am concerned about a foreign corporation coming into Fall River County to conduct mining operations which have a continuous history of contaminating water supplies and states, including in South Dakota. Our State, like our neighboring States, will likely continue to requiring unrealistically low bonds to be posted by the company, grossly insufficient cover the actual costs of whatever reclamation can actually be technologically accomplished when the mine shuts down.

14. Radioactive contamination is essentially forever. We already know this from naturally existing leaching of radioactive materials into our water and increased contamination from uranium mining to this point. We already have too high a level of cancer and other related problems. Why would we want to risk making this situation worse by allowing this mining operation?

15. The three major aquifers - the Madison, Minnelusa, Lakota - all support all our surrounding towns such as Edgemont, Provo, and Hot Springs. If we contaminate the water supplies of these communities, it will be catastrophic as there is no other water supplies for these towns to continue to exist. , ranches and the impact - tourism. You cannot run ranches without local towns to provide schools, banking and other local services. We will also no longer be a desirable place for tourists to come and enjoy our area and thereby promote and sustain local businesses.

16. Large acreage of public land in the area leased by local ranch operations would be similarly impacted by any contamination of surface and subsurface water supplies.

17. Since I live and conduct my cattle raising operation south, south-east of the proposed mining site, and am also concerned about the potential of air contamination from too typical winds from the northwest, particularly including Powertech's proposed mine site area. In the 1950's and 1960's, toxic air contamination from the Black Hills Depot resulted in some deaths in the area. Should there be radioactive air discharges from the mining area carried by the winds to the area of my ranch, I am concerned that surface water used by livestock and other animals will become contaminated over thousands of acres.

18. The local economic benefits from this proposed mining operation will be temporary and limited. They will be minor in comparison to the profits this foreign company will take out of the country and the risks it will leave to our entire way of life.

19. I am concerned about this foreign corporation has its corporate headquarters and worldwide assets outside the United States. Thus, ultimate decisions about the operation of the proposed mine and any compliance with federal and state laws and regulations will be made by foreign based persons outside the jurisdiction of our federal and state regulatory agencies and courts, and therefore the laws designed to protect our water, air, and health.

20. I am further concerned by my knowledge that the South Dakota Mining and Water Management Boards have recently changed the regulations which removed the requirement that any in-situ leach mining company to prove it could return ground water to its baseline conditions before it could get a mining permit. I am further concerned about the "reform" of these regulations which now only require this foreign company to do the best it can to restore water to pre-mining levels, which is not the same as returning to baseline and fails to protect my and our water supplies. My concern is increased by the knowledge that Powertech will have to seek a permanent exemption from the regulations and requirements of the federal Safe Drinking Water Act for the underground water at any moment located vertically below from the surface of its proposed 15,800 acre boundary mining operation. They wouldn't have to do this if existing technology and any amount of money could actually restore water to baseline levels and mine operation contamination of the underground water was not a health and safety issue.

21. Why would we consider giving this foreign corporation a permanent exemption from the Safe Drinking Water Act which is designed to protect our water resources, when other corporate or domestic activities are barred from similar exemptions, as they should be? As part of my involvement in this challenge to Powertech's in-situ leach mining operation, I intend to challenge any application for a permanent aquifer exemption by EPA and the State of South Dakota of the company from the requirements of this Act.

22. Foreign corporations like Powertech understand that our State environmental enforcement capacity is limited and poorly financed, resulting it our state being incapable of realistically monitoring and controlling such a mining operation so as to prevent destruction of our water supplies. Powertech is therefore coming here because think they can get by without strict enforcement of already weakened regulations and laws designed to protect our water, because our State agencies have a history of not been able to and appear likely to continue to be unable to realistically protect our water.

23. I have additional concerns from the standpoint of our local and national security interest. Not only do we have no control over who ultimately gets the uranium mined here once it is shipped out of the country, but it does not make sense to make yellowcake in a remote area such as ours, which borders three states. and where there are few law enforcement resources around. The reality of this situation means that we will have only minimal protection from local theft of yellowcake for terrorist purposes. There are those who would attack us with radioactive materials who would have too easy a time to acquire it from this proposed operation. .

24. I therefore wish to be a Petitioner and be heard in Powertech's permit application to the NRC for a mining permit and anything having to do with the company's efforts to get a permanent exemption from the Safe Water Act.

This Affidavit is submitted in accordance with 10 C.F.R. Section 2.304(d) and 28 U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

Susan B Henderson
SUSAN HENDERSON

Sworn and subscribed to this 5th day of March, 2010.

Cheryl Ann McClain
Notary Public

My commission expires: September 8, 2012

My Commission Expires: _____
(SEAL)

CHERYL ANN McCLAIN
SEAL NOTARY PUBLIC SEAL
SOUTH DAKOTA

GEOLOGY AND HYDROLOGY IN URANIUM AREAS IN THE SOUTHERN BLACK HILLS

This paper provides a summary of the scholarly literature on the geology and hydrology of the southern Black Hills, and particularly of the area proposed for a uranium mine by Powertech Uranium (USA). This project is known as the Dewey-Burdock project, due to its location adjacent to the (very) small towns of Dewey and Burdock, along the Wyoming-South Dakota border.

While a few sources for this research were funded by the uranium industry during past uranium booms, most was either peer-reviewed or produced through the U.S. Geological Survey (USGS). I did not refer to the current permit application except for in a few cases, because I didn't want to use the applicant's information. I wanted to use independently-produced, scholarly information. I have tried to produce copious endnotes that will lead readers to more information.

First, a disclaimer – I am not a geologist or a hydrologist. I have looked at the available information about the area, used reference works, cross-checked sources with each other, and done the best I can. Most of the source information is located at the South Dakota School of Mines and Technology in Rapid City. I have a background in environmental policy, with a Ph.D. in Political Science.

Having said that, this is a summary of what I think the literature says about uranium areas in the Southern Black Hills.

A GEOLOGICAL OVERVIEW OF THE BLACK HILLS

The Black Hills, located in southwestern South Dakota and eastern Wyoming, were formed by a Laramide domal uplift, beginning about 62 million years ago. They are a geologic anomaly, often called "an island of trees in a sea of grass." The geology and hydrology of the Hills are complex. At their center, the Hills have a core of Precambrian granite. More recent Paleozoic and Mesozoic sedimentary rocks layer outward from that core in a series of concentric circles.[i]

These "circles" of layers of rock are the result of the uplift, which tilted underground rock layers from horizontal toward the vertical. The differing thicknesses of the layers – both when they are more vertical within the Hills and as they drop to horizontal on the edges of the uplift – make the geology of the area not only complex, but highly localized.[ii] We will return to this point below

The major developed aquifers of the region, from deepest to shallowest, are the Madison, Minnelusa, and Inyan Kara. See Figure 1 for a summary of the rock layers in the Black Hills region. Figures are located at the back of this report.[iii]

Where the rock layers of the aquifers are more vertical around the edges of the Black Hills, the aquifers collect rainwater and runoff. In some places, streams disappear underground as they run across the upturned edges of the aquifers. This water recharges the aquifers. Generally, the water moves through the rock and down gradient. Water captured by the Black Hills uplift provides important recharge for aquifers to the east toward the Missouri River and to the west to the Powder River basin, as shown in Figure 2. Within the United States, the rocks that contain the Inyan Kara formation, for example, underlie all of North Dakota, the eastern half of Montana, the northeastern part of Wyoming, and all of South Dakota except its southeast corner.[iv]

URANIUM DEPOSITS

The uranium in the Black Hills is found in the Inyan Kara group, which circles the Hills on its outer rim. The deposits that companies seek to exploit are along the northwest and southwest rims of the uplift. The Inyan Kara group is made up of the Lakota and Fall River formations, with the former underlying the latter. The

Lakota formation, in turn, is composed of the Fuson, Minnewaste ("good water"), and Chilson layers. The Fall River formation is the largest producing aquifer in Fall River County, which includes the southern part of the proposed mining area, and the Lakota formation is the second largest.[v] A map showing where the Inyan Kara group outcrops and -- where it is underground -- the depth to the top of the aquifer is shown in Figure 3.

To provide some idea of the irregularity of rock layers and the complexity of the area's geology, the Inyan Kara group is on top of the Morrison formation along the Wyoming-South Dakota border. To the east, it is on top of the Unkpapa sandstone. In the southwestern Hills, in some places the Fuson layer is at the center of the Lakota Formation. In others places, it directly overlays the Minnewaste limestone, or the Chilson layer, or the Morrison formation. In places, it is at the surface. In other words, its extent is sporadic and varies in depth. In places, erosion has removed one layer of rock, which was replaced by "fingers" of another type of rock. This, obviously, complicates any mining operation that relies on a series of drill holes to characterize a potential in situ leach mining site or to determine where excursions (underground leaks) are most likely.[vi]

The layer under the Inyan Kara group is generally described as a "semiconfining unit of Jurassic-age rocks," including the Morrison formation. The layer on top of the Inyan Kara is the Skull Creek shale. Where the two layers meet, the rock of the Inyan Kara is described as typically being "intertongued with sandstones and black shales of the Skull Creek Shale."[vii]

In the proposed mining area, the Skull Creek shale contains faults and sandstone dikes, which can act as conduits through the shale. It also has "cone-in-cone" structures, which are --- as the name implies – tubes shaped like ice cream cones. In the proposed mining area, these can be as much as two feet in diameter.[viii] In other words, there is neither a "tight fit" at the top of the Inyan Kara group nor at the bottom. The neighboring layers of rock would not necessarily stop mining fluids from moving either up or down.

The geology and hydrology of this area were first described in detail in the 1960s and 1970s. The Atomic Energy Commission (AEC) oversaw the creation of thirteen studies on geographic quadrangles in the southern Black Hills. The quadrangles stretched from just south of Newcastle in Weston County, WY, and went southeast around the rim of the Hills to Hot Springs and Angostura Reservoir in South Dakota. The studies focused on defining the area's geology more completely, so that uranium deposits could be identified. The studies were then summarized in 1974, as a new uranium boom was shaping up. Although a number of the maps – including key ones of uranium areas – are missing from the copy of these studies located at the South Dakota School of Mines and Technology, they are still a key resource.[ix]

GEOLOGY OF THE MINING AREA

The AEC summary report details each rock layer within the Inyan Kara group, its history, and its extent across the area. It then describes the general structure of the area, noting that there are 6,000 feet of structural relief. The uplift process that formed the Black Hills repeatedly deformed the sedimentary rocks of the Inyan Kara group. The location of current mining plans, is characterized as: "the southwest-dipping flank of the Black Hills, which is modified by the broad Dewey terrace, by three northwest-trending anticlines [domes], by the northeast-trending normal faults of the Dewey and Long Mountain structural zones … and by smaller normal faults."[x]

The report than describes the area's folds and faults in more detail. In the description of folds, the emphasis is on the dramatic rising and falling landscape features. The descriptions of faults focuses on the area near the proposed mining area. To the north of the proposed mining site is the Dewey Fault and Structural Zone. To the south is the Long Mountain Structural Zone. Faults run on both sides of both zones.[xi]

The larger faults are in the Dewey Zone, where the uplift zone is 500 feet, and the fault zone can be traced for thirteen miles. The report says that, "Although no direct evidence of horizontal movement along the faults is reported, the sinuous en echelon trace of the faults suggests that a minor strike-slip component of movement may possibly exist within the fault zone."[xii] The Long Mountain Zone involves faults in the Inyan Kara group

and the deeper Sundance Formation that have as much as 40' of displacement, and in some places have another 60' of additional relief due to folding. There are also "randomly oriented" faults in the area of the proposed mine.[xiii]

Earthquake data from 1872 – 1986 show ten earthquakes in Custer and Fall River Counties, the counties targeted by Powertech's project. Eight earthquakes had epicenters just north of the town of Hot Springs, one was just south of the proposed mining project, and one was in eastern Fall River County. These earthquakes ranged from 1.5 to three on the Richter Scale.[xiv] A more recent map, which is updated to 2007, shows a stronger quake – about a 4.0 – in the active area north of Hot Springs.[xv]

HYDROGEOLOGY

There are four major aquifers in the proposed mining areas, which are shown on Figure 1. The deepest is the Deadwood, which we will not discuss further. From deepest to more shallow, the other three are the Madison (Pahasapa Limestone), Minnelusa, and Inyan Kara. The Minnelusa is directly on top of the Madison, and several layers of varying thickness are located between the Madison and the Inyan Kara group.

In the Madison and Minnelusa formations, scholars uniformly report substantial structural collapse. These include subsidence, breccia pipes [chimneys], and caverns. According to the US Geological Society, breccia pipes "are likely to develop at the intersection of fractures, particularly in zones of intense fracturing and (or) faulting, such as the Dewey and Long Mountain structural zones." Some faults in the area are known to have "served as pathways of vertical migration." This, of course, means that faults do not block water from either horizontal or vertical movement in the area that is proposed for uranium mining.[xvi] The breccia pipes are as much as 1300 feet high and several hundred feet across. They reach from the Minnelusa formation into the lower part of the Inyan Kara group, "even though relatively impermeable confining material intervenes."

A lot of the water in the proposed mining area is artesian – that is, it moves upward without being pumped. This is because it moves down the flanks of the Black Hills, first as rain and runoff and later underground, builds up a "head of steam," and then finds a way to the surface. Water movement from the Minnelusa to the Inyan Kara is primarily upward. Water can move either up or down between the Madison and the Minnelusa.[xvii] The additional pressure created by pumping solutions under pressure into the Inyan Kara as part of in situ leach mining could potentially reverse natural water flows or could be enough to push contaminants into areas not currently reached by artesian pressure.

Water from the Inyan Kara is also under pressure in places and discharges into springs or recharges alluvial [riverbank] aquifers. This connection mixes subsurface water with shallow wells and with surface water, greatly increasing the area potentially impacted by mining activities. In its application to the Nuclear Regulatory Commission, Powertech says there are 30 flowing wells within 2 km of its permit boundary. In 1970, there were shallow alluvial wells (8 – 59 feet deep) along the waterways in the area. There are also a number of old uranium mines and overburden piles in the proposed mining site – most of which are not reclaimed. Depending on the topography, this could also provide ways for runoff, spills, or excursions from mining to reach both surface and groundwater.[xviii]

But flowing wells are not the only issue. Subsurface water movement is also increased by the presence of other wells. A 1970 study located 269 wells in western Fall River County, with 123 of them tapping the Inyan Kara. According to reports from a 1983 study by the Tennessee Valley Authority (TVA), which explored the area in the 1970s, there were 35 wells in the Inyan Kara formation within four miles of an area just northwest of the proposed mine. A 1980 TVA report counted 49 domestic and stock wells tapping the Inyan Kara within four miles of their Burdock site. Powertech counted about 80 wells within 2 km of its permit boundary. Even if some of these wells are no longer in use, they may be improperly cased or plugged, allowing vertical and/or horizontal movement of water in the proposed mining area.[xix]

And, perhaps most problematic, there are also approximately 4000 exploratory drill holes in the proposed mining area. Maps provided by Powertech in its application shows the old holes across the site, with – not surprisingly – are concentrated in the areas they plan to mine.[xx]

In this case, this is not just a theoretical problem. Old exploration holes in the Burdock – or southern – part of the proposed mining area have been shown to leak vertically. Pumping tests done in 1979 by TVA showed leakage between the Fall River and Lakota formations of the Inyan Kara group, indicating that the Fuson layer, which is sometimes characterized as effectively separating the two formations, did not fill that function. According to the study's authors, Boggs and Jenkins, "The hydraulic communication between the two aquifers observed during the tests is believed to be the result of (1) general leakage through the primary pore space and naturally occurring joints and fractures of the Fuson shale, and (2) direct connection of the aquifers via numerous old unplugged exploration boreholes."[xxi]

This suggests that in situ leach mining should not rely on the Fuson as a confining layer to keep mine fluids within a certain boundary. And the research also shows that there is general communication among the major aquifers in the proposed mine area. Where water is under artesian pressure, mining contaminants could be moved between aquifers or moved into surface waters either during mining or after a company has completed its mining and left.

Remembering that, overall, water collected by the Black Hills moves downward and away from the Hills, the research on regional water movement is also important. Figure 4 shows the directions of water flow in the Madison aquifer. The details of flow in the Minnelusa aquifer are shown in Figure 5. The latter shows that water moves from the proposed mining area to the east and around the southern part of the Black Hills.

The available information indicates that the water in the Inyan Kara formation also flows to the east. Uranium in the Cascade Springs area indicates that there has been horizontal, eastward movement of uranium-bearing water from the Edgemont mining district. This is evidence of contamination moving through the aquifer that is proposed for mining from the proposed mine area to the Cascade Springs area.[xxii]

Whether subsurface mining contaminants reach distant water is governed, for the most part, by how fast the groundwater moves in an area. In a recent USGS study, the authors state that one of the threats to groundwater in the Black Hills is "relatively fast flow velocities." Fast flow velocities are, of course, site-specific. But the Inyan Kara is also the most porous of the major aquifers in the area.[xxiii]

This rapid movement (in geological terms) is present in the Inyan Kara group in the proposed mining area. In 1967, samples were taken from 26 wells in the Inyan Kara group to measure the amount of tritium in the water. Tritium is a radioactive isotope that was deposited in higher-than-natural amounts as a result of nuclear testing in the 1950's – 1960s. Because nuclear testing is a recent phenomenon, higher amounts of tritium indicate that water has reached a sampled area relatively recently. The 1967 samples showed that groundwater had moved 4 miles in approximately 15 years. Water flow was most rapid in three areas. One was just north of the Dewey fault zone, one was west of Edgemont near the Cheyenne River, and the third was southwest of Burdock. All three of these are within several miles of the proposed mining area. In the west-central part of the Burdock quadrangle, an area that could include the proposed mining site, water moved 15 feet per day.[xxiv]

The complex geology and hydrology of the proposed in situ mining area will not produce the controlled conditions necessary for pumping chemicals under pressure into the groundwater, taking radioactive materials and heavy metals out of a stable state, and pumping those materials back to the surface. As Boggs put it, "Hydrogeologic conditions in the site region are complex due to hydrologic boundaries (e.g., aquifer outcrop zone and the Dewey fault) and heterogeneity of the aquifer system. Under such conditions simple analytical methods cannot be applied with an acceptable level of confidence."[xxv]

Even under the best of circumstances, spills, leaks, and excursions are typical of in situ leach mining sites. To mine in an area with a number of known hydraulic connections and fast water movement is, at best,

irresponsible. To mine in such an area when it is the source of water for a large, semi-arid region is unprincipled.

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FIGURE ONE: STRATIGRAPHIC COLUMN FOR THE BLACK HILLS

ERATHEM	SYSTEM	ABBREVIATION FOR STRATIGRAPHIC INTERVAL	GEOLOGIC UNIT	THICKNESS IN FEET	DESCRIPTION
CENOZOIC	QUATERNARY & TERTIARY (?)	QTac	UNDIFFERENTIATED ALLUVIUM AND COLLUVIUM	0-50	Sand, gravel, boulders, and clay.
	TERTIARY	Tw	WHITE RIVER GROUP	0-300	Light colored clays with sandstone channel fillings and local limestone lenses.
		Tui	INTRUSIVE IGNEOUS ROCKS	--	Includes rhyolite, latite, trachyte, and phonolite.
MESOZOIC	CRETACEOUS	Kps	PIERRE SHALE	1,200-2,700	Principal horizon of limestone lenses giving teepee buttes. Dark-gray shale containing scattered concretions. Widely scattered limestone masses, giving small teepee buttes. Black fissile shale with concretions.
			NIOBRARA FORMATION	[1]80-300	Impure chalk and calcareous shale.
			CARLILE SHALE	[1]350-750	Light-gray shale with numerous large concretions and sandy layers. Dark-gray shale.
			GREENHORN FORMATION	225-380	Impure slabby limestone. Weathers buff. Dark-gray calcareous shale, with thin Orman Lake limestone at base.
			GRANEROS GROUP: BELLE FOURCHE SHALE	150-850	Gray shale with scattered limestone concretions. Clay spur bentonite at base.
			GRANEROS GROUP: MOWRY SHALE	125-230	Light-gray siliceous shale. Fish scales and thin layers of bentonite.
			GRANEROS GROUP: MUDDY SANDSTONE / NEWCASTLE SANDSTONE	0-150	Brown to light-yellow and white sandstone.
			GRANEROS GROUP: SKULL CREEK SHALE	150-270	Dark-gray to black siliceous shale.
		Kik	INYAN KARA GROUP: FALL RIVER FORMATION	10-200	Massive to thin-bedded, brown to reddish-brown sandstone.
			INYAN KARA GROUP: LAKOTA FORMATION	35-700	Yellow, brown, and reddish-brown massive to thinly bedded sandstone, pebble conglomerate, siltstone, and claystone. Local fine-grained limestone and coal.
	JURASSIC	Ju	MORRISON FORMATION	0-220	Green to maroon shale. Thin sandstone.
			UNKPAPA SS	0-225	Massive fine-grained sandstone.
			SUNDANCE FORMATION	250-450	Greenish-gray shale, thin limestone lenses. Glauconitic sandstone; red sandstone near middle.
			GYPSUM SPRING FORMATION	0-45	Red siltstone, gypsum, and limestone.
	TRIASSIC	TrPs	SPEARFISH FORMATION	375-800	Red silty shale, soft red sandstone and siltstone with gypsum and thin limestone layers. Gypsum locally near the base.
PALEOZOIC	PERMIAN	Pmk	MINNEKAHTA LIMESTONE	[1]25-65	Thin to medium-bedded, fine grained, purplish gray laminated limestone.
		Po	OPECHE SHALE	[1]25-150	Red shale and sandstone.
		PIPm	MINNELUSA FORMATION	[1]375-1,175	Yellow to red cross-bedded sandstone, limestone, and anhydrite locally at top. Interbedded sandstone, limestone, dolomite, shale, and anhydrite. Red shale with interbedded limestone and sandstone at base.
	PENNSYLVANIAN				
	MISSISSIPPIAN	MDme	MADISON (PAHASAPA) LIMESTONE	[1]<200-1,000	Massive light-colored limestone. Dolomite in part. Cavernous in upper part.
	DEVONIAN		ENGLEWOOD FORMATION	30-60	Pink to buff limestone. Shale locally at base.
	ORDOVICIAN	Ou	WHITEWOOD (RED RIVER) FORMATION	[1]0-235	Buff dolomite and limestone.
			WINNIPEG FORMATION	[1]0-150	Green shale with siltstone.
	CAMBRIAN	OCd	DEADWOOD FORMATION	[1]0-500	Massive to thin-bedded brown to light-gray sandstone. Greenish glauconitic shale, flaggy dolomite, and flat pebble limestone conglomerate. Sandstone, with conglomerate locally at the base.
PRECAMBRIAN		pCu	UNDIFFERENTIATED IGNEOUS AND METAMORPHIC ROCKS		Schist, slate, quartzite, and arkosic grit. Intruded by diorite, metamorphosed to amphibolite, and by granite and pegmatite.

[1] Modified based on drill-hole data

Modified from information furnished by the Department of Geology and Geological Engineering, South Dakota School of Mines and Technology (written commun., January 1994)

FIGURE TWO: GENERAL WATER MOVEMENT IN THE NORTH CENTRAL STATES

Figure 17. General direction of ground-water flow in regional aquifer system within Paleozoic aquifer units (modified from Downey and Dinwiddie, 1988; Whitehead, 1996).

FIGURE THREE: DEPTH TO TOP OF INYAN KARA GROUP

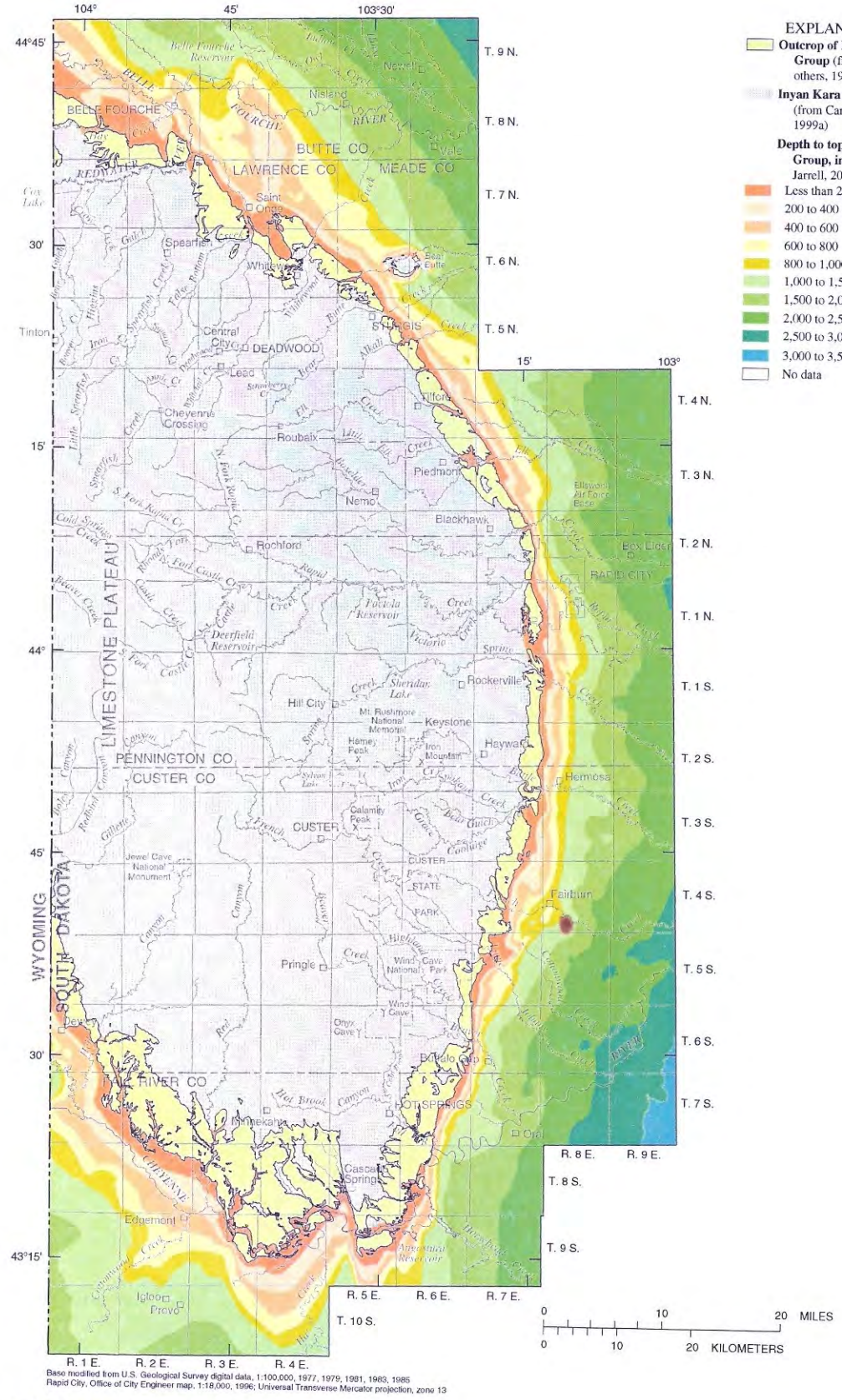

Figure 52. Depth to top of Inyan Kara Group.

FIGURE FOUR: DIRECTIONS OF WATER FLOW IN THE MADISON AQUIFER

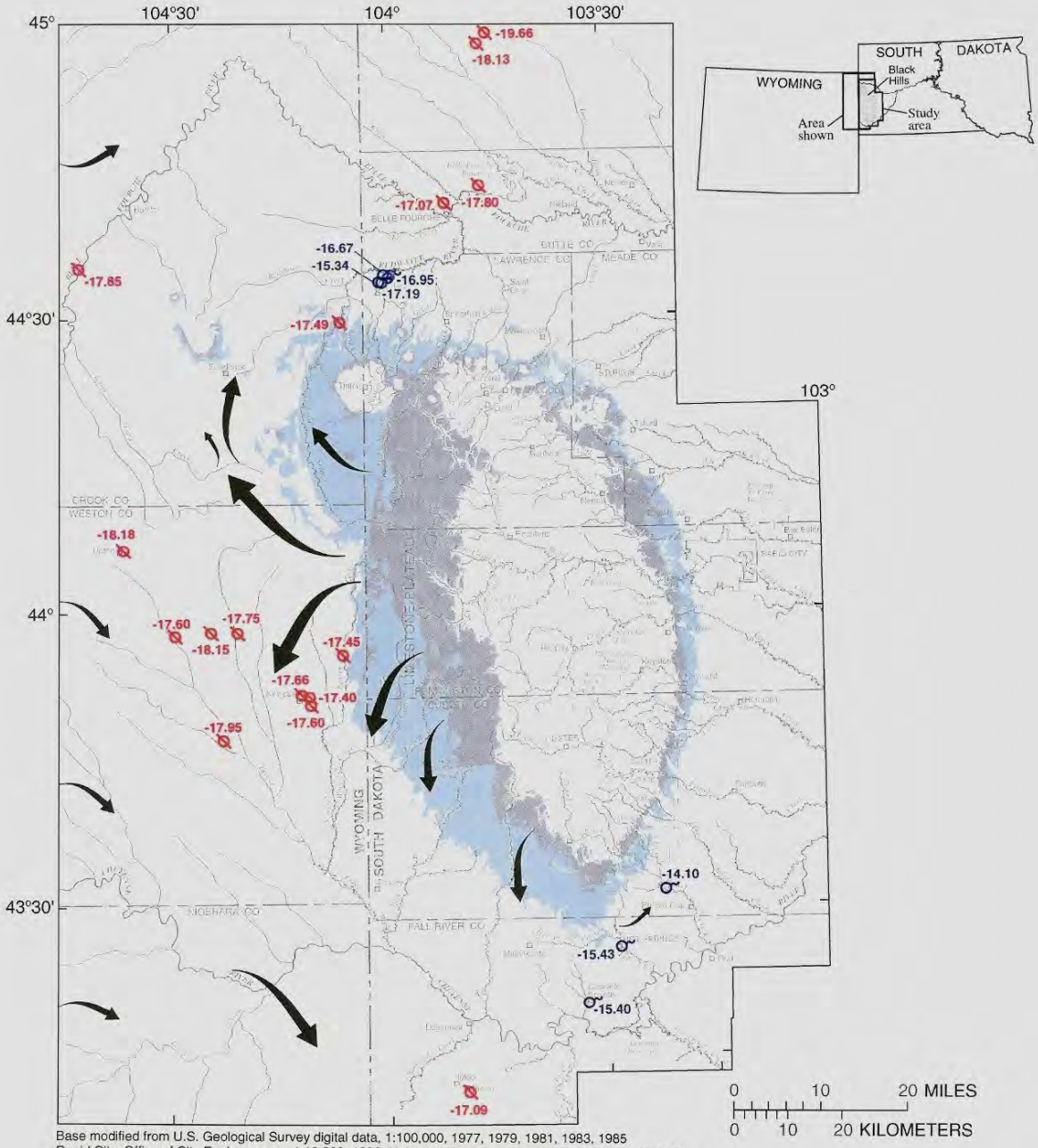

Figure 84. Distribution of $\delta^{18}O$ in selected Madison wells and springs and generalized flowpaths, based on $\delta^{18}O$ values, in the Black Hills of South Dakota and Wyoming (from Naus and others, 2001).

FIGURE FIVE: DIRECTION AND AMOUNT OF MINNELUSA AQUIFER FLOW

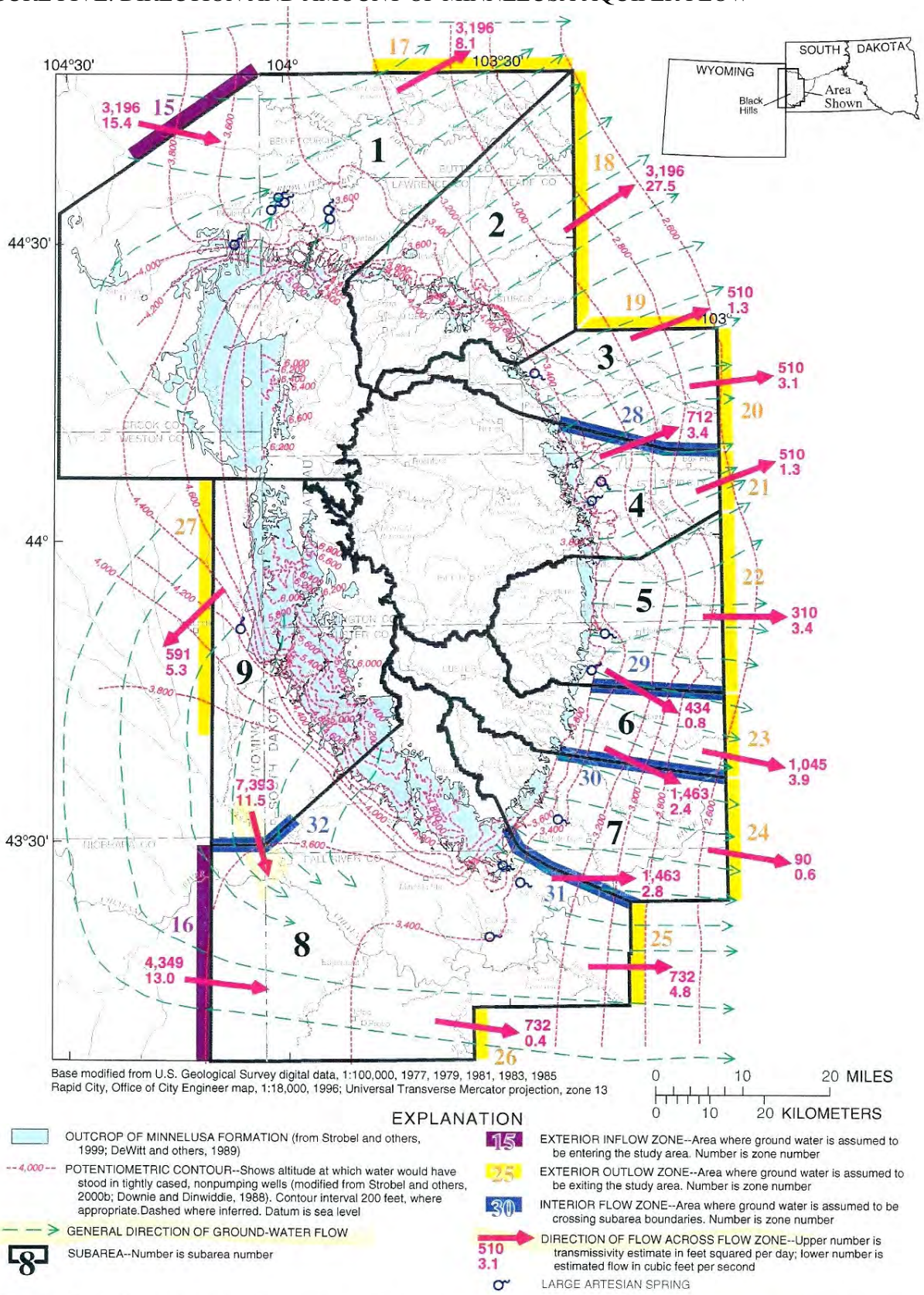

Figure 70. Subareas, generalized ground-water flow directions, and flow zones for the Minnelusa aquifer. Estimated transmissivities and flow components for flow zones also are shown (from Carter, Driscoll, Hamade, and Jarrell, 2001).

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EXPERT OPINION REGARDING THE PROPOSED DEWEY-BURDOCK PROJECT ISL MINE NEAR EDGEMONT, SOUTH DAKOTA

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INTRODUCTION

In early March 2010 I was contacted by Lilias Jarding (WMAN) to review an application to the US Nuclear Regulatory Commission for construction of an ISL facility (the Dewey-Burdock Project) for mining uranium near Edgemont, South Dakota. I had previously provided an expert opinion to the Western Nebraska Resources Council (among others) regarding ISL uranium mining near Crawford, Nebraska. I am offering this expert opinion regarding ISL uranium mining near Edgemont because I am concerned that the issues that I raised in the earlier opinion also apply to the proposed Dewey-Burdock Project. As I have stated previously, I am not against uranium mining in fact or principle. This issue isn't about uranium. It's about protecting the region's water supply, and the future inhabitability of southwestern South Dakota and adjacent Nebraska. In this document, I will briefly explain the basis for my concerns.

PROFESSIONAL BACKGROUND

I have 20 years experience studying the rocks and fossils of northwestern Nebraska and adjacent South Dakota. From 1988-1991 I collected fossils from northern Sioux County, Nebraska for my dissertation work. From 1991-1996 I led field parties from the University of Nebraska State Museum while mapping the fossils and geology of the Oglala National Grassland in Sioux and Dawes counties, Nebraska. From 1996-2006 I led teams of geologists from the Nebraska Geological Survey that mapped in detail the surficial geology of most of northwestern Nebraska (a total of 80 1:24,000 quadrangles). The completion of this work frequently required detailed study of equivalent strata in adjacent South Dakota. These maps, including digital versions (ArcInfo) and supporting field notes, are available from the University of Nebraska-Lincoln School of Natural Resources (contact James B. Swinehart). As a direct consequence of this mapping, I have published peer-reviewed articles on the Chadron Formation (Terry & LaGarry 1998), the Brule Formation (LaGarry 1998), the mapping of surficial deposits (Wysocki & others 2000, 2005), and local faults (Fielding & others 2007). From 2006-2008 I continued this work as an Adjunct Professor of Geology at Chadron State College (CSC) in Chadron, Nebraska. During this time I worked with and advised students studying the region's groundwater, surface water, and geologic structures (principally faults). In May 2008, my CSC colleagues and I, along with Chadron residents, scientists from the Nebraska Geological Survey, the United States Geological Survey, the University of Nebraska School of Natural Resources, and the Upper Niobrara-White Natural Resource District, convened "Our Water, Our Future: a Town Hall Meeting." Our consensus opinion was that water shortages and declining water quality are real and worsening problems in northwestern Nebraska and the northern Great Plains region. Since 2008 I have been serving the Oglala Sioux Tribe as an Instructor in the Department of Math, Science, & Technology at Oglala Lakota College (OLC), and since 2009, as co-chair of that department. Since joining the faculty at OLC, I have been working with students and faculty to

continue to study the geology, groundwater, surface water, and heavy metal contamination of southwestern South Dakota and the Pine Ridge Reservation. In pursuing these studies, we have formed working partnerships with Chadron State College, the South Dakota Geological Survey, the South Dakota School of Mines and Technology, South Dakota State University, the University of Illinois Urbana-Champaign, the University of Illinois Center for Advanced Materials Purification of Water Systems, the Department of Health Physics at the University of Michigan School of Nuclear Engineering, the University of Washington Burke Museum, and the University of Washington Native American Research Center for Health. Our research has been funded for the next 5 years by the National Science Foundation Tribal Colleges and Universities Program.

THE CONCERNS

My concerns regarding the Dewey-Burdock Project are centered around the problems of secondary porosity in the form of faults and joints, the lack of confinement, artesian flow, and the horizontal flow of water within the uranium-bearing strata. I found the Powertech's environmental report to be poorly referenced overall, but especially parts concerning the geology of the region. The conclusions concerning the geology within the proposed area are based on in-house studies and unpublished theses and reports. It is beyond the scope of this opinion to review the entire scientific literature for the region, but I provide the most readily available recent research. Where appropriate, I also refer to specific sections of Powertech's environmental report to the US Nuclear Regulatory Commission (NRC) for the construction of the Dewey-Burdock Project.

The problem of secondary porosity

Secondary porosity, in the form of intersecting faults and joints, is common in all of the rocks north, east, and south of the Black Hills Dome, especially north of and along the Pine Ridge Escarpment (see Swinehart & others 1985). These faults and joints are generally oriented NW-SE and SW-NE, and are most likely a result of the ongoing uplift of the Black Hills of southwestern South Dakota. Although a few people consider the Black Hills uplift to have ended by the late Cretaceous (~65 Ma), the Black Hills were tectonically active in the late Eocene (Evans & Terry 1994), and continued to fault, fracture, and fold the rocks of northwestern Nebraska and southwestern South Dakota into the middle Miocene (Fielding & others 2007). Based on numerous small earthquakes along the Sandoz Ranch-Whiteclay Fault, the area is still tectonically active (McMillan & others 2006). These earthquakes are relatively mild, and don't significantly damage surface infrastructure. However, even small earthquakes represent shifting and flexing of the earth's crust, and are continuously creating, closing, and redistributing the secondary porosity of the region's rocks. This means that joints incapable of transmitting water one day may be able to transmit water at a later date. These faults and fractures transect all major bedrock units of the region. These faults likely connect the uranium-bearing strata to adjacent aquifers as well as modern river alluvium.

In 2007, Chadron Creek, the stream that supplies water to the city of Chadron, Nebraska, went dry for the first time in the citys' history. Subsequent study of the creek's water flow rates by Chadron State College students suggested that normal amounts of water are flowing from the

springs, but the water is disappearing into deeper alluvium or into fractures in the rock (Balmat & others 2008, Butterfield & others 2008). Following these observations, a Chadron State College graduate student began studying the widespread faults and lineaments of northwestern Nebraska and southwestern South Dakota using data collected by high-flying aircraft, satellites, and the space shuttle (Balmat & Leite 2008). Many of the faults in northwestern Nebraska and southwestern South Dakota persist for tens of miles (Diffendal 1994, Fielding & others 2007). Also, many of the ancient river deposits of the Tertiary strata, along with the alluvium deposited by modern rivers such as the Cheyenne River, the White River, and Hat Creek, follow fault zones because fractured rock erodes more easily. A review of the scientific literature shows that faults and joints are well-known in rocks surrounding the Black Hills, and are known to interconnect major aquifers and the land surface (Swinehart & others 1985, Peters & others 1988, Fielding & others 2007). Powertech's application asserts that although fault zones are known both north and south of the project area (section 3.3.2.1), there are no known faults within the project area and therefore little or no secondary porosity. This is a false perception, because joints (cracks in the rock lacking measurable displacement) are exceedingly common in this region and form the vast majority of secondary porosity and contaminant pathways.

The problem of lack of confinement

In order for ISL mining to be considered safe, the uranium-bearing, mined strata must be isolated from rocks above and below by confining layers. There are three principal pathways through which contaminated water could migrate away from the uranium-bearing strata through adjacent confining layers. The first, and most common, are along joints and faults (see above). Where present, joints and faults penetrate confining layers above and below. The second is through thinning or pinching out of confining layers. In their application to the NRC, Powertech concedes that the upper confining layers thin and there are breaches in the upper confining layers (sections 3.3.2.2, 3.4.3.1.7, 3.4.3.1.10, and 3.4.3.2). The third pathway for mine fluids to breach containment is through perforations made by wells. In Powertech's application, they repeatedly mention "thousands of exploratory wells," along with wells that supply drinking water (the uranium-bearing strata are a local drinking water supply) and water for livestock. In addition, many of these wells are abandoned and most likely improperly plugged (section 3.4.1.2). Once mining begins, and minerals are being extracted, flow pathways within the uranium-bearing rocks will change, potentially creating circumstances in which any one of these wells could allow lixiviant to breach confinement. Once into adjacent water-bearing strata or the land surface, contaminants can enter rivers and flow downstream with each successive rain event, or flow downgradient into other water supplies.

The problem of artesian flow

Artesian flow occurs when there is a hydrologic connection, through faults or highly permeable strata, between groundwater sources and the land surface. The weight of water in overlying strata exerts pressure downward into water within the uranium-bearing strata, which can then be released as artesian water flow where the topographically lower uranium-bearing strata is exposed at the surface, or where it is punctured by drilling. Artesian flow was observed or predicted by Powertech in their Dewey-Burdock Project proposal (sections 3.4.1.2, 3.4.3.1, and 3.4.3.1.7). Artesian flow is most likely where the upper confining layer is perforated by

secondary porosity (section 3.3.2.1), poorly constructed or improperly sealed exploration wells (sections 3.3.2 and 3.4.1.2), or thinning or absence of upper confining layers (section 3.4.3.1.7). Artesian flow could transmit lixiviant, the most toxic mineral-laden of waters, onto the land surface (and into Cheyenne River, White River, or Hat Creek alluvium) and discharge large amounts of contaminants into aquifers or faults in a very short time.

The problem of horizontal flow

Confining layers adjacent to uranium-bearing strata limit the unwanted spread of contaminants from an ISL site. However, horizontal flows within the uranium-bearing strata are also of concern. Such flow can rapidly redirect lixiviant or mine waste away from the mine site and into unexpected breaches in the confining layers. In their application to the NRC, Powertech reports horizontal flows within the uranium-bearing strata (the Inyan Kara Group) of up to 35.5 meters/day (Chilson Member, section 3.3.2.2) based on local conditions, and of up to 6,000 ft^2/day (section 3.4.3.1.2) elsewhere in the Black Hills region. Even if secondary porosity, artesian flow, or lack of confinement did not contaminate nearby water supplies, down gradient flow along the Cascade and Chilson anticlines (Rothrock 1931a, 1931b, 1948) would transmit contaminants to the major, mapped faults north of the Pine Ridge in Nebraska in less than 5 years (using the smaller value).

CONCLUDING REMARKS

Based on the arguments presented above, it is my expert opinion that ISL mining in the Edgemont, South Dakota should not be allowed. Artesian flow, the potential lack of confinement due to secondary porosity and drilling, along with potentially high horizontal flow in the uranium-bearing strata indicate that during the course of its operation the Dewey-Burdock ISL Project will most likely contaminate the region with unconfined lixiviant. This contamination could plausibly pollute groundwaters and surface waters southwards into Nebraska and surface waters within the Cheyenne River drainage eastwards into greater South Dakota. Also, based on my reading of Powertech's application, no review of the geologic literature was conducted. In my view, the use of outdated scientific literature, or in this case, a general lack of review of recent study, should not be seen as an opportunity to operate in a knowledge vacuum. Much of the Great Plains region was studied prior to the 1980's and the general acceptance of Plate Tectonics Theory, and therefore generally misrepresents the geologic setting of the region. This was true of the geologic literature used to justify ISL mining near Crawford, Nebraska, and is also true of the data used to justify proposed mining near Edgemont, South Dakota. It is incumbent upon potential ISL operators, as it is with any natural resource consumers, to seek out the most recent research and expert opinions on the geological settings in which they propose to operate.

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LaGarry, H. E. & L. A. LaGarry. 1997. Geology of the Montrose, Orella, Wolf Butte, Roundtop, and Horn 7.5′ USGS quadrangles, Sioux and Dawes counties, Nebraska. University of Nebraska-Lincoln Conservation and Survey Division Open-file Report 48, 161 p.

McMillan, M. E., P. L. Heller, & S. L. Wing. 2006. History and causes of post-Laramide relief in the Rocky Mountain Orogenic Plateau. Geological Society of America Bulletin 118(3/4):393-405.

Peter, K. D., K. E. Kolm, & T. C. Nichols, Jr. 1988. Lineaments: significance, criteria for determination, and varied effects on ground-water systems – a case history in the use of remote sensing, pp. 46-68 *in* (A. I. Johnson & C. B. Petersson, eds.) Geotechnical Applications of Remote Sensing and Remote Data Transmission. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Rothrock, E. P. 1931. The Cascade Anticline. South Dakota Geological Survey Reports of Investigations 8, 25 p.

Rothrock, E. P. 1931. The Chilson Anticline. South Dakota Geological Survey Reports of Investigations 9, 26 p.

Rothrock, E. P. 1948. Structures in Fall River County. South Dakota Geological Survey Reports of Investigations 62, 64 p.

Swinehart, J. B., V. L. Souders, H. M. DeGraw, & R. F. Diffendal Jr. 1985. Cenozoic paleogeography of western Nebraska, pp. 209– 229 in (R. M. Flores & S. S. Kaplan, eds.), Cenozoic Paleogeography of West-Central United States. Proceedings of Rocky Mountain Paleogeography Symposium 3, Society of Economic Paleontologists and Mineralogists. Denver, Colorado.

Terry, D. O., Jr. & H. E. LaGarry. 1998. The Big Cottonwood Creek Member: a new member of the Chadron Formation in northwestern Nebraska, pp. 117-142 in (D. O. Terry, Jr., H. E. LaGarry, & R. M. Hunt, Jr., eds.) Depositional environments, lithostratigraphy, and biostratigraphy of the White River and Arikaree Groups (late Eocene to early Miocene, North America). Geological Society of America Special Paper 325, 216 p.

Terry, D. O., Jr. 1998. Lithostratigraphic revision and correlation of the lower part of the White River Group: South Dakota to Nebraska, pp. 15-38 in (D. O. Terry, Jr., H. E. LaGarry, & R. M. Hunt, Jr., eds.) Depositional environments, lithostratigraphy, and biostratigraphy of the White River and Arikaree Groups (late Eocene to early Miocene, North America). Geological Society of America Special Paper 325, 216 p.

Wysocki, D. A., P. J. Schoeneberger, & H. E. LaGarry. 2005. Soil Surveys: a window to the subsurface. Geoderma 126:167-180.

Wysocki, D. A., Schoeneberger, & H. E. LaGarry. 2000. Geomorphology of soil landscapes, pp. E5-E39 in (M. E. Sumner, editor-in-chief) CRC Handbook of Soil Science. Chemical Rubber Company Press.

Hannan E. LaGarry

CURRICULUM VITAE

updated 4 March, 2010

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Home: 210 North Main Street, Chadron NE 69337

EDUCATION

Regents' Diploma, 1980. Norwood-Norfolk Central School, Norwood NY.

B. A. (Geology), 1985. State University of New York @ Potsdam NY (Advisor: W. Kirchgasser).

M. S. (Geology), 1988. Fort Hays State University, Hays KS (Advisor: R. J. Zakrzewski).

Ph. D. (Geology), 1997. University of Nebraska-Lincoln, Lincoln NE (Advisor: R. M. Hunt, Jr.).

CURRENT EMPLOYMENT

2008-present **CONSERVATION BIOLOGY INSTRUCTOR/RESEARCHER,** Oglala Lakota College, Kyle SD 57752. Dr. Gerald Giraud, 605-455-6035.

2009-present **CO-CHAIR, DEPARTMENT OF MATH, SCIENCE, & TECHNOLOGY.** Oglala Lakota College, Kyle SD 57752. Dr. Gerald Giraud, 605-455-6035.

WORK EXPERIENCE (see BIBLIOGRAPHY for list of publications)

1985 **PALEONTOLOGICAL FIELD ASSISTANT,** Sternberg Memorial Museum

1985-1987 **GRADUATE TEACHING ASSISTANT,** Fort Hays State University

1986 **PROJECT PALEONTOLOGIST I,** Illinois State Museum

1988 **INSTRUCTOR OF GEOLOGY,** Fort Hays State University

1988 **PROJECT PALEONTOLOGIST III,** Illinois State Museum

1988-1989 **GRADUATE TEACHING ASSISTANT,** University of Nebraska-Lincoln

1989-1990 **GRADUATE TECHNICAL ASSISTANT,** University of Nebraska-Lincoln

1991-1995 **RESEARCH TECHNICIAN III,** University of Nebraska State Museum

1991-1995 **PHYSICAL SCIENCE TECHNICIAN,** USDA NRCS National Soil Survey Center

1996-1997 **RESEARCH ASSISTANT II,** University of Nebraska-Lincoln

1997-1998 **RESEARCH GEOSCIENTIST,** University of Nebraska-Lincoln

1999-2006 **ASSISTANT GEOSCIENTIST,** University of Nebraska-Lincoln

2007-2008 **INTERPRETER,** Hudson-Meng Bison Kill Site (USFS), Crawford, Nebraska

ADJUNCT & COURTESY APPOINTMENTS

1999-2006 **COURTESY APPOINTMENT, Department of Geosciences,** University of Nebraska-Lincoln.

2006-2008 **ADJUNCT PROFESSOR OF GEOSCIENCES, Department of Physical & Life Sciences,** Chadron State College, Nebraska

COLLEGE & UNIVERSITY COURSES TAUGHT

FORT HAYS STATE UNIVERSITY, HAYS, KANSAS

1985-1986 **Historical Geology laboratory** (1 credit hour, 2 semesters)
1985-1986 **Invertebrate Paleontology laboratory** (1 credit hour, 2 semesters)
1987 **Field Methods** (3 credit hours, 1 semester)
1987 **Field Camp** (6 credit hours, 1 summer session)
1987 **Structural Geology** (3 credit hours, 1 semester)

BARTON COUNTY COMMUNITY COLLEGE, GREAT BEND, KANSAS

1988 **Life of the Past** (3 continuing education credit hours, 1 semester)

UNIVERSITY OF NEBRASKA-LINCOLN, LINCOLN, NEBRASKA

1988-1989 **Historical Geology laboratory** (1 credit hour, 2 semesters)
1990-1991 **Invertebrate Paleontology laboratory** (1 credit hour, 2 semesters)
1991-2002 **Independent Study in Geology** (3 credit hours, 3 semesters)
1992-1995 **Physical Geology laboratory** (1 credit hour, 4 semesters)
1995-1996 **Independent Study in Museum Studies** (3 credit hours, 2 semesters)
1998-2005 **Regional Field Geology** (1 required credit hour, 8 semesters)

CHADRON STATE COLLEGE, CHADRON, NEBRASKA

2006 **Sedimentology & Stratigraphy** (3 credit hours, 1 semester)
2007-2008 **Earth Systems Science** (3 general studies credit hours, 3 semesters)

OGLALA LAKOTA COLLEGE, KYLE, SOUTH DAKOTA

2008 **Groundwater** (3 credit hours, 1 semester)
2008-2009 **Introduction to Statistics** (3 credit hours, 3 semesters)
2009 **Renewable Energy** (3 credit hours, 1 semester)
2009 **Junior/Senior Research** (3 credit hours, 1 semester)
2009 **Anatomy & Physiology II** (4 credit hours, 1 semester)
2010 **Soil Geomorphology** (3 credit hours, 1 semester)
2010 **Anatomy & Physiology I** (4 credit hours, 1 semester)

RESEARCH INTERESTS

1984-1985 **Lake acidification, northern Adirondack Mountains, New York**
1984-1985 **Ordovician marine paleoecology, Trenton Group of northern New York**
1985-present **Taphonomy & paleoecology of Neogene mammals, Nebraska**
1985-present **Taxonomy & systematic description of Neogene mammals, Nebraska**
1988-present **Biostratinomy of the Deer Creek Formation (Pennsylvanian), Nebraska**
1988-present **Reptiles, amphibians, & lungfish, Eskridge Formation (Permian), Nebraska**
1988-present **Taphonomy & paleoecology of Paleogene faunas, Nebraska**
1991-present **Cenozoic paleosols of western Nebraska & southwestern South Dakota**
1993-present **Cenozoic trace fossils of northwestern Nebraska**
1996-present **Cenozoic lithostratigraphy of western Nebraska**
1998-present **Cenozoic lithostratigraphy of north-central Nebraska**
2008-present **Cenozoic lithostratigraphy of southwestern South Dakota**
2008-present **Groundwater and mineral resources of the Pine Ridge Reservation**

FIELD EXPERIENCE

1981-1988 **Precambrian & early Paleozoic rocks, northern New York State**

1984-1985 **Limnology of acidified lakes, northern New York State**

1984-1985 **Early Paleozoic strata, northern New York State**

1985-1988 **Cretaceous & Neogene rocks & fossils of western Kansas**

1985-1988 **Late Paleozoic rocks & fossils of eastern Kansas**

1986-1987 **Paleozoic & Mesozoic strata, Utah & Colorado**

1988-1989 **Wisconsinan peat bogs, archeology, & vertebrates, northern Illinois**

1988-1995 **Late Paleozoic rocks & fossils of eastern Nebraska**

1989-1990 **Paleogene carnivores, Agate Fossil Beds National Monument**

1991-2002 **Vertebrate fossil resources of the Oglala National Grassland, Nebraska**

1996-present **Cenozoic lithostratigraphy & fossils of NW Nebraska & SW South Dakota**

1998-present **Cenozoic lithostratigraphy & fossils of north-central Nebraska**

1998-present **Cenocoic paleosols a& modern soils, northern Great Plains, USA**

2000-2005 **Pleistocene strata & paleosols of eastern Nebraska**

2006-present **Archeology of NW Nebraska & SW South Dakota**

2008-present **Groundwater and surface water of NW Nebraska & SW South Dakota**

STUDENT RESEARCH SUPERVISED

UNIVERSITY OF NEBRASKA-LINCOLN

1989-1992 **Michael R. Myers, Department of Geology [independent study].** *"Mortality profiles of* Mammuthus imperator *(Leidy), Sheridan County, Nebraska."*

1989-1992 **W. Brantly Wells, Department of Geology [independent study].** "*Vertebrate trace fossils of the Toadstool Park Trackway Site, Oglala National Grassland, Nebraska."*

1991-1992 **Dennis W. Moser, Department of Geology [class project].** *"Biostratinomy of the Haynies limestone bed (Pennsylvanian), a compound distal tempestite from southeastern Nebraska"* **(1992 STUDENT PAPER AWARD, North-Central Section, Geological Society of America)**.

1991-1992 **Steven L. Holmes, Department of Geology [class project].** *"Biostratinomy of the Haynies limestone bed (Pennsylvanian), a compound distal tempestite from southeastern Nebraska"* **(1992 STUDENT PAPER AWARD, North-Central Section, Geological Society of America)**.

1996-1997 **April Whitten, Department of Anthropology [MS thesis: LuAnn Wandsnider, Advisor].** *"Late Holocene environments at the Arner Hearth Site, northwestern Nebraska."*

1996-1997 **Justin A. Kinsley, Department of Museum Studies [Independent Study].** *"A vertebrate coprocoenocis from the Orella Member of the Brule Formation (Oligocene), northwestern Nebraska."*

2000-2001 **Erin L. Richardson, Department of Anthropology [MS thesis: LuAnn Wandsnider, Advisor].** *"Holocene landscape reconstruction at the Sand Creek Hearth Site, Dawes County, Nebraska, USA."*

UNIVERSITY OF CALIFORNIA-BERKELEY

1999-2003 **Caroline A. E. Stromberg, Department of Evolutionary and Integrative Biology [Ph. D. dissertation: David A. Lindberg, Advisor].** "*Origin and spread of Tertiary grasslands in North America"* **(2003 ALFRED SHERWOOD ROMER PRIZE, Society of Vertebrate Paleontology)**.

TULANE UNIVERSITY

2001-2002 **Stephanie G. Thomas, Department of Geology [American Association of State Geologists Undergraduate Field Mentorship Program].** *"Lithostratigraphic revision and redescription, White River and Arikaree groups"*

CHADRON STATE COLLEGE

2006-2007 **Jennifer L. Balmat, Department of Physical & Life Sciences [Undergraduate Capstone Thesis: Michael B. Leite, advisor]** *"Physical sedimentology of the Hudson-Meng Bison Kill Site, northwestern Nebraska"*

2006-2007 **Joshua W. Balmat, Department of Physical & Life Sciences [Undergraduate Capstone Thesis: Michael B. Leite, advisor]** *"Buried soils and ancient landscapes at the Hudson-Meng Bison Kill Site, northwestern Nebraska"*

OGLALA LAKOTA COLLEGE

2008-2009 **Helene Quiver-Gaddy, Department of Math, Science, & Technology [Undergraduate Senior Research: Hannan E. LaGarry, advisor]** *"New lithostratigraphic correlations of the White River Group from northwestern Nebraska to southwestern South Dakota"*

2009 **Dylan Brave, Department of Math, Science, & Technology [Undergraduate Junior Research: Hannan E. LaGarry, advisor]** *"New vertebrate trackway sites from the White River Group (Late Eocene) of southwestern South Dakota"*

STUDENTS EMPLOYED

1989-1992 **Michael R. Myers (undergraduate in Geology), University of Nebraska-Lincoln.** Vertebrate fossil resource inventories of the Oglala National Grassland.

1989-1995 **W. Brantly Wells (undergraduate in Geology), University of Nebraska-Lincoln.** Vertebrate fossil resource inventories of the Oglala National Grassland.

1989-1995 **Chris E. Rudnick (graduate in Geology), University of Nebraska-Lincoln.** Vertebrate fossil resource inventories of the Oglala National Grassland.

1991-1992 **Daryl K. Pavey (undergraduate in Biology), University of Nebraska-Lincoln.** Vertebrate fossil resource inventories of the Oglala National Grassland.

1993-1994 **Michelle K. David (graduate in Geology), Fort Hays State University.** Vertebrate fossil resource inventories of the Oglala National Grassland.

1994-1995 **Carrie L. Herbel (graduate in Geology), University of Nebraska-Lincoln.** Vertebrate fossil resource inventories of the Oglala National Grassland.

1996-1997 **David L. Dyer (graduate in Museum Studies), University of Nebraska-Lincoln.** Curated White River Group vertebrate fossils from northwestern Nebraska.

1996-1997 **Justin A. Kinsley (undergraduate in Museum Studies), University of Nebraska-Lincoln.** Curated White River Group vertebrate fossils from northwestern Nebraska.

2002-2003 **Stephanie G. Thomas (undergraduate in Geology), Tulane University.** Geologic mapping (STATEMAP) in northwestern Nebraska.

2007 **Jennifer L. Balmat (undergraduate in Geology), Chadron State College.** Renovation of the Eleanor Barbour Cook Museum of Geology.

2007 **Joshua W. Balmat (undergraduate in Geology), Chadron State College.** Renovation of the Eleanor Barbour Cook Museum of Geology.

2008-2009 **Helene Quiver-Gaddie (undergraduate in Environmental Science), Oglala Lakota College,** Lithostratigraphy of the White River Group in SW South Dakota.

2009-2010 **Dylan Brave (undergraduate in Conservation Biology), Oglala Lakota College,** Fossil mammal trackways of the White River Group, South Dakota.

2009-2010 **Curtis Belile (undergraduate in Natural Resources), Oglala Lakota College.** Uranium contamination in southwestern South Dakota.

2009-2010 **Elisha Yellow Thunder (undergraduate in Natural Resources), Oglala Lakota College.** Uranium contamination in southwestern South Dakota.

SCHOLARSHIPS, HONORS, & AWARDS

1980 **National Honor Society**
Alumni Fund Scholarship (Norwood-Norfolk Central School Alumni: $150)

1985 **Earth Stewardship Award** (Earth Stewardship Council, Washington, DC: $150)
Graduate Teaching Assistantship (FHSU Department of Earth Sciences: $2,450)

1986 **Graduate Teaching Assistantship** (FHSU Department of Earth Sciences: $3,250)

1987 **Sigma Xi** (Hays, Kansas Chapter)

1988 **Distinguished Masters Thesis Award** (Midwestern Council of Graduate Schools)
Graduate Teaching Assistantship (UNL Department of Geology: $6,000)

1989 **Graduate Teaching Assistantship** (UNL Department of Geology: $7,000)
M. C. Green Fieldwork Scholarship (University of Nebraska State Museum: $1,000)

1990 **Curatorial Assistantship** (University of Nebraska State Museum: $7,000)
Student Seminar Award – 1st place (UNL Department of Geology: $100)
Eunice & T. Mylan Stout Student Paper Award (Nebraska Geological Society: $50)
M. C. Green Fieldwork Scholarship (University of Nebraska State Museum: $1,000)

1991 **Global Climate Change Internship** (USDA NRCS National Soil Survey laboratory)
Eunice & T. Mylan Stout Student Paper Award (Nebraska Geological Society: $50)
Lincoln Gem & Mineral Club Scholarship (Lincoln Gem & Mineral Club:$150)
Curatorial Assistantship (University of Nebraska State Museum: $7,000)

1992 **Student Seminar Award – 1st place** (UNL Department of Geology: $100)
Student Paper Award (North-Central Section, Geological Society of America: $50)

1993 **Curatorial Assistantship** (University of Nebraska State Museum: $7,000)

1994 **Student Presentation Travel Award** (UNL Department of Geology: $250)

1996 **Volunteer Service Recognition** (Nebraska National Forest)
Student Presentation Travel Award (UNL Department of Geology: $250)

1997 **Extra Effort Cash Award** (USDA NRCS National Soil Survey Center: $500)

2004 **Letter of Commendation** (USDA NRCS: CSD STATEMAP Research Program)

2009 **Special Invitation Travel Award** (NSF BIO Directorate, 2009 JAM: $1200)

PROFESSIONAL MEMBERSHIPS & AFFILIATIONS

1985-1988 **PALEONTOLOGICAL SOCIETY**

1985-2000 **SOCIETY OF VERTEBRATE PALEONTOLOGY**

1986-2000 **KANSAS ACADEMY OF SCIENCE**

1987-2000 **SIGMA XI**

1988-present NEBRASKA ACADEMY OF SCIENCES

2006-2007 ASSOCIATION FOR WOMEN GEOSCIENTISTS

2006-present GEOLOGICAL SOCIETY OF AMERICA

SERVICE TO PROFESSIONAL ORGANIZATIONS

1992 **TECHNICAL SESSION CONVENER:** 7th Annual Meeting of the Society for the Preservation of Natural History Collections, Lincoln, Nebraska.

EARTH SCIENCE SECTION CHAIR: 102nd Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

1995 **SYMPOSIUM CO-CONVENER (with D. O. Terry, Jr. & R. M. Hunt, Jr.):** *Depositional Environments, Lithostratigraphy, and Biostratigraphy of the White River and Arikaree Groups.* 29th Annual Meeting of the North & South-Central Sections, Geological Society of America, Lincoln, Nebraska.

FIELD TRIP CO-LEADER (with D. O. Terry, Jr.): *The White River Group Revisited: Vertebrate Trackways, Ecosystems, and Stratigraphic Revision, Redefinition, and Redescription.* 29th Annual Meeting of the North & South Central Sections of the Geological Society of America, Lincoln, Nebraska.

1996 **FIELD TRIP CO-LEADER (with D. O. Terry, Jr., R. Benton, & E. Evanoff):** *Hayden's Lakes Revisited: The Origin and New Stratigraphic interpretations of the White River Sequence, South Dakota, Nebraska, and Wyoming.* 1996 Annual Meeting of the Geological Society of America, Denver, Colorado.

1998 **FIELD TRIP CO-LEADER (with B. A. Beasley):** *Fossil Resource Management of the Oglala National Grassland and the Toadstool Park Trackway Site*. 5th Conference on Fossil Resources, Rapid City, South Dakota.

1999 **EARTH SCIENCE SECTION CO-CHAIR (with S. Tucker):** 109th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

DEHNER AWARD JUDGE (posters): 131st Annual Meeting of the Kansas Academy of Science, Manhattan, Kansas.

2000 **SYMPOSIUM CO-CONVENER (with E. L. Richardson):** *Nebraska Stratigraphy*, 110th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

EARTH SCIENCE SECTION CO-CHAIR (with A. Carter): 110th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

2002 **EUNICE & T. MYLAN STOUT STUDENT PAPER AWARD JUDGE (platform):** 112th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

DEHNER AWARD JUDGE (platform): 134th Annual Meeting of the Kansas Academy of Science, Hays, Kansas.

2003 **EUNICE & T. MYLAN STOUT STUDENT PAPER AWARD JUDGE (platform):** 113th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

2004 **NEBRASKA GEOLOGICAL SOCIETY STUDENT PAPER AWARD JUDGE (platform):** 114th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

2005 **NEBRASKA GEOLOGICAL SOCIETY STUDENT PAPER AWARD JUDGE (platform):** 115th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

2006 **NEBRASKA GEOLOGICAL SOCIETY STUDENT PAPER AWARD JUDGE (platform):** 116th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

2007 **EARTH SCIENCE SECTION CHAIR:** 117th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

FIELD TRIP CO-LEADER (with L. A. LaGarry, M. P. Muniz, & L. D. Agenbroad): *Geoarcheology of the Hudson-Meng Bison Kill Site, Oglala National Grassland,*

Nebraska. 65th Annual Meeting of the Plains Anthropological Society, Rapid City, South Dakota.

2008 NEBRASKA GEOLOGICAL SOCIETY STUDENT PAPER AWARD JUDGE (platform): 118th Annual Meeting of the Nebraska Academy of Sciences, Lincoln, Nebraska.

SERVICE TO FEDERAL & STATE AGENCIES

1992 **Paleontological resources of the Oglala National Grassland,** US Forest Service (Region 2), US Forest Service Regional Team Leadership Meeting, Nebraska National Forest, Chadron, Nebraska.

1993-2004 **North American Geologic-map Data Model Science-Language Technical Team, Sedimentary & Surficial Deposits subgroups,** US Geological Survey National Geologic Mapping Working Group Steering Committee.

2004 **Petrocalcic soils tour of the north-central Great Plains (with J. Wilson & P. Young). NRCS National Soil Survey Laboratory,** USDA Natural Resources Conservation Service, Lincoln, Nebraska.

2009 **Tribal Colleges & Universities Information and Planning Meeting,** National Science Foundation BIO Directorate, Arlington, Virginia.

Research Experiences for Undergraduates Program workshop facilitator (with L. Patino), Tribal Colleges & Universities Program Leadership Conference, National Science Foundation, Albuquerque, New Mexico.

2009-2010 ***Ad hoc* Grant Proposal Reviewer,** National Science Foundation, Arlington, Virginia.

SERVICE TO COLLEGES & UNIVERSITIES

2007-2008 **FACULTY MENTOR (with 6 others),** *"People, Planet, & Prosperity"* Environmental Protection Agency (student) Sustainability Design Competition, Chadron State College, Chadron, Nebraska.

2008 **MANUSCRIPT REVIEWER (with 3 others),** *"Outside the Lines"* student essay competition and published volume, Chadron State College, Chadron, Nebraska.

2008-2009 **Instructional Affairs Committee (Distance Learning Subcommittee),** Oglala Lakota College, Kyle, South Dakota

2008-2009 **Higher Learning Commission Focus Visit Task Force (faculty representative),** Oglala Lakota College, Kyle, South Dakota

2008-2010 **Institutional (Research) Review Board (Department of Math, Science, & Technology representative),** Oglala Lakota College, Kyle, South Dakota

2009 **Graduate Study Advisory Group,** Oglala Lakota College, Kyle, South Dakota

JUDGE OF 7th & 8th GRADE PROJECTS, Oglala Lakota College Reservation-wide Science Fair, MIE Conference Room, Piya Wiconi Administrative Campus

"Oglala Lakota College Department of Math, Science, & Technology: the year in review," Oglala Lakota College Faculty Retreat Annual, Rapid City, South Dakota.

"Oglala Lakota College Department of Math, Science, & Technology: the year in review," Oglala Lakota College Board of Trustees Annual Retreat, Rapid City, South Dakota.

"Water and uranium on the Pine Ridge Reservation," All-Faculty Meeting Special Presentation, Piya Wiconi Administrative Campus, Oglala Lakota College, Kyle, South Dakota

SERVICE TO ACADEMIC DEPARTMENTS & STUDENT ORGANIZATIONS

1983 **SECRETARY, Students for Environmental Awareness** SUNY @ Potsdam

1984-1985 **VICE PRESIDENT, Students for Environmental Awareness** SUNY @ Potsdam

1984-1985 **Student Member, Geology Club** Geology Department, SUNY @ Potsdam

1985-1988 **Student Member, Sternberg Geology Club** FHSU Dept. of Earth Sciences

1988-1993 **Student Member, Geology Club** UN-L Department of Geosciences

1993-1995 **STUDENT REPRESENTATIVE at faculty meetings** UN-L Department of Geosciences

2006-2007 **Faculty Member, Geology Club** Chadron State College

2009 **"Student participation in research at OLC's Department of Math, Science, & Technology,"** Native Science Field Center Program National Leadership Conference, Rapid City, South Dakota.

"Student research opportunities in the OLC Department of Math, Science, & Technology," Department of Math, Science, & Technology Student Intern Meeting (October), Piya Wiconi Administrative Campus, Oglala Lakota College, Kyle, South Dakota

SERVICE TO COMMUNITY & NONPROFIT ORGANIZATIONS

1993 **FIELD TRIP CO-LEADER (with L. A. LaGarry & D. A. Nixon)** *"Nebraska Rocks!"* Homestead Council, Girl Scouts of America.

2008 **Expert opinion,** *"Geological and hydrological implications of proposed Crow Butte Resources' North Trend Expansion of in-situ leach mining north of Crawford, Nebraska,"* provided to Western Nebraska Resources Council, Owe Aku, and concerned residents http://savecrowbutte.org/files/Crow%20Butte%20LBP-08-06%20042908.pdf

PROGRAM CHAIR & MODERATOR, *"Our Water, Our Future: A Hard Look at the Dry Facts"* Town Hall Meeting, Chadron State College Student Center Ballroom, Chadron, Nebraska.

Expert Opinion, *"Geology, groundwater resources, and implications of Crow Butte Resources' continued in-situ leach mining north of Crawford, Nebraska,"* provided to Western Nebraska Resources Council, Owe Aku, concerned residents, and the Oglala Sioux Tribe http://plentyinternational.wordpress.com/2008/07/31/expert-opinion-regarding-isl-mining-in-dawes-county-nebraska/

2009 **PROGRAM CO-CHAIR (with Darwin Apple) & MODERATOR,** *"Informational Meeting Between Oglala Lakota College and Renewable Energy Development Experts*," Oglala Lakota College MIE (Math & Science Department) Conference Room, Kyle, South Dakota

PROFESSIONAL CONFERENCES ATTENDED (dates)

American Association for the Advancement of Science (1988)

Cenozoic Vertebrate Tracks and Traces Conference (2007)

Conference on Fossil Resources (1992, 1994, 1998)

Digital Mapping Techniques Conference (2000)

Geological Society of America (1994, 1996, 1999, 2006-07)

Geological Society of America (Northeast Region) (1984)

Geological Society of America (North-central Region) (1992, 1995)

Island in the Plains Historical & Archeological Symposium (2006-07)

Kansas Academy of Science (1987-88, 1991-92, 1994, 1999, 2001-02)

National Science Foundation Joint Annual Meeting (2009)

Nebraska Academy of Sciences (1989-93, 1995-2000, 2002-08)

North American Paleontological Convention (2001)

Northern Plains Governors' Conference (1992)

Plains Anthropological Society (2006-07)

Society of Vertebrate Paleontology (1985, 1987, 1991-93)

Society for the Preservation of Natural History Collections (1992)

Western South Dakota Hydrology Conference (2009)

PROFESSIONAL DEVELOPMENT ACTIVITIES

1991 **Laboratory Exercises in Paleopedology (Instructor: G. Retallack),** University of Nebraska-Lincoln Department of Geology, Lincoln, NE

1999 **Digital Mapping Methods: Accurate Digital Data Capture and Analysis for the Field Geoscientist,** Geological Society of America short course, Denver, CO

2008 **Quality Education for Minorities Network Grant-writing Workshop,** National Science Foundation (Research in Disabilities Education Program), Washington, D.C.

National Science Foundation Tribal College Workshop, NSF Office of Budget, Finance, & Award Management (Division of Institution & Award Support), Arlington, VA

2009 **UNCFSP Tribal College Technical Assistance Training,** United Negro College Fund Special Projects unit, Albuquerque, NM

Funding Opportunities (NSF BIO Directorate), National Science Foundation 2009 Joint Annual Meeting, Washington, DC

Special Networking Session (NSF BIO Directorate), National Science Foundation 2009 Joint Annual Meeting, Washington, DC

Tribal Colleges & Universities Program Leadership Conference, National Science Foundation (Division of Education & Human Resources), Albuquerque, New Mexico

Incorporating Native Culture into the STEM Curriculum, National Science Foundation (Tribal Colleges & Universities Program/Quality Education for Minorities Network), Albuquerque, New Mexico

INVITED PUBLIC LECTURES

1994 ***"Mapping vertebrate fossil resources in northwestern Nebraska"*** Stout Lecture Series, Department of Geology, University of Nebraska-Lincoln, Lincoln, Nebraska..

1996 ***"The geology of Nebraska north of the Pine Ridge"*** CHAUTAUQUA '96, Chadron/ Dawes County Chamber of Commerce, Chadron, Nebraska.

1999 ***"New stratigraphic classification of the 'basal Chadron Formation' of northwestern Nebraska"*** Crawford Rock Club Annual Rock & Fossil Swap, Crawford, Nebraska.

2002 ***"Late Cretaceous and early Tertiary stratigraphy of the French Creek agate locality near Fairburn, South Dakota"*** **(with L. A. LaGarry)** 54th Annual Lincoln Gem & Mineral Show, Lincoln, Nebraska.

2003 ***"Diet and behavior in fossil carnivores"*** Friends of the Prehistoric Prairies Discovery Center Annual Meeting, Crawford, Nebraska.

2004 ***"Recent advances in the Tertiary stratigraphy of Nebraska"*** Water Center Seminar Series, School of Natural Resources, University of Nebraska-Lincoln, Lincoln, Nebraska.

"Tracks and trails from the Tertiary of Nebraska" **(with W. B. Wells)** Nebraska Geological Society, Omaha, Nebraska.

2005 ***"Recent research at Agate Fossil Beds National Monument"*** 40th Anniversary Celebration Program, Agate Fossil Beds National Monument, Nebraska.

2006 ***"Geological survey (1996-2006) in northwestern Nebraska"*** 2nd Annual Earth Day Celebration, Chadron State College, Chadron, Nebraska.

2008 ***"Introduction and agenda- Our Water, Our Future: A Hard Look at the Dry Facts"*** Town Hall Meeting, Chadron State College Student Center Ballroom, Chadron, Nebraska.

"Geology and groundwater resources of northwestern Nebraska and southwestern South Dakota" **(with L. A. LaGarry)** Oglala Sioux Tribe Natural Resources Regulatory Agency meeting, Pine Ridge, South Dakota

"Oglala Lakota College's potential role in managing the vertebrate fossil resources of the Pine Ridge Reservation" Oglala Sioux Parks & Recreation Authority public information meetings in Red Shirt and Kyle, South Dakota

2009 ***"The local uranium mining scene"*** Western Mining Action Network annual meeting (Defenders of the Black Hills), Rapid City, South Dakota

GRANTS & CONTRACTS (~ $5,245,550 to date, including matching funds)

1991 **CO-INVESTIGATOR (with R. M. Hunt, Jr.): Nebraska National Forest** Paleontological resource inventories of the Oglala National Grassland **($40,000).**

PRINCIPLE INVESTIGATOR: Nebraska Geological Society's Yatkola-Edwards Research Grant Vertebrate taphonomy and paleoecology in NW Nebraska **($250).**

1992 **CO-INVESTIGATOR (with R. M. Hunt, Jr.): Nebraska National Forest** Paleontological resource inventories of the Oglala National Grassland **($48,000).**

1993 **CO-INVESTIGATOR (with R. M. Hunt, Jr.): Nebraska National Forest** Paleontological resource inventories of the Oglala National Grassland **($42,000).**

1994 **CO-INVESTIGATOR (with R. M. Hunt, Jr.): Nebraska National Forest** Paleontological resource inventories of the Oglala National Grassland **($42,000).**

1995 **CO-INVESTIGATOR (with R. M. Hunt, Jr.): Nebraska National Forest** Paleontological resource inventories of the Oglala National Grassland **($60,000).**

1999 **CO-INVESTIGATOR (with J. B. Swinehart): US Geological Survey STATEMAP Program** Geologic Mapping in NW Nebraska **($178,000).**

2000 **CO-INVESTIGATOR (with J. B. Swinehart & R. M. Hunt, Jr.): US Geological Survey STATEMAP Program** Geologic mapping in NW Nebraska **($192,000).**

2001 **CO-INVESTIGATOR (with J. B. Swinehart & B. E. Bailey): US Geological Survey STATEMAP Program** Geologic mapping in NW Nebraska **($196,000).**

2002 **CO-INVESTIGATOR (with J. B. Swinehart & B. E. Bailey): US Geological Survey STATEMAP Program** Geologic mapping in NW Nebraska **($200,000).**

2003 **CO-INVESTIGATOR (with J. B. Swinehart, B. E. Bailey, & R. M. Hunt, Jr.): US Geological Survey STATEMAP Program** Geologic mapping in northwestern Nebraska **($220,000).**

2004 **CO-INVESTIGATOR (with J. B. Swinehart, R. M. Joeckel, B. E. Bailey, R. M. Hunt, Jr., G. A. Liggett, & R. Lisichenko): US Geological Survey STATEMAP Program** Geologic mapping in northwestern and eastern Nebraska **($340,000).**

2005 **CO-INVESTIGATOR (with J. B. Swinehart, R. M. Joeckel, M. B. Leite, and R. Lisichenko): U. S. Geological Survey STATEMAP Program** Geologic mapping in northwestern and southeastern Nebraska **($196,000).**

2006 **CO-INVESTIGATOR (with L. A. LaGarry & M. B. Leite): US Forest Service Region 2 (Hudson-Meng Bison Kill Site)** Holocene geochronology in the vicinity of the Hudson-Meng Bison Kill Site **($11,200).**

2007 **CO-INVESTIGATOR (with R. Weedon, M. B. Leite, C. McAllister, S. Rolfsmeier, & L. Stewart-Phelps): Chadron State College VISION 2011 Strategic Planning Committee** Laying the groundwork for the second century of the CSC natural history museum **($37,790).**

CO-INVESTIGATOR (with M. B. Leite): Nebraska National Forest Photogrammetry and casting of the Toadstool Park Trackway Site, Oglala National Grassland, Nebraska **($15,400).**

2009 **CO-INVESTIGATOR (with G. Giraud): National Science Foundation Model Institutions for Excellence Phase III** Modular science, technology, engineering, and mathematics (STEM) course content for sharing among tribal colleges **($900,000).**

CO-INVESTIGATOR (with C. J. Tinant & G. Giraud): National Science Foundation Tribal Colleges & Universities Program Phase I Faculty and curriculum development, scientific collections and library development, and student research support and dissemination **($2,500,000).**

PERMITS & AUTHORIZATIONS

1990 **SPECIAL-USE PERMIT (3 years, User Number 2033)** Nebraska National Forest, Chadron, Nebraska. Permission to excavate federally owned and protected vertebrate fossils from the Oglala National Grassland during dissertation fieldwork and paleontological resource inventories.

1991-1995 **ARCHEOLOGICAL SITE EVALUATION CLEARANCE** Nebraska National Forest, Chadron, Nebraska. Clearance to assess potential archeological sites during dissertation fieldwork and paleontological resource inventories of the Oglala National Grassland.

1993 **SPECIAL-USE PERMIT RENEWAL (User Number 2033-4)** Nebraska National Forest, Chadron, Nebraska. Permission to excavate federally owned and protected vertebrate fossils from the Oglala National Grassland during dissertation fieldwork and paleontological resource inventories.

1994-1995 **SPECIAL-USE PERMIT (3 years, User Number 2033-4)** Nebraska National Forest, Chadron, Nebraska. Permission to excavate federally owned and protected vertebrate fossils from the Oglala National Grassland during dissertation fieldwork and paleontological resource inventories.

1998-2000 **ARCHEOLOGICAL SITE EVALUATION CLEARANCE** Nebraska National Forest, Chadron, Nebraska. Clearance to assess potential archeological sites during STATEMAP fieldwork in the Pine Ridge Ranger District, Dawes County, Nebraska.

1998-2000 **SPECIAL-USE PERMIT (3 years, User Number 2033-4)** Nebraska National Forest, Chadron, Nebraska. Permission to excavate federally owned and protected vertebrate fossils from the Pine Ridge Ranger District, Dawes County, Nebraska, during STATEMAP fieldwork.

1998-2000 **SPECIAL-USE PERMIT (3 years, User Number 2033-4)** Nebraska National Forest, Chadron, Nebraska. Permission to trench covered or weathered exposures and collect rock and volcanic ash samples from the Pine Ridge Ranger District, Dawes County, Nebraska, during STATEMAP fieldwork.

MISCELLANEOUS

TELEVISION APPEARANCES

1996 **RESTLESS PRAIRIE (science documentary: 60 min.)** Joe Turco, Producer. Science, Outreach, & Specials Unit, University of Nebraska-Lincoln Television. Broadcast on Nebraska Educational Television (NETV) Network. *12 min segment: Toadstool Park Trackway site and Fossil Conservation on the Oglala National Grassland* **(with W. B. Wells & D. A. Nixon).**

RADIO APPEARANCES

2008 **Sound Off (KCSR Radio, Chadron, Nebraska: 30 min.)** *"Our Water, Our Future: A Hard Look at the Dry Facts"* Town Hall Meeting, Chadron State College Student Center Ballroom **(with Mr. Glen Price, landowner**).

2008 **Community Focus (KCSR Radio, Chadron, Nebraska: 15 min.)** *"Our Water, Our Future: A Hard Look at the Dry Facts"* Town Hall Meeting, Chadron State College Student Center Ballroom.

FIELD HANDBOOK DATA SHEETS

1998 Schoeneberger, P. J., D. A. Wysocki, E. C. Benham, & **H. E. LaGarry. *Miscellaneous,*** pp. 7-1 to 7-14 *in* (P. J. Schoeneberger, D. A. Wysocki, E. C. Benham, & W. D. Broderson, compilers) *Field Book for Describing and Sampling Soils (Ver. 1.1).* USDA Natural Resources Conservation Service, National Soil Survey Center, Lincoln NE.

2002 Schoeneberger, P. J., D. A. Wysocki, E. C. Benham, & **H. E. LaGarry. *Miscellaneous,*** pp. 7-1 to 7-14 *in* (P. J. Schoeneberger, D. A. Wysocki, E. C. Benham, & W. D. Broderson, compilers) *Field Book for Describing and Sampling Soils (Ver. 2.1).* USDA Natural Resources Conservation Service, National Soil Survey Center, Lincoln NE.

ILLUSTRATION CREDITS

1985 ***"Artist's conception of a middle Ordovician life scene during Trenton (limestone) time. The orthocone cephalopod is similar to those found at the Clairmont Quarry."*** p. 297 *in* Van Diver, B. B. 1985. *Roadside Geology of New York.* Missoula, Montana, Mountain Press Publishing Company.

1996 ***"USGS quadrangles (solid lines) examined in the CSD open-file report by LaGarry and LaGarry, adjacent quadrangles also mapped, and federal lands of the Oglala National Grassland."*** p. 35 *in* Flowerday, C. A. 1996. *Fossil inventories yield geologic mapping, revision of the White River Group.* Resource Notes, 10:33-35.

PHOTOGRAPH CREDITS

1988 ***"Below: Each biological specimen found during the excavation was isolated from the majority of the surrounding sediment and was subsequently wrapped for removal to the laboratory. A portion of the pelvis of the stag-moose is seen in the center of the photo, and spruce logs in the foreground,"*** p. 41 *in* Warren, R. E. & R. W. Graham. 1988. Cervalces*: an Ice Age discovery.* The Living Museum, 50(3):38-41.

1996 ***"A field party made up of CSD, UNL Geology, and UN State Museum geologists examine the Chamberlain Pass Formation near Toadstool Park in northern Sioux County. Observers are (from left) Leigh Anne LaGarry, CSD; Dennis Terry, UNL Geology; Dave Loope, UNL Geology; Dave Nixon, UN State Museum; Brant Wells, UNL Geology; and Jim Swinehart, CSD."*** p. 33 *in* Flowerday, C. A. 1996. *Fossil inventories yield geologic mapping, revision of the White River Group.* Resource Notes, 10:33-35.

2004 ***"The petrocalcic field tour led by SNR geoscientist Hannan LaGarry stops to look at the Box Butte Formation on the highway south of Marsland in the upper Niobrara River valley. Co-leader and former SNR soil scientist Phil Young (far right, crouching) talks to the group, which includes scientists from various Great Plains offices of the U. S. Natural Resources Conservation Service and from the NRCS National Soil Survey Center in Lincoln. SNR soil scientist Francis Belohlavy sits in the cab of the white pickup."*** p. 6 *in* Flowerday, C. A. 2004. SNR tour helps federal scientists solve soil classification riddle, saves money. Natural Resource Links, 4(4):1-12.

"An example of a calcic, not a petrocalcic, horizon near Marsland. White concretions show carbonate buildup. Marks on tape measure are every 10 centimeters." p. 6 *in* Flowerday, C. A. 2004. SNR tour helps federal scientists soil classification riddle, saves money. Natural Resource Links, 4(4):1-12.

BOOK COVERS

1998 ***"Fine-grained volcaniclastic rocks of the White River Group initially studied by N. H. Darton (1899) at the Pine Ridge escarpment in northwestern Nebraska."*** Terry, D. O., Jr., H. E. LaGarry, & R. M. Hunt, Jr. (eds.). 1998. Depositional Environments, Lithostratigraphy, and Biostratigraphy of the White River and Arikaree Groups (Late Eocene to Early Miocene, North America). Geological Society of America Special Paper 325, 216 pp.

NEWSPAPER ARTICLES

2006 ***"Earth Day celebration to focus on water in the High Plains"*** **(with L. A. LaGarry)** p. 4A *in* The Chadron Record, Wednesday, April 12, 2006 (www.thechadronnews.com).

BIBLIOGRAPHY

PEER-REVIEWED PAPERS

1990 Thomasson, J. R., R. J. Zakrzewski, **H. E. LaGarry,** & D. E. Mergen. ***A late Miocene (Late Early Hemphillian) biota from northwestern Kansas*.** National Geographic Research, 6(2):231-244.

1993 **LaGarry, H. E.** & M. R. Myers. ***Mortality profiles of* Mammuthus imperator *(Leidy), Sheridan County, Nebraska.*** Transactions of the Kansas Academy of Science, 96(3-4):196-203.

1994 **LaGarry, H. E.** ***Results & recommendations of the 1991 paleontological resource survey of the Oglala National Grassland,*** pp. 69-72 *in* (R. Benton & A. Elder, eds.) Proceedings of the 3rd Conference on Fossil Resources. Natural Resources Report NPS/NRFOBU/NRR-94-14, 98 p.

1995 Terry, D. O., Jr., **H. E. LaGarry,** & W. B. Wells. ***The White River Group revisited: vertebrate trackways, ecosystems, and lithostratigraphic revision, redefinition, and redescription,*** pp. 43-57 *in* (C. Flowerday, ed.) Geologic field trips in Nebraska and adjacent parts of Kansas and South Dakota. University of Nebraska-Lincoln Conservation and Survey Division Guidebook 10, 136 p.

1997 **LaGarry, H. E.** ***Paleontological resource inventories of the Oglala National Grassland: a model for generating paleontological and geological research on public lands,*** pp. 108-113 *in* (M. Johnson & J. McChristal, eds.) Proceedings of the 4th Conference on Fossil Resources. Natural Resources Report NPS/NRFLFO/NRR-97/01, 239 p.

LaGarry, H. E. & D. O. Terry, Jr. ***Regional distribution of lithotopes within the Chadron Formation of northwestern Nebraska,*** pp. 9-22 *in* (R. Hunter, ed.) Geology and paleontology of the White River Formation. Tate Geological Museum Guidebook 2, 139 p.

1998 Terry, D. O. Jr., **H. E. LaGarry,** & R. M. Hunt, Jr. (eds.). ***Depositional environments, lithostratigraphy, and biostratigraphy of the White River and Arikaree Groups (Late Eocene to Early Miocene, North America).*** Geological Society of America Special Paper 325, 216 p.

Terry, D. O., Jr. & **H. E. LaGarry.** ***The Big Cottonwood Creek Member: a new member of the Chadron Formation of northwestern Nebraska,*** pp. 117-142 *in* (D. O. Terry, Jr., H. E. LaGarry, & R. M. Hunt, Jr., eds.) Depositional environments, lithostratigraphy, and biostratigraphy of the White River and Arikaree Groups (Late Eocene to Early Miocene, North America). Geological Society of America Special Paper 325, 216 p.

LaGarry, H. E. ***Lithostratigraphic revision and redescription of the Brule Formation (White River Group), northwestern Nebraska*,** pp. 63-92 *in* (D. O. Terry, Jr., H. E. LaGarry, & R. M. Hunt, Jr., eds.) Depositional environments, lithostratigraphy, and biostratigraphy of the White River and Arikaree Groups (Late Eocene to Early Miocene, North America). Geological Society of America Special Paper 325, 216 p.

LaGarry, H. E., W. B. Wells, D. O. Terry, Jr., & D. A. Nixon. ***The Toadstool Park Trackway Site, Oglala National Grassland, Nebraska,*** pp. 92-107 *in* (J. Martin & R. Benton, eds.) Proceedings of the 5th Conference on Fossil Resources. Dakoterra 5, 143 p.

2000 Wysocki, D. A., P. J. Schoeneberger, & **H. E. LaGarry. *Geomorphology of soil landscapes*,** pp. E5-E39 *in* (M. E. Sumner, editor-in-chief) CRC Handbook of Soil Science, Chemical Rubber Company Press.

2004 **LaGarry, H. E. *Taphonomic evidence of bone processing from the Oligocene of northwestern Nebraska***. University of Nebraska-Lincoln School of Natural Resources Professional Paper 2, 35 p.

2005 Wysocki, D. A., P. J. Schoeneberger, & **H. E. LaGarry. *Soil surveys: a window to the subsurface.*** Geoderma 126:167-180.

2007 Fielding, C. R., **H. E. LaGarry,** L. A. LaGarry, B. E. Bailey, & J. B. Swinehart. ***Sedimentology of the Whiteclay gravel beds in northwestern Nebraska, USA: structurally controlled drainage promoted by early Miocene uplift of the Black Hills Dome.*** Sedimentary Geology 202:58-71.

2008 **LaGarry, H. E. *Taphonomic evidence of predation and scavenging from the Minium Quarry Local Biota (late Miocene) of north-central Kansas, USA,*** pp. 61-76 *in* (G. H. Farley & J. R. Choate, eds.) Unlocking the Unknown: Papers Honoring Dr. Richard J. Zakrzewski. Fort Hays Studies Special Issue 2, 153 p.

Diffendal, R. F., M. R. Voorhies, E. J. Voorhies, **H. E. LaGarry,** C. L. Timperley, & M. E. Perkins. ***Geologic Map of the O'Neill 1^{o} x 2^{o} Quadrangle, Nebraska, with Configuration Maps of Surfaces of Formations (1:250,000).*** University of Nebraska-Lincoln School of Natural Resources (Conservation & Survey Division) map GMC-34 (25" x 36" map w/ 29 p. explanation booklet).

ABSTRACTS

1987 **LaGarry, H. E. *Camelidae (Mammalia: Artiodactyla) from the Minium Quarry local biota (Early Hemphillian), Graham County, Kansas.*** Kansas Academy of Science Abstracts, 6:29.

1988 **LaGarry, H. E. *Notes on the taphonomy of the Early Hemphillian-aged Minium Quarry local biota, Graham County, Kansas.*** Kansas Academy of Science Abstracts, 7:22.

1989 **LaGarry, H. E.,** C. E. Rudnick, & J. I. Kirkland. ***Biostratinomy, paleoecology, and storm wave disturbance in the Pennsylvanian-aged "Haynies limestone" bed (Deer Creek Fm.) of Cass County, Nebraska.*** Proceedings of the 99th Annual Meeting of the Nebraska Academy of Sciences, pp. 58-59.

Bailey, B. E., C. L. Herbel, **H. E. LaGarry,** C. E. Rudnick, & M. R. Voorhies. ***Population dynamics of Pleistocene* Equus *from the "*Equus *beds:" age profiles of fossil horse dentitions from Gordon Quarry, Late Irvingtonian, Sheridan County, Nebraska.*** Proceedings of the 99th Annual Meeting of the Nebraska Academy of Sciences, p. 49.

1990 **LaGarry, H. E.** & C. Wellstead. ***New Permian vertebrate localities in the Eskridge Fm., Richardson County, Nebraska.*** Proceedings of the 100th Annual Meeting of the Nebraska Academy of Sciences, pp. 61-62

1991 **LaGarry, H. E. *Carnivore-induced bone modification patterns in large ungulates of the Minium Quarry local biota (Late Miocene) of north-central Kansas.*** Kansas Academy of Science Abstracts, 10:16.

LaGarry, H. E. *Taphonomic evidence of predation and scavenging in the Minium Quarry local biota (Early Hemphillian) of northwestern Kansas.* Journal of Vertebrate Paleontology-Abstracts, 11(3):41A.

LaGarry, H. E. ***Stratigraphy and sedimentology of the upper Trenton Group (Middle Ordovician), Kellogg Hill, New York.*** Proceedings of the 101st Annual Meeting of the Nebraska Academy of Sciences, pp. 58-59.

LaGarry, H. E. ***Community paleoecology and biofacies analysis of the upper Trenton Group (Middle Ordovician), Kellogg Hill, New York.*** Proceedings of the 101st Annual Meeting of the Nebraska Academy of Sciences, p. 59.

1992 **LaGarry, H. E.** ***1991 paleontological resource survey of the Oglala National Grassland (Roundtop 7.5' Quadrangle), Sioux County, Nebraska.*** Kansas Academy of Science Abstracts, 11:22.

LaGarry, H. E., C. E. Rudnick, D. W. Moser, & S. L. Holmes. ***Taphonomy of the Haynies limestone bed (Pennsylvanian), a compound distal tempestite from southeastern Nebraska.*** Geological Society of America Abstracts with Programs, 24(4):7.

LaGarry, H. E. ***Cladistic reanalysis of the Camelidae (Mammalia: Tylopoda).*** Proceedings of the 102nd Annual Meeting of the Nebraska Academy of Sciences, pp. 68-69.

LaGarry, H. E. ***The impact of unauthorized collecting of vertebrate fossils on the Oglala National Grassland (Roundtop 7.5' Quadrangle), Sioux County, Nebraska.*** Proceedings of the 102nd Annual Meeting of the Nebraska Academy of Sciences, p. 69.

LaGarry, H. E. ***Unauthorized collecting of fossil vertebrates on federal lands in northwest Nebraska: a case study.*** Seventh Annual Meeting of the Society for the Preservation of Natural History Collections Program and Abstracts, p. 17.

1993 Myers, M. R. & **H. E. LaGarry.** ***Mortality profile of Mammuthus imperator (Leidy) from the Rushville and Gordon Quarries (Irvingtonian) of Sheridan County, Nebraska.*** Proceedings of the 103rd Annual Meeting of the Nebraska Academy of Sciences, pp. 61-62.

Nixon, D. A. & **H. E. LaGarry.** ***Oligocene trackways in the White River Group type section at Toadstool Park, Sioux County, Nebraska.*** Proceedings of the 103rd Annual Meeting of the Nebraska Academy of Sciences, pp. 64-65.

LaGarry, H. E., D. A. Nixon, & W. B. Wells. ***1992 USDA Forest service survey and assessment of Toadstool Park as a sensitive site.*** Proceedings of the 103rd Annual Meeting of the Nebraska Academy of Sciences, pp. 61-62.

Nixon, D. A. & **H. E. LaGarry.** ***New trackway site in the White River Group type section at Toadstool Park, Nebraska; paleoecology of an Oligocene braided stream, riparian woodland, and adjacent grassland.*** Journal of Vertebrate Paleontology – Abstracts, 13(3):51A.

LaGarry, H. E. ***Survey of paleontological resources on U. S. Forest Service lands (Oglala National Grassland) in NW Nebraska.*** Journal of Vertebrate Paleontology-Abstracts, 13(3):45A.

1994 Terry, D. O., Jr. & **H. E. LaGarry.** ***Lithostratigraphic correlation and provisional redefinition of the Eocene-Oligocene White River Group, Nebraska and South Dakota.*** Geological Society of America Abstracts with Programs, 26(7):249.

LaGarry, H. E., D. A. Nixon, W. B. Wells, & B. A. Beasley. ***1993 paleontological resource survey of the Oglala National Grassland, Nebraska.*** Kansas Academy of Science Abstracts, 13:24.

LaGarry, H. E. ***Results and recommendations of the 1991 paleontological resource survey of the Oglala National Grassland*****,** p. 25 *in* (R. Benton & A. Elder, eds.) Proceedings of the Third Conference on Fossil Resources in the National Park Service (Natural Resources Report NPS/NRFOBU/NRR-94/14).

1995 **LaGarry, H. E.** ***Provisional revision of lithostratigraphic boundaries of the Brule Formation in northwestern Nebraska.*** Geological Society of America Abstracts with Programs, 27(3):66-67.

Terry, D. O., Jr. & **H. E. LaGarry.** ***Provisional redescription and redefinition of the upper part of the Chadron Formation in northwestern Nebraska.*** Geological Society of America Abstracts with Programs, 27(3):89.

Wells W. B., D. O. Terry, Jr., & **H. E. LaGarry**. ***Stratigraphic implications of a fluvial origin for the "nodular zones," Brule Formation (Orella Member), northwestern Nebraska*****.** Geological Society of America Abstracts with Programs, 27(3):95.

LaGarry, H. E. ***Bone processing behaviors of extinct mammals from the Eocene-Oligocene White River Group of northwestern Nebraska*****,** Geological Society of America Abstracts with Programs, 27(3):67.

LaGarry, H. E., W. B. Wells, D. A. Nixon, & B. A. Beasley. ***1994 paleontological resource survey of the Oglala National Grassland, Nebraska.*** Proceedings of the 105th Annual Meeting of the Nebraska Academy of Sciences, pp. 55-56.

LaGarry, H. E. ***Geology of the "Old Floyd Hall Place" (UNSM localities Sx-6 and Sx-7), Sioux County, Nebraska.*** Proceedings of the 105th Annual meeting of the Nebraska Academy of Sciences, p. 55.

1996 **LaGarry, H. E.**, L. A. LaGarry, & D. O. Terry, Jr. ***A new vertebrate fauna from the Chamberlain Pass Fm. (Eocene), Sioux County, Nebraska.*** Proceedings of the 106th Annual Meeting of the Nebraska Academy of Sciences, pp. 45-46.

LaGarry, H. E. & L. A. LaGarry ***New geologic maps of the Montrose, Orella, Wolf Butte, Roundtop, and Horn 7.5' USGS Quadrangles, Sioux and Dawes Counties, Nebraska.*** Proceedings of the 106th Annual Meeting of the Nebraska Academy of Sciences, p. 45.

LaGarry, H. E., W. B. Wells, & B. A. Beasley. ***1995 Paleontological resource survey of the Oglala National Grassland, Sioux and Dawes counties, Nebraska.*** Proceedings of the 106th Annual Meeting of the Nebraska Academy of Sciences, p. 46-47.

LaGarry, H. E., L. A. LaGarry, & B. A. Beasley. ***1995 Paleontological resource survey of the Samuel R. McKelvie National Forest, Cherry County, Nebraska.*** Proceedings of the 106th Annual Meeting of the Nebraska Academy of Sciences, p. 47.

LaGarry, H. E., L. A. LaGarry, & B. A. Beasley. ***1995 Paleontological resource survey of the Bessey Unit of the Nebraska National Forest, Thomas and Blaine Counties, Nebraska.*** Proceedings of the 106th Annual Meeting of the Nebraska Academy of Sciences, p. 46.

LaGarry, H. E., W. B. Wells, & D. O. Terry, Jr. ***A giant notostracan (?) from the Brule Formation (Oligocene) at Toadstool Park, Sioux County, Nebraska.*** Geological Society of America Abstracts with Programs, 28(4):14.

1997 Whitten, A., P. Reeder, L. Wandsnider, & **H. E. LaGarry.** ***Late Holocene environments at the Arner Site, northwestern Nebraska.*** Proceedings of the 107th Annual Meeting of the Nebraska Academy of Sciences, p. 12.

Kinsley, J. A. & **H. E. LaGarry.** ***Preliminary report of a vertebrate coprocoenocis from the Orella Member of the Brule Formation (Oligocene), northwestern Nebraska.*** Proceedings of the 107th Annual Meeting of the Nebraska Academy of Sciences, p. 46.

Terry, D. O., Jr. & **H. E. LaGarry.** ***Regional distribution of lithotopes within the Chadron Formation of northwestern Nebraska.*** The Contact, 44(6):2-4.

LaGarry, H. E. ***Regional distribution of lithotopes within the Brule Formation of northwestern Nebraska,*** p. 30 *in* (R. A. Hunter, ed.) The Geology and Paleontology of the White River Formation, Tate Museum Guidebook 2, 139 p.

1998 **LaGarry, H. E.** ***"Coyote-like" feeding behaviors of Oligocene carnivores based on coprolite contents.*** Proceedings of the 108th Annual Meeting of the Nebraska Academy of Sciences, p. 47.

LaGarry, H. E. ***"Wolf-like" feeding behaviors of Oligocene carnivores based on evidence of bone processing.*** Proceedings of the 108th Annual Meeting of the Nebraska Academy of Sciences, p. 48.

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NEBRASKA GEOLOGICAL SURVEY OPEN-FILE MAPS

Table 1. Open-file (OFM) and open-file digital (OFDM) maps from the Alliance 1:250,000 Quadrangle available from the Nebraska Geological Survey (University of Nebraska-Lincoln Conservation & Survey Division, School of Natural Resources). Digital maps were produced by the Department of Geosciences at Fort Hays State University, supervised by R. Lisichenko, J. Heinrichs, G. Liggett, and K. R Neuhauser. All maps are Nebraska quadrangles except as noted.

Map Name[1]	Date[2]	Map No.[3]	Authors
Sherrill Hills (WY-NE)	1997	53	LaGarry & LaGarry
Story	1997	54	LaGarry & LaGarry
(digital version 1.1)	2001	54D	LaGarry, LaGarry, & Swinehart
Story NE	1997	55	LaGarry & LaGarry
(digital ver. 1.1)	2001	55D	LaGarry, LaGarry, & Swinehart
Lone Tree Ranch	1997	56	LaGarry & LaGarry
(digital ver. 1.1)	2001	56D	LaGarry, LaGarry, & Swinehart
Wayside	1997	57	LaGarry & LaGarry
(digital ver. 1.1)	2001	57D	LaGarry, LaGarry, & Swinehart
Bohemian Creek	1997	58	LaGarry & LaGarry
(digital ver. 1.1)	2001	58D	LaGarry, LaGarry, & Swinehart
Kirtley (WY-NE)	1997	59	LaGarry & LaGarry
Warbonnet Ranch	1997	60	LaGarry & LaGarry
(digital ver. 1.1)	2001	60D	LaGarry, LaGarry, & Swinehart
Bodarc	1997	61	LaGarry & LaGarry
(digital ver. 1.1)	2001	61D	LaGarry, LaGarry, & Swinehart
Five Points	1997	62	LaGarry & LaGarry
(digital ver. 1.1)	2001	62D	LaGarry, LaGarry, & Swinehart
Whitney	1997	63	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2001	63D	LaGarry, LaGarry, & Swinehart
Trunk Butte	1997	64	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2001	64D	LaGarry, LaGarry, & Swinehart
Chadron West	1997	65	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2001	65D	LaGarry, LaGarry, & Swinehart
Crawford	1998	66	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	66D	LaGarry, LaGarry, & Swinehart
Crow Butte	1998	67	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	67D	LaGarry, LaGarry, & Swinehart
Chimney Butte	1998	68	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	68D	LaGarry, LaGarry, & Swinehart
Coffee Mill Butte	1998	69	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	69D	LaGarry, LaGarry, & Swinehart
Dead Mans Creek	1998	70	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	70D	LaGarry, LaGarry, & Swinehart
Belmont	1998	71	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	71D	LaGarry, LaGarry, & Swinehart
Coffee Mill Butte SW	1998	72	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	72D	LaGarry, LaGarry, & Swinehart
Coffee Mill Butte SE	1998	73	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2002	73D	LaGarry, LaGarry, & Swinehart
Van Tassell (WY-NE)	1999	74	LaGarry, LaGarry, & Swinehart

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Table 1 (continued).

Map Name[1]	Date[2]	Map No.[3]	Authors
Harrison West	1999	75	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	75D	LaGarry, LaGarry, & Swinehart
Harrison East	1999	76	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	76D	LaGarry, LaGarry, & Swinehart
Andrews	1999	77	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	77D	LaGarry, LaGarry, & Swinehart
Smiley Canyon	1999	78	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	78D	LaGarry, LaGarry, & Swinehart
Van Tassell SE (WY-NE)	1999	79	LaGarry, LaGarry, & Swinehart
Harrison SW	1999	80	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	80D	LaGarry, LaGarry, & Swinehart
Harrison SW	1999	81	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	81D	LaGarry, LaGarry, & Swinehart
Kyle Creek	1999	82	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	82D	LaGarry, LaGarry, & Swinehart
Glen	1999	83	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2002	83D	LaGarry, LaGarry, & Swinehart
Isinglass Buttes	2000	84	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2003	84D	LaGarry, LaGarry, & Swinehart
Chadron NE	2000	85	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2003	85D	LaGarry, LaGarry, & Swinehart
Chadron East	2000	86	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2003	86D	LaGarry, LaGarry, & Swinehart
Bordeaux	2000	87	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2003	87D	LaGarry, LaGarry, & Swinehart
Kings Canyon/Chadron 3 NW	2000	88	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2003	88D	LaGarry, LaGarry, & Swinehart
Hay Springs Creek/Chadron 3 NE	2000	89	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2003	89D	LaGarry, LaGarry, & Swinehart
Sand Canyon West/Chadron 3 SW	2000	90	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2003	90D	LaGarry, LaGarry, & Swinehart
Sand Canyon East/Chadron 3 SE	2000	91	LaGarry, Swinehart, & LaGarry
Beaver Wall	2001	92	LaGarry, Swinehart, & LaGarry
Whiteclay	2001	93	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2005	93D	LaGarry, LaGarry, & Swinehart
Whiteclay SW	2001	94	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2004	94D	LaGarry, LaGarry, & Swinehart
Whiteclay SE	2001	95	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2005	95D	LaGarry, LaGarry, & Swinehart
Hay Springs	2001	96	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2004	96D	LaGarry, LaGarry, & Swinehart
Hay Springs NE	2001	97	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2005	97D	LaGarry, LaGarry, & Swinehart

Continued on next page

Table 1 (continued).

Map Name[1]	Date[2]	Map No.[3]	Authors
Hay Springs SW	2001	98	LaGarry, Swinehart, & LaGarry
(digital version 1.1)	2004	108D	LaGarry, LaGarry, & Swinehart Hay
Springs SE	2001	99	LaGarry, Swinehart, & LaGarry
Montrose	2001	108	LaGarry & LaGarry
(digital version 1.1)	2001	108D	LaGarry, LaGarry, & Swinehart
Orella	2001	109	LaGarry & LaGarry
(digital version 1.1)	2001	109D	LaGarry, LaGarry, & Swinehart
Wolf Butte	2001	110	LaGarry & LaGarry
(digital version 1.1)	2001	110D	LaGarry, LaGarry, & Swinehart
Roundtop	2001	111	LaGarry, LaGarry, & Swinehart
(digital version 1.1)	2001	111D	LaGarry, LaGarry, & Swinehart
Horn	2001	112	LaGarry & LaGarry
(digital version 1.1)	2001	112D	LaGarry, LaGarry, & Swinehart
Clinton NW	2002	113	LaGarry, Swinehart, & LaGarry
Clinton NE	2002	114	LaGarry, Swinehart, & LaGarry
Clinton SW	2002	115	LaGarry, Swinehart, & LaGarry
Clinton	2002	116	LaGarry, Swinehart, & LaGarry
Rushville SE	2002	117	LaGarry, Swinehart, & LaGarry
Rushville SW	2002	118	LaGarry, Swinehart, & LaGarry
Rushville NE	2002	119	LaGarry, Swinehart, & LaGarry
Rushville	2002	120	LaGarry, Swinehart, & LaGarry
Gordon NW	2003	121	LaGarry, Swinehart, & LaGarry
Hog Island	2003	122	LaGarry, Swinehart, & LaGarry
Gordon	2003	123	LaGarry, Swinehart, & LaGarry
Gordon SE	2003	124	LaGarry, Swinehart, & LaGarry
South of Gordon	2003	125	LaGarry, Swinehart, & LaGarry
Coburn Canyon	2003	126	LaGarry, Swinehart, & LaGarry
Bovee Valley West/Rushville 3 SW	2003	127	LaGarry, Swinehart, & LaGarry
Bovee Valley East/Rushville 3 SE	2003	128	LaGarry, Swinehart, & LaGarry
Whistle Creek NW	2004	129	LaGarry, Swinehart, & LaGarry
Whistle Creek NE	2004	130	LaGarry, Swinehart, & LaGarry
Marsland NW	2004	131	LaGarry, Swinehart, & LaGarry
Marsland	2004	132	LaGarry, Swinehart, & LaGarry
Box Butte Reservoir West	2004	133	LaGarry, Swinehart, & LaGarry
Box Butte Reservoir East	2004	134	LaGarry, Swinehart, & LaGarry
Box Butte NW	2005	137	LaGarry, Swinehart, & LaGarry
Box Butte NE	2005	138	LaGarry, Swinehart, & LaGarry
Skunk Lake NW	2005	139	LaGarry, Swinehart, & LaGarry
Skunk Lake NE	2005	140	LaGarry, Swinehart, & LaGarry
Smith Lake	2005	141	LaGarry, Swinehart, & LaGarry

Continued on next page

Table 1 (continued).

Map Name[1]	Date[2]	Map No.[3]	Authors
Twin Lakes NE	2005	142	LaGarry, Swinehart, & LaGarry
Dolly Warden Lake	2005	143	LaGarry, Swinehart, & LaGarry
Billys Lake	2005	144	LaGarry, Swinehart, & LaGarry

Notes for Table 1:
1. **Where two names are given, the former name is listed first, and the current name second**
2. **Date indicates when map went on open file.**
3. **Numbers were assigned by the Conservation & Survey Division, and "D" denotes a digital version**

Table 2. Open-file (OFM) maps from the O'Neill 1:250,000 Quadrangle available from the Nebraska Geological Survey (University of Nebraska-Lincoln Conservation & Survey Division, School of Natural Resources). All maps are Nebraska quadrangles except as noted.

Map Name	Date	Map No.	Authors
Meadville NW	in review	pending	LaGarry, LaGarry, & Diffendal
Meadville NE	in review	pending	LaGarry, Diffendal, & LaGarry
Springview NW	in review	pending	LaGarry, Diffendal, & LaGarry
Burton	in review	pending	LaGarry, Diffendal, & LaGarry
Mills	in review	pending	LaGarry, Diffendal, & LaGarry
Jamison	in review	pending	LaGarry, Diffendal, & LaGarry
Meadville	in review	pending	LaGarry, Diffendal, & LaGarry
Huddle Table	in review	pending	LaGarry, Diffendal, & LaGarry
Springview	in review	pending	LaGarry, Diffendal, & LaGarry
Springview SE	in review	pending	LaGarry, Diffendal, & LaGarry
Jamison SW	in review	pending	LaGarry, Diffendal, & LaGarry
Mariaville	in review	pending	LaGarry, Diffendal, & LaGarry
Ainsworth NW	in review	pending	LaGarry, Diffendal, & LaGarry
Dutch Creek	in review	pending	LaGarry, Diffendal, & LaGarry
Bassett NW	in review	pending	LaGarry, Diffendal, & LaGarry
Riverview	in review	pending	LaGarry, Diffendal, & LaGarry
Carns	in review	pending	LaGarry, Diffendal, & LaGarry
Newport NE	in review	pending	LaGarry, Diffendal, & LaGarry

ARCHIVED FIELD NOTES

Table 3. Field notes archived at the Conservation & Survey Division of the University of Nebraska-Lincoln. All compilations are color .jpg files on CDROM. Copies of these notes also reside with the author(s).

Author(s)	Date[1]	Vol.[2]	Pages	Compiler (date)
LaGarry, H. E.	1985-1986	1	117[3]	R. W. Vasek (2003)
LaGarry, H. E.	1986-1987	2	117[3]	R. W. Vasek (2003)
LaGarry, H. E.	1987-1988	3	117[3]	R. W. Vasek (2003)
LaGarry, H. E.	1987-1988	3B	45[3]	R. W. Vasek (2003)
LaGarry, H. E.	1987-1988	4	117[3]	R. W. Vasek (2003)
LaGarry, H. E.	1988-1989	5	117[3]	R. W. Vasek (2003)
LaGarry, H. E.	1988-1989	6	117[3]	R. W. Vasek (2003)
LaGarry, H. E.	1989-1992	7	117[3]	R. W. Vasek (2003)
LaGarry, H. E.	1992-1993	8	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E.	1993-1994	9	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E.	1994-1995	10	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E.	1994-1995	11	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E.	1994-1995	12	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. Armantrout	1994-1995	12B	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1994-1995	13	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1995-1996	14	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1996-1997	15	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1996-1997	16	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1998-1999	17	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1998-1999	18	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1998-1999	18B	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1998-1999	19	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1998-1999	20	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1998-1999	21	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1999-2000	22	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1999-2000	23	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1999-2000	24	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1999-2000	25	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1999-2000	26	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	1999-2000	27	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2000-2001	28	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2000-2001	29	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2000-2001	30	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2000-2001	31	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2000-2001	32	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2000-2001	34	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2001-2002	38	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2001-2002	40	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2001-2002	42	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2001-2002	44	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2002-2003	45	167[3,4]	R. W. Vasek (2003)
LaGarry, H. E. & L. A. LaGarry	2002-2003	46	167[3,4]	R. W. Vasek (2003)

Notes for Table 3:

1. **Includes notes archived for the Nebraska National Forest (1991-1995) and the U. S. Geological Survey STATEMAP Program (1996-2006).**
2. **Volume numbers were assigned by the authors.**
3. **Includes inserts (typically other peoples' published work used as reference material).**
4. **Includes maps (original field maps and compilations of original maps at various scales).**

LOUIS ARTHUR REDMOND, PhD
P.O. BOX 116
3153 WY State Highway 154
YODER, WY 82244
(307) 534-2172
e-mail: redfeather@wyomail.com

PERSONNEL INFORMATION:
Born: August 9, 1945, Utica, NY, USA

EDUCATION:
2004: Graduate Study, Doctoral Program, at-a-distance, Canbourne University, London, UK
Degree awarded: **Doctor of Philosophy (Anthropology)**
1989-1990: Graduate Study, Doctoral Program, University of New Mexico, Albq, NM (Resigned, Studies Chairman retired)
Degree Awarded: None
1989 Graduate Study, Master/Doctoral Program, University of New Mexico, Albq, NM
Degree Awarded: **Master of Arts (Anthropology) minor: Quaternary Studies**
1987 B.S., Anthropology, University of New Mexico, Albq, NM (Magna cum Laude)
Degree Awarded: **Baccalaureate of Science** (**magna cum laude**)
(Major: Anthropology / Minor: Quaternary Studies)
1977-1978 Under Graduate Coursework, La Mesa Junior College, San Diego, CA
1974-1975 Coursework at Naval Explosive Ordnance Disposal School, Indian Head, MD/Charles County Community College, La Plata, MD in Nuclear Physics, Engineering Techniques and Improvised Explosive Device Technology
1974 **Associate of Arts**, Education, El Paso Community College, El Paso, TX and Education Center, Ft. Bliss, TX

ACADEMIC HONORS:
Doctor of Philosophy, Department of Anthropology, Canbourne University, London, U.K., 2004
Master of Arts, Department of Anthropology, UNM, Albq, NM, 1989
Teaching Assistant, Department of Anthropology, UNM, Albq, NM 1989
Bachelor of Science (Magna cum Laude), Department of Anthropology, UNM, Albq, NM, 1987
Distinguished Graduate, Senior NCO Course, Redstone Arsenal, AL, 1979
Distinguished Graduate, Nuclear Phase, EOD School, Indian Head, MD, 1975
Distinguished Graduate, Surface Phase, EOD School, Indian Head, MD, 1975
Honor Graduate, NCO Academy, Ft. Hood TX, 1967
Honor Graduate, Trainee Leadership School, Ft. Dix, NJ, 1963

PROFESSIONAL HONORS:
1995 USDA Certificate of Merit (Sacred Cow Award) , Implementation of Programmatic Agreements with State Historic Preservation Offices, South Dakota and Nebraska.
1994 USDA, Certificate of Merit, Organizing and Coordinating Forest Service and Volunteer project at Fiddle Creek Archeological District and Hudson-Meng Archeological Project.
1994 USDA, Certificate of Appreciation, Contributions to Ecosystem Management, Multiple Use, and Special Resource Emphasis on the Nebraska National Forest Units.
1994 USDA, Certificate of Appreciation, Washington Office, Contributions to Conserving and Managing Natural Resources and Advancing the Forest Service Volunteer-Related Services.
1994 R2, USFS, USDA, Certificate of Appreciation, Showcasing special projects for R2 office training.
1993 USDA, Certificate of Merit, Organizing and Coordinating the Hudson-Meng Archeological Project.
1992 USDA, Certificate of Appreciation, Assistance and Training of Foresters from Mall, Africa.

(Multiple professional awards from US Army, International Association of Bomb Technicians and Investigators, 1975-1985)

EMPLOYMENT HISTORY:

1995- **President** , Red Feather Archeology , Consultation and Training to Indian Tribes and Federal Agencies on NAGPRA, Tribal Historic Preservation Offices, Historic Preservation Laws; Survey and Evaluation of Archeological Resources; Evaluations of Historical/Archeological Significance.

1992-1995 **Heritage Program Manager**, Supervisory Archeologist, American Indian Special Emphasis Program Manager and Assistant Manager, Assistant Recreation Staff Officer, Forest Tribal Liaison Officer, Nebraska National Forest, Chadron, NE. **Supervisors**: Elizabeth Ohlrogge, Dalton Ellis

1991-1992 **Assistant Heritage Program Manager**, Supervisory Archeologist, Cibola National Forest, Albuquerque, NM **Supervisor**: Dr. Joseph Tainter

1989-1991 **Archeologist**, Survey Crew Chief, Cibola National Forest, Albuquerque, NM
Supervisors: Emily Garber, Dr. Joseph Tainter

1988-1989 **Archeologist**, Survey Crew Chief, Archeological Researches, INC, Albuquerque, NM
Supervisor: Christopher Nightingale

1988 **Archeologist**, Office of Contract Archeology, University of New Mexico, Albuquerque, NM
Supervisor: Dr. Daniel Amick

1963-1985 **United States Army**, Served in capacities from Rifleman in Europe and Asia to Enlisted Commander of the 259th Explosive Ordnance Disposal Unit at Fort Irwin, CA. Duties included assignments in Europe, Africa, Asia, South America, as well as North America. Various supervisory roles with responsibility for groups of 5 to over 200 persons at varying times. Administrative duties included: Squad/Team Leader, Platoon Sergeant, Platoon Leader, First Sergeant, Operations Sergeant, Enlisted Commander, Personnel Chief, Supply Sergeant, Property Book Officer, and Budget Manager. Budgets ranged to $1.5 million dollars.
(More complete list on request)

FIELD EXPERIENCE:

1995-	Principal Investigator, Red Feather Archeology, Inc; consultation with tribal groups on matters involving Heritage Preservation Laws and NAGPRA. Contracts on archeological survey and investigations for Federal Agencies and Indian Tribes. Also involved in peripheral studies of treaty implications for tribes and Federal Agencies. Contracting to provide para-archaeology training to tribal groups and agencies.
1992-1995:	Heritage Program Manager/Principal Investigator, Nebraska N.F.; Site Manager, Hudson-Meng Archeological Project; Assistant Recreation Staff Officer; Forest Tribal Liaison Officer; American Indian Special Emphasis Program Manager/Assistant Manager, Nebraska National Forest, Chadron, NE
1991-1992:	Principal Investigator/Assistant Heritage Program Manager, Supervisory Archeologist, Cibola N.F., Albuquerque, NM
1988-1991:	Principal Investigator/Supervisory Archeologist, Cibola N.F. Albuquerque, NM
1987-1988	Survey supervisor, Archaeological Researches, Inc, Austin, Tx, J.Neely & C.Nightingale, investigators
1988	Survey/excavation member/Dive Master, Econfina/Auchilla Rivers Off-shore Project, Northwest Florida, J.Dunbar, Florida Dept of State, & M.Faught, ASU, investigators (Marine Archeology)
1988	Survey/excavation member, Office of Contract Archaeology, University of New Mexico, Land exchange project, P.Hogan & D.Chapman, investigators
1987	Excavation member, volunteer, Stewart's Cattle Guard, D.Stanford & M.Jodry, investigators
1987	Excavation/Survey member, UNM Field School, SU Site, Reserve, NM, W.W.Wills, investigator
1985	Excavation/Survey member, UNM/NMSU Field School, Ramah, NM, F.Plog, S.Plog, & L.Cordell, investigators

AREA OF INTEREST:

I am primarily interested in North American Coastal Archeology as it pertains to the Paleo Indian/Archaic adaptations in the Western Hemisphere. I am also interested in pre-Paleo Indian sites that emphasize occupational patterning of the original Native peoples especially those sites that are currently submerged along the coastal plains of the Hemisphere or in high altitude areas (e.g. the Rocky Mtns.)

ORGANIZATIONS:

Society of American Archeologists
Association of American Archeologists
Wyoming Association of Professional Archeologists
Nebraska State Historical Society
United First People's Anthropological Association (co-founder)
Plains Anthropological Society
South Dakota Association of Professional Archeologists
South Dakota Archaeological Society
Keepers of the Treasures
Professional Association of Diving Instructors (Dive Master/Master Diver)
National Explosive Ordnance Disposal Association (Life Member)
Society of the Purple Heart (Life Member)
Disabled American Veterans (Life Member)
Veterans of Foreign Wars (Life Member)

PROFESSIONAL REPORTS: (short list)

2007 **A Cultural Resource Survey for Abraxas Petroleum Corporation Sites Desert Falcon, Canyon Hawk and Golden Eagle in Niobrara County in the State of Wyoming, Abraxas Petroleum Company, San Antonio, TX**

2007 **A Level III Heritage Resource Survey for the North Face Taylor Creek Fuels Treatment Project on the Custer National Forest in Powder River County, Montana.**

2007 **A Level III Heritage Resource Survey for the 10-mile Fuels Treatment Project on the Custer National Forest in Powder River County, Montana.**

2006 **A Level III Heritage Resource Survey for the Rampart Pod project in Campbell County, Wyoming for Quality Services, Rapid City, SD.**

2006 **A Level III Heritage Resource Survey for the New Prison Site in Goshen County, Torrington, WY.** Submitted to the town of Torrington, WY.

2005 **A Cultural Resource Survey for the Hoback Ranches Fuels Reduction Project on Bureau of Land Management Lands in Sublette County, Wyoming.** Submitted to the BLM, Pinedale, WY.

2005 **A Cultural Resource Survey for the Hoback Fuels Reduction Project on Bureau of Land Management Lands in Sublette County, Wyoming.** Submitted to the BLM, Cody, WY.

2004 **A Level III Heritage Resource Survey for the proposed First National Bank building site in Wheatland, Wyoming.** Submitted to the First National Bank, Torrington, WY.

2004 **A Level III Heritage Resource Survey for the Belltower Fire Restoration Area on the Sioux Ranger District of the Custer National Forest in Carter County, Montana.** Submitted to the Custer National Forest, Billings, MT.

2004 **A Level III Heritage Resource Survey for the FY 2005 Rescissions Project on the Custer National Forest in Harding County, South Dakota.** Submitted to the Custer National Forest, Billings, MT.

2004 **A Level III Heritage Resource Survey for the FY 2005 Rescissions Project on the Custer National Forest in Carter County, Montana.** Submitted to the Custer National Forest, Billings, MT.

2004 **A Level III Heritage Resource Survey for the FY 2005 Prescribed Burn on the Buffalo National River, Arkansas.** Submitted to the Buffalo National River, Harrison, AR.

2003 **A Level III Heritage Resource Survey for the Ekalaka Fuels Treatment Project on the Custer National Forest in Carter County, Montana.** Submitted to the Custer National Forest, Billings, MT

2003 **A Level I and Level III Heritage Resource Survey on Selected Parcels within the Higgins Gulch Range Allotment and evaluation of 4 Previously Record Sites on the Northern Hills**

Ranger District, BHNF, Spearfish, SD. Submitted to the Northern Hills Ranger District, BHNF, Spearfish, SD.

2002 **A Level III Heritage Survey of Selected Parcels within the Elk Bugs Planning Unit in Lawrence County, South Dakota.** Submitted to the Northern Hills Ranger District, BHNF, Spearfish, SD.

2002 **The Washboard Heritage Survey on the Mount Taylor District of the Cibola National Forest, New Mexico.** Submitted to the Cibola National Forest, Albuquerque, NM.

2001 **A Level III Heritage Resource Survey for the Power Analysis Area on the Spearfish Ranger District of the Black Hills National Forest, Lawrence County, South Dakota.** Submitted to the Black Hills National Forest, Spearfish, South Dakota.

2001 **A Level III Heritage Resource Survey of the Buford-New Castle Road Corridor Project.** Submitted to the White River National Forest, Glenwood Springs, CO.

2000 **A Level III Heritage Resource Survey of 94 miles of Shoreline in North and South Dakota within the exterior boundaries of the Standing Rock Sioux Reservation.** Submitted to the Standing Rock Tribal Historical Preservation Officer, Fort Yates, ND.

1999 **A Level III Heritage Resource Survey for the Dutchman Timber Analysis on the Black Hills National Forest, Pennington County, South Dakota.** Submitted to the Black Hills National Forest, Hill City, SD.

1999 **A Level III Heritage Resource Study for the 1999 Upper Blue Stewardship Project on the White River National Forest, Summit County, CO.** Submitted to the White River National Forest, Glenwood Springs, CO.

1999 **A Level III Heritage Resource Survey on 12 Grazing Allotments on the Harney/Pactola Ranger District, Black Hills National Forest, Pennington County, South Dakota.** Submitted to the Black Hills National Forest, Hill City, SD.

1998 **Test Excavations Performed at Four Archeological Sites in Garfield County, Colorado.** Report submitted to the White River National, Glenwood Springs, CO.

1998 **A Level III Archeological Survey of Selected Parcels for the Red Springs Timber Treatment Project, Eagle County, CO.** Report submitted to the White River National Forest, Glenwood Springs, CO.

1997 **A Level III Archeological Survey of Selected Parcels for the Cache Timber Sale, Eagle County, CO.** Report submitted to the White River National Forest, Glenwood Springs, CO.

1997 **A Level III Archeological Survey of Selected Parcels for the Yoder Timber Sale, Eagle County, CO.** Report submitted to the White River National Forest, Glenwood Springs, CO.

1997 **Archeological Survey of Selected Parcels in Alliance, Nebraska.** Report submitted to the Chadron Community Development Center in Chadron, Nebraska.

1997 **Level III Archeological Survey of Selected Parcels on the Wakpala and Kenel Districts of the Standing Rock Indian Reservation.** Report submitted to the Tribal Historic Preservation Office of Standing Rock Indian Reservation.

1996 **Level I Archeological Research of the Standing Rock Indian Reservation In Sioux County, North Dakota and Corson County, South Dakota.** Report submitted to the Tribal Historic Preservation Office of Standing Rock Indian Reservation.

1996 **Level III Archeological Survey of Selected Portions of the Shoshone National Forest along North Bennett Creek, Clark, WY.** Report submitted to Discovery Explorations, Inc. Denver, CO.

1996 **Implications of Treaty Language for National Grasslands Managed by the US Forest Service in Nebraska, North Dakota, South Dakota, and Wyoming**. Research paper prepared for Northern Grassland Forest Plan effort, Nebraska National Forest, Chadron, NE.

1988-1995 In excess of 300 technical field reports submitted for studies on the Cibola and Nebraska National Forests submitted to the SHPO's of New Mexico, Oklahoma, Texas, Nebraska & South Dakota.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of	)	
POWERTECH, INC.	)	Docket No. 40-9075-MLA
(In Situ Leach Facility, Dewey-Burdock, SD	)	

PETITIONER DECLARATION

I, David Frankel, hereby make the following declaration:

1.I make this affidavit as Legal Director and on behalf of Aligning for Responsible Mining in connection with a Petition to in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine in Custer County and Fall River County, South Dakota (the "Mine"). My physical address is 1705 S Maple, Chadron, NE 69337. The mailing address is POB 3014, Pine Ridge, SD 57770.

2. I have authorized attorneys Bruce Ellison, David Frankel and other attorneys working with the Clean Water Alliance and Aligning for Responsible Mining to represent Aligning for Responsible Mining in this matter and to file contentions on its behalf. I am fully familiar with the facts stated herein, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents hereof.

3. Members of Aligning for Responsible Mining use water which comes from the Madison Aquifer and use water from the Inyan Kara for personal, household, domestic purposes, drinking, and bathing, gardening and irrigation.

This Declaration is submitted in accordance with 10 C.F.R. Section 2.304(d) and 28 U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

March 8, 2010

_____
David Frankel, Legal Director

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of	)	
POWERTECH, INC.	)	Docket No. _____
(In Situ Leach Facility, Dewey-Burdock, SD	)	License SUA-_____

STATE OF SOUTH DAKOTA)
) SS:
COUNTY OF FALL RIVER)

AFFIDAVIT OF LILIAS JARDING
EXECUTIVE DIRECTOR, CLEAN WATER ALLIANCE

I, Lilias Jarding, Ph.D, hereby state as follows:

1. I make this affidavit as Executive Director and on behalf of the Clean Water Alliance (CWA) in connection with a Petition to intervene in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine near Edgemont, South Dakota (the "Mine"). The mailing address for me as CWA Executive Director is P.O. Box 591, Rapid City, SD 57709.

2. I have authorized attorneys Bruce Ellison, David Frankel, and other attorneys working with the Clean Water Alliance to represent the CWA in this matter. I am fully familiar with the facts stated in this affidavit, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents of this affidavit.

3. The Clean Water Alliance is a local Black Hills citizen's organization founded to educate ourselves and our community, and to protect our air, water, and soil resources, from the potential negative impacts of in-situ leach uranium mining in and surrounding the Black Hills. Our members live across the region, including near the proposed mining site, in northern Nebraska, and in Rapid City, SD.

4. We recognize that protecting the natural resources which nourish and sustain our land and wildlife, our families, and our agricultural and tourist based economies from contamination, is the responsibility of our generation, and on behalf of our children and their children's children.

Without uncontaminated water, soil, and air, we cannot exist and thrive as a region.

5. Studies indicate there is potential natural inter-mixing of aquifers in the proposed mining areas due to old unplugged drill holes and the lack of confining layers. Hence, there is no way the mining companies can guarantee that the Inyan Kara, the Madison, and the other major aquifers will not become polluted and unusable to people and animals.

6. There are over 4,000 abandoned exploration holes, many of them improperly plugged, in the proposed mining area, as well as abandoned old uranium mines in the area. There is the potential for these older uranium mining and exploration projects, together with the fractured nature of the rock in the area, to result in intermixing and contamination of groundwater resources.

7. Radioactive contamination is essentially forever. We already know this from naturally existing leaching of radioactive materials into our water and increased contamination from uranium mining to this point. There is already too high a level of cancer and other related problems in the Black Hills region. The public health and safety would seem to balance against permitting any mining operation which potentially could make this situation worse by contaminating our water, land and air resources with carcinogenic and toxics.

8. The three major aquifers - the Madison, the Minnelusa, and the Inyan Kara Group - all support the area economy. If Powertech (USA) Inc.'s proposed in-situ leach mine were to contaminate the water supplies of our communities and rural areas, it would be catastrophic as there are no other water supplies upon which our area could rely. The southern Black Hills would also no longer be a desirable place for tourists to come and enjoy our area, and thereby promote and sustain local businesses.

9. Large acreage public land in the area leased by local ranch operations, would be similarly impacted by any contamination of surface and subsurface water supplies.

10. History has shown the in-situ leach uranium mining contaminates water supplies in mined aquifers and aquifers that are hydrologically connected to the mined area. Such uranium mining operations have a history of accidents and spills. It is not technologically feasible to clean up wells and aquifers once they are contaminated.

11. The Clean Water Alliance expects the United States government and its agencies, such as the Nuclear Regulatory Commission, to protect our air and our surface and ground water resources from potential negative impacts of in-situ leach mining operations which may potentially pollute them.

12. CWA is also concerned about the NRC authorizing an in-situ mining permit to this foreign corporation whose corporate headquarters and primary investor are outside the United States. Thus, ultimate decisions about the operation of the proposed mine and any compliance with federal and state laws and regulations will be made by foreign based persons outside the

jurisdiction of our federal and state regulatory agencies and courts, and therefore the laws designed to protect our water, air, and health.

13. Foreign corporations like Powertech understand that South Dakota's environmental enforcement capacity is limited and poorly financed, resulting in the State being less capable of realistically monitoring and controlling such a mining operation so as to prevent destruction of our water supplies and other environmental and cultural resources. Compared to the other state in which the company proposes to gain mining permits, Colorado, the laws in South Dakota are weak. Powertech is therefore applying to the NRC to permit this in-situ leach mine partly because think they can get by without strict enforcement of effective environmental laws.

14. There are additional concerns from the standpoint of our local and national security interests. Once the yellowcake created from the foreign owned mine is shipped out of the country, we lose control over who ultimately gets the uranium mined here.

15. There are also security questions around the idea of permitting yellowcake production in a remote area where there are few law enforcement resources. The fact that the mining area straddles county boundaries and is on a state boundary also creates jurisdictional issues for law enforcement. The reality of this situation means that we will have only minimal protection from local theft of yellowcake for terrorist purposes.

16. The CWA therefore wishes to be a Petitioner and to be heard in any proceedings regarding Powertech's permit application to the NRC for a mining permit and anything having to do with the company's efforts to get a permanent exemption from the Safe Water Act.

This Affidavit is submitted in accordance with 10 C.F.R. Section 2.304(d) and 28 U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

Dated this 8th day of March, 2010.

Lilias Jarding, PhD

Lilias Jarding, Ph.D.
Executive Director, Clean Water Alliance

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of	)	
POWERTECH, INC.	)	Docket No. 40-9075-MLA
(In Situ Leach Facility, Dewey-Burdock, SD	)	

PETITIONER DECLARATION

I, David Frankel, hereby make the following declaration:

1. I make this affidavit in connection with a Petition to in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine in Custer County and Fall River County, South Dakota (the "Mine"). My physical address is 101 Walnut Street, Buffalo Gap, SD 57722. The mailing address for me is POB 143, Buffalo Gap, SD 57722. I am a member of Aligning for Responsible Mining.

2. I have authorized attorneys Bruce Ellison, and other attorneys working with the Clean Water Alliance and Aligning for Responsible Mining to represent me in this matter and to file contentions on my behalf. I am fully familiar with the facts stated herein, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents hereof.

3. I use water for personal, household, domestic purposes, drinking, and bathing which comes from the Madison Aquifer via Fall River Water District and I use water from a well in the Inyan Kara for gardening and irrigation at my residence.

This Declaration is submitted in accordance with 10 C.F.R. Section 2.304(d) and 28 U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

March 8, 2010

_____
David Frankel

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of	)	
POWERTECH, INC.	)	Docket No. 40-9075-MLA
(In Situ Leach Facility, Dewey-Burdock, SD	)	

PETITIONER DECLARATION

I, Gary Heckenlible, hereby make the following declaration:

1. I make this affidavit in connection with a Petition to in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine in Custer County and Fall River County, South Dakota (the "Mine"). My physical address is 612 ST James, South Dakota _____. The mailing address for me is Rapid city SD 57701. I am a member of Aligning for Responsible Mining.

2. I have authorized attorneys Bruce Ellison, David Frankel, and other attorneys working with the Clean Water Alliance and Aligning for Responsible Mining to represent me in this matter and to file contentions on my behalf. I am fully familiar with the facts stated herein, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents hereof.

3. I use water for personal, household, domestic purposes, [including gardening, irrigation, bathing, drinking]. To my knowledge, my water comes from the Madison aquifer. ~~[I have a well in that aquifer.]~~

4. ~~[~~I also use water ~~for ranching purposes and maintain livestock including.....]~~

5.

This Declaration is submitted in accordance with 10 C.F.R. Section 2.304(d) and

28
U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

March 8, 2010

Gary E. Hackenbracht

[name]

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of	)	
POWERTECH, INC.	)	Docket No. 40-9075-MLA
(In Situ Leach Facility, Dewey-Burdock, SD	)	

PETITIONER DECLARATION

I, Lilias C. Jones Jarding, hereby make the following declaration:

1. I make this affidavit in connection with a Petition to in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine in Custer County and Fall River County, South Dakota (the "Mine"). My physical address is 628 Harter Drive, Rapid City, South Dakota 57702. The mailing address for me is 628 Harter Drive, Rapid City, South Dakota 57702. I am a member of the Clean Water Alliance.

2. I have authorized attorneys Bruce Ellison, David Frankel, and other attorneys working with the Clean Water Alliance to represent me in this matter and to file contentions on my behalf. I am fully familiar with the facts stated herein, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents hereof.

3. I use water for personal, household, and domestic purposes, including gardening, bathing, and drinking. To my knowledge, my water comes from the Madison Aquifer, among other sources.

4. According to the Application of Powertech, Inc., the company plans to use up to 2,243 Million gallons of water from the Madison Aquifer. This represents a substantial withdrawal from the Aquifer, which is the same aquifer used by the City of Rapid City, which provides water for my use.

5. To my knowledge, my water also comes from the Minnelusa Aquifer, which overlies the Madison Aquifer and is hydrologically connected to it. This aquifer is also used by the City of Rapid City, which provides water for my use.

6. A drawdown in the Madison Aquifer could also lead to a drawdown in the Minnelusa

Aquifer.

7. The well-being of my family, my property, my animals, and myself relies on adequate quantities of clean water. I believe that the project proposed under this Application could have negative impacts on my supply of clean water.

This Declaration is submitted in accordance with 10 C.F.R. Section 2.304(d) and 28 U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

March 7, 2010

Lilias C. Jones Jarding

Red Feather Archeology
PO Box 116
Yoder, WY 82244
(307) 534-2172
redfeather@wyomail.com

Date: January 14, 2010

To: David C. Frankel, esq.

Mr. Frankel,

As per your recent request, I have reviewed the areas or neighboring areas of concern dealing with current mining projects in the areas of the Black Hills and adjoining counties. It is my considered opinion that without an in-depth investigation of any of these areas, involving both surface and subsurface areas on at least a strong sampling effort, that there is the strong possibility of massive disturbance of cultural materials. This observation is based on several primary sources of investigation, but also the ***Black Hills National Forest: Cultural Resources Overview, vol. 1 synthetic summary***, edited by Lance Rom, Tim Church and Michele Church, dated 1996. My primary sources include several reports written by myself: ***A Level III Heritage Resource Survey for the Power Analysis Area on the Spearfish District of the Black Hills National Forest, Lawrence County, South Dakota; A Level III Heritage Survey of Selected Parcels within the Elk Bugs Planning Unit in Lawrence County, South Dakota; A Level III Heritage Resource Survey on 12 Grazing Allotments on the Harney/Pactola Ranger District, Black Hills National Forest, Pennington County, South Dakota; A Level III Cultural Resource Investigation of the Fiddle Creek Area on the Nebraska National Forest, Fall River County, South Dakota.*** I have worked in the area of the Black Hills and surrounding counties in several states for over 15 years as both a Federal archeologist, and a private archeological contractor. It has been my experience that in the majority of areas that are defined by either current or extinct water resources, there is a high degree of probability of encountering both historic and prehistoric cultural remains, to include human burials (see the above reports and overview). As both a professional archeologist and a responsible citizen of this region, I would find any degree of ground disturbance without some form of in-depth surface and subsurface investigation to be not only remiss, but disrespectful of our collective heritage. If there are any further questions or actions that you might require of me, please do not hesitate to contact me at the above address, telephone number and/or e-mail address.

Sincerely,

Louis A. Redmond, PhD
President/owner
Red Feather Archeology

2-23-2010

Robert E. Moran, Ph.D.
Michael-Moran Assoc., LLC
Water Quality/Hydrogeology/Geochemistry
Golden, Colorado, U.S.A.
remwater@gmail.com

To: Grace Dugan
Gonzalez Law Firm
522 7th Street, Suite 202
Rapid City, SD 57701

Subject: Need for 60-Day Extension, Dewey-Burdock License Application Expert Review

Dear Ms. Dugan,

I am a hydrogeologist / geochemist with more than 38 years of applied experience related to natural resource development, including consulting related to uranium mining, processing, and environmental impacts. In addition, I have been contracted to supply comments to Powertech (USA) Inc.'s Dewey-Burdock In Situ Recovery NRC License Application for the express purpose of aiding the Oglala Sioux Tribe, and others, in the drafting of contentions to be submitted to the NRC. My CV is attached.

After reviewing a large portion of the approximately 6000 pages of relevant documents [Technical Report is 3103 pg.; Environmental Report is 2615 pg.; Supplement is 66 pg.], I find it is not possible to provide a meaningful expert review and technical comment on the adequacy of the documents within the time provided because they are quite disorganized, often with little consistency between the various documents, and frequently presenting information and interpretations in a technically inadequate manner. More importantly, the reports fail to provide the most important information necessary to commenting intelligently on these matters. Further details are presented below.

As such, in my professional judgment, in order for a qualified expert to have a meaningful opportunity to fully review, assess, and provide technical comment on the submitted Application, a minimum of an additional 60 days past the current contention submission deadline of March 8, 2010 is required. Failure to provide such an extension of the submittal date for contentions would effectively deprive the public of the required opportunity for review.

With respect to details as to the difficulty in review caused by the manner in which the application materials have been prepared, Tables 2.7-27, 28 and 29 of TR (pg. 2-198-199) serve as representative examples of the poorly-written, confusing nature of these documents. Because their titles are so inadequate, [i.e.,Table 2.7-27: Quarterly Sampled Groundwater Quality Well Data; Table 2.7-

29: Additional Well Data] the reader has no way of knowing what sampling dates are represented. The total depths and screened intervals for many of the wells listed in Table 2.7-27 are not known. Hence, how can the reader reasonably interpret their usefulness?

Frequently the text will refer to a specific table or figure, but when the reader goes to that table or figure, it is not the one referred to. A typical example can be found on pg. 2-199 of the TR, where the text refers to Table 2.7-29, when in fact it is discussing Table 2.7-30. Such mistakes are common in these Application documents and are quite confusing to the reader.

No coordinated, statistically-sound data set for **all** Baseline Water Quality (both surface and ground water) is presented in these documents—as is required in NURGEG--1569. 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 Section 2.7, there are no tables that actually summarize, statistically, 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 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.

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. 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. Powertech must 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.

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 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 baseline (pre-operational) ground water quality data that describes the **non-ore zone regions of the relevant aquifers.**

Overall, the presentation of the information and technical data is in such a state that a comprehensive review of the materials for use in the preparation of any contentions will require a minimum of 60 days additional time beyond the current deadline.

Thank you for considering these comments. I can be contacted at the following coordinates if you have further questions:
Work: 303.526.1405;
Cell: 303.358.8720—functions only when away from home/office;
remwater@gmail.com

Best regards,

Robert E. Moran

Robert E. Moran, Ph.D.
Michael Moran Associates, L..L..C.
Water Quality/Hydrogeology/Geochemistry
Golden, Colorado, U.S.A.
Phone: (303) 526-1405
Fax: (303) 526-2678
remwater@gmail.com

EDUCATION

University of Texas, Austin: Ph.D., Geological Sciences, 1974
San Francisco State College: B.A., Zoology, 1966

PROFESSIONAL HISTORY

Michael-Moran Associates, LLC, Partner, 2003 to present
Moran and Associates, President, 1983 to 1992; 1996 to 2003
Woodward-Clyde Consultants, Senior Consulting Geochemist, 1992 to 1996
Gibbs and Hill, Inc., Senior Hydrogeologist, 1981 to 1983
Envirologic Systems, Inc., Senior Hydrogeologist/Geochemist, 1980 to 1981
Tetra Tech Intl./ Sultanate of Oman, Senior Hydrogeologist, 1979 to 1980
Science Applications, Inc., Geochemist/Hydrologist, 1978 to 1979
U.S. Geological Survey, Water Resources Division, Hydrologist/Geochemist, 1972 to 1978
Texas Bureau of Economic Geology, Research Scientist Assistant, 1970 to 1971

REPRESENTATIVE EXPERIENCE

Dr. Moran has more than thirty-seven 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, non-governmental organizations, law firms, and governmental agencies at all levels. His experience includes the following representative project assignments:

- Comisión de Gestión Integral de Aguas de Bolivia (Commission for the Integrated Management of Bolivian Waters) and Federación Regional Única de los Trabajadores Campesinos del Altiplano Sud (Regional Farmers Federation of the Southern Altiplano), Bolivia. Review of present mining activities and documents related to the San Cristobal Mine. Activities funded by the Municipality of Colcha K (Potosí, Bolivia), the Centro de Estudios de la Universidad de San Simón, Cochabamba, and Global Green Grants Fund.
- Shute, Mihaly & Weinberger / San Diego State University Research Foundation. Review of hydrogeologic / environmental impacts associated with quarry construction near a university wildlife refuge.
- Sarah Vogel Law Firm, North Dakota. Litigation support and evaluation of environmental impacts resulting from a release of oilfield waters onto livestock lands and waters.

- IKV Pax Christi (Netherlands), Tolima, Colombia. Technical review of proposed La Colosa gold project (Anglo Gold Ashanti); interaction with regulators, civil society and company; prepare recommendations & report.
- Thompson Divide Coalition, Western Colorado. Technical assistance to a consortium of environmental groups in designing and conducting a baseline water sampling program in anticipation of gas drilling activities.
- Global Green Grants / Nature's Own, Papua New Guinea.
  Prepare technical / policy papers on marine disposal of mining wastes.
- SAVIA, School of Ecological Thought / Comision Pastoral Paz y Ecologia, Guatemala. Presentations on ecological aspects of resource legislation to Guatemalan government ministries, high-level officials, and educational institutions. Conduct water quality training classes; assist with development of laboratory capabilities.
- Astrella & Rice, Colorado, U.S.A. Technical assistance in preparing litigation arguments for citizen lawsuit involving alleged drinking water contamination by oil and gas activities.
- Office of the Prime Minister, Iraqi Kurdistan. Development of information infrastructure and management training for numerous ministries in Northern Iraq; done in partnership with faculty of American University, Washington, D.C. Headed an audit team for the Regional Statistics Organization.
- Southwest Research and Information Center / Buryat Regional Organization on Baikal / Mongolia Nature Protection Coalition; Buryatia, Siberia, Russia and northern Mongolia. Technical information exchanges with local NGOs, government officials and mining company staffs.
- Rulison Citizens Group / Public Counsel of the Rockies. Colorado. Development of technical arguments and potential litigation support intended to define environmental issues related to gas development near the Rulison underground nuclear test site. Hearing testimony.
- The Nature Conservancy, Trout Unlimited, Alaska Conservation Foundation, Trustees for Alaska and Renewable Resources Coalition, Alaska. Presentations to public interest groups and development of technical issues and papers relating to construction of the Pebble copper-molybdenum-gold mine, proposed for operation above the largest sockeye salmon fishery in the world.
- Wild Salmon Center, Alaska. Technical evaluation of hydrogeological, and chemical issues that may impact fisheries near the proposed Pebble Mine.
- Miller, Axline & Sawyer / Meyers, Nave, Riback, Silver & Wilson / City of Grass Valley, California. Technical and litigation support in a suit alleging contamination by Newmont Mining Corporation; deposition testimony.
- Latin American Water Tribunal. San Salvador, El Salvador. Prepare presentations and conduct workshops on water and water quality. Funding: Heinrich Boll Foundation.
- Alburnus Maior, Rosia Montana, Romania. Evaluation of EIA and preparation of summary report on a proposed gold mine in Transylvania. Funded by the Staples Trust, U.K. and the Open Society Foundation, Romania.

- Asociacion de Desarrollo Social Santa Marta (ADES), El Salvador. Evaluate EIA and related documents; technical presentation at national forum; prepare review report. Funded by DIAKONIA, Swedish Ecumenical Action.

- Alburnus Maior, Romania. Review documents and prepare comments related to development of proposed Rosia Montana Mine for a Romanian NGO.
- La Lumiere, Senegal and WACAM, Ghana. Conducted water quality training sessions for NGO and government staffs, as related to mining and other development activities. Funded by Oxfam America.
- ESRI (Environmental Systems Research Institute). Provide technical assistance to several Iraqi Ministries to define information management needs, deploy map-based systems (GIS), and establish a Middle East-based Center of Excellence to support these ministries.
- Colectivo Madre Selva, Guatemala. Evaluation of Marlin Mine site, review of EIA and preparation of report; attendance at national and indigenous mining forums; conducted water quality training; review of CAO / IFC documents. Funded partly by Misereor, Catholic Bishops' Development Organization, Germany.
- International Union for Conservation of Nature and Natural Resources (IUCN, Switzerland). Review of the Mining and Metals Supplement of the Global Reporting Initiative (GRI).
- World Bank, Extractive Industry Review. Member of Advisory Group assisting WB in evaluating extractive industry practices.
- Nishnawbe Aski and other Ontario First Nation bands---Ontario, Canada. Review of environmental documents relating to Montcalm Mine, a proposed copper-nickel facility. Activities paid for by Falconbridge Limited.
- Kazakh Institute of Physics and Technology / ISTC---Almaty, Kazakhstan. Technical oversight of environmental program, evaluating migration of radionuc-lides at the Semipalatinsk Nuclear Test site.
- Greenpeace Argentina / Mineral Policy Center---Esquel, Argentina. Review of EIA (water, environ. issues) and conditions at proposed mine in Patagonia.
- Oxfam America / Sahel Development Foundation ---Syama Mine, Southern Mali. Review of environmental conditions and documents related to an IFC-funded gold mine (2003); conduct technical workshops and policy meetings with Mali government and press (2004).
- Kivalina Relocation Planning Committee---Alaska. Litigation support to Center on Race, Poverty & the Environment regarding water quality issues, Red Dog Mine. Deposition testimony.
- Asociation de Organismos No Gubernamentales—Santa Rosa de Copan, Honduras. Independent review of water / environmental issues at San Andres mine; funded by Dan Church Aid (Danish government and NGOs) and Christian Aid (English NGO).
    - Oxfam America / Friends of the Earth Int'l. / Global Green Grants---Quellaveco, Peru. Independent review of mining, water and environmental issues at request of Asociacion Civil "Labor", Lima.

- Oxfam America / Mineral Policy Center / Environmental Mining Council of B. C.: Tambogrande, Peru. Independent review of mining water and environmental issues. Includes numerous public presentations to citizens and governmental groups, including members of the Peruvian Congress.
- New Mexico Environment Department---New Mexico. Review of cost estimates for water treatment systems for closure plans / bonding calculations, Chino and Tyrone Mines.
- International Institute for Environment and Development—London, U.K. Consultant to MMSD project on sustainable development / mining issues.
- Technical Chamber of Greece---Thrace, Greece. Technical assistance to an advisory arm of the Greek government and citizens groups regarding gold mining / environmental issues.
- Malerah-Wahlabul Native Title Claimants / Friends of the Earth—Sydney, Australia. Review of water quality issues related to cyanide leach gold operations on aboriginal lands, and testimony at Land and Environment Court.
- Loeb Aron &Co.---London, U.K. Preparation of report evaluating the Baia Mare, Romania waste spill for an investment banking firm.
- Centro de Investigacion y Planificacion del Medio Ambiental (CIPMA) / World Resources Institute / International Development Research Centre---Chile. Evaluation of environmental costs associated with copper mining in Chile.
- Carl Duisberg Gesellschaft / Univ. of Witwatersrand / United Nations---South Africa. Teaching cyanide technology and environmental technology assessment issues.
- Dogrib Nation / Pape and Salter---Yellowknife, Canada. Geochemical consulting and testimony regarding the proposed Diavik diamond mine.
- Soros Foundation Kyrgyzstan---Bishkek, Kyrgyzstan. Water quality instruction to regulators and NGOs regarding mining, sampling, laboratory procedures, and general environmental issues. Review laboratory.
- General Chemical / Sierra Club---Piceance Basin, Colorado. Review of water quality, treatment, legal and policy issues regarding the proposed Yankee Gulch soda ash mine; hearing testimony.
- Sierra Club Legal Defense Fund / Okanogan Highlands Alliance----Crown Jewel Mine, Washington. Litigation support on water quality, geochemistry, treatment issues to groups opposing proposed gold operation; test case on federal mining law; deposition testimony.
- National Wildlife Federation---Carlota Mine, Arizona. Litigation support for challenge of EPA regarding water quality/ treatment issues at copper mine. Review of TMDL issues related to Pinto Creek for NWF and local citizens.
- International Rivers Network---Review of proposed dam project and associated mine water quality issues at the San Roque site, Philippines.
- Mineral Policy Center---Preparation of technical documents on the environmental behavior, analysis and toxicity of cyanides.

- Holnam Industries---Penrose, Colorado. Ground water quality/ geochemistry study for cement operation.
- World Resources Institute---mining water quality/ geochemistry assistance on Venezuelan forestry / mining environmental regulations, and on environmental economics of copper mining practices, Chile.
- U.S. EPA / American Geological Services---French Gulch, Colo. Geochemical / treatment /remediation support at an abandoned mine site; negotiated Superfund issues.
  - Stoel Rives---Richmond Hill Mine, So. Dakota. Review water quality treatment and geochemistry issues at a closed gold mine site with discharge violations.
  - Nacho Nyak Dun First Nation/ Pape and Salter—Yukon, Canada. Evaluation of proposed heap-leach gold mining facilities and practices for native group and barristers.
  - Molycorp/ Unocal—Questa, New Mexico. Review of water quality/ geochemical / aquatic biology issues at a molybdenum mine/ mill site.

  - Homestake Mining< Lead, South Dakota, U.S.A. Review of water quality and geochemical problems and waste rock storage and tailings stability issues.

  - U.S. Bureau of Land Management / Summo Minerals—Lisbon Valley, Utah. Review of water quality and geochemistry, and assistance in preparation of an EIS at a proposed copper mining and recovery site.

  - Southern Peru Copper Corp. –Toquepala, Peru. Design and oversight of water quality, geochemistry, and remediation issues at an open-pit copper mine, mill, and waste facilities.

  - Cortez Mining/ Placer Dome / U.S. Bureau of Land Management - Pipeline Project, Nevada. Review of water quality and geochemistry and preparation of EIS-related reports at this proposed open pit gold site.

  - Kennecott Utah Copper. Interacted with the law firm of Bogle and Gates to assist an active metal mining company in defending against a CERCLA listing. Activities involved interpreting water quality/geochemical and other environmental data within the Hazardous Ranking System (HRS) context.

  - Asarco - Leadville, Colorado. Oversight of water quality and geochemical activities at a historic metal mining and processing site where the client is involved in CERCLA negotiations. Interaction with State and EPA representatives and legal staff.

  - Cambior Minerals - Metates Mine, Mexico. Water quality and geochemistry evaluation of a new gold property.

- Fraser Stryker and the Lindsey Chemical Co. - Nebraska. Technical support to legal staff involved in negotiations regarding a Superfund industrial processing site.

- W.R. Grace - Motorwheel Site, Michigan. Technical assistance to Grace legal staff involved in CERCLA negotiations at a hazardous waste site.

- Zortman Mining Co./U.S. Bureau of Land Management. Technical and management responsibilities for water resources and geochemistry tasks in preparation of revised EIS at a gold-cyanide leach site with existing acid drainage problems.

- Echo Bay Mining, Lamefoot Mine, Republic, Washington. Responsible for geochemistry and water quality aspects of a supplemental EIS at a new gold mine site. Development of monitoring, testing and remedial recommendations to the BLM.

- Angelina Farms, Louisiana. Technical support to legal staff of oil production companies accused of contaminating groundwaters with brines.

- Chino Mines, New Mexico. Technical evaluation of water quality and geochemical issues associated with leaching operations at an operating copper facility.

- Amax Gold/Haile Mining, South Carolina. Water quality consulting at a gold mining site with existing acid drainage problems.

- Shea and Gardner / Rockwell--Rocky Flats Plant, Colorado. Reviewed and evaluated geochemical studies; proposed future activities in preparation of potential litigation.

- Saunders, Snyder, Ross and Dickson/American Water Development, Inc. - San Luis Valley, Colorado. Coordinated water quality and geochemistry activities in support of water rights litigation. Oversaw water quality sampling, evaluated water quality and remote sensing data, assisted attorneys in technical strategy development and opponents' depositions; supplied deposition testimony.

- Arnold and Porter/Keystone Ski Corporation - Keystone, Colorado. Designed water quality and geochemical sampling program for ski area expansion in a previously mined area. Evaluated data and proposed remediation activities.

- Advanced Sciences, Inc./EG&G - Rocky Flats Plant, Colorado. Evaluated existing water quality and geochemical sampling programs; prepared

document on non-facility related sources of chemical constituents and background.

- City of Brighton - Brighton, Colorado. Evaluated existing surface and groundwater quality data and suggested remedial activities to deal with excessive manganese and dissolved organic concentrations. Provided testimony to City Council.

- Chadwick & Associates, Inc./Newmont Mining - Telluride, Red Mountain, Colorado. Provided diverse water quality and geochemical consulting relating to remediation of acid mine drainage problems.

- Intergraph Corp. - Reston, Virginia. Assisted in technical development and marketing of a new environmental data management/GIS product.

- U.S. Forest Service - Salmon, Idaho. Acted as a geochemical/water quality consultant at the Beartrack mine site, a proposed cyanide-leach gold project.

- Earth Satellite Corporation/Navajo Nation/Patton, Boggs, and Blow - Window Rock, Arizona. Conducted a preliminary reconnaissance of water resources on the joint-use area of the Navajo/Hopi reservations using satellite imagery.

- Mission-Viejo/Morrison and Forester - Denver Basin, Colorado. Acted as a geochemical consultant in a groundwater rights dispute.

- Bunker Hill Corporation/Dames and Moore - Kellogg, Idaho. Reviewed field and laboratory water quality procedures at a CERCLA metal-mining and processing facility. Audited proposed laboratory.

- Saunders, Snyder, Ross, and Dickson/Adolph Coors Company - Golden, Colorado. Water quality consultant; reviewed data from Central City/Blackhawk, CERCLA site, and determined potential impact to the Coors water treatment plant. Provided testimony at stream classification hearings, Colorado Water Quality Control Commission.

- Colorado Water Resources and Power Authority - San Luis Valley, Colorado. Conducted water quality/geochemical and Landsat evaluations of deep groundwater to aid in development decisions.

- Armstrong, Teasdale, Kramer, Vaughan, and Schlafly / Anschutz Corp.-- Fredricktown, Missouri. Supervised technical activities of a CERCLA / SARA-related lawsuit; acted as a technical liaison with attorneys and regulators; managed consultants; authored reports; deposition testimony.

- Holland and Hart/White and Jankowski/Weller, Friedrich, Ward and Andrew/Breckenridge Ski Corporation - Breckenridge, Colorado. Technical supervision of water quality-related issues in a private lawsuit against Breckenridge Ski Corporation. Managed sampling and data interpretation; interacted with attorneys on strategy and assisted at depositions; authored reports; expert witness.

- Dames and Moore/Hecla Mining Corporation - Leadville, Colorado. Acted as hydrogeological/geochemistry consultant to Hecla on a natural resources damage suit; interacted with attorneys at Davis, Graham and Stubbs.

- Dames and Moore/Davis, Graham and Stubbs - Eagle Mine, Colorado. Supervised water quality/hydrogeology activities in preparation of a legal defense of Gulf and Western Corporation versus the State of Colorado in a natural resources damage suit; supervised and participated in all sampling; QA activities and report preparation; interacted with attorneys and regulators; assisted at depositions; deposition testimony; testified before Colorado Water Quality Control Commission on appropriateness of proposed metals standards.

- Jacobs Engineering - Albuquerque, New Mexico. Prepared policy documents on water quality/geochemistry procedures associated with the Uranium Mill Tailings Remedial Actions Project (UMTRA).

- University of Wisconsin. Designed a proposed groundwater exploration program for Gambia, West Africa, in conjunction with Earth Satellite Corporation.

- Harza Engineering Company/University of Michigan - Senegal, Guinea, and Gambia, West Africa. Evaluated potential impacts of new dam construction within the Gambia River basin. Reviewed local hydrogeology, mining production and exploration data; interacted with local officials.

- Engineering-Science, Inc. Faisalabad, Pakistan. Assisted in design of a well field for a groundwater supply in the central Punjab where high salinity and TDS were major problems; negotiated with local officials; prepared reports for Asian Development Bank.

- Holme Roberts and Owen - Canon City, Colorado. Reviewed and interpreted existing hydrogeology and water quality data at the Cotter uranium mill and tailings; proposed future activities; interpreted background concepts, prepared position papers for attorneys in negotiations with State of Colorado.

- Earth Satellite Corporation - Sultanate of Oman. Conducted an interpretive study of regional groundwater potential in Oman, with the staff of Earth Satellite Corporation. Activities included interpretation of existing geology and Landsat imagery combined with conventional low altitude flight and ground reconnaissance. Prepared reports for government of Oman.

- Anschutz Mining Corporation - Fredericktown, Missouri. Managed water resource-related activities for environmental baseline studies at a proposed cobalt/ nickel mine. Designed sampling programs, oversaw sampling, data interpretation, and report preparation.

- Kemmerer Coal Company - Frontier, Wyoming. Managed and conducted hydrogeologic and water quality studies at a proposed open-pit coal mine. Supervised well installation, aquifer testing, sampling, report preparation; interacted with state regulators.

- Anaconda Copper Company - Rico, Colorado. Conducted an investigation of hydrology, water chemistry, and aquatic biology at a complex ore mining district.

- Union Carbide Corporation - Uravan, Colorado. Managed and conducted a water quality monitoring program for a proposed uranium tailings disposal area and effluent evaporation basin. Assisted in design of geochemical testing program to evaluate potential leachate quality.

- Anschutz, Mining Corporation - Laredo, Texas. Managed and conducted an investigation of groundwater hydrology and soils geochemistry and associated hazardous wastes at a metal ore handling and reagent storage facility. Designed sampling protocol; prepared reports; negotiated with state regulators; interacted with attorneys at Baker, Botts.

- Snowmass Coal Company - Carbondale, Colorado. Managed and conducted hydrogeology investigation of an underground coal mine with steeply dipping seams.

- Marline Uranium Corporation/Union Carbide Corporation - Danville, Virginia. Managed water resources portion of a baseline investigation at a proposed hard-rock uranium mine site. Oversaw well installation monitoring programs and dewatering investigations.

- Southern Pacific Petroleum - Means, Kentucky. Conducted baseline hydrogeological/geochemical investigations at a proposed oil shale mine and retort facility.

- Central Arizona Association of Governments - Globe/Miami, Arizona. Conducted study to determine hydrogeologic/geochemical impact of long-term copper mining and processing facility. Designed monitoring programs; interacted with federal, state, local and tribal officials; prepared numerous reports.

- United Nuclear - Homestake Partners - Milan, New Mexico. Conducted hydrogeological/geochemical evaluation of an existing monitoring program for a uranium milling and waste-disposal facility.

- Sultanate of Oman/Tetra Tech International - Muscat, Oman. Member of Water Resources Council Staff, Sultanate of Oman, based in Muscat, Oman. The Water Resources Council was an interministerial body intended to coordinate all water-related activities within the Sultanate. Duties involved planning and design of surface and groundwater projects (both exploration and utilization) for the Omani government; development of water resources policy for the government; hydrogeological field work on both exploration and resource characterization projects - aquifer testing, borehole geophysics, water quality sampling, hydrogeologic mapping; review of work performed (or planned) by other consultants to the government, published reports on water resources of Oman.

- EG&G - Idaho National Engineering Laboratory, Idaho Falls, Idaho. Managed a hydrologic investigation of transuranic nuclide migration in groundwater. Contributed geochemical expertise to evaluation of waste isolation and transport modeling.

- Kerr-McGee Corporation - Grants, New Mexico. Conducted investigation into geochemistry of selenium associated with uranium mining/ milling.

While with the U.S. Geological Survey Water Resources Division, Dr. Moran was responsible for the design, management, and implementation of the following hydrogeological / geochemical studies:

- Metal-Mine Drainage - Colorado. Study of extent and magnitude of mining and mine drainage on the quality of Colorado streams.

- Selenium in Groundwater - Golden, Colorado. Hydrogeological/geochemical investigation of selenium and associated constituents at the margins of Rocky Flats nuclear plant.

- Geothermal Resources - Colorado. Reconnaissance investigation of potential geothermal resources throughout Colorado.

- Underground Coal Mine Water Quality - Colorado. Evaluation of existing and potential water quality problems from underground coal mines.

- In Situ Uranium Leaching - Grover, Colorado. Study of geochemical and hydrologic processes associated with in situ uranium mining and reinjection of waste products.

- Alluvial Metal Transport - Telluride, Colorado. Investigation of metal movement from tailings ponds into alluvium.

- Southwest Colorado Groundwater - Colorado. Study to determine availability and quality of groundwater in southwestern Colorado.

- Oil Shale Waters - Piceance Basin Colorado. Evaluation of disposal of saline groundwater discharged to the surface during oil shale development.

- Grace Coal Site - Axial Basin, Colorado. Hydrogeological /water quality study of proposed open-pit coal site.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

In the Matter of	)	
POWERTECH, INC.	)	Docket No. 40-9075-MLA
(In Situ Leach Facility, Dewey-Burdock, SD	)	

PETITIONER DECLARATION

I, Theador P. Ebert, hereby make the following declaration:

1. I make this affidavit in connection with a Petition to in the Application of Powertech, USA, d/b/a Powertech (a Canadian corporation), a/k/a The Dewey-Burdock Project concerning *in situ leach* uranium mine in Custer County and Fall River County, South Dakota (the "Mine"). My physical address is 538 Albany Ave, Hot Springs, SD South Dakota 57747. The mailing address for me is Same. I am a member of Aligning for Responsible Mining.

2. I have authorized attorneys Bruce Ellison, David Frankel, and other attorneys working with the Clean Water Alliance and Aligning for Responsible Mining to represent me in this matter and to file contentions on my behalf. I am fully familiar with the facts stated herein, and where opinions are expressed, I am competent to state such opinions based on my training, knowledge, experience and expertise. If sworn as a witness, I am competent to testify to the contents hereof.

3. I use water for personal, household, domestic purposes, [including gardening, irrigation, bathing, drinking]. To my knowledge, my water comes from the Ogalala aquifer.
4. At present I have lived in the County of Fall River and the Town of Hot Springs for the last 9 years. I can attest that the water in Edgemont has worsened in just the time I have been here (In both cloudiness and Oder). It
5. Febuary 28th 2010; I drove the stretch of road between Edgmont and Dewey SD there was no evidence that cattle had been grazing on the land west of the tracks for some time. I say this because of the claim that the water is save. It appears the land owners themselves are not so sure of that.

6. I live her and my thoughts are to the future. My great grand children have a right to clean water and a cleaner invirоment. Uranium is just too deadly to mess with. I can understand as a Country we must defend ourselves. The uranium being mined is not for our country and we have no regulation that could holdup to stop Power Tech from selling it to whom ever they choose.

7. As a member of Fall River County and The human race I'm not convinced that this or any other minining technique is safe. That in less it is in direct use for National Defence it should be strictly prohibited.

This Declaration is submitted in accordance with 10 C.F.R. Section 2.304(d) and 28
U.S.C. Section 1746. I declare under penalty of perjury that the foregoing is true and correct.

March 5, 2010

[name]