UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of CROW BUTTE RESOURCES, INC. (In Situ Leach Facility, Crawford, NE) MARSLAND EXPANSION	Docket No. 40-8943 License SUA-1543 January 29, 2013

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: Antonia Loretta Afraid of Bear Cook, Bruce McIntosh, Debra White Plume, Western Nebraska Resources Council ("WNRC"), 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 January 29, 2013 based on the FRN published at 77 Fed. Reg. 71454 (November 30, 2012). Capitalized terms that are not defined herein have the meanings assigned to them in the Marsland Expansion Area

License Amendment Application (the “Application”), which contains the Technical Report (May 2012) (“TR”) and Environmental Report (May 2012) (“ER”) filed by Applicant Crow Butte Resources, Inc. (“Applicant” or “CBR”).

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. A petitioner’s participation in a licensing proceeding hinges on a demonstration of the requisite standing. The requirements for standing are derived from section 189a of the Atomic Energy Act of 1954 (AEA), which instructs the NRC to provide a hearing “upon the request of any person whose interest may be affected by the proceeding.” The Commission’s implementing regulation, 10 C.F.R. § 2.309(d), directs a licensing board, in ruling on a request for a hearing, to consider (1) the nature of the petitioner’s right under the AEA or the National Environmental Policy Act (NEPA) to be made a party to the proceeding; (2) the nature and extent of the petitioner’s property, financial, or other interest in the proceeding; and (3) the possible effect of any decision or order that may be issued in the proceeding on the petitioner’s interest. In that regard, the Commission has long applied the test employed in the federal courts in resolving standing issues — i.e., the petitioner must allege “***a concrete and particularized injury that is ... fairly traceable to the challenged action and [is] likely to be redressed by a favorable decision***.” (Emphasis added.) In addition, the claimed injury must be arguably within the zone of interests protected by the governing statute. In order to determine whether an interest is in the “zone of interests” of a statute, “it is necessary ‘first [to] discern the interests “arguably ... to be protected" by the statutory provision at issue,' and 'then to inquire whether the [petitioner's] interests affected by the agency action are among them.' " *In The Matter of Crow Butte Resources, Inc. (In Situ Leach Facility, Crawford, Nebraska),* 68 N.R.C. 691, 701-702 (2009)(citations omitted).

When NEPA is among the relevant statutes, the zone of interests is quite wide and includes procedural protections and impacts to aesthetic and other non-economic values. See, *Rocky Mt. Oil & Gas Assoc. v. United States Forest Serv.,* 157 F. Supp. 2d 1142, 1144 (D. Mont. 2000), *aff'd.* 12 Fed. Appx. 498 (2001) *cert denied* 534 U.S. 1018 (holding that "the possibility of oil and gas technology spoiling the pristine scenery and diverse resources" and "value of place" are proper factors to consider when raised by the public in a NEPA analysis). On behalf of its Oglala members, ARM also asserts a concrete interest in the protection of lands, natural resources, economic prosperity, and the health, safety, and welfare of the Oglala, which are all threatened by the proposed project.

Background:

A hearing is required in order to shed the light of day on this proposed action near existing uranium recovery operations of Applicant near Crawford and Marsland, NE. Each Requestor/Petitioner is located within the 80 Km radius of the MEA and/or is in the pathway of contaminants from the ISL uranium mining operations of Applicant CBR described in the APPLICATION and/or has an interest in traditional cultural resources at the MEA. These pathways are further described in the geologic and stratiagraphic opinion letter of Dr. Hannan LaGarry. In summary, CBR's operations are mining uranium in mineralized fractures and faults which cause inter-connection between the aquifer being mined and other aquifers being used for drinking and other purposes in and around Crawford and Chadron, Nebraska, and Pine Ridge Indian Reservation; as well as inter-connection with the Niobrara River and White River. Further, as described in the opinion of Dr. Lou Redmond, the survey and description of cultural resources and consultations are inadequate and violate applicable law.

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[1]

A. Individuals

Antonia Loretta Afraid of Bear Cook. Slim Buttes, Pine Ridge Indian Reservation and Chadron, Nebraska. Antonia Loretta Afraid of Bear Cook is an enrolled member of the Oglala Sioux Tribe. She and her husband own a home and five acres in Chadron, NE and a home and vegetable farming operation located alongside the White River in southwestern Pine Ridge Indian Reservation, at Allotment 1144-C situated three miles north of the Nebraska state line near BIA Road 41. At both of the houses, the Cooks use water for all personal and domestic household purposes. Mrs. Cook believes that her

[1] 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.

water in Chadron comes from the secondary porosity of the Brule Formation, within which she has a 90 ft. well. On the Reservation, her water comes from a tribal pipeline drawing from the Arikaree aquifer some miles north of Pine Ridge Village. She also uses water from the White River for vegetable gardening both for subsistence and marketing and sale and have done so for the past 28 years. Her daughter and son-in-law make their living by market gardening and by the outreach gardening assistance program of which the Cooks are a part. That program supported 416 family and community gardens at Pine Ridge Reservation in 2012. Mrs. Cook asserts vested interests in traditional cultural properties that may exist within the MEA. Antonia Loretta Afraid of Bear Cook is a member of Aligning for Responsible Mining ("ARM") and is associated with Western Nebraska Resources Council ("WNRC").

Bruce McIntosh: Chadron, Nebraska. Mr. McIntosh is a member of Western Nebraska Resources Council. He uses water for personal, household, domestic purposes, including gardening, bathing, and drinking. He has lived, worked and played in Dawes County for 67 years. He is also concerned about potential natural inter-mixing of aquifers from the mining areas due to fracturing in the rock as well. Mr. McIntosh states that the harm to his wellbeing, health and to the communities surrounding the Licensed Area would be catastrophic if the water supplies are contaminated or diminished, which would include harms to tourism, ranching businesses and livelihood. Mr. McIntosh is very concerned about recent local fires, caused by man induced drought.

Debra White Plume. Manderson, Pine Ridge Indian Reservation. She is an enrolled member of the Oglala Sioux Tribe. She uses water for personal, household, domestic purposes, including gardening, irrigation, bathing, drinking. To her knowledge, her water comes from the Arikaree aquifer. She has a well in that aquifer. She also uses water for ranching purposes and maintains livestock including horses and buffalo. She states that 'the elk and deer and antelope drink water also as do the birds and other life forms. The water must be protected for them as well." *White Plume Declaration at 1*. She states "Water is sacred and a gift for life. Water is finite. It is my duty to protect our sacred water for our coming Lakota and Northern Cheyenne generations. Our generations did not give free, prior and informed consent for this mining to happen in our area." *Id*.

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 member Antonia Loretta Afraid of Bear Cook is an individual petitioner in this proceeding. Mr. Frankel's Declaration on behalf of ARM states ARM's address and is filed herewith. ARM is seeking organizational standing in this proceeding; and in the alternative, ARM is seeking representational standing in this proceeding.

Western Nebraska Resources Council, by Bruce McIntosh, Vice-Chairman: Western Nebraska Resources Council ("WNRC"), is a Nebraska nonprofit which was formed in 1983 to protect the natural resources of Western Nebraska with a focus on groundwater contamination from uranium mining. WNRC member Bruce McIntosh is an individual petitioner in this proceeding. WNRC is seeking organizational standing in this proceeding; and in the alternative, WNRC is seeking representational standing in this proceeding.

EXPERT OPINIONS

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, January 28, 2013 ("LaGarry Opinion"), attached to this Petition as Exhibit 1, which is incorporated herein by this reference as if fully set forth at length herein.

(b) Opinion of Dr. Lou Redmond, January 28, 2013 ("Redmond Opinion"), attached to this Petition as Exhibit 2, which is incorporated herein by this reference as if fully set forth at length herein.

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 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.

NRC Regulation Section 40.9 provides that all information provided to the Commission by Applicant shall be complete and accurate in "all material respects." 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.

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 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.** (Emphasis added.)

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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.** (Emphasis added.)

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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: Failure to Quantify and Describe Preoperational Baseline Water Quality and Failure to Analyze and Describe Cumulative Impacts of Multiple DDWs

(A)(1) The Application violates 10 C.F.R. § 51.45, 51.60, and the National Environmental Policy Act, requiring a description of the affected environment, in that it fails to accurately quantify and describe the pre-operational baseline water quality within the MEA, in violation of Section 51.45(c) and 10 CFR Part 40 Appendix A, Criterion 5(B)(3)(a)(iii).

(A) (2) It further violates such sections by failing to analyze or describe the cumulative impacts of Applicant's existing DDWs in combination with the DDW planned for the MEA.

Basis and Discussion:

This contention is supported by the LaGarry Opinion, although as a contention of omission, it is not necessary to provide expert support.

10 C.F.R. § 51.45 and the National Environmental Policy Act require a description of the

affected environment containing sufficient data to aid the Commission in its conduct of an independent analysis. 10 C.F.R. Part 40, Appendix A, criterion 7 requires the Applicant to provide "complete baseline data on a milling site and its environs." NUREG-1569 section 2.7.1(4) requires that ISL applications must provide an "assessment of available ground-water resources and ground-water quality within the proposed permit boundaries and adjacent properties, including a quantitative description of the chemical and radiological characteristics of the ground water and potential changes in water quality caused by operations." NUREG-1569 section 2.7.3(4) sets forth acceptance criteria for the Application requiring a "reasonably comprehensive chemical and radiochemical analysis of water samples, obtained within and at locations away from the mineralized zone(s)...to determine pre-operational baseline conditions." NUREG-1569, section 2.7.3(4). This acceptance criteria also requires an applicant to "show that water samples were collected by acceptable sample procedures...." Id. See also NUREG-1569 Section 2.7.4. Lastly, NUREG-1569 requires that "[t]he applicant should identify the list of constituents to be sampled for baseline concentrations. The list of constituents in Table 2.7.3-1 is accepted by the NRC for *in situ* leach facilities." NUREG-1569, section 2.7.3.

(A) (3) The Application documents repeatedly attempt to convey the impression that the ground water quality is already degraded, rather than compile statistically-defensible data from both the ore zones and non-mineralized zones.

Much of the Application discussion concerning ground water quality seems focused on showing that the site waters are already contaminated or of low quality. This would not be surprising given the presence of the uranium mineralization which would have caused increased concentrations of numerous chemical constituents above true, pre-mining baseline.

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ER 3.3.1.1 Regional Setting

Review of geophysical logs from within the permit boundaries indicates that the upper/middle Chadron has poor reservoir characteristics and minimal water saturation. When compared to aquifers of the Brule Formation and basal sandstone of the Chadron Formation (discussed below), inflections in resistivity, neutron, and SP curves are almost wholly unseen within the upper/middle Chadron (Figures 3.3-3a through 3.3-3n and 3.3-4).

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ER 3.4.1 Water Use

Groundwater from the underlying basal sandstone of the Chadron Formation is not used as a domestic supply within the **MEA** because of the greater depth (800 to 1,150 feet bgs) and inferior water quality. Gosselin et al. (1996) state that: (1) *"the sands near the bottom of the Chadron Formationyield sodium-sulphatewater with high total dissolved solids,"* and (2) in proximity to *"uranium deposits in the Crawford area, groundwaterfrom the Chadron Formation is not suitable for domestic or livestock purposes because of high radium concentrations." In* addition, it is economically impractical to install water supply wells into the deeper basal sandstone of the Chadron Formation in the vicinity of the MEA, in contrast to the vicinity of the NTEA, where most basal sandstone of the Chadron Formation wells either flow at the surface or have water levels very close to surface elevation because of artesian pressure. (Emphasis in original.)

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ER 3.4.3.1 Groundwater Occurrence and Flow Direction

In the vicinity of the MEA, the alluvium, Arikaree Formation, Brule Formation, and basal sandstone of the Chadron Formation are considered water-bearing intervals. The alluvial deposits and Arikaree Formation are not typically considered to be reliable water sources. Sandy siltstones, overbank sheet sandstones, and occasional thick channelized sandstones that occur throughout the Orella Member of the Brule Formation may be locally water-bearing units. These sandstone and siltstone units are difficult to correlate over any large distance and are discontinuous lenses rather than laterally continuous strata. Although the Brule Formation is a local water-bearing unit, it does not always produce usable amounts of water. Despite this characteristic, the Brule Formation has historically been considered the shallowest aquifer above the basal sandstone of the Chadron Formation, and water supply wells have been completed in this unit.

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The hydrologic parameters observed at the MEA are consistent with, although slightly higher than, the aquifer properties determined for the areas of the CPF, TCEA, and NTEA

(Table 3.4-8). No water level changes of concern were observed in any of the overlying wells during testing. The pumping test results demonstrate the following important conclusions:

* The pumping well and all observation wells completed in the basal sandstone of the Chadron Formation exhibited' significant and predictable drawdown during the test, demonstrating that the production zone has hydraulic continuity throughout the MEA test area.

" The average transmissivity of the basal sandstone of the Chadron Formation within the portion of the MEA investigated during the test is significantly higher than the areas investigated within the TCEA, NTEA, and existing Crow Butte operations.

2. * A zone of relatively lower permeability is apparent in the vicinity of the pumping well (CPW-2010-lA) and observation wells CPW-1 and Monitor-3, with significantly higher transmissivity noted elsewhere within the ROI ofthe test.

3. * Adequate confinement exists between the overlying Brule Formation and the basal sandstone of the Chadron Formation, as evidenced by no discernable drawdown in the Brule Formation observation wells.

4. * The hydrologic properties of the basal sandstone of the Chadron Formation have been adequately characterized within the majority of the proposed MEA to proceed with Class HI UIC permitting and Nan NRC License Amendment Application for the MEA. These conclusions indicate that, though variance in thickness and hydraulic conductivity may impact mining operations (e.g., well spacing, completion interval, and injection/production rates), it is not anticipated to impact regulatory issues.

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ER 3.4.3.3 Hydrologic Conceptual Model for the Marsland Expansion Area

Tables 3.3-1 and 3.3-2 present the regional and local stratigraphic columns in the vicinity of MEA. The water-bearing units within the stratigraphic section present at the MEA include alluvial deposits (rarely), permeable intervals of the Arikaree Formation, permeable intervals in the Orella Member of the shallow Brule Formation, and the deeper confined basal sandstone of the Chadron Formation. The upper and lower confining units and the hydrologic conditions for the water-bearing intervals present at the MEA are discussed below.

<u>Confining Layers</u>

Upper confinement for the basal sandstone of the Chadron Formation within the MEA is represented by 430 to 940 feet of smectite-rich mudstone and claystones of the upper Chadron and middle Chadron (Figures 3.3-3a through 3.3-3n, 3.3-7, and 3.3-8). Particle grain size analyses of four core samples from the upper confining layer within the MEA indicate that all samples were clayey siltstone (Appendix G). XRD analyses indicate that compositions of mudstone and claystone intervals of core samples from the middle Chadron are highly similar to the Pierre Shale (e.g., predominantly mixed-layered illite/smectite or montmorillonite with quartz), which would be expected if the Pierre Shale was a source of materials for the overlying middle Chadron (Appendix G). Significant water-bearing sandstones of the upper/middle Chadron are not present within the MEA. As a result, the Brule Formation is vertically and hydraulically isolated from the underlying aquifer proposed for exemption.

Lower confinement for the basal sandstone of the Chadron Formation in the vicinity of the MEA is represented by approximately 750 to more than 1,000 feet of black marine shale deposits of the Pierre Shale. Additional low permeability confining units are represented by the underlying Niobrara Formation, Carlile Shale, Greenhorn Limestone, and Graneros Shale. Together with the Pierre Shale, these underlying low permeability units hydraulically isolate the basal sandstone of the Chadron Formation from the underlying "D", "G", and "J" sandstones of the Dakota Group by more than 1,000 vertical feet (Table 3.3-1). The Pierre Shale is not a water-bearing unit, exhibits very low permeability, and is considered a regional aquiclude. Regional estimates of hydraulic conductivity for the Pierre Shale range from **10-7** to 1012 cm/sec (Neuzil and Bredehoeft 1980; Neuzil et al. 1982; Neuzil 1993). The Pierre Shale has a measured vertical hydraulic conductivity at the CPF of less than 1 x **10-1l** cm/sec (Wyoming Fuel Company 1983), which is consistent with other studies in the region. Particle grain-size analyses of two samples collected from the Pierre Shale within the MEA indicate low permeability silty clay compositions. Regional studies also indicate that there is no observed transmissivity between vertical fractures in the Pierre Shale, which appear to be short and not interconnected (Neuzil et al. 1982).

Estimates of hydraulic conductivity were developed using particle grain size distribution data from the four core samples collected within the upper Chadron and middle Chadron. Results of the particle size distribution analyses indicate sediments dominated by silts and clays. Hydraulic conductivity estimates were developed using the Kozeny-Carman equation, which is appropriate for sands and silts, but not for cohesive clayey soils with a high degree of plasticity. Estimated hydraulic conductivities of the two core samples collected within the upper Chadron ranged from 5.4xl0-5 to 5.9xl **0-5** cm/sec. Estimated hydraulic conductivities of the two core samples collected within the middle Chadron ranged from 1.7x1 ***0-5*** to 2.9xl ***0-5*** cm/sec. Hydraulic conductivities for the two core samples collected within the Pierre Shale were not estimated by the Kozeny-Carman method due to significant levels of clay. The vertical hydraulic conductivity across the upper and lower confining layers is likely to be even lower due to vertical anisotropy. Additionally, hydraulic resistance to vertical flow is expected to be low due to the significant thickness of the upper confining zone within the MEA, which ranges between 430 and 940 ft.

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In the vicinity of the MEA, groundwater flow in the basal sandstone of the Chadron Formation is predominantly to the northwest toward the White River drainage at a lateral hydraulic gradient of 0.0004 ft/ft (Aqui-Ver 2011). Regional water level information for the basal sandstone of the Chadron Formation is currently only available in the vicinity of the current production facility and the NTEA, but suggest a discharge point at an elevation of at least 3,700 feet amsl (or below) located east of Crawford, presumably at a location where the basal sandstone of the Chadron Formation is exposed.

Regional water level information for the Brule Formation is currently only available in the vicinity of the current production facility. However, within the MEA, groundwater generally flows to the southeast across the entire MEA toward the Niobrara River at a lateral hydraulic gradient of 0.011 ft/ft (Aqui-Ver 2011). Though the Brule Formation is the primary groundwater supply in the vicinity of the MEA, low production rates indicate that the discontinuous sandstone lenses of the Orella Member may not be hydraulically well connected. Recharge to this unit likely occurs directly within the MEA, as the unit is unconformably overlain by 50 to 210 feet of overlying Arikaree Formation and 0 to 30 feet of unconsolidated alluvial and colluvial deposits (depending on local topography). Monitoring wells will be installed in the Brule Formation

between the license boundary and the Niobrara River to monitor water quality in the event of failure of an injection well or production well, and to prevent potential communication of mining fluids with surface water (see Section 6.2.2.2 for a more detailed discussion). Installation of such monitoring wells is required under the Class III injection well permit. Alluvial deposits along the margins of the Niobrara River may offer limited groundwater storage depending on river levels.

The Brule Formation and basal sandstone of the Chadron Formation within the MEA have distinct and differing water level elevations (Figures 3.3-3a through 3.3-3n and Table **6.1-7).** See discussions of water level measurements for CBR monitor wells in Section 6.1.2.2. The available water level data suggest hydrologic isolation of the basal sandstone of the Chadron Formation with respect to the overlying water-bearing intervals in the MEA. This inference is further supported by the difference in geochemical groundwater characteristics between the basal sandstone of the Chadron Formation and the Brule Formation (see Section 6.1.2.3; Tables 6.1-4,

6.1-8, 6.1-9, 6.1-10 and **6.1-11).** In summary, the following multiple lines of evidence indicate adequate hydrologic confinement

of the basal sandstone of the Chadron Formation within the MEA.

" Results of the May 2011 aquifer pumping test demonstrate no discernable drawdown in the overlying Brule Formation observation wells screened throughout the **MEA** (see Section 3.4.3.2).

- Large differences in observed hydraulic head (330 to 500 feet) between the Brule Formation and the basal sandstone of the Chadron Formation indicate strong vertically downward gradients and minimal risk of naturally occurring impacts to the overlying Brule Formation (see Section 3.4.3.1).

* Significant historical differences exist in geochemical groundwater characteristics between the basal sandstone of the Chadron Formation and the Brule Formation (Section 6.1.2.3).

5. * Site-specific XRD analyses, particle grain size distribution analyses, and geophysical logging confirm the presence of a thick (up to 940 feet), laterally continuous upper. confining layer consisting of low permeability mudstone and claystone, and a thick (more than 750 feet), regionally extensive lower confming layer" composed of very low permeability black marine shale.

6. * Analyses of particle size distribution results suggest a maximum estimated hydraulic conductivity of **10-'** cm/sec for core samples from the upper confining layer.

7. * Hydraulic resistance to vertical flow is expected to be low due to the significant thickness of the upper confining zone within the MEA.

8. * The vertical hydraulic conductivity across the upper and lower confining layers is likely to be even lower than ***105*** cm/sec due to vertical anisotropy.

ER 3.4.3.4 Description of the Proposed Mining Operation and Relationship to Site Geology and Hydrology

The basal sandstone of the Chadron Formation is currently mined using ISR techniques within the MUs of the current Crow Butte operations and represents the production zone and target of solution mining in the MEA. Ore-grade uranium deposits underlying the MEA are located in the basal sandstone of the Chadron Formation (Figure 1.3-1). The ore body located within the MEA is a stacked roll-front system, which occurs at the boundary between the up-dip and oxidized part of a sandstone body and the deeper down-dip and reduced part of the sandstone body. Stratigraphic thickness of the unit within the MEA ranges from approximately 20 to 110 feet, with an average thickness of approximately 55 feet. The unit occurs at depths ranging from about 817 to 1,130 feet bgs within the MEA (Figures 3.3-3a through 3.3-3n). A competent upper confming layer consists of the overlying middle Chadron and upper Chadron, which consist predominantly of clay, claystone, and siltstone. Based on extensive exploration hole data collected to date (more than 1,650 drill locations), the thickness of the upper confining layers in the MEA range from 430 to 940 feet (Figures 3.3-3a through 3.3-3n). Estimated hydraulic conductivities based on particle grain size distribution analyses for site-specific core samples collected within the upper confining layer are on the order of **10-5** cm/sec (see Confining Layers above). Geophysical logs from nearby oil and gas wells indicate that the thickness of the Pierre Shale lower confining layer ranges from approximately 750 to more than 1,000 feet (see White River Group in Section 3.3.1.1). The full thickness of the Pierre shale is not depicted on Figures 3.3-3a through 3.3-3n, as the required scale would obscure stratigraphic details of the overlying White River Group. The Pierre Shale exhibits very low permeabilities on the order of 0.01 millidarcies (md; less than 1 x **10-10** cm/sec; Wyoming Fuel Company 1983).

Based on similar regional deposition, the MEA ore body is expected to be similar mineralogically and geochemically to that of the CPF. The ore bodies in the two areas are within the same geologic unit (i.e., basal sandstone of the Chadron Formation) and have the same mineralization source (see Section 3.3.1.2). The sites are separated by only a few miles, and the cause of mineral deposition in the two areas appears to be similar (see Section 3.31.2). Neither site is anticipated to be affected by any recharge or other processes that would uniquely affect each area, so the groundwater characteristics of the current Crow Butte mineralized zone are presumed

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TR **2.6.1** Geology and Seismology

2.6.1.1 Regional Setting

… Though a thick (approximately 1,200 to 1,500 feet), regionally extensive stratigraphic section of sedimentary units underlies the Pierre Shale, those units are not relevant to this proposal. The absence of sandstone units for more than 1,000 feet below the top of the Pierre Shale precludes the need for monitoring zones below the surface of the Pierre Shale. Discussion in this report is limited to the Arikaree Group, White River Group, and Pierre Shale (Petrotek 2004; Wyoming Fuel Company 1983).

***

On most MEA logs, resistivity values for alluvium are very high, beyond the log scale, indicating the presence of either soil vapor or fresh water (Figure 2.6-4). In general, shallow zones with elevated resistivity are also distinguished by a negatively deflected spontaneous potential (SP) curve, suggesting the presence of a permeable zone and formation fluid with lower resistivity than the fluid within the borehole. Although these log signatures suggest that the base of the alluvium can be readily identified in geophysical logs, this relationship has not been verified at MEA. Therefore, the alluvium-Arikaree Group contact illustrated on cross-section Figure 2.6-3a through Figure 2.6-3n is an inferred contact.

Arikaree Group (Oli2ocene-Miocene)

The Oligocene-Miocene Arikaree Group is a water-bearing unit overlain by alluvium. The thickness varies from 50 to 210 feet depending upon the degree of erosion. The Arikaree lies unconformably above the Brule Formation and is composed of the upper Harrison Beds, Harrison-Monroe Creek and Gering Formations, aged youngest to oldest, respectively (Table **2.6-** 2) (Collings and Knode 1984; Swinehart et al. 1985; LaGarry 1998; McFadden and Hunt, Jr.1998).

Literature has named the upper Harrison Beds the Marsland Formation or split into the Harrison and Monroe Creek Formations. This application uses nomenclature presented in Swinehart et al. (1985), which uses the upper Harrison Beds, Harrison-Monroe Creek, and Gering Formations.

***

On geophysical logs, the Arikaree Group is characterized by an off-scale resistivity signature (Figure 2.6-4). The neutron-neutron (N-N) or spontaneous potential (SP) curve exhibits small fluctuations and is relatively straight. The SP or neutron curve can also be off the scale. The gamma curve indicates no anomalous radioactivity. No distinguishing features are seen within.the geophysical logs to ascertain contacts within the Arikaree Group. The contact between the Arikaree Group and the overlying alluvium is difficult to ascertain. Often, the SP or neutron curve will begin at the base of the alluvium and the resistivity will move sharply to the right. The contact between the Arikaree and Brule Formations is indicated where the resistivity begins to move left (becomes lower). Little change is seen within the gamma or SP curves.

***

There have been various interpretations of the history of stratigraphic nomenclature for the White River Group of Nebraska and South Dakota as described by Harksen and Macdonald (1969). The following stratigraphic nomenclature retains the formal and informal members based on nomenclature by Schultz and Stout (1955), but also includes more recent nomenclature (Terry and LaGarry 1998; Terry 1998; LaGarry 1998; Hoganson et al. 1998).

Brule Formation

The Oligocene Brule Formation represents the youngest unit within the White River Group, which outcrops throughout most of the Crow Butte area. The unit conformably overlies the Chadron Formation and is unconformably overlain by sandstones of the Arikaree Group (Figure 2.6-1). The Brule Formation was originally subdivided by Swinehart, et al. (1985) and later revised by LaGarry (1998) into three members, from youngest to oldest: the "brown siltstone" member, the Whitney Member, and underlying Orella Member (Table 2.6-2). The "brown siltstone" member consists of pale brown and brown, nodular, cross bedded eolian volcaniclastic siltstones and sandy siltstones.

The contact with the underlying Whitney Member varies from a gradational contact to a sharp disconformity where the "brown siltstone" fills valleys incised into the older strata of the Whitney Member. The Whitney Member consists mostly of pale brown, massive, typically nodular eolian siltstones with rare thin interbeds of brown and bluish-green sandstone, and volcanic ash. The basal 10 meters of the Whitney Member consist of white or green laminated fluvial siltstones, sheet sandstones, and channel sandstones. The contact between the Whitney Member and the underlying Orella Member is intertonguing. The Orella Member consists of pale brown, brown, and brownish-orange volcaniclastic overbank clayey siltstones and silty claystones, brown and bluish-green overbank sheet sandstones, and thin volcanic ashes. Rare thick, fine to medium grained, channelized sandstones appear throughout the Orella Member. These sandstones appear to have very limited lateral extent. The overall thickness of the Brule Formation within the MEA

is generally less than 400 feet and ranges from approximately 50 to 350 feet.

An isopach map of the undifferentiated Brule Formation is shown on Figure 2.6-6. The thickness ranges from approximately 50 to 350 feet and averages about 170 feet. The unit steadily increases in thickness from the southeast to the northwest end of the project, and the unit is stratigraphically continuous.

The contact between the Brule Formation and underlying Chadron Formation is difficult to identify in some places, as the contact between the two formations is intertonguing (LaGarry 1998). Regionally, the contact is recognized as the lithologic change from thinly interbedded and less pedogenically modified brown, orange, and tan volcaniclastic clayey siltstones and sheet sandstones of the Orella Member to pedogenically modified green, red, and pink volcaniclastic silty claystones of Big Cottonwood Creek Member in the upper Chadron Formation (Terry and LaGarry 1998). The Brule Formation is characterized by rapidly fluctuating geophysical log curves, or "log chatter" (Figure 2.6-4). This response is recognized in resistivity curves, and to a lesser extent in SP curves,. throughout the MEA. Such fluctuations result from resistivity contrasts between the thinly interbedded siltstones and sandstones of the Orella Member. Because the sandstones' are porous and constitute a part of the regional aquifer, the contacts with the interbedded, dry siltstones are sharp and easily recognized on logs (Gutentag et al. 1984). Lateral correlation of beds within the Brule Formation is very difficult due to generally thin bed thicknesses and limited lateral extent.

The contact between the interbedded siltstones and sandstone of the Brule Formation and the silty claystones of the upper Chadron Formation is distinguished by a dropoff of "log chatter' and establishment of relatively flat or straight curves (i.e., the shale baseline) on both resistivity and SP logs (Figure 2.6-4). Because of the intertonguing nature of the lower Brule and upper Chadron Formations, thin, isolated sandstones and siltstones may be present in the upper Chadron, making it appear that the formation contact is deeper in some wells. Figures 2.6-3a through 2.6-3n depict the subsurface geology of the Brule Formation within the MEA.

Chadron Formation

The Eocene-Oligocene Chadron Formation is in the lower part of the White River Group (Table 2.6-2). The Chadron Formation conformably overlies the basal sandstone and is conformably overlain by the Brule Formation. From top to bottom, the Chadron Formation historically consists of the following stratigraphic units: Big Cottonwood Creek Member (herein referred to as the informal upper Chadron and upper/middle Chadron to be consistent with historical permitting), Peanut Peak Member (herein referred to as the informal middle Chadron to also be consistent with historical permitting), and basal sandstone of the Chadron Formation (also known formally as the Chamberlain Pass Formation)- The basal sandstone of the Chadron Formation represents the production zone and target of ISR mining within the MEA. Figures 2.6-3a through 2.6-3n depict the subsurface geology of the Chadron Formation within the MEA.

Upper Chadron Formation

The upper Chadron Formation and upper/middle Chadron Formation are composed primarily of volcaniclastic overbank silty' claystones interbedded with tabular and lenticular channel sandstones, lacustrine limestones, pedogenic calcretes, marls, volcanic ashes, and gypsum (Terry and LaGarry 1998). Tuffs in the Toadstool Park area that occur in the upper Chadron were dated by $^{40}Ar/^{39}Ar$ methods as late Eocene (-34,000,000 years ago) in age (Terry and LaGarry 1998). The lower boundary of this member is an intertonguing contact with the underlying middle Chadron, or is a local unconformity where the upper/middle Chadron fills valleys and depressions (Terry and LaGarry 1998; Table 2.6-2). The upper boundary is recognized by a lithologic change from pedogenically modified green, red, and pink volcaniclastic silty claystones of the upper Chadron to thinly interbedded and less pedogenically modified brown, orange, and tan volcaniclastic clayey siltstones and sheet sandstones of the Orella Member of the Brule Formation (Terry and LaGarry 1998; Table 2.6-2).

The upper Chadron is the youngest member of the Chadron Formation (Table 2.6-2). The upper part of the upper Chadron is light green-gray bentonitic clay grading downward to green and frequently red clay, though interbedded sandstones also occur. An isopach map of the upper Chadron is shown on Figure 2.6-7. The available data suggest that the upper Chadron ranges in stratigraphic thickness from approximately 410 to 650 feet and averages about 507 feet across the MEA (Figure 2.6-3a through 2.6-3n). Two core samples (M-1454c, Run 1and M-1624c, Run 1) were collected from the upper Chadron by CBR at boreholes M-1454c and M1624c, sections 1 and 12, T29N, R51W of the MEA (Figure 2.6-2). X-ray diffraction (XRD) analyses of M-1454c Run 1 and M-1624 Run 1 samples indicate varied compositions. M-1454c Run 1 was primarily composed of calcite, montmorillonite, and quartz. Minor amounts of plagioclase, potassium feldspar, and illite/mica were recorded. M-1624c was primarily composed of mixed layered illite/smectite, calcite, and quartz. Minor amounts of plagioclase, potassium feldspar, magnetite, and illite/mica were recorded. Particle size distribution analyses of M-1454c Run 1 and M-1624c.

***

Typical GR, SP, and resistivity log signatures for the middle Chadron exhibit curves representative of the shale baseline (Figure 2.6-4). The contact between the top of the middle Chadron and the overlying upper Chadron is difficult to ascertain due to similarities in grain size. At MEA, due to like lithology and geophysical log responses between the upper/middle and middle Chadron Formation, it is difficult to define the contact between these units. Therefore, Figures 2.6-3a through Figure 2.6-3n show an inferred stratigraphic location for the upper/middle Chadron and middle Chadron contact across the license area.

The upper and middle Chadron units represent the upper confining zone for the basal sandstone of the Chadron Formation within the MEA (see detailed discussion in Section 2.7.2.3). Isopach maps created for the formations that comprise the upper confining zone are presented as Figures 2.6-7 (upper Chadron) and 2.6-8 (middle Chadron). Because the upper/middle Chadron is not recognizable on geophysical logs or in cores, its thickness is considered to be zero across the **MEA** and it is not included as part of either upper confining zone isopach map. The total thickness of the upper confining zone ranges from approximately 430 to 940 feet, averages about 690 feet, and generally appears to thicken toward the south and southwest across the MEA.

***

All geologic units encountered during the drilling of oil and gas exploration wells in the vicinity of the MEA appear to be consistent with known regional stratigraphy. Geologic units that are consistently identified in all wells include the Niobrara Formation, Carlile Shale, Greenhorn Limestone, "D" and "J" sands of the Dakota Group, and the Skull Creek Formation (Table 2.6- 1).

***

TR 2.6.1.3 Structural Geology

The most prominent structural expression in northwest Nebraska is the Chadron Arch (Figures 2.6-11 and 2.6-12). Together with the Chadron Arch, the Black Hills Uplift produced many of the prominent structural features presently observed in the region. The Chadron Arch is an anticlinal feature that strikes roughly northwest-southeast along the northeastern boundary of Dawes County. Swinehart et al. (1985) suggested multiple phases of probable uplift in northwestern Nebraska near the Chadron Arch between about 28 Ma and <5 Ma. The only known surficial expressions of the Chadron Arch are outcroppings of Cretaceous rocks that predate deposition of the Pierre Shale in the northeastern corner of Dawes County, as well as in small portions of Sheridan County, Nebraska and Shannon County, South Dakota. The general locations of faults in northwest Nebraska are depicted on the State Geologic Map shown on Figure **2.6-1.**

The 230-mile (370-km) long Pine Ridge escarpment exhibits. an average of 1,200 feet of.relief (Nixon 1995). The Pine Ridge is an are roughly concentric to the Black Hills Dome, which suggests an apparent structural relationship. Nixon (1995) interpreted the escarpment as representing the southern outermost cuesta of the Black Hills Dome. The escarpment is capped by sandstone of the Arikaree Group with exposed deposits of the White River Group mapped along the topographically lower, northern side ofthe escarpment.

The Crow Butte area, including the CPF, NTEA, and TCEA, is within the Crawford Basin (DeGraw 1969). The proposed MEA lies just outside of the southern boundary of the basin along the Cochran Arch.! DeGraw (1969) substantiated known structural features and proposed several previously unrecognized structures in western Nebraska based on detailed studies of primarily deep, oil test hole data collected from pre-Tertiary subsurface geology. The Crawford Basin was defined by DeGraw (1969) as a triangular asymmetrical basin about 50 miles (80 kin) long in an east-west direction and 25 miles (40.2 km) to 30 miles (48.3 km) wide. The basin is bounded by the Toadstool Park Fault on the northwest, the Chadron Arch and Bordeaux Fault to the east, and the Cochran Arch and Pine Ridge Fault to the south (Figures 2.6-11 and 2.6-12). The Crawford Basin is structurally folded into a westward-plunging syncline that trends roughly east-west. Note that the Bordeaux Fault, Pine Ridge Fault, and Toadstool Park Fault proposed by DeGraw (1969) are not presented on the State Geologic Map (Figure 2.6-1). The Toadstool Park Fault has been mapped at one location (T33N, R53W) and is estimated to have had approximately 60 feet of displacement (Singler and Picard 1980). The City of Crawford is located near the axis of the Crawford Basin. More recent fault interpretations by Hunt (1990) for northwest Nebraska are also shown on Figure 2.6-12, which include the Whetstone Fault, Eagle Crag Fault, Niobrara Canyon Fault, and Ranch 33 Fault in the vicinity of the Town of Harrison in Sioux County. The faults identified by Hunt (1990) all trend to the northeast-southwest, sub-parallel to the Pine Ridge Fault (Figure 2.6-12).

Diffendal (1994) performed lineament analyses on a mosaic of early Miocene synthetic-aperture radar images and largely confirmed known faults in the vicinity of Chadron. Lineaments in the radar image along Pine Ridge, located to the south of Chadron, are attributed to jointing or faulting and trend N40E and N50W (Diffendal 1982). Similar features were also noted west of Fort Robinson. Swinehart et al. (1985) report that these features are likely an extension of the Wheatland-Whalen trend in Wyoming (Hunt 1981; Wheeler and Crone 2001).

Former drilling activities at the Crow Butte Project identified a structural feature, referred to as the White River Fault, located between the CPF Class III permit area and the **NTEA** (Figure **2.6-** 12). Evidence of a fault was identified during the exploration drilling phase of the Crow Butte Project (Collings and Knode. 1984). The fault is manifested in the vicinity of the NTEA as a significant northeast-trending subsurface fold. The detailed kinematics of the White River Fault were investigated during preparation of the NTEA Petition for Aquifer Exemption. An extensive review of drilling and logging data determined that, while the White River Fault may cut the Pierre Shale at depth along with stratigraphically lower units, there is no evidence that a fault offsets the geologic contact between the Pierre Shale and overlying White River Group or individual members of the White River Group. This fault does not appear to be present in the vicinity of the MEA.

***

(A)(4) Some of the Application discussion is admitted by Applicant to be based on information previously filed with respect to Applicant's other projects – CPF, NTEA, TCEA. However, it is inappropriate to make reference to other proceedings or attempt to incorporate materials from other proceedings. The TCEA is according to the Application not a focus of Applicant and on hold. The NTEA proceeding is pending. Nothing about those two proceedings should be a basis for materials in the Application. The Application needs to stand on its own. Therefore it violates Section 51.45, 51.60, NEPA, and 10 CFR Part 40 Appendix A, Criterion 5(B)(3)(a)(iii).

***

TR 3.4.3 Groundwater

This section describes the regional and local groundwater hydrology including local and regional hydraulic gradient and hydrostratigraphy, hydraulic parameters, baseline water quality conditions, and local groundwater use (including well locations related to the MEA). The discussion is based on information from investigations performed within the MEA, <u>data presented in previous applications/reports for the current CPF where ISR mining is being conducted, the proposed NTEA and TCEA</u>, and the geologic information presented in Section 3.3. In this regard, <u>the hydrogeology of the MEA is expected to be similar in many respects to that encountered in the CPF, NTEA, and TCEA</u>. Groundwater monitoring results and discussions are presented in Section 6.1.2. (Emphasis added.)

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The Application states in a conclusory way that the water is of poor quality and has not been used in the past and cites a 1978 study. This is a failure to include current events and current research. Water in 2013 is a scarce commodity which is expected to become even more scarce during the expected life of this project. Since 1978 the technology for water purification has improved and the cost of filtering water has reduced. The Applicant knows this because it has represented itself as being expert in water filtration technology in order to accomplish the restoration of mine units and wellfields.

***

TR 2.7 Hydrology

2.7.1 Surface Water

2.7.1.1 Water Features Descriptions

2.7.1.1.1 Rivers, Creeks and Drainages

There are 25 segments within the Niobrara River Subbasin N14 (Figure 2.7-3). The MEA is located within the Niobrara River Subbasin N14, with the southernmost license boundary being located approximately 0.25 mile (0.4 km) from the Niobrara River in Segment 4000 (Figure 2.7- **3).**

The Niobrara River originates near Manville, Niobrara County, eastern Wyoming and flows in an east-southeast direction into western Nebraska (Figure **2.7-3** and 2.7-4). The river flows across Sioux County in Nebraska, east through the Agate Fossil Beds National Monument, past Marsland to the south of the proposed MEA project site, and through Box Butte Reservoir. From the reservoir, the river flows east across northern Nebraska, and joins the Snake River approximately 13 miles (20.9 kin) southwest of Valentine. The Niobrara River joins the Keya Paha River approximately 6 miles (9.6 km) west of Butte, Nebraska. The river eventually joins the Missouri River northwest of Niobrara, Nebraska in northern Knox County.

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TR 2.8.5.3 Vegetation and Land Cover Types

Drainages

Drainages in the south end of the project area are well drained and usually dry, covering 2.9 percent of the project area (Table 2.8-2; Figure 2.8-1). The vegetation composition in these intermittent tributaries to the Niobrara River is similar to that of surrounding grassland, though the vegetation is generally more robust. Meadow death camas *(Zigadenusvenenosus),* wild onion *(Allium sp.),* and monkeyflower *(Mimulus sp.)* were observed in these areas. In the north side of the project area, conifers dominate the overstory of drainages with smooth brome in the understory. Standing water was only observed in the northern portion of the survey area, mostly in the area mapped as deciduous streambank forest. The weed houndstongue *(Cynoglossum officinale)* was observed in low densities.

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2.8.10 Aquatic Ecology

The MEA is located within the Niobrara River Basin. Annual flows within the Niobrara River Basin are regulated mainly by snowmelt, precipitation, and groundwater discharge. No perennial streams occur within the MEA. The Niobrara River, located just south of the project area, is the prominent drainage in the vicinity of the MEA and flows into Box Butte Reservoir. Other small drainages include Dooley Spring, Willow Creek, and other small unnamed drainages, but all are dry and re-vegetated. All lack distinct stream channels and banks. Qccasional runoff may create small pools in a few places, but there is no evidence of persistent stream flows in recent times (HWA 2011). Based on existing land uses, intensive grazing and agricultural practices are likely the largest factors influencing water quality in the area.

***

2.9.3 Baseline Groundwater Monitoring

This section discusses the results of the radiological and non-radiological analyses for private water supply wells with the MEA and CBR monitor wells installed within the MEA for purposes of assessing the **MEA** site. In general, groundwater quality in the vicinity near the MEA is poor (Engberg and Spalding 1978). Groundwater obtained from the basal sandstone of the Chadron Formation has a strong sulfur odor as a result of localized reducing conditions associated with the ore body.

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TR 5.7.7.5 Vegetation

5.7.7.6 Food

Due to the arid nature of the area in which the MEA is located, the ephemeral drainages that traverse to MEA license boundary do not carry sufficient water flow to support a fish population. The two major ephemeral drainages eventually connect to the Niobrara River, which is the nearest stream with permanent water. The river is located south of the license boundary, flowing west to east. The Box Butte Reservoir is located on the Niobrara River approximately 3.5 miles (5.6 kin) from the southeastern corner of the MEA license boundary. The Marsland operations will not discharge any liquids to the ephemeral drainages or to any other areas of the proposed operations. Any spills that could occur would be contained per the site spill control plans, and it is highly unlikely that any liquid spills would ever reach the Niobrara River. Therefore, operational sampling of fish is not deemed to be of value.

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6.1.2.4 Oxidation

The oxidant consumers in the basal sandstone of the Chadron Formation are H2S in the groundwater, uranium, vanadium, iron pyrite, and other trace and heavy metals. The impact of these oxidant consumers on the operation of the facility is a general increase in the oxidant consumption over that which would be required for uranium alone. The second effect is a release of iron and sulfate into solution from the oxidation of pyrite. A third effect is an increase in the levels of some trace metals such as arsenic, vanadium, and selenium into solution. As mentioned previously, the iron solubilized will most likely be precipitated as the hydroxide or carbonate, depending on its oxidation state. Any vanadium oxidized along with the uranium will be solubilized by the lixiviant, recovered with the uranium, and could potentially contaminate the precipitated yellowcake product. H20 2 precipitation of uranium is used to reduce the amount of vanadium precipitated in the product. Oxidation will also solubilize arsenic and selenium. The restoration program will return these substances to acceptable levels. A final potential oxidation reaction is the partial oxidation of sulfur species, increasing the concentrations of compounds

such as polythionates, which can foul ***IX*** resins. In *in-situ* operations with chemistries similar to the MEA, these sulfur species are completely oxidized to sulfate, which poses no problems.

***

6.1.3.1 Establishment of Baseline Water Quality

In addition to pre-operational baseline groundwater monitoring, before mining in each MU, the baseline groundwater quality is determined. The baseline data are established in each MU by assigning and evaluating groundwater quality in "baseline restoration wells". A minimum of one baseline restoration well for each 4 acres, but not fewer than six wells total for each MU, are sampled to establish the MU baseline water quality. A minimum of four samples are collected from each well. The samples are collected at least 14 days apart. The samples are analyzed for the parameters listed in Table **6.1-1.**

Table 2.7-5 is the restoration tables for Mine Unit 1 in the current commercial license area. This is provided as an example of the 11 restoration tables for Mine Units 1 through 11. These tables provide the baseline average and the range for all restoration parameters as well as the NDEQ restoration standard approved for that MU in the NOI. Similar tables will be provided for the MEA mine units at the appropriate time to address restoration activities.

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TR 2.7.2 Groundwater

This section describes the regional and local groundwater hydrology including local and regional hydraulic gradient and hydrostratigraphy, hydraulic parameters, baseline water quality conditions, and local groundwater use (including well locations related to the MEA). The discussion is based on information from investigations performed within the MEA, data presented in previous applications/reports for the current CPF where ISR mining is being conducted, the proposed NTEA and TCEA, and the geologic information presented in Section 2.6. In this regard, the hydrogeology of the **MEA** is expected to be similar in many respects to that encountered in the CPF, NTEA, and TCEA.

The hydrostratigraphic section of interest for MEA includes the following (presented in descending order):

* Alluvium* Brule Formation (including the first "aquifer" in the Brule sand/clay)

9. * Chadron Formation (Upper Confining Unit including the upper Chadron confining layer, middle/upper Chadron sand [aquifer, where present], and middle Chadron confining layer)

10. * Basal sandstone of the Chadron Formation (Mining Unit)

11. * Pierre Shale (Lower Confining Unit) With regard to the CPF, NTEA, TCEA, and MEA in particular, two groundwater sources are of interest in the Crow Butte and surrounding area. These are the Brule Formation sand and the basal sandstone of the Chadron Formation. The basal sandstone of the Chadron Formation contains the uranium mineralization at the CPF, NTEA, TCEA, and MEA.

12.2.7.2.1 Groundwater Occurrence And Flow Direction

13.In the vicinity of the MEA, the alluvium, Arikaree Formation, Brule Formation, and basal sandstone of the Chadron Formation are considered water-bearing intervals. The alluvial deposits and Arikaree Formation are not typically considered to be reliable water sources. Sandy siltstones, overbank sheet sandstones, and occasional thick channelized sandstones that occur throughout the Orella Member of the Brule Formation may be locally water-bearing units. These sandstone and siltstone units are difficult to correlate over any large distance and are di'scontinuous lenses rather than laterally continuous strata. Although the Brule Formation is a local water-bearing unit, it does not always produce usable amounts of water. Despite this characteristic, the Brule Formation has historically been considered the shallowest aquifer above the basal sandstone of the Chadron Formation, and water supply wells have been completed in this unit.

14. Locations of all groundwater monitoring wells in the vicinity of the MEA are shown on Figures 2.7-6 and 2.9-3. There are nine active monitoring wells screened in the Brule Formation (BOW- 2010-1, BOW-2010-2, BOW-2010-3, BOW-2010-4, BOW-2010-4A, BOW-2010-5, BOW-2010- 6, BOW-2010-7, and BOW-2010-8). The Walters Drillers Pond-720 (Walters-2) and Walters Drillers Pond-721 (Walters-I) wells are also employed as monitoring wells for the Brule Formation. Well BOW-2010-4 is not being used for baseline water quality monitoring, and plans are to abandon this well in the future. During reaming of this well for casing, the driller lost a bit that he was unable to retrieve. Unsuccessful attempts made to convert the well to a shallow monitor well resulted in the well being considered unacceptable for baseline monitoring. A new replacement Well (BOW-2010-4A) was drilled nearby. Well completion records for these monitoring wells are included in Appendix **E-2.**
15. Thirteen active monitoring wells are screened in the basal sandstone of the Chadron Formation (CPW-2010-1, CPW-2010-1A, Monitor-1, Monitor-2, Monitor-3, Monitor-4A, Monitor-5, Monitor-6, Monitor-7, Monitor-8, Monitor-9, Monitor-10, and Monitor-11) (Figure 2.7-6). Well
16. completion reports for these monitoring wells are included in Appendix **E-2.** Water level measurements and water quality results for groundwater monitor wells are presented
17. **1**
18. in Section 2.9. Private well monitoring results are discussed in Section 2.9.

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TR 2.7.2.2 Aquifer Testing And Hydraulic Parameter Identification Information

The drawdown response measured in all basal sandstone of the Chadron Formation observation wells monitored during the test confirm hydraulic communication between the production zone pumping well and the surrounding observation wells across the entire test area. During the test (pumping and recovery periods), no discernible drawdown or recovery responses attributed to the test were observed in overlying Brule Formation observation wells, which supports the conclusion that adequate confinement exists between the overlying Brule Fornation and the basal sandstone ofthe Chadron Formation.

Drawdown and recovery data collected from observation wells were graphically analyzed to determine the aquifer properties, including transmissivity and storativity. The methods of analysis included the Theis (1935) drawdown and recovery methods and the Jacob Straight-Line

Distance-Drawdown method (Cooper and Jacob 1946).

Estimated hydraulic parameters for individual well locations for the 2011 pumping test are summarized in Table 2.7-3. Results of the 2011 pumping test within the basal sandstone of the Chadron Formation indicate a mean hydraulic conductivity of 25 feet per day (ft/day; ranging from 7 to 62 ft/day) or 8.82 x **10-3** centimeters per second (cm/sec) based on an average net sand

thickness of 40 feet and a mean transmissivity of 1,012 square feet per day (ft^2/day; ranging from 230 to 2,469 ft2/day). Based on both the drawdown and recovery analyses, hydraulic conductivities of the aquifer materials in the vicinity of the pumping well (CPW-2010-1 A, CPW- 2010-1, and Monitor-3) were approximately three to nine times greater than hydraulic conductivities estimated for other observation wells in the pumping test area. An apparent higher conductivity boundary condition effect in these wells was indicated by a flattening of drawdown and recovery curves. Transmissivities for the recovery data were slightly higher than for the drawdown data and are considered more representative of the aquifer properties due to the slight variability in the discharge rate during the drawdown phase of the test. The mean storativity was 2.56 x 10-4 (ranging from 1.7 x ***10-3*** to **832** x **10-5).** Storativity units are a measure of the volumes of water that a permeable unit will absorb or expel from the storage unit per unit of surface area per unit of change in head. Storativity is a dimensionless quantity.

The hydrologic parameters observed at the MEA are consistent with, although slightly higher than, the aquifer properties determined for the areas of the CPF, TCEA, and NTEA (Table 2.7-4). No water level changes of concern were observed in any of the overlying wells during testing. The pumping test results demonstrate the following important conclusions:

* The pumping well and all observation wells completed in the basal sandstone of the Chadron Formation exhibited significant and predictable drawdown during the test, demonstrating that the production zone has hydraulic continuity throughout the MEA test area.

19. * The average transmissivity of the basal sandstone of the Chadron Formation within the portion of the MEA investigated during the test is significantly higher than the areas investigated within the TCEA, NTEA, and existing Crow Butte operations.

20. * A zone of relatively lower permeability is apparent in the vicinity of the pumping well (CPW-2010-1A) and observation wells CPW-1 and Monitor-3, with significantly higher transmissivity noted elsewhere Within the ROI of the test. * Adequate confinement exists between the overlying Brule Formation and the basal sandstone of the Chadron Formation, as evidenced by no discernible drawdown in the Brule Formation observation wells.

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TR 2.7.2.3 Hydrologic Conceptual Model for the Marsland Expansion Area

Tables **2.6-1** and 2.6-2 present the regional and local stratigraphic columns in the vicinity of MEA. The water-bearing units within the stratigraphic section present at the MEA include alluvial deposits (rarely), permeable intervals of the Arikaree Formation, permeable intervals in the Orella Member of the shallow Brule Formation, and the deeper confined basal sandstone of the Chadron Formation. Discussions below describe the upper and lower confining units and the hydrologic conditions for the water-bearing intervals present at the MEA.

Confining Layers

Upper confinement for the basal sandstone of the Chadron Formation within the MEA is represented by 430 to 940 feet of smectite-rich mudstone and claystones of the upper Chadron and middle Chadron (Figures 2.6-3a through 2.6-3n, 2.6-7, and 2.6-8). Particle grain-size analyses of four core samples from the upper confining layer within the MEA indicate that all samples were clayey siltstone (Appendix G). XRD analyses indicate that compositions of mudstone and claystone intervals of core samples from the middle Chadron are highly similar to the Pierre Shale (e.g., predominantly mixed-layered illite/smectite or montmorillonite with quartz), which would be expected if the Pierre Shale was a source of materials for the overlying middle Chadron (Appendix **G).** Significant water-bearing sandstones of the upper/middle Chadron are not present within the MEA. As a result, the Brule Formation is vertically and hydraulically isolated from the underlying aquifer proposed for exemption.

Lower confinement for the basal sandstone of the Chadron Formation in the vicinity of the MEA is represented by approximately 750 to more than 1,000 feet of black marine shale deposits of the Pierre Shale. Additional low permeability confining units are represented by the underlying Niobrara Formation, Carlile Shale, Greenhorn Limestone, and Graneros Shale. Together with the Pierre Shale, these underlying low permeability units hydraulically isolate the basal sandstone of the Chadron Formation from the underlying "D", "G", and "J" sandstones of the Dakota Group by more than 1,000 vertical feet (Table 2.6-1). The Pierre Shale is not a water-bearing unit, exhibits very low permeability, and is considered a regional aquiclude. Regional estimates of hydraulic conductivity for the Pierre Shale range from **10-7** to 10-12 cm/sec (Neuzil and Bredehoeft 1980; Neuzil et al. 1982; Neuzil 1993). The Pierre Shale has a measured vertical hydraulic conductivity at the CPF of less than 1 x 10-1° cm/sec (Wyoming Fuel Company 1983), which is consistent with other studies in the region. Particle grain-size analyses of two samples collected from the Pierre Shale within the MEA indicate low permeability silty clay compositions. Regional studies also indicate that there is no observed transmissivity between vertical fracturesin the Pierre Shale, which appear to be short and not interconnected (Neuzil et al. 1982).

Estimates of hydraulic conductivity were developed using particle grain-size distribution data from the four core samples collected within the upper Chadron and middle Chadron. Results of the particle size distribution analyses indicate sediments dominated by silts and clays. Hydraulic conductivity estimates were developed using the Kozeny-Carman equation, which is appropriate for sands and silts, but not for cohesive clayey soils with a high degree of plasticity. Estimated hydraulic conductivities of the two core samples collected within the upper Chadron ranged from 5.4x1 ***0-5*** to 5.9x10-5 cm/sec. Estimated hydraulic conductivities of the two core samples collected within the middle Chadron ranged from 1.7x10-5 to 2.9x10-5 cm/sec. Hydraulic conductivities for the two core samples collected within the Pierre Shale were not estimated by the Kozeny-Carman method due to significant levels of clay. The vertical hydraulic conductivity across the upper and lower confining layers is likely to be even lower due to vertical anisotropy. Additionally, hydraulic, resistance to vertical flow is expected to be low due to the significant thickness of the upper confining zone within the MEA, which ranges between 430 and 940 ft.

Hydrologic Conditions

A potentiometric map and cross-sections of the basal sandstone of the Chadron Formation indicate confined groundwater flow (Figures 2.9-5 and 2.6-3a through 2.6-3n). Elevations of the potentiometric surface of the basal sandstone of the Chadron Formation indicate that the recharge zone must be located above a minimum elevation of 3,715 feet amsl. Confined conditions exist at the MEA as a result of an elevated recharge zone most likely located west or southwest of the MEA. The top of the basal sandstone of the Chadron Formation occurs at much lower elevations within the MEA, ranging from approximately 3,360 to 3,480 feet amsl (Figures 2.6-3a through 2.6-3n).

In the vicinity of the MEA, groundwater flow in the basal sandstone of the Chadron Formation is predominantly to the northwest toward the White River drainage at a lateral hydraulic gradient of 0.0004 ft/ft (Aqui-Ver 2011). Regional water level information for the basal sandstone of the Chadron Formation is currently only available in the vicinity of the current production facility and the NTEA, but suggest a discharge point at an elevation of at least 3,700 feet amsl (or below) located east of Crawford, presumably at a location where the basal sandstone of the Chadron Formation is exposed.

Regional water level information for the Brule Formation is currently only available in the vicinity of the current production facility. However, within the MEA, groundwater generally flows to the southeast across the entire MEA toward the Niobrara River at a lateral hydraulic gradient of 0.011 ft/ft (Aqui-Ver 2011). Though the Brule Formation is the primary groundwater supply in the vicinity of the MEA, low production rates indicate that the discontinuous sandstone lenses of the Orella Member may not be hydraulically well-connected. Recharge to this unit likely occurs directly within the MEA, as the unit is unconformably overlain by 50 to 210 feet of overlying Arikaree Formation and 0 to 30 feet of unconsolidated alluvial and colluvial deposits (depending on local topography). Monitoring wells will be installed in the Brule Formation between the license boundary and the Niobrara River to monitor water quality in the event of failure of an injection well or production well, and to prevent potential communication of mining fluids with surface water (see Section 2.7.2.4 for a more detailed discussion). Installation of such monitoring wells is required under the Class III injection well permit. Alluvial deposits along the margins of the Niobrara River may offer limited groundwater storage depending on river levels.

The Brule Formation and basal sandstone of the Chadron Formation within the MEA have distinct and differing water level elevations (Figures 2.6-3a through 2.6-3n, Table 2.9-7). The available water level data suggest hydrologic isolation of the basal sandstone of the Chadron

Formation with respect to the overlying water-bearing intervals in the MEA. This inference is. further supported by the difference in geochemical groundwater characteristics between the basal sandstone of the Chadron Formation and the Brule Formation (see Section 2.9.3; Tables 2.9-8, **2.9-9, 2.9-10,** and 2.9-11).

In summary, the following multiple lines of evidence indicate adequate hydrologic confinement of the basal sandstone of the Chadron Formation within the MEA.

21. * Results of the May 2011 aquifer pumping test demonstrate no discernable drawdown in the overlying Brule Formation observation wells screened throughout the MEA (see Section 2.7.2.2).

22. * Large differences in observed hydraulic head (330 to 500 feet) between the Brule Formation and the basal sandstone of the Chadron Formation indicate strong vertically downward gradients and minimal risk of naturally occurring impacts to the overlying Brule Formation (see Section 2.7.2.1).

23. * Significant historical differences exist in geochemical groundwater characteristics between the basal sandstone of the Chadron Formation and the Brule Formation (Section 2.9.3.3).

24. * Site-specific XRD analyses, particle grain-size distribution analyses, and geophysical logging confirm the presence of a thick (between 430 and 940 feet), laterally continuous upper confining layer consisting of low permeability mudstone and claystone, and a thick (more than 750 feet), regionally extensive lower confining layer composed of very low permeability black marine shale (see Section 2.7.2.3).

25. * Analyses of particle size distribution results suggest a maximum estimated hydraulic conductivity of **10-5** cm/sec for core samples from the upper confining layer.

• Hydraulic resistance to vertical flow is expected to be low due to the significant thickness

of the upper confining zone within the MEA.

* The vertical hydraulic conductivity across the upper and lower confining layers is likely

to be even lower than 10-5 cm/sec due to vertical anisotropy (see Section 2.7.2.3).

2.7.2.4 Description of the Proposed Mining Operation and Relationship to Site Geology and Hydrology

The basal sandstone of the Chadron Formation is currently mined using ISR techniques within the mine units of the current Grow Butte operations and represents the production zone and target of solution mining in the MEA. Ore-grade uranium deposits underlying the MEA are located in the basal sandstone of the Chadron Formation (Figure 1.4-1). The ore body located within the **MEA** is a stacked roll-front system, which occurs at the boundary between the up-dip and oxidized part of a sandstone body and the deeper down-dip and reduced part of the sandstone body. Stratigraphic thickness of the unit within the MEA ranges from approximately 20 to 110 feet, with an average thickness of approximately 55 feet. The unit occurs at depths ranging from about 817 to 1,130 feet bgs within the **MEA** (Figures 2.6-3a through 2.6-3n). A competent upper confining layer consists of the overlying middle Chadron and upper Chadron, which consist predominantly of clay, claystone, and siltstone. Based on extensive exploration hole data collected to date (more than 1,650 drill locations), the thickness of the upper confining layers in the MEA. range from 430 to 940 feet (Figures 2.6-3a through 2.6-3n). Estimated hydraulic conductivities based on particle grain-size distribution analyses for site-specific core samples collected within the upper confining layer are on the order of **10-5** cm/sec (see Section 2.7.2.3). Geophysical logs from nearby oil and gas wells indicate that the thickness of the Pierre Shale lower confining layer ranges from approximately 750 to more than 1,000 feet (see discussions in Montana Group under Section 2.6.1.1). The full thickness of the Pierre shale is not depicted on Figures .2.6-3a through 2.6-3n, as the required scale would obscure stratigraphic details of the overlying White River Group. The Pierre Shale exhibits very low permeabilities on the order of 0.01 millidarcies (md; less than 1 x **10-10** cm/sec) (Wyoming Fuel Company 1983).

Based on similar regional deposition, the MEA ore body is expected to be similar mineralogically and geochemically to that of the CPF. The ore bodies in the two areas are within the same geologic unit (i.e., basal sandstone of the Chadron Formation) and have the same mineralization source (see Section 2.6. The sites are separated by only a few miles, and the cause of mineral deposition in the two areas appears to be similar (see Section 2.6). Neither site is anticipated to be affected by any recharge or other processes that would uniquely affect each area, so the groundwater characteristics of the current Crow Butte mineralized zone are presumed representative of the MEA. Table 2.7-5 is the Baseline and Restoration Values for MU 1 in the, current Crow Butte operations area. The values in this table is expected to be representative of the geochemical characteristics of the MEA ore body. The MEA ore body, the outline of which is provided on Figure 1.4-1, is considered a zone of distinct water quality characteristics primarily due to the presence of relatively concentrated uranium and radium in the zone when compared to the concentrations of these parameters outside of the production zone (e.g., Table 2.9-4).

During the course of mining, the water quality is expected to change as outlined in Table

2.7-6. The chemicals used in the mining and recovery process will include sodium bicarbonate ($NaHCO_3$)($NaHCO_3$)-dissolved solids (TDS). Significant increases are also likely to occur in calcium concentrations as a result of IX with clays. The oxidant will cause significant increases in uranium, vanadium, and radium and minor increases in trace metals such as copper, arsenic, molybdenum, and selenium. The genesis of the ore body and the facies of the host rock at the **MEA** are similar to that of the current Crow Butte site, so it is probable the change in water quality at the MEA will be similar to that experienced at the current Crow Butte site. Historic restoration activities at the current Crow Butte site have demonstrated the ability to successfully restore groundwater to established restoration standards. Groundwater restoration is discussed in detail in Section 6.

The site-specific ISR mining process for the MEA is described in Section 3.1.4.

***

The hydrologic properties of the basal sandstone of the Chadron Formation must be known to formulate the best injection/extraction well arrays and for appropriate containment. Based on the pumping rate, test duration and formation characteristics, the ROI (i.e., the area over which drawdown occurs) can also be determined for a given test. Tables 2.7-3 and 2.7-4 present relevant hydrologic information based on an aquifer test performed in the MEA in May 2011, compared with the same properties in the CPF, NTEA, and TCEA. These data indicate that mean transmissivity and hydraulic conductivity at the MEA are more than adequate to successfully develop the MEA for ISR mining activities.

***

Accordingly, the Application fails to adequately describe the affected aquifers at the site and on adjacent lands and fails to provide the required quantitative description of the chemical and radiological characteristics of these waters necessary to assess the impacts of the operation, including potential changes in water quality caused by the operations.

The Application states repeatedly that it will rely on the DDW almost exclusively for disposal of wastes from the MEA.

ER 1.3.2.11 Liquid Waste

Liquid Waste Disposal

CBR has operated a DDW at the CPF for more than 10 years with excellent results and no serious compliance issues. A second DDW was added in 2011. CBR expects that the liquid waste stream at the MEA site will be chemically and radiologically similar to the waste disposed of in the current DDW.

CBR plans to install a DDW at the MEA site as the primary liquid waste disposal method. CBR has found that permanent deep disposal is preferable to evaporation in evaporation ponds. All compatible liquid wastes at the MEA site will be disposed of in the planned deep well.

***

3.12.2.1 Liquid Waste Generated

DDW

CBR currently operates two non-hazardous. Class I injection well in the CPF license area for disposal of wastewater under Permits #NE0206369 and #NE0210825 (Well #1 and Well #2, respectively). The well is permitted under NDEQ regulations in Title 122 (NDEQ 2010b) and operated under a Class I UIC Permit. The permits for both wells allow unlimited flow and maximum operating pressure of 650psi650 psi. To preserve optimum performance, Well #1 has typically been operated at up to 40 psi with a 200gpm200 gpm flow.

CBR has -operated Well #1 at the CPF license area for more than 10 years with excellent results and no serious compliance issues. Well #2 was incorporated into the license by action of the CBR Safety and Environmental Review Panel on November 18, 2011. CBR expects that the liquid waste stream at the satellite facility will be chemically and radiologically similar to the waste disposed of in the current DDW. Radiological data for the years 2008 through 2010 for

CBR's current DDW injection stream are shown in Table **3.12-1.** The non-radiological data for the DDW injection stream for 2010 is presented in Table 3.12-2.

CBR plans to install a DDW at the MEA as the primary liquid waste disposal method. CBR has found that permanent deep disposal is preferable to evaporation in ponds. The basic reasons for this position are as follows:

26. * The potential for human contact while using a deep well lower because the waste is handled in enclosed systems.

27. * The potential for emissions from the pond surface is higher than the enclosed deep well disposal system.

28. * Evaporation ponds carry the potential for leaks.

29. * Use of evaporation ponds creates a larger amount of 11 (e)(2) byproduct waste. All compatible liquid wastes at the satellite facility will be disposed of at a planned on-site Class I UIC DDW. CBR will apply to the NDEQ for the construction and operation of a Class I UIC Permit at the satellite facility. The deep well will be installed in sufficient time to be used for wastewater disposal allowed by the permit. Details of the DDW operations, controls, monitoring, waste management, and spill issues will be addressed in a future NDEQ permit application. No wastewaters will be discharged to the land surface or surface water of the State of Nebraska.

***

4.12.2.2 Exposures from Water Pathways

The solutions in the zone to be mined will be controlled and adequately monitored to ensure that migration does not occur. The overlying aquifers will also be monitored.

The satellite facility will not have evaporation ponds to store waste solutions, thereby eliminating the potential of releases and exposures via water pathways. In lieu of evaporation ponds, the facility will employ six 30,000-gallon storage tanks for the temporary storage of process wastewater. The storage tanks will be located within spill containment dikes in order to control any spills or releases from the storage tanks.

The wastewater surge/equalization tanks will discharge to a DDW, which will be the primary method of waste disposal at the satellite facility. The DDW will be completed at a depth of approximately 4,000 to 5,000 **ft,** isolated from any underground source of drinking water by approximately 1,500 ft of Pierre Shale. The well will be constructed under a permit from the NDEQ and will meet all requirements of the **UIC** program.

The satellite facility processing building will be located on a curbed concrete pad to prevent any liquids from entering the environment. Solutions used to wash down equipment will drain to a sump and will be pumped to the ponds. The pad will be of sufficient size to contain the contents of the largest tank if it ruptures.

Because no routine liquid discharges of process water are expected, there are no definable water- related pathways.

***

4.13.2 Liquid Waste4.13.2.1 Sources of Liquid Waste

As a result of ISR mining, there are several sources of liquid waste. The potential wastewater sources that exist at the satellite facility will be similar to those currently generated and managed at the CPF. These sources of wastewater include the following:

Water Generated During Well Development

This water is recovered groundwater and has not been exposed to any mining process or chemicals; however, the water may contain elevated concentrations of naturally occurring radioactive material if the development water is collected from the mineralized zone. The water will be discharged directly to the solar evaporation pond and silt, fines, and other natural suspended matter collected during well development will settle out in the pond. Well development water may also be treated with filtration and/or RO and used as plant make-up water or disposed of in the DDW. The quantity of wastewater generated by well development activities is estimated at approximately 2,500,000 gallons per year based on the current operation.

Liquid Process Waste

The operation of the satellite facility results in one primary source of liquid waste, a production bleed as previously discussed. This bleed will be routed to either the DDW or an evaporation pond. Process bleed is estimated at 0.5 to 2.0 percent of the process flow of 6,000 gpm. The impact of this process bleed was discussed in Sections 3.12.2.1 and 4.4.3.

Aquifer Restoration Waste

Restoration of the affected aquifer commences following mining operations at MEA, which results in the production of wastewater. The current groundwater restoration plan consists of four activities:

1. Groundwater Transfer

30.Groundwater Sweep

31.Groundwater.Treatment

32.Wellfield Circulation

Only the groundwater sweep and groundwater treatment activities will generate wastewater. During groundwater sweep, water is extracted from the mining zone without injection, causing an influx of baseline quality water to sweep the affected mining area. The extracted water must be sent to the wastewater disposal system during this activity. The impact of this restoration waste

stream was discussed in Section 3.12.2.1.

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4.13.2.2 Liquid Waste DisposalOne primary method of disposal of liquid wastes is proposed for the satellite facility.

DDW

CBR has operated the DDW at the CPF license area for more than 10 years with excellent results and no serious compliance issues. CBR expects that the liquid waste stream at the satellite facility will be chemically and radiologically similar to the waste disposed in the current DDW. A second DDW became operational at the CPF in late 2011.

CBR plans to install a DDW at the satellite facility as the primary liquid waste disposal method. CBR has found that permanent deep disposal is preferable to evaporation in evaporation ponds. All compatible liquid wastes at the satellite facility will be disposed of in the planned DDW. No adverse environmental impacts are expected from this type of disposal because the liquid waste is permanently isolated in an unusable geologic formation.

TR 1.8 Waste Management and Disposal **1.8.1** Liquid Waste

There were three wastewater disposal options considered for the proposed satellite facility: evaporation in solar evaporation ponds, deep well injection, and land application. The currently selected method of disposal will be deep well injection with no plans for evaporation ponds. In lieu of evaporation ponds, the site will employ wastewater surge/equalization tanks (total capacity of 300,000 gallons) to temporarily hold wastewater prior to pumping to the deep disposal well (DDW) for injection. There are currently no plans for land application of wastewaters. However, this option could be applied if such disposal is deemed feasible and more beneficial for a specific wastewater stream. Any such action would require an NRC license amendment and a discharge permit from the NDEQ.

3.1.5 Wellfield and Process Wastes

All well development water will be captured in water trucks specifically labeled and dedicated for such purpose, and equipped with signage indicating that these trucks may only discharge their contents to the MEA wastewater surge/equalization tanks followed by disposal in the DDW.

The operation of the satellite facility will result in a production bleed stream that is continuously withdrawn from the recovered lixiviant stream at a rate that is expected to be 0.5 to 2.0 percent of the total volume of recovered lixiviant. The production bleed stream is taken following the recovery of uranium by IX and has the same chemical characteristics as the lixiviant. The production bleed waste stream will be managed by use of a DDW, which will be constructed and operational at the satellite facility prior to commencement of production.

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4.2.1 Liquid Waste

As a result of ISR mining, there are several sources of liquid waste. The potential wastewater sources that exist at the satellite facility include the following:

4.2.1.1 Water Generated During Well Development

This water is recovered groundwater and has not been exposed to any mining process or chemicals. However, the water may contain elevated concentrations of naturally occurring radioactive material if the development water is collected from the mineralized zone. Well development water will be captured in water trucks specifically labeled for such purpose and equipped with signage indicating that these trucks may only discharge their contents to the MEA wastewater disposal system (wastewater surge/equalization tanks and DDW). If required, well development water may be transported to the CPF site for disposal in the lined evaporation ponds. Well development Water may also be treated with filtration and/or RO and used as plant make-up water.

4.2.1.2 Liquid Process Waste

The operation of the satellite facility results in one primary source of liquid waste, a production bleed, as previously discussed in Section 3. This bleed will be routed to surge/equalization tanks and then pumped from the tanks to the DDW.

4.2.1.6 Laboratory Waste

Liquid waste from the laboratory will be disposed of in the DDW. Approximately 1,000 gallons per month of non-hazardous liquid waste from the laboratory, composed of sample discards, lab solutions, dish washing wastewater, and lab cleanup wastewater will be disposed of in the DDW via surge/equalization tanks.

4.2.1.7 Liquid Waste Disposal

Disposal of liquid operational wastes for the satellite -facility will be via a DDW. Surge/equalization storage tanks will initially receive all wastewater before injection into the DDW. The surge/equalization tanks will be used for wastewaters that would otherwise be discharged to an evaporation pond. No evaporation ponds are planned for the MEA project site. In addition to this disposal method, the NDEQ has issued CBR an NPDES permit. for the CPF license area that allows land application of treated wastewater. CBR has not used this waste disposal method at the current operation. At this time, CBR does not intend to apply for an NPDES permit to allow land application at the satellite facility. It is expected that liquid waste generated in the MEA can be satisfactorily managed with the use of the surge/equalization tanks and a DDW. If needed in an emergency situation, contaminated wastewater can be collected and trucked to an approved commercial disposal facility for disposal.

DDW

CBR currently operates two non-hazardous Class I injection wells in the CPF license area for disposal of wastewater. The wells are permitted under NDEQ regulations in Title 122 (NDEQ 2010b) and operated under a Class I UIC Permit. CBR has operated the initial DDW at the current license area for more than 10 years with excellent results and no serious compliance issues. CBR expects that the liquid waste stream at the satellite facility will be chemically and radiologically similar to the waste disposed of in the current DDW. Radiological data for the years 2008 and 2010 for current DDW injection stream are shown in Table 4.2-1. The non- radiological data for the DDW injection stream for 2010 are presented in Table 4.2-2.

CBR plans to install a DDW at the satellite facility as the primary liquid waste disposal method. CBR has found that permanent deep disposal is preferable to evaporation in ponds. The basic reasons for this position are as follows:

33. * The potential for human contact while using a deep well is lower because the waste is handled in enclosed systems.

34. * The potential for emissions from the pond surface is higher than the enclosed deep well disposal system.

35. * Evaporation ponds carry the potential for leaks and impacts to the environment.

* Use of evaporation ponds creates a larger amount of 11 (e)(2) byproduct waste. The DDW will be located near the satellite building (Figure **1.7-5).** All tankage, filtration, and process equipment will be located at the main operating satellite facility. Feed from the satellite facility to the DDW will be via a 4-inch PVC/HDPE pipeline. Per NDEQ permitting requirements, CBR will be required to continually monitor and record

the injection pressure, injection flowrate and volume, and annual pressure. Any failure of the monitoring system requires that the DDW be shut down immediately until the potential for a release has been investigated.

All compatible liquid wastes at the satellite facility will be disposed of at the planned onsite Class I UIC DDW. CBR will apply to the NDEQ for the construction and operation of a Class I UIC Permit at the satellite facility. The deep well will be installed in sufficient time to be used for wastewater disposal allowed by the permit. Details of the DDW operations, controls, monitoring, waste management, and spill issues will be addressed in a future NDEQ permit application. No wastewaters will be discharged to the land surface or surface water of the State of Nebraska.

Radioactive liquids not referenced above will be disposed ofper NRC License SUA-1534.

36.***

5.7.1.2 Liquid EffluentsThe liquid effluents from the satellite facility can be classified as follows:

37. * Water generated during well development - This water is recovered groundwater and has not been exposed to any mining process or chemicals. The water will be discharged directly to a wastewater surge/equalization tanks, and silt, fines, and other natural suspended matter collected during well development will settle out.

38. * Liquid process waste - The operation of the satellite facility results in one primary source of liquid waste: a production bleed stream. The production bleed will be disposed of in the DDW permitted under the Nebraska NDEQ Class I UIC Program. * Aquifer restoration - Restoration of the affected aquifer following mining operations results in the production of wastewater. The current groundwater restoration plan consists of four activities: **1)** Groundwater Transfer; 2) Groundwater Sweep; 3) Groundwater Treatment; and, 4) Wellfield Recirculation. Only the groundwater sweep and groundwater treatment activities will generate wastewater. During groundwater sweep, water would be extracted from the mining zone without injection, causing an influx of baseline quality water to sweep the affected mining area. The extracted water must be sent to the wastewater disposal system during this activity (i.e., wastewater surge tanks), followed by deep well disposal injection.

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The existing NRC Source Materials License allows CBR to dispose of wastewater from the CPF by three methods:

39. * Evaporation from the evaporation ponds;

40. * Deep well injection; and

41. * Land application. At the MEA, CBR proposes to handle liquid effluents from the satellite facility using only deep well injection.

***

7.2.5.3 Potential Groundwater Impacts from Accidents

Groundwater quality could potentially be impacted during operations due to an accident such as an uncontrolled release of process liquids due to a wellfield accident. If there should be a wellfield accident, potential contamination of the shallow aquifer (Brule), as well as surrounding

soil, could occur. Wellfield accidents could take the form of a slow leak or a catastrophic failure, a shallow excursion, an overflow due to excess production or restoration flow, or due to the addition of excessive rainwater or runoff.

The satellite building will have curbing around the structure, and the six 30,000-gallon wastewater storage tanks will have diking to contain any accidental spills or releases of contaminated fluids. This will eliminate the potential for such discharges to the adjoining groundwater surface and potential contamination of the surrounding soils and the Brule Formation.

The DDW will receive wastewater from the wastewater surge/equalization tanks located at the satellite processing facility via an underground PVC/HDPE pipeline. Flow rates from the tankage, tank levels, and flow rates are all controlled and monitored to ensure any potential leakage is rapidly detected. All flows and pressures will have limits and alarms programmed in to alert the operator as limits are approached and to control feed pumps. The details of these systems will be addressed in the Class I permit application that will be submitted to the NDEQ as part of the required permitting process. CBR has successfully operated a Class I DDW for approximately 19 years without any significant spills or releases.

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7.3.2 Exposures from Water Pathways

The solutions in the zone to be mined will be controlled and adequately monitored to ensure that migration does not occur. The overlying aquifers will also be monitored.

The satellite facility will not have evaporation ponds to store waste solutions, thereby eliminating the potential of releases and exposures via water pathways. In lieu of evaporation ponds, the

facility will employ six 30,000-gallon storage tanks for the temporary storage of process wastewater. The storage tanks will be located within spill containment dikes in order to control any spills or releases from the storage tanks.

The wastewater surge/equalization tanks will discharge to a DDW, which will be the primary method of waste disposal at the satellite facility. The deep well will be completed at a depth of approximately 4,000 to 5,000 fi, isolated from any underground source of drinking water by approximately 1,500 ft of Pierre Shale. The well will be constructed under a permit from the NDEQ and meet all requirements of the UIC program.

The satellite facility processing building will be located on a curbed concrete pad to prevent any liquids from entering the environment. Solutions used to wash down equipment will drain to a sump and will be pumped to the ponds. The pad will be of sufficient size to contain the contents of the largest tank if it ruptures.

Because no routine liquid discharges of process water are expected, there are no definable water- related pathways.

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7.3.4.2 Fluid Discharges

There are currently no planned discharges from the satellite facility, with wastewaters being discharged to a Class **I** DDW. Therefore, any fluid discharges would be associated with spills (e.g., pipeline break or leak). Spills of this type would be expected to occur within the restricted wellfield areas and between the wellfield and satellite process facility. The satellite processing building, fuel tanks, and chemical tanks would be constructed on pads engineered to contain any spill from a pipe rupture, leaking vessel, or inadvertent spill. Therefore, it is unlikely that any spills in the processing area would reach soils and vegetation. CBR operating procedures provide for ongoing monitoring of operational activities and for a rapid corrective action response to any spill, which would result in cleanup of the spilled material and, if applicable, removal of any contaminated soil and vegetation.

Long-term experience at CBR has shown that single-event spills typically do not cause significant contamination of soil and vegetation.

There is limited potential for wildlife or domestic animals to consume contaminated vegetation or seeds. Other than the potential for accidental spills discussed above, which would be immediately assessed and cleaned up, the satellite facility would not be expected to significantly impact food sources such as vegetation and seeds that local animals depend upon.

CONTENTION B: Lack of Adequate Confinement Inimical To Public Health and Safety; Failure to Quantify and Describe the "Flare" of Lixiviant and Resulting Oxidation and Mobilization of Contaminants to Pathways to People, Animals, Birds, Fish, and Plants

(B)(1) The lack of adequate confinement of the host aquifer makes the proposed operation inimical to public health and safety in violation of Section 40.31(d). Further, Applicant's failure to describe faults and fractures between aquifers, through which the groundwater can spread uranium, thorium, radium 226 and 228, arsenic, and other harmful substances, violates Section 51.45(c) and (e).

(B)(2) Applicant's admission that there is a 'flare' of between 20%-80% in which lixiviant is expected to travel beyond the MEA means that naturally occurring uranium will likely be oxidized and mobilized by such lixiviant in unknown and unpredictable ways that may be in pathways to consumption by people, animals, birds, fish and plants. The failure to describe these impacts also violates NEPA and Section 51.45 and 51.60. The failure to monitor for mobilized contaminants downstream, especially in the Niobrara River, is further inimical to public health and safety in violation of Section 40.31(d). Applicant is required to quantify the flare for purposes of calculating a surety. Based on Applicant's experiences in restoring mine units at the CPF, it should be able to quantify and describe the size of the flare experienced in mine units being restored. Applicant has estimated $1.6 million cost to restore each mine unit at the MEA so it should be able to describe how many volumes of water and restoration activity were required to deal with the impacts of the flare in mine units being restored. Failure to do so violates Section 51.45, 51.60; 10 C.F.R. Part 40, Appendix A, Criteria 4(e) and 5G(2).

***

TR 6.1.4.2 Restoration Process
A preliminary calculated pore volume for the first MEA wellfield will be approximately 177,193,095 gallons. This is based on a calculated square footage (3,267,000 ft2) of the

potential wellfield area, an average under-ream interval of 25 feet and an estimated 29% open pore space value.

NUREG-1569 indicates that, for surety purposes, the licensee should include the flare factor in its calculation of the number of pore volumes necessary for groundwater restoration (NRC 2003). The flare factor is defined by the NRC *as a proportionalityfactor designed to estimate the amount of aquifer water outside of the pore volume that has been impacted by lixiviantflow during the extractionprocess*. The flare factor is usually expressed as a horizontal and vertical component to account for differences between the horizontal and vertical hydraulic conductivity of an aquifer material (NRC 2003). The horizontal and vertical flares are typically expressed as a multiple of the calculated pore volume. However, R/CR-6870 states that there are zones with low permeabilities that have proven more of a concern than in a wellfield where the balance is maintained. As in the case of the current CBR operations, a wellfield at **MEA** will be balanced on an individual pattern basis. Within the uranium ISR industry, this is the most effective way to mine an *in-situ* wellfield and restore groundwater (Powertech 2009). During operations, CBR will balance the **MEA** individual wells daily, a method that will reduce the pore volumes for restoration and minimize excursions beyond the flare zone. CBR bases their projected restoration volumes at the **MEA** project on historical experience and past successful restoration activities.

Acceptance criteria 2 in Section 6.1.3 of RG-1569 (NRC 2003) states, "Specific flare factors approved in the past vary from 20 to 80 percent and are typically based on experience from research and development pilot demonstrations. CBR's technical basis for the proposed flare factor is operational experience and hydrological modeling at the nearby commercial ISR operation.

***

TR 9.2.9 Satellite Facility Decommissioning Costs

The cost estimates presented in this section are based on the cost per year to restore one MU and reclaim one MU (surface and subsurface features). The CBR mine plan calls for sequential restoration and reclamation, and CBR will have approximately two to three MUs in restoration, mining, or reclamation at any one time. The surety cost estimates will be adjusted as necessary when additional MUs are to be brought on line and the proposed operations are better defined. A current and updated surety is required at least 90 days prior to commencement of construction of a new MU or significant expansion.

***

Table **P.1-I** presents the primary assumptions that serve as the basis for the surety cost estimates associated with restoration and reclamation of one mine unit. Table P.1-2 provides a summary of the total estimated costs for projected restoration and reclamation activities for MU 1 ($1,641,969), which includes a contract administration and contingency fees of 10 and 15

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Applicant fails to meet the requirements of 10 C.F.R. §§ 40.31(f), 51.45, 51.60, Appendix A to Part 40, NEPA, and NUREG-1569325 by neglecting "to provide sufficient information regarding the geological setting of the area . . . ." Petitioners submit that adequate information is necessary "to adequately characterize the site and off site consequences.

The Application fails to provide sufficient information regarding the geological setting of the area to meet the requirements of 10 C.F.R. § 40.31(f); 10 C.F.R. § 51.45; 10 C.F.R. § 51.60; 10 C.F.R. Part 40, Appendix A, Criteria 4(e) and 5G(2); the National Environmental Policy Act; and NUREG-1569 section 2.6. The Application similarly fails to provide sufficient information to establish potential effects of the project on the adjacent surface and ground-water resources, as required by 10 C.F.R. § 51.45, NUREG-1569 section 2.7, and the National Environmental Policy Act.

(B)(3) 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 White River and the Niobrara River.

(B)(4) 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 White River and the Niobrara River.

Basis and Discussion:

This contention is supported by the LaGarry Opinion, although as a contention of omission, it is not necessary to provide expert support.

Dr. LaGarry opines that:

> **Pliocene, Pleistocene, and Holocene river alluvium – overlies all bedrock units at one place or another. Consists of layers of silt, sand, and coarse gravel. Unit also overlies major fault zones. Unit is used as aquifer, and supplies water to residences, livestock, and in the case of the White River, supplies water to the cities of Crawford, Nebraska and Pine Ridge, South Dakota, among others. In the Marsland area these sediments are exposed at the land surface, are extremely porous and permeable, and include at least three terraces of the Niobrara River.**
>
> **The recent mapping of the geology of northwestern Nebraska has shown that the simplified, "layer cake" concept applied by pre-1990′s workers is incorrect, and overestimates the thickness and areal extent of many units by 40-60%. Many units' distributions are heavily influenced by the contours of the ancient landscapes onto which they were deposited. For example, when considered to be the 'basal Chadron sandstone,' the Chamberlain Pass Formation was assumed to have a distribution equal to that of the overlying Chadron Formation. However, the Chamberlain Pass Formation is 1-1.5 million years (Ma) older than the Chadron Formation, and has a distribution determined by the ancient topography weathered into the Pierre Shale prior to deposition of the Chamberlain Pass Formation. The Chadron Formation was then deposited later on a different landscape.**
>
> **CONTAMINANT PATHWAYS**
>
> **In-situ leach mining in the Marsland area would likely contribute toxic heavy metal contaminants, including but not limited to uranium, through three pathways: (a) surface leaks and spills, (b) underground leaks and spills (excursions), and (c) lack of containment. Once in the aquifer, contaminants would (d) migrate laterally through porous and permeable sandstones into the White and Niobrara rivers (Figure 1).**
>
> **<u>Surface leaks and spills</u>. The soils in western Nebraska are thin, and directly overly permeable, porous bedrock. The rocks exposed at the surface near Marsland are either the Anderson Ranch Formation of the**

Arikaree Group or the Runningwater Formation of the Ogallala Group. Both are sandstone. Any leaks or spills onto the landscape would be transmitted directly into the High Plains Aquifer within a few years. There are no confining layers within this aquifer, and in some areas the water table is within 20 meters of the surface. Figure 1 shows the interval of the aquifer vulnerable to surface leaks and spills.

Underground leaks and spills (excursions). In order to reach the uranium in the Chamberlain Pass Formation, injection and extraction wells will need to be drilled through the Anderson Ranch, Harrison, Coffee Mill Butte, Monroe Creek, and Ash Creek formations of the Arikaree Group. All of these contain water, and an excursion into any of them would be catastrophic, with contaminants quickly spreading thoughout the entire section of the aquifer. Under these rocks are the less permeable siltstones of the Brule and Chadron formations, which may contain useable water if sufficiently fractured (otherwise not). Below these are the uranium bearing rocks of the Chamberlain Pass Formation. Figure 1 shows the interval of the aquifer vulnerable to underground excursions.

Lack of containment. Diffendal (1994) showed that there are several potential faults in the Marsland area, and Swinehart and others (1985) show known faults both north and south of Marsland. These faults may allow the transmission of mining fluids to travel upward into the aquifer and laterally into adjacent areas to the west and east. The faults shown in Figure 1 are those that were large enough to be discovered by Swinehart and others (1985) who compiled data from ~12,500 drilling records in western Nebraska and conducted new drilling at 5 mile intervals along the transect shown. My work over the past 25 years has shown that there are likely hundreds more that are too small to be shown on such a diagram.

Lateral migration. Water in underground aquifers does not stay in the same place. It moves around laterally following the contours of the ancient landscapes the aquifer sediments were deposited onto. This water is also draw to wells (such as center pivots and stock tanks), springs (such as those that spawn the White River), and groundwater-fed rivers (such as the close-by Niobrara River). If contaminants were to escape into the High Plains Aquifer, within a few hears it could be drawn out of the ground and sprayed onto crops by center pivots, or be drawn to the surface by stock tanks placed to water cattle and horses. It would likely migrate eastwards (down gradient) and contaminate the White River, which supplies the towns of Glenn, Crawford, Whitney, and Pine Ridge with water. It could quickly find its way into the Niobrara River, which is a National Scenic River used by thousands of people for

recreation every year (Figure 1).

CONCLUDING REMARKS

Based on the arguments presented above, it is my expert opinion that ISL mining in the Marsland, Nebraska area should not be allowed. Of greatest concern is its proximity to the Niobrara River (a National Scenic River), which is used for recreation by thousands of people each year. Unfortunately, if the High Plains Aquifer were to become contaminated, the effects would be irreversible and catastrophic for the local agricultural economy. It would likely lead to the depopulation of the region.

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10 C.F.R. § 40.31 and 10 C.F.R. § 51.60 require an Applicant to submit an environmental report with its license application. 10 C.F.R. § 51.45 and the National Environmental Policy Act require that the environmental report include a description of the affected environment and the impact of the proposed project on the environment, with sufficient data to enable the Commission to conduct its independent analysis. 10 C.F.R. Part 40, Appendix A, Criterion 4(e) requires that uranium processing facilities, including ISL uranium mining facilities, be located away from faults that may cause impoundment failure. Criterion 5G(2) requires an adequate description of the characteristics of the underlying soils and geologic formations.

The descriptions of the affected environment under the above authorities must be sufficient to establish the potential effects of the proposed ISL operation on the adjacent surface water and ground water resources. As discussed in NUREG-1569 at 2.7.1(3), the application must include a description of the "effective porosity, hydraulic conductivity, and hydraulic gradient" of site hydrogeology, including any "other information relative to the control and prevention of excursions." At minimum, the Applicant must develop an acceptable conceptual model of site hydrology adequately supported by the data presented in the site characterization. NUREG-1569 section 2.7.2. This data and model must demonstrate with scientific confidence that the area hydrogeology, including horizontal and vertical hydraulic conductivity, will result in the confinement of extraction fluids and expected operational and restoration performance.

In this case, the Application fails to present sufficient information in a scientifically-defensible manner to adequately characterize the site and off-site hydrogeology to ensure confinement of the extraction fluids.

These deficiencies include unsubstantiated assumptions as to the isolation of the aquifers in the ore-bearing zones and failure to account for natural and man-made hydraulic conductivity through natural formations, existing wells, and the historic drilling of other drill holes in the aquifers and ore-bearing zones in question, which were not properly abandoned, as well as the cumulative impact of Applicant's existing and planned DDWs.

The Application presents overly-optimistic conclusions about the isolation of the ore-bearing zones, aquifers, and the lack of fluid excursions that will occur, both vertically and horizontally. Applicant's description and evaluation of possible water-related impacts [**cite**] are unreasonably optimistic.

It is unlikely that the process waters can be contained within the project boundaries given the following sources of the evidence.

Hydraulically, such sedimentary packages typically allow ground waters to flow between the inter-fingering facies, both vertically and horizontally, when the coarser- grained sediments are stressed by long-term pumping.

Thus, ore-bearing sandstones in typical sedimentary packages associated with roll- front uranium deposits do not routinely behave as hydraulically-isolated bodies. Numerous specific lines of evidence from the Application documents indicate that the project sediments possess various pathways for the migration of water and contaminants from the ore zones into neighboring sediments, both vertically and laterally.

There are numerous old and existing water wells in the MEA, many with rusty and leaky casings, often unplugged or partially-plugged, drilled through several formations which act as potential pathways for flow between water- bearing units.

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

The discussion above presents ample evidence that the MEA sediments contain numerous possible subsurface pathways for project leach fluids to migrate vertically between water-bearing units and outside the project boundaries. Unfortunately, as noted above,

Applicant has not adequately defined the baseline water levels or water quality conditions of neighboring wells.

Based on this evidence, the Application fails to provide an adequate site characterization of geology and hydrogeology and fails to demonstrate the ability of the applicant to determine effective porosity of the affected aquifers or to demonstrate the ability to confine the leaching fluids.

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ER 3.3.1.1 Regional Setting

– "Although these log signatures suggest that the base of the alluvium can be readily identified in geophysical logs, this relationship has not been verified at MEA. Therefore, the alluvium-Arikaree Group contact illustrated on cross-sections Figures 3.3-3a through 3.3-3n is an inferred contact.

***

Within the license boundary, the thickness of the Arikaree Group ranges from approximately 50 to 210 feet and averages about 106 feet. The unit is thickest throughout the central portion of the license boundary but thins on both the northwest and southeast ends of the project. The unit is stratigraphically continuous across the MEA.

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An isopach map of the undifferentiated Brule Formation is shown on Figure 3.3-6. The thickness ranges from approximately 50 to 350 feet and averages about 170 feet. The unit steadily increases in thickness from the southeast to the northwest end of the project, and the unit is stratigraphically continuous.

***

The contact between the Brule Formation and underlying Chadron Formation is difficult to identify in some places, as it is intertonguing (LaGarry 1998).

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Chadron Formation

The Eocene-Oligocene Chadron Formation is in the lower part of the White River Group (Table 3.3-2). The Chadron Formation conformably overlies the basal sandstone and is conformably overlain by the Brule Formation.

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ER 3.3.1.3 Structural Geology

The most prominent structural expression in northwest Nebraska is the Chadron Arch (Figures 3.3-11 and 3.3-12). Together with the Chadron Arch, the Black Hills Uplift produced many of the prominent structural features presently observed in the region. The Chadron Arch represents an anticlinal feature that strikes roughly northwest-southeast along the northeastern boundary of Dawes County. Swinehart et al. (1985) suggested multiple phases of probable uplift in northwestern Nebraska near the Chadron Arch between c.a. 28 Ma and <5 Ma. The only known surficial expressions of the Chadron Arch are outcroppings of Cretaceous rocks that predate deposition of the Pierre Shale in the northeastern comer of Dawes County, as well as in small portions of Sheridan County, Nebraska and Shannon County, South Dakota. The general locations of faults in northwest Nebraska are depicted on the State Geologic Map shown on Figure **3.3-1.**

The 230-mile (370.1-km) long Pine Ridge escarpment exhibits an average of 1,200 feet of relief (Nixon 1995). The Pine Ridge is an arc roughly concentric to the Black Hills Dome, which suggests an apparent structural relationship. Nixon (1995) interpreted the escarpment as representing the southern outermost cuesta of the Black Hills Dome. The escarpment is capped by sandstone of the Arikaree Group with exposed deposits of the White River Group mapped along the topographically lower northern side of the escarpment.

***

The Crow Butte area, including the CPF, NTEA, and TCEA, is within the Crawford Basin (DeGraw 1969). The proposed **MEA** lies just outside of the southern boundary of the basin along the Cochran Arch. DeGraw (1969) substantiated known structural features and proposed several previously unrecognized structures in western Nebraska based on detailed studies of primarily deep, oil test hole data collected from pre-Tertiary subsurface geology. The Crawford Basin was defined by DeGraw (1969) as a triangular asymmetrical basin about 50 miles (80 kin) long in an east-west direction and 25 miles (40.2 km) to 30 miles (48.3 kin) wide. The basin is bounded by the Toadstool Park Fault on the northwest, the Chadron Arch and Bordeaux Fault to the east, and the Cochran Arch and Pine Ridge Fault to the south (Figures 3.3-11 and 3.3-12). The Crawford Basin is structurally folded into a westward-plunging syncline that trends roughly east-west. Note that the Bordeaux Fault, Pine Ridge Fault, and Toadstool Park Fault proposed by DeGraw (1969) are not presented on the State Geologic Map (Figure 3.3-1). The Toadstool Park Fault has been mapped at one location (T33N, R53W) and is estimated to have had approximately 60 feet of displacement (Singler and Picard 1980). The City of Crawford is located near the axis of the Crawford Basin. More recent fault interpretations by Hunt (1990) for northwest Nebraska are also shown on Figure 3.2-12, which include the Whetstone Fault, Eagle Crag

Fault, Niobrara Canyon Fault, and Ranch 33 Fault in the vicinity of the Town of Harrison in Sioux County. The faults identified by Hunt (1990) all trend to the northeast-southwest, sub-parallel to the Pine Ridge Fault (Figure 3.3-12).

Diffendal (1994) performed lineament analyses on a mosaic of early Miocene synthetic-aperture radar images and largely confirmed known faults in the vicinity of Chadron. Lineaments in the radar image along Pine Ridge, located to the south of Chadron, are attributed to jointing or faulting and trend N40E and N50W (Diffendal 1982). Similar features were also noted west of Fort Robinson. Swinehart et al. (1985) report that these features are likely an extension of the Wheatland-Whalen trend in Wyoming (Hunt 1981; Wheeler and Crone 2001).

Former drilling activities at the Crow Butte Project identified a structural feature, referred to as the White River Fault, located between the CPF Class HI permit area and the NTEA (Figure 3.3- 12). Evidence of a fault was identified during the exploration drilling phase of the Crow Butte Project (Collings and Knode 1984). The fault is manifested in the vicinity of the NTEA as a significant northeast-trending, subsurface fold. The detailed kinematics of the White River Fault were investigated during preparation of the NTEA Petition for Aquifer Exemption. An extensive review of drilling and logging data determined that, while the White River Fault may cut the Pierre Shale at depth along with stratigraphically lower units, there is no evidence that a fault offsets the geologic contact between the Pierre Shale and overlying White River Group or individual members of the White River Group. **This fault does not appear to be present in the vicinity of the MEA.**

***

Historic restoration activities at the current Crow Butte site have demonstrated the ability to successfully restore groundwater to established restoration standards. Groundwater restoration is discussed in detail in Sections 5.4.1.3 and 5.4.1.4.

***
ER 3.5.7.3 Raptors

… The Niobrara River drainage immediately south of the site provides habitat for tree-nesting species and provides potential roosting sites for wintering raptors (e.g., bald eagle, rough-legged hawk *[Buteo lagopus])*. All raptors and their nests are protected from "take" or disturbance under the Migratory Bird Treaty Act (16 USC, §703 *et seq.;* USFWS 201 la). Golden eagles and bald eagles also are afforded additional protection under the Bald and Golden Eagle Protection Act, amended in 1973 (16 USC, §669 *et seq.)*. In addition, several raptor species are considered at-risk or sensitive by NNLP and/or Nebraska National Forest-Pine Ridge Ranger District.

***

ER 4.5.3 Surface Waters and Wetlands

The Niobrara River is a perennial stream located downstream of the MEA; this river could potentially be indirectly affected by changes in water quality or quantity. Water quantity would not be changed by the proposed project. Hydrologic analysis completed for this project indicates that the MEA generally carries a low potential for erosion (and therefore a low potential for sediment delivery to the Niobrara River). However, there are some small, localized areas within the MEA that carry a moderate to high erosion potential.

***

ER 5.4 Water Resources Impact Mitigation Measures

5.4.1 Groundwater Quality Impact Mitigation Measures

Impacts to groundwater quality in the mining zone are mitigated by groundwater restoration activities following completion of mining. The primary purpose of restoration is to ensure that affected water in the exempted aquifer cannot impact an adjacent underground source of drinking water. To accomplish this purpose, the goal of groundwater restoration is to return the affected groundwater in the mining zone to suitability for pre-mining uses. It should be noted that the methods used for groundwater restoration result in a consumptive use of the groundwater resources, particularly during the groundwater sweep phase. Water usage was discussed in Section 3.4.1.

The methods to achieve this objective for the affected groundwater are described in the following sections. Before discussing restoration methodologies, a discussion of the ore body genesis and chemical and physical interactions between the ore body and the lixiviant is provided.

(B)(5) what results from CBR's existing restoration on existing mine units -? Applicant should discuss the results of existing restoration in terms of volumes of water and actual versus projected time and money to complete and confirm that the projections for MEA have been updated to be based on the actual experiences of Applicant in restoring mine units to date. A failure to do so makes the Application in violation of Section 40.9(a) and (b), Section 51.45, 51.60 and NEPA.

***

TECHNICAL REPORT

1.2 Crow Butte Uranium Project Background

CBR has successfully operated the current production area since commercial operations began in 1991. Production of uranium has been maintained at design quantities throughout that period with no adverse environmental impacts. Groundwater restoration for Mine Unit 1 has been completed and approved by the NRC and Nebraska Department of Environmental Quality (NDEQ), with NRC issuing the final approval on February 12, 2003. The operating history and schedules for the current production area are discussed in more detail in Section 1.7.

NB – no mention of how long it took compared to projected; more time, more water used, more money, etc.

***

5.4.1.2 Chemical and Physical Interactions of Lixiviant with the Ore Body

Oxidation

The oxidant consumers in the basal sandstone of the Chadron Formation are hydrogen sulfide in the groundwater, uranium, vanadium, iron pyrite, and other trace and heavy metals. The impact of these oxidant consumers on the operation of the facility is a general increase in the oxidant consumption over that which would be required for uranium alone. The second effect is a release of iron and sulfate into solution from the oxidation of pyrite. A third effect is an increase in the levels of some trace metals such as arsenic, vanadium, and selenium into solution. As mentioned previously, the iron solubilized will most likely be precipitated as the hydroxide or carbonate, depending on its oxidation state. Any vanadium oxidized along with the uranium will be solubilized by the lixiviant, recovered with the uranium, and could potentially contaminate the precipitated yellowcake product. H20 2 precipitation of uranium is used to reduce the amount of vanadium precipitated in the product. Oxidation will also solubilize arsenic and selenium. The restoration program will return these substances to acceptable levels. A final potential oxidation reaction is the partial oxidation of sulfur species, increasing the concentrations of compounds such as polythionates, which can foul IX resins. In *in-situ* operations with chemistries similar to the MEA, these sulfur species are completely oxidized to sulfate, which poses no problems.

CONTENTION C: INADEQUATE ANALYSIS OF GROUND WATER QUANTITY IMPACTS

(C)(1) The Application violates the National Environmental Policy Act in its failure to

provide an analysis of the ground water quantity impacts of the project. These failings violate 10 C.F.R. § 40.32(c), 40.32(d), and 51.45.

Basis and Discussion:

This contention is a contention of omission so it is not necessary to provide expert support. 10 CFR 40.32(c) requires the Applicant's proposed equipment, facilities, and procedures to be adequate to protect health and minimize danger to life or property; 10 CFR 40.32(d) requires that the issuance of the license not be adverse to the common defense and security or to the health and safety of the public; and 10 CFR 51.45 and the National Environmental Policy Act require the Applicant to provide sufficient data for a scientifically-defensible review of the environmental impacts of the operation and for the Commission to conduct an independent analysis. The Application as submitted fails to meet these requirements in that it does not provide reliable and accurate information as to the project's ground water consumption. Thus, the Applicant has not established that its procedures are adequate to protect, and to not be adverse to, human health or that they will minimize danger to life or property.

(C)(2) The Application contains inadequate analysis of Ground Water Quantity Impacts. The Application violates 10 C.F.R. §§ 40.32(c),(d), and 51.45 by failing to analyze the impacts of groundwater consumption on public health and safety and property. Petitioners submit that the Application presents conflicting groundwater consumption information, thereby making this information impossible to evaluate accurately.

***

ER 3.11.1.2 Potential Declines in Groundwater Quality

Excursions at the current operation represent a potential effect on the adjacent groundwater. During production, injection of the lixiviant into the wellfield results in a temporary degradation of water quality in the exempted aquifer, compared to pre-mining conditions. Movement of this water out of the wellfield results in an excursion. Excursions of contaminated groundwater in a wellfield can result from: an improper balance between injection and recovery rates; undetected high permeability strata or geologic faults; improperly abandoned exploration drill holes; discontinuity and unsuitability of the confining units which allow movement of the lixiviant out of the ore zone; poor well integrity; and hydrofracturing of the ore zone or surrounding units.

To date, there have been several confirmed horizontal excursions in the Chadron sandstone in the CPF license area. These excursions were quickly detected and recovered through overproduction in the immediate vicinity of the excursion. In the majority of cases, the reported vertical excursions were actually due to natural seasonal fluctuations in Brnle groundwater quality and very stringent upper control limits (UCLs). In no case did the excursions threaten the water quality of an underground source of drinking water (USDW) because the monitor wells are located well within the aquifer exemption area approved by the EPA and the NDEQ. Table **3.11-** 1 provides a summary of excursions reported for the CPF license area.

***

ER 4.4.3.1 Groundwater Consumption

Groundwater consumption from the operation is expected to be on the order of 0.5 to 2.0 percent of the total mining flow (6,000 gpm). Consumptive volume (1,500 gpm) will increase during aquifer restoration, especially the groundwater sweep phase. However, it is expected that the net consumption for the entire operation will be on the order of 50 to 100 gpm.

(C)(3) Elsewhere (see TR 2.2.3) population usage was described in gals per day – here it is gals per min – but that minimizes the numbers unless the reader does a calculation – not clear or concise – not easy to understand – to calculate it – 2% x 6,000 gpm x 60 min x 24 hrs = 172,800 gallons per day -

***

TR 2.2.3 Water Use Information 2.2.3.1 Dawes County Water Use

Every 5 years since 1950, the USGS assesses U.S. water use (USGS 2005) and includes water use estimates for the State of Nebraska. For Nebraska water use data, the USGS works in cooperation with the NDNR. The latest study examines usage in 2005. The 2005

USGS report presents water usage in each state by county. The next report was scheduled to be issued in 2010, but due to delays, the next report completion and data availability is not expected until 2014 (USGS 2005).

Estimated water use in 2005 for Dawes County, Nebraska is presented in Table 2.2-9 (USGS 2005). The total 2005 population for Dawes County was 8,636 people, with public supply groundwater and surface water use totaling 2,590,000gallons per day (gpd). Irrigation using groundwater and surface water accounted for a total of 24,550,000gpd to irrigate an estimated 13 thousand acres. Essentially all of the rural residents of Dawes County use groundwater for their domestic supply.

A sunmnary of the number and types of registered non-abandoned water wells located in Dawes County as of August 23, 2011 is presented in Table 2.2-10. Note that this table refers to registered wells. Under current Nebraska law, water supply wells used solely for domestic purposes and completed prior to September 09, 1993, do not have to be registered (NRS 2008). Therefore, there are a number of domestic/agricultural and agricultural unregistered wells located in Dawes County. CBR identifies such wells through interviews with landowners and local drillers.

There are a total of 5,609 registered water wells in Dawes County used for a variety of purposes, as described in Table 2.2-10. According to the NDNR, there are a total of 243 domestic and 252 livestock wells located in Dawes County. There are 40 public water supply wells located in Dawes County (NDNR 2011a). Livestock water wells make up the majority of the wells identified in the MEA.

2.2.4 Marsland Expansion Area Project Area

The town nearest to the MEA project site .is Marsland, NE, which is located approximately 4 miles southwest of the nearest MEA license boundary. There is no public water supply system for Marsland. The residential homes scattered throughout the MEA area are supplied with domestic water from private wells. Private well use is discussed in more detail below.

In general, groundwater supplies in the vicinity of the MEA are limited due to topography and shallow geology (University of Nebraska-Lincoln 1986). Groundwater quality in the vicinity near the MEA is generally poor (Engberg and Spalding 1978). Locally, groundwater is obtained from the Arikaree and Brule Formations. The primary groundwater supply is the Brule Formation, typically encountered at depths from approximately 50 to 350 feet bgs. In general, the static water level for Brule Formation wells in the MEA ranges from 50 to 150 feet bgs, depending on local topography (Figures 2.6-3a through 2.6-3n and 1.4-1).

Groundwater from the underlying basal sandstone of the Chadron Formation is not used as a domestic supply within the MEA because of the greater depth (800 to 1150 feet bgs) and inferior water quality. Gosselin et al. (1996) state that: ***(1)*** *"the sands near the bottom of the*

Chadron Formationyield sodium-sulphate water with high total dissolved solids," and (2) in proximity to

"*uranium deposits in the Crawford area, groundwaterfrom the Chadron Formation is not suitable for domestic or livestock purposes because of high radium concentrations.*" In addition, it is economically impractical to install water supply wells into the deeper basal sandstone of the Chadron Formation in the vicinity of the MEA, in contrast to the vicinity of the NTEA where most basal sandstone of the Chadron Fornation wells either flow at the surface or have water levels very close to surface elevation because of artesian pressure.

Based on the American Water Works Association Research Foundation (AWWARF), the average household water use annually (including outdoor) is approximately 350 gpd (Mayer et al. 1999). This suggests a daily indoor per capita water use of 69.3 gallons.. Because there is only one occupied residence located within the proposed MEA (NW1⁄4 SW1⁄4 Section 7, T29N R50W), water use would be expected to use an average of approximately 350 gpd. Eight occupied residences have been identified within the 2.25-mile AOR. Therefore, water use would be expected to average about 2,800 gpd for the entire area.

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TR 7.2.5.1 Groundwater Consumption

Groundwater impacts and consumption related to the satellite facility operation will be fully assessed in an Industrial Groundwater Permit application required by NDEQ. Information from the existing Groundwater Permit for the current license area indicates that the drawdown from mining operations in the basal sandstone of the Chadron Formation is minimal (e.g., on the order of 10 percent of the available head). Based on drawdown data from years of operation in the current license area, and on the formation characteristics from the MEA pumping test, the drawdown effect on the Chadron aquifer as a result of operations has been and is expected to remain minimal.

Groundwater consumption from the operation is expected to be on the order of 0.5 to 2.0 percent of the total mining flow (6,000 gpm). Consumptive volume (1,500 gpm) will increase during aquifer restoration, especially the groundwater sweep phase. However, it is expected that the net consumption for the entire operation will be on the order of 50 to 100 gpm.

7.2.5.2 Potential Declines in Groundwater Quality

Excursions represent a potential effect on the adjacent groundwater as a result of operations. During production, injection of the lixiviant into the wellfield results in a temporary degradation of water quality in the exempted aquifer compared to pre-mining conditions. Movement of this water out of the wellfield into the monitor well ring results in an excursion. Excursions of contaminated groundwater in a wellfield can result from an improper balance between injection and recovery rates, undetected high permeability strata or geologic faults, improperly abandoned exploration drill holes, discontinuity and unsuitability of the confining units which allow movement of the lixiviant out of the ore zone, poor well integrity, and hydrofracturing of the ore zone or surrounding units.

To date, there have been several confirmed horizontal excursions in the basal sandstone of the Chadron Formation in the current license area. These excursions were quickly detected and recovered through overproduction in the immediate vicinity of the excursion. In the majority of the excursions, the reported vertical excursions were actually due to natural seasonal fluctuations in Brule groundwater quality and very stringent UCLs. In no case did the excursions threaten the water quality of an underground source of drinking water because the monitor wells are located well within the aquifer exemption area approved by the EPA and the NDEQ. Table **7.2-1** summarizes the excursions reported for the current license area.

7.2.5.3 Potential Groundwater Impacts from Accidents

Groundwater quality could potentially be impacted during operations due to an accident such as an uncontrolled release of process liquids due to a wellfield accident. If there should be a wellfield accident, potential contamination of the shallow aquifer (Brule), as well as surrounding

soil, could occur. Wellfield accidents could take the form of a slow leak or a catastrophic failure, a shallow excursion, an overflow due to excess production or restoration flow, or due to the addition of excessive rainwater or runoff.

The satellite building will have curbing around the structure, and the six 30,000-gallon wastewater storage tanks will have diking to contain any accidental spills or releases of contaminated fluids. This will eliminate the potential for such discharges to the adjoining groundwater surface and potential contamination of the surrounding soils and the Brule Formation.

The DDW will receive wastewater from the wastewater surge/equalization tanks located at the satellite processing facility via an underground PVC/HDPE pipeline. Flow rates from the tankage, tank levels, and flow rates are all controlled and monitored to ensure any potential leakage is rapidly detected. All flows and pressures will have limits and alarms programmed in to alert the operator as limits are approached and to control feed pumps. The details of these systems will be addressed in the Class I permit application that will be submitted to the NDEQ as part of the required permitting process. CBR has successfully operated a Class I DDW for approximately 19 years without any significant spills or releases.

Another potential cause-of groundwater impacts from accidents could be releases as a result of a spill of injection or production solutions from a wellfield building or associated piping. To control these types of releases, all piping is either PVC, HDPE with butt-welded joints, or equivalent. All piping is leak-tested prior to production flow and following repairs or maintenance.

7.2.6 SurfaceWaterImpactsofOperations

7.2.6.1 Surface Water Impacts from Sedimentation

Protection of surface water from stormwater runoff during ongoing wellfield construction related to operations is regulated by the NDEQ as discussed in Section 7.1.4.

7.2.6.2 Potential Surface Water Impacts from Accidents

Surface water quality could potentially be impacted by accidents such as failure or an uncontrolled release of process liquids due .to a wellfield accident. Section 7.1.4 discussed the measures to prevent and control wellfield spills. Wellfield areas are installed with dikes or berms as an additional measure to protect surface water. The berms prevent surface spills from entering all surface water bodies and drainages that connect to surface water bodies and eliminate public

dose and contaminant pathways to surface water.

The satellite building will have secondary containment (curbing around the structure, and the six 30,000-gallon wastewater storage tanks will have diking) to contain any accidental spills or releases of contaminated fluids. This will eliminate the potential for such discharges to the adjoining groundwater surface and potential contamination of the surrounding soils and the Brule Formation. In addition, there is a regular program of inspections and preventive maintenance.

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7.2.7.3 Surface Waters and Wetlands

Dooley Spring, Willow Creek, and other ephemeral features are the only potentially availablesurface waters within the MEA. These features lack defined banks and have no streambed.Generally, these features are dry and they would only be expected to carry water duringexceptional precipitation events. Direct disturbance to these features would take place where they would be crossed by access roads. This would occur in several locations, including one location along the main access road to the satellite facility. Culverts will be installed below each road crossing to maintain natural flows. Therefore, there would not be any long-term direct impacts on the integrity of any of the drainages within the MEA.

The Niobrara River is a perennial stream located downstream of the MEA; this river could potentially be indirectly affected by changes in water quality or quantity. Water quantity would not be changed by the proposed project. Hydrologic analysis completed for this project indicates that the MEA generally carries a low potential for erosion (and therefore a low potential for sediment delivery to the Niobrara River). However, there are some small, localized areas within the MEA that carry a moderate to high erosion potential. If wells cannot be placed outside of areas within the wellfield deemed to carry moderate to high erosion risks, mitigation measures (e.g., berms) will be implemented to minimize the potential for flooding and erosion. The mitigation measures will be defined during final engineering and prior to any construction. As a result of these mitigation measures, sediment delivery to the Niobrara River will be negligible.

One wetland site was identified by HWA (2011) within the MEA. This wetland is located outside of the area proposed for disturbance. Therefore, no direct impacts to wetlands are anticipated. Also, for the reasons mentioned above, the potential for sedimentation of wetlands within and near the MEA is anticipated to be minimal due to mitigation measures that would be implemented to reduce erosion risk.

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7.3.2 Exposures from Water Pathways

The solutions in the zone to be mined will be controlled and adequately monitored to ensure that migration does not occur. The overlying aquifers will also be monitored.

The satellite facility will not have evaporation ponds to store waste solutions, thereby eliminating the potential of releases and exposures via water pathways. In lieu of evaporation ponds, the

facility will employ six 30,000-gallon storage tanks for the temporary storage of process wastewater. The storage tanks will be located within spill containment dikes in order to control any spills or releases from the storage tanks.

The wastewater surge/equalization tanks will discharge to a DDW, which will be the primary method of waste disposal at the satellite facility. The deep well will be completed at a depth of approximately 4,000 to 5,000 fi, isolated from any underground source of drinking water by approximately 1,500 ft of Pierre Shale. The well will be constructed under a permit from the NDEQ and meet all requirements of the UIC program.

The satellite facility processing building will be located on a curbed concrete pad to prevent any liquids from entering the environment. Solutions used to wash down equipment will drain to a sump and will be pumped to the ponds. The pad will be of sufficient size to contain the contents of the largest tank if it ruptures.

Because no routine liquid discharges of process water are expected, there are no definable water- related pathways.

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TR 7.5.3 Groundwater Contamination Risk
7.5.3.1 Lixiviant Excursion

Excursions of lixiviant at ISR facilities have the potential to contaminate adjacent aquifers with radioactive and trace elements mobilized by the mining process. These excursions are typically classified as horizontal or vertical. A horizontal excursion is a lateral movement of mining solutions outside the exempted portion of the ore-body aquifer. A vertical excursion is a movement of ISR fluids into overlying or underlying aquifers.

CBR controls lateral movement of lixiviant by maintaining wellfield production flow at a rate slightly greater than the injection flow. This difference between production and injection flow.is referred to as process bleed. The bleed solution is either recycled in the processing facility or is sent to the liquid waste disposal system. When process bleed is properly distributed among the many mining patterns within the MU, the wellfield is said to be balanced.

CBR monitors for lateral movement of lixiviant using a horizontal excursion monitoring system. This system consists of a ring of monitor wells completed in the same aquifer and zone as the injection and production wells. The current NRC License and NDEQ Class III UIC Permit require that Chadron aquifer monitor wells be located no more than 300 feet from the nearest mineral production wells and no more than 400 feet from each other. These spacing requirements have proven effective for monitoring horizontal excursions CBR and will be employed at the satellite facility or as otherwise provided in the final permit. Monitor wells are sampled biweekly for approved excursion indicators. CBR proposes to implement the current approved excursion monitoring program at the satellite facility. The program was discussed in detail in Section 5.7.8.

Section 7.2.5.2 provided a discussion of horizontal excursions reported at the current Crow Butte operation. The historical experience indicates that the selected indicator parameters and UCLs allow detection of horizontal excursions early enough that corrective action can be taken before water quality outside the exempted aquifer boundary is significantly degraded. As noted in NUREG/CR-6733, significant risk from a horizontal excursion would occur only if it persisted for a long period without being detected (NRC 2000).

Vertical excursions can be caused by improperly cemented well casings, well casing failures, improperly abandoned exploration wells, or leaky or discontinuous confining layers. CBR controls vertical excursions through aquifer testing programs and rigorous well construction, abandonment, and testing requirements. Aquifer testing is conducted before mining wells are installed to detect any leaks in the confining layers. Aquifer test reports are submitted to the NDEQ for review and approval before well construction activities may proceed. Well construction and integrity testing is conducted in accordance with NDEQ regulations contained in Title 122 and methods approved by NRC and NDEQ. Construction and integrity testing methods were discussed in detail in Section 3.1. Well abandonment is conducted in accordance with methods approved and monitored by the NDEQ and discussed in detail in Section 6.2. Procedures for these activities are contained in the SHEQMS Volume III, Operating Manual.

CBR monitors for vertical excursions in the overlying aquifers using shallow monitor wells. These wells are located within the wellfield boundary at a density of one well per 4 acres. Shallow monitor wells are sampled biweekly for approved excursion indicators. CBR proposes to implement the current approved excursion monitoring program at the satellite facility, subject to NRC/NDEQ approval. The program was discussed in detail in Section 5.7.8.

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TR 7.5.4 Wellfield Spill Risk

The rupture of an injection or recovery line in a wellfield, or a trunkline between a wellfield and the satellite facility, would result in either a release of barren or pregnant lixiviant solution, which would contaminate the ground in the area of the break. All piping from the satellite facility to and within the wellfield will be buried for frost protection. Pipelines are constructed of PVC,- HDPE with butt-welded joints, or equivalent. All pipelines are pressure tested at operating pressures prior to final burial and production flow and following maintenance activities that may affect the integrity of the system.

Each MU will have a number of wellhouses where injection and production wells will be continuously monitored for pressure and flow. With the control system currently employed at CPF, individual wells may have high and low flow alarm limits set. All monitored parameters and alarms will be observed in the satellite control room via the computer system. In addition, each wellfield building will have a "wet building" alarm to detect the presence of any liquids in the building sump. High and low flow alarms have been proven effective.at the current operation in detection of significant piping failures (e.g., failed fusion weld).

Occasionally, small leaks at pipe joints and fittings in the wellhouses or at the wellheads may occur. Until remedied, these leaks may drip process solutions onto the underlying soil. CBR currently implements a program of continuous wellfield monitoring by roving wellfield operators and required periodic inspections of each well that is in service. Based on experience from the current operation, small leaks in wellfield piping typically occur in the injection system due to the higher system pressures. These leaks seldom result in soil contamination based on monitoring using field survey instruments and soil samples for radium-226 and uranium. Following repair of a leak, CBR procedures require that the affected soil be surveyed for contamination and the area of the spill documented. If contamination is detected, the soil is sampled and analyzed for the appropriate radionuclides. Contamination may be removed as appropriate.

CONTENTION D: FAILURE TO PROVIDE ADEQUATE ANALYSIS AND DESCRIPTION OF CULTURAL RESOURCES

(D)(1) The Application is not in conformance with 10 C.F.R. § 40.9 and 10 C.F.R. § 51.45 because the Application does not provide analyses that are adequate, accurate, and complete in all material respects to demonstrate that cultural and historic resources . . . are identified and protected pursuant to Section 106 of the National Historic Preservation Act. As a result, the Application fails to comply with Section 51.60.

(D)(2) The Application fails to meet the requirements of 10 C.F.R. §§ 51.60 and 51.45, and the National Environmental Policy Act because it lacks an adequate description of either the affected environment or the impacts of the project on archaeological, historical, and traditional cultural resources. The Application also fails to demonstrate compliance under the National Historic Preservation Act, and the relevant portions of NRC guidance included at NUREG-1569 section 2.4.

Basis and Discussion:

This contention is supported by the Redmond Opinion, although as a contention of omission, it is not necessary to provide expert support. 10 C.F.R. § 51.60 requires Applicant to submit with its Application an environmental report containing the information specified in 10 C.F.R. § 51.45. 10 C.F.R. § 51.45(b) requires a "description of the environment affected" and a discussion of the "impacts of the proposed action on the environment." These requirements are also mandated under the National Environmental Policy Act. In this case, the Environmental Report, at Appendix 4.10-A, demonstrates that a significant number of archaeological, historical, and traditional cultural resources on site have not been evaluated; therefore, the potential impacts to these resources have not been addressed.

Despite the fact that Applicant is aware of freezing and snow conditions in the period from September to May [TR 2.8.3 - The "last freeze" occurs during late May and the "first freeze" in mid to late September], it conducted its archeological survey between November and February during which it is difficult, if not impossible, to find evidence of cultural resources (e.g., artifacts, arrowheads, tools, grave marker stones). Dr. Redmond states that in his experience, he would often find such items at camp sites along waterways, springs and was surprised that ZERO cultural artifacts were uncovered by Applicant's survey.

The Applicant has included an entire report that it has found no archaeological, historical, or traditional cultural resources at the site, but as Dr. Redmond notes, the survey was conducted in the frozen winter month of February at which time about 85% of the ground is covered with ice and snow making it unlikely for any survey to find cultural resources. Further, finding no cultural resources leads Dr. Redmond to conclude that the survey is inadequate. The survey also failed to include subsurface testing which is critical when there is a plan, such as in the Application, to create major surface soil and ground disturbance.

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ER 3.8 Regional Historic, Archeological, Architectural, Scenic, and Natural Landmarks

3.8.1 Historic, Archeological, and Cultural Resources

There have been few cultural resources investigations on private land in southern Dawes County. Cultural resources investigations have been more numerous around the White

River and the Cities of Chadron and Crawford about 10 miles (16.1 kin) to 15 miles (24.1 km) to thenorth, and the results of those surveys can serve as a cultural context for comparison to the MEA. Known resources in that area include indigenous people, artifact scatters, faunal kill and processing sites, and camps; fur trade and other contact period sites; the Sidney-Deadwood Trail; historic railroads; historic fanning sites; Fort Robinson; and the Cities of Chadron and Crawford. In the mid-i 800s, this region was occupied predominantly by bands of Lakota Sioux and Cheyenne. In the 1870s, the Red Cloud Indian Agency was located at Fort Robinson west of Crawford. By 1878, the tribes had officially been relocated to reservations, but sporadic Lakota and Cheyenne resistance continued through the 1880s. The **MEA** is south of the Pine Ridge Escarpment near the Niobrara River, and the nearby Town of Marsland is small in comparison to the Cities of Chadron and Crawford. The Town of Marsland is located along the Sidney-Deadwood Trail, along one of the historic railroad corridors that also passed through Crawford, and along a major river that would have attracted fur trappers. The fur trade in northwest Nebraska was centered along the White and Niobrara Rivers.

The proposed MEA is located on private lands east of SH 2/71 and north of the Niobrara River. An archaeological files search through the Archaeology Division ofthe Nebraska State Historical Society (NSHS) indicated that there have been no previous archaeological investigations within 1 mile (1.6 km) of the **MEA** and that no archaeological sites have been previously reported. An architectural and structural properties search through the Nebraska State Historic Preservation Office (SHPO) indicated that four historic structures (DWOO-240, DWOO-241, DWOO-242, and DWOO-243) have been reported in the study area. Two of these structures are within the MEA, and the other two are close to the MEA. A search of the BLM Public Land Patent Records indicates that nine patents were granted for lands in the **MEA** from 1891 to 1917. This is consistent with the completion of the Chicago, Burlington, and Quincy Railroad through Crawford in 1889, which made the land more accessible to homesteaders, and with a brief moist period in the region between 1910 and 1920. A search of the NationalRegister of Historic Places (NRHP) on-line database for Dawes County yielded 11 sites in the northern portions of the county. None of these NRHP-listed sites is within 10 miles (16.1 km) of the MEA. Fort Robinson and the Red Cloud Indian Agency, about 15 miles (24.1 kin) north-northwest of the **MEA,** are 'also listed as a National Historic Landmark.

ARCADIS completed an intensive pedestrian block cultural resources inventory ofapproximately 4,500 acres for the **MEA** during the period from November 2010 to February 2011 (Graves et al. 2011). The **MEA** was inventoried for the presence of euroamerican and indigenous peoples' properties (cultural resources that are listed or eligible for listing on the NRHP) and may be impacted by proposed mine development. Graves et al. (2011) recorded 15 newly discovered euroamerican historic sites and five euroamerican historic isolated finds and updated the documentation on two of the previously recorded historic farmstead sites (DWOO-242 and DWOO-243).

ARCADIS submitted the "Cameco Resources Marsland Expansion Area Uranium Project Cultural Resource Inventory" report and associated Nebraska Archeological Site Survey

Forms to the Nebraska State Historic Preservation Society/State Historic Preservation Office on April 28, 2011, and SHPO concurrence was granted by the Deputy State Historic Preservation Officer on May 19, 2011.

CBR requested ARCADIS complete a field survey of an additional 160 acres in section 36 **T30N** R5 1W completed during the original field investigation but not reported in the original report. The 160 acres was field investigated by ARCADIS on February 19, 2011 and no new cultural resources were discovered. One historic bridge (25DW362) was identified in section 36 T30N R5 1W and reported within the original cultural resource inventory report. An addendum to the original cultural resources report was prepared to address the additional 160 acres (Graves 2012). Historic site 25DW362 was recommended not eligible for listing on the NRHP with SHPO concurrence.

The Nebraska SHPO concurred with the findings of the addition to the cultural resources report that no archaeological, architectural, or historic context property resources will be affected by the proposed project (NSHS 2012). As stated in the SHPO concurrence letter, the SHPO's review does not constitute the opinions of any Native American Tribes that may have an interest in Traditional Cultural Properties potentially affected by this project.

No indigenous people sites or artifacts were found in the project area. Regardless, a process for tribal identification of Traditional Cultural Properties is being developed and will be implemented during review of the MEA Environmental Report to satisfy NEPA.

The newly recorded historic sites included six farmsteads (25DW359, 25DW360, 25DW361, 25DW365, 25DW366, and 25DW370), three artifact scatters (25DW357, 25DW363, and 25DW369), two cisterns (25DW358 and 25DW364), one corral and windmill (25DW367), one bridge (25DW362), one dugout depression and berm (25DW368), and one stone quarry (25DW371). All ofthese sites were recommended not eligible for the NRHP.

The previously recorded farmstead sites were recorded jointly by SHPO and NSHS as part of a historic building survey of Dawes County in 2005 as the B. Chapman House (DWOO-242; built about 1910); and an abandoned farmhouse (DWOO-243; built about 1890). Updated documentation was prepared for the two buildings in the survey area. This documentation included the completion of NSHS archaeological site survey forms that included recording of associated artifacts and features in addition to the buildings. Updated documentation of the DWOO-242 included a concrete cistern, a storage shed, two modem propane tanks, and historic and modern artifacts. The house is well maintained and appears to be occupied. Site DWOO-243 is more extensive. This site includes two abandoned 1-.5-story farmhouses; a smaller 1-story house; two storage sheds; one stock shelter; one foundation with a chicken coop gate; two metal grain bins; abandoned vehicles, wagons, and farm implements; a network of fenced enclosures; and a large pile of historic debris.

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…If these recommendations are followed, the proposed project will have no adverse effect on historic properties, and no further cultural resource investigations are recommended.

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ER 4.8 Historic and Cultural Resources Impacts

ARCADIS (Graves et al. 2011) completed an intensive pedestrian block cultural resources inventory of approximately 4,500 acres for the **MEA** during the period from November 2010 to February 2011. The **MEA** was inventoried for the presence of historic properties (cultural resources that are listed or eligible for listing on the NRHP) and may be impacted by proposed mine development. This inventory recorded 15 newly discovered historic sites and five historic isolated finds and updated the documentation on two previously recorded historic farmstead sites. All of the newly recorded historic sites were recommended not eligible for the NRHP and do not qualify as historic properties. Isolated finds are by definition not eligible for the NRHP. Historic farmstead DWOO-242 is recommended not eligible for the NRHP, but appears to be currently or recently occupied. Site DWOO-243 may have the potential to yield information important in history and may be potentially eligible for the NRHP' but is not recommended eligible based on the currently available information. Avoidance of these two sites by project actions is recommended. If these recommendations are followed, the proposed project will have no adverse effect on historic properties and no further cultural resource investigations are recommended.

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TR 2.4 Regional Historic, Archeological, Architectural, Scenic and Natural Landmarks
TR 2.4.1 Historic, Archeological, and Cultural Resources

There have been few cultural resources investigations on private land in southern Dawes County. Cultural resources investigations have been more numerous around the White River and the Cities of Chadron and Crawford about 10 miles (16.1 kin) to 15 miles (24.1 km) to the north, and the results of those surveys can serve as a cultural context for comparison to the MEA. Known resources in that area include indigenous people, artifact scatters, faunal kill and processing sites, and camps; fur trade and other contact period sites; the Sidney-Deadwood Trail; historic railroads; historic farming sites; Fort Robinson; and the Cities of Chadron and Crawford. In the mid 1800s, this region was occupied predominantly by bands of Lakota Sioux and Cheyenne. In the 1870s, the Red Cloud Indian Agency was located at Fort Robinson west of Crawford. By 1878, the tribes had officially been relocated to reservations, but sporadic Lakota and Cheyenne resistance continued through the 1880s. The MEA is south of the Pine Ridge Escarpment near the Niobrara River, and the nearby Town of Marsland is small in comparison to the Cities of

Chadron and Crawford. The Town of Marsland is located along the Sidney-Deadwood Trail, along one of the historic railroad corridors that also passed through Crawford, and along a major river that would have attracted fur trappers. The fur trade in northwest Nebraska was centered along the White and Niobrara Rivers.

The proposed MEA is located on private lands east of SH 2/71 and north of the Niobrara River. An archaeological files search through the Archaeology Division of the Nebraska State Historical Society (NSHS) indicated that there have been no previous archaeological investigations within 1 mile (1.6 kin) of the MEA and that no archaeological sites have been previously reported. An architectural and structural properties search through the Nebraska State Historic Preservation Officer (SHPO) indicated that four historic structures (DWOO-240, DWOO-241, DWOO-242, and DWOO-243) have been reported in the study area. Two of these structures are within the MEA and the other two are close to the MEA. A search of the BLM Public Land Patent Records indicates that nine patents were granted for lands in the MEA from 1891 to 1917. This is consistent with the completion of the Chicago, Burlington, and Quincy Railroad through Crawford in 1889, which made the land more accessible to homesteaders, and with a brief moist period in the region between 1910 and 1920. A search of the National Register of Historic Places (NRHP) online database for Dawes County yielded 11 sites in the northern portions of the county. None of these NRHP-listed sites is within 10 miles (16.1 km) of the MEA. Fort Robinson and the Red Cloud Indian Agency, about 15 miles (24.1 kin) north-northwest of the MEA, are also listed as a National Historic Landmark.

ARCADIS completed an intensive pedestrian block cultural resources inventory of approximately 4,500 acres for the MEA during the period from November 2010 to February 2011 (Graves et al. 2011). The MEA was inventoried for the presence of euroamerican and indigenous peoples' properties (cultural resources that are listed or eligible for listing on the NRHIP) and may be impacted by proposed mine development. Graves et al. (2011) recorded 15 newly discovered euroamerican historic sites and five euroamerican historic isolated finds and updated the documentation on two of the previously recorded historic farmstead sites (DWOO-242 and DWOO-243).

ARCADIS submitted the "Cameco Resources Marsland Expansion Area Uranium Project Cultural Resource Inventory" report and associated Nebraska Archeological Site Survey Forms to the Nebraska State Historic Preservation Society/State Historic Preservation Office on April 28, 2011, and SHPO concurrence was granted by the Deputy State Historic Preservation Officer on May 19, 2011.

CBR requested ARCADIS complete a field survey of an additional 160 acres in section 36 **T30N** R51W completed during the original field investigation but not reported in the original report. The 160 acres was field investigated by ARCADIS on February 19, 2011 and no new cultural resources were discovered. One historic bridge (25DW362) was identified in section 36 **T30N** .R5 1W and reported within the original cultural resource inventory report. An addendum to the original cultural resources report was prepared to address the additional 160 acres (Graves 2012).Historic site 25DW362 was recommended not eligible for listing on the NRHP with SHPO concurrence.

<u>**The Nebraska SHPO concurred with the findings of the addition to the cultural resources report that no archaeological, architectural, or historic context property resources will be affected by the proposed project (NSHS 2012).**</u> As stated in the SHPO concurrence letter, the SHPO's review does not constitute the opinions of any Native American Tribes that may have an interest in Traditional Cultural Properties potentially affected by this project. (Emphasis added.)

Dr. Redmond states:

> **[T]he survey that was performed in this area was over approximately 4,500 acres, which was surveyed between November 2010 and February 2011. It was also my experience in working in this area that during that time of the year, snow and ice covered most of the ground surface, at least greater than 85%. My problem with this scenario is that it would be relatively impossible to locate 99% of prehistoric/Native American sites without a much higher level of ground surface observation, i.e., greater than 60-75%, preferably greater than 90%. As stated in the synopsis of the cultural report, this area of the Nebraska Panhandle has not been subjected to even minor investigation. Due to this lack of research, it would appear intuitively evident that an investigation with little or no ground surface visibility would be insufficient to state that no Native American/prehistoric materials were present.**

TR states - No indigenous people sites or artifacts were found in the project area. Regardless, a process for tribal identification of Traditional Cultural Properties is being developed and will be implemented during review of the MEA Environmental Report to satisfy the National Environmental Policy Act (NEPA).

The newly recorded historic sites included six farmsteads (25DW359, 25DW360, 25DW361, 25DW365, 25DW366, and 25DW370), three artifact scatters (25DW357, 25DW363, and 25DW369), two cisterns (25DW358 and 25DW364), one corral and windmill (25DW367), one bridge (25DW362), one dugout depression and berm (25DW368), and one stone quarry (25DW371). All of these sites were recommended not eligible for the NRHP.

The previously recorded farmstead sites were recorded jointly by SHPO and NSHS as part of a historic building survey of Dawes County in 2005 as the B. Chapman House (DWOO-242; built about 1910) and an abandoned farmhouse (DWOO-243; built about 1890).

Updated documentation was prepared for the two buildings in the survey area. This documentation included the completion of NSHS archaeological site survey forms that included recording of associated artifacts and features in addition to the buildings. Updated documentation of the DWOO-242 included a concrete cistern, a storage shed, two modem propane tanks, and historic and modern artifacts. The house is well maintained and appears to be occupied. Site DWOO-243 is more extensive. This site includes two abandoned 1V-story farmhouses; a smaller 1-story house; two storage sheds; one stock shelter; one foundation with a chicken coop gate; two metal grain bins; abandoned vehicles, wagons, and farm implements; a network of fenced enclosures; and a large pile of historic debris.

All of the newly recorded historic sites were recommended not eligible for the NRHP and do not qualify as historic properties. Isolated finds are by definition not eligible for the NRHP. Historic farmstead DWOO-242 is recommended not eligible for the NRHP, but appears to be currently or recently occupied. Site DWOO-243 may have the potential to yield information important in history and may be potentially eligible for the NRHP. Avoidance of these two sites by project actions is recommended. If these recommendations are followed, the proposed project will have no adverse effect on historic properties, and no further cultural resource investigations are recommended.

Specific information included in cultural resources investigations falls under the confidentiality requirement for archaeological resources under Section 304 of the National Historic Preservation Act (16 U.S.C. 470w-3(a)). In addition, disclosure of such information is protected under Nebraska State Statute Section 84-712.05 (13 and 14). The cultural resources inventory report and Attachment A of that report have been marked "FOR OFFICIAL USE ONLY: DISCLOSURE OF SITE LOCATIONS IS PROHIBITED (43 CFR 7.18). In compliance with Nebraska SHPO, NRC NUREG-1569 Section 24, and NDEQ Title 122 Ch. 11 Sections 006.07, "These materials should be treated as confidential information for the purpose of public disclosure of this NRC license amendment." The cultural resources report will be submitted to the NRC and State of Nebraska SHPO under separate cover.

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TR 2.8.5.3 and TR 2.8.10 refer to the kinds of drainages and areas that are possible **ancient camping sites of the kind referred to in the Redmond Opinion.**

> **Dr. Redmond states:**
>
> **First, I worked in this general area from 1992 through the Fall of 1995 as the Forest Archeologist for the Nebraska National Forest. It was my experience that whenever we surveyed areas near or bordering on water resources, ponds, creeks, et cetera, we would almost invariably**

find prehistoric camp sites and related process sites. Throughout this proposed project area, there are a number of both permanent and intermittent water resources of all kinds, including creeks, springs and natural ponds.

Under the National Historic Preservation Act ("NHPA"), a federal agency must make a reasonable and good faith effort to identify historic properties, 36 C.F.R. § 800.4(b); determine whether identified properties are eligible for listing on the National Register based on criteria in 36 C.F.R. § 60.4; assess the effects of the undertaking on any eligible historic properties found, 36 C.F.R. §§ 800.4(c), 800.5, 800.9(a); determine whether the effect will be adverse, 36 C.F.R. §§ 800.5(c), 800.9(b); and avoid or mitigate any adverse effects, 36 C.F.R. §§ 800.8[c], 800.9(c). The [federal agency] must confer with the State Historic Preservation Officer ("SHPO") and seek the approval of the Advisory Council on Historic Preservation ("Council").

CONTENTION E – FAILURE TO PROPERLY CONSULT WITH TRIBAL AUTHORITIES CONCERNING TRADITIONAL CULTURAL PROPERTIES

(E)(1) The Application fails to include a description of proper consultation with all affected Indian Tribes concerning cultural resources at the MEA in violation of NEPA, NHPA, Section 51.45, 51.60, and 10 CFR Part 40 Appendix A.

NUREG-1569 Section 2.4 imposes several requirements in terms of Section 2.4.3 Acceptance Criteria that have not been met in this case. In particular, Section 2.4.3(1) requires a listing for all properties included in, or eligible for inclusion in, the National

Register. Section 2.4.3(3) specifically mandates consultation with tribal authorities on the likely impacts on Native American cultural resources, which has not occurred in this case. Similarly, section 2.4.3(4) requires evidence of contact with appropriate state historical preservation office and tribal authorities – information lacking in the application with respect to tribal contact. Lastly, section 2.4.3(5) explicitly contemplates a memorandum of agreement "among the state historic presentation officer, tribal authorities, and other interested parties regarding their satisfaction with regard to the protection of historic, archaeological, architectural, and cultural resources during site construction and operations."

Among the additional requirements are those under the National Historic Preservation Act ("NHPA") and related Executive Orders. Under these authorities, the NRC is required to fully involve Native American Tribes in all aspects of decision-making affecting Tribal interests such as those directly impacted by the project.

These mandates require NRC to consult with Tribes as early as possible in the decisionmaking process. The federal courts have addressed the strict mandates of the National Historic Preservation Act: *Muckleshoot Indian Tribe v. U.S. Forest Service,* 177 F.3d 800, 805 (9th Cir. 1999). *See also* 36 CFR § 800.8(c)(1)(v)(agency must "[d]evelop in consultation with identified consulting parties alternatives and proposed measures that might avoid, minimize or mitigate any adverse effects of the undertaking on historic properties and describe them in the EA.") The Advisory Council on Historic Preservation ("ACHP"), the independent federal agency created by Congress to implement and enforce the NHPA, has exclusive authority to determine the methods for compliance with the

NHPA's requirements. See *National Center for Preservation Law v. Landrieu,* 496 F. Supp. 716, 742 (D.S.C.), *aff'd per curiam,* 635 F.2d 324 (4th Cir. 1980). The ACHP's regulations "govern the implementation of Section 106," not only for the Council itself, but for all other federal agencies. Id. See *National Trust for Historic Preservation v. U.S. Army Corps of Eng'rs,* 552 F. Supp. 784, 790-91 (S.D. Ohio 1982).

NHPA § 106 ("Section 106") requires federal agencies, prior to approving any "undertaking," such as this Project, to "take into account the effect of the undertaking on any district, site, building, structure or object that is included in or eligible for inclusion in the National Register." 16 U.S.C. § 470(f). Section 106 applies to properties already listed in the National Register, as well as those properties that may be eligible for listing. See *Pueblo of Sandia v. United States,* 50 F.3d 856, 859 (10th Cir. 1995). Section 106 provides a mechanism by which governmental agencies may play an important role in "preserving, restoring, and maintaining the historic and cultural foundations of the nation." 16 U.S.C. § 470.

If an undertaking is the type that "may affect" an eligible site, the agency must make a reasonable and good faith effort to seek information from consulting parties, other members of the public, and Native American tribes to identify historic properties in the area of potential effect. *See* 36 CFR § 800.4(d)(2). See also *Pueblo of Sandia,* 50 F.3d at 859-863 (agency failed to make reasonable and good faith effort to identify historic properties).

The NHPA also requires that federal agencies consult with any "Indian tribe ... that attaches religious and cultural significance" to the sites. 16 U.S.C. § 470(a)(d)(6)(B). Consultation must provide the tribe "a reasonable opportunity to identify its concerns about historic properties, advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, articulate its views on the undertaking's effects on such properties, and participate in the resolution of adverse effects." 36 CFR § 800.2(c)(2)(ii).

Apart from requiring that an affected tribe be involved in the identification and evaluation of historic properties, the NHPA requires that "[t]he agency official **shall ensure that the section 106 process is initiated early in the undertaking's planning,** so that a broad range of alternatives may be considered during the planning process for the undertaking." 36 CFR § 800.1(c) (emphasis added). The ACHP has published guidance specifically on this point, reiterating in multiple places that consultation must begin at the earliest possible time in an agency's consideration of an undertaking, even framing such early engagement with the Tribe as an issue of respect for tribal sovereignty. ACHP.

Regarding respect for tribal sovereignty, the NHPA requires that consultation with Indian tribes "recognize the government-to-government relationship between the Federal Government and Indian tribes." 36 CFR § 800.2(c)(2)(ii)(C). *See also* Presidential Executive Memorandum entitled "Government-to-Government Relations with Native American Tribal Governments" (April 29, 1994), 59 Fed. Reg. 22951, and Presidential Executive Order 13007, "Indian Sacred Sites" (May 24, 1996), 61 Fed. Reg. 26771. The federal courts echo this principle in mandating all federal agencies to fully implement the federal government's trust responsibility. See *Nance v. EPA,* 645 F.2d 701, 711 (9th Cir.

1981) ("any Federal Government action is subject to the United States' fiduciary responsibilities toward the Indian tribes").

Dr Redmond states:

> **[A]lthough it is true that the primary tribal use of this area was by the Sioux (sic) and Cheyenne, a number of tribes utilized the Nebraska Panhandle area. According to just the treaties from this area, a number of tribes are not noted for this cultural review. One of the most encompassing of these treaties is the 1851 Fort Laramie Treaty involving the Sioux or Dahcotah (sic), Cheyennes, Arrapahoes, Crows, Assinaboines, Gros-Ventre Mandans, and Arrickaras. The People listed as "Sioux or Dahcotah" are not easily defined, but include the Lakota Nations of the Sicangu, Brule, Oglala, Minnecoujou, Hunkpapa, Izipaco, Sihasapa, and Ooinunpa nations. Added to these are the Sans Arcs, Santee and Yanktons who are Dakota speakers. The Mandans and Arrickara noted in the said treaty would also include the Hidatsa peoples of the Three Affiliated Nations. As to the Cheyenne defined in the 1851 Treaty, this would indicate both the current Northern and Southern Cheyenne Nations since the division is an artificial artifact of the Government reservation system. In addition, although not listed in this treaty, the Pawnee would also have utilized this area, at least the northern Pawnee or Skidi. This last is indicated by the number of stories, legends or accounts of battles between the Pawnee and many of the above noted Peoples throughout the current project areas. Added to this treaty are a number of other treaties signed with individual tribes between 1851 and 1868, the time period of the two major treaties signed by the United States and a number of interested or subjugated tribes.**

It does not appear from the Application that the Tribes referenced above by Dr. Redmond have been properly consulted with and therefore there has been a violation of NHPA, NEPA, Section 51.45, Section 51.60, and the applicable Executive Orders concerning tribal consultations and government-to-government communications and consultations. As a result, the Application fails to describe the required consultations in violation of the above-referenced sections.

CONCLUSION

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

Dated this 29th day of January, 2013.

Respectfully submitted,

/s/ - electronically signed by

David Frankel, as Attorney
for Above-Referenced Requestor/Petitioners[2]

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