August 17, 2018

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket No. 40-8943-MLA-2
CROW BUTTE RESOURCES, INC.	)	
	)	ASLBP No. 13-926-01-MLA-BD01
(Marsland Expansion Area)	)	

NRC STAFF'S INITIAL STATEMENT OF POSITION

The Staff of the U.S. Nuclear Regulatory Commission (Staff) submits its Initial Statement of Position on the Oglala Sioux Tribe's (OST's) Contention 2. In this contention, the OST challenges the Environmental Assessment (EA) prepared by the NRC Staff for Crow Butte Resources, Inc.'s (CBR's) proposed Marsland Expansion Area (MEA) license amendment application, as well as portions of the MEA application. For the reasons set forth below, the Board should resolve Contention 2 in favor of the Staff and CBR because the MEA application and the Staff's environmental review complied with NRC regulations and applicable law.

I. Background

A. The MEA Application

CBR holds NRC source materials license SUA-1534, which authorizes operation of an in-situ uranium recovery (ISR) facility in Dawes County, Nebraska.[1] On May 16, 2012, CBR submitted an application requesting a license to operate an ISR facility at the MEA.[2] As part of

[1] Ex. NRC009.

[2] "License No. SUA-1534, Docket Number 40-8943, Marsland Expansion Area License Amendment Application" (ADAMS Package No. ML121600598) (May 16, 2012). As explained in A.5 of the Staff's testimony (Ex. NRC001), CBR periodically updated the ER and TR during the review period, with the most recent updates submitted in April 2014 and June 2017, respectively. The Staff's environmental review is based on the ER and subsequent TR updates as applicable. The Staff's safety review is based on the 2015 version of the TR, as updated through 2017. CBR has provided compiled versions of the ER

the application, CBR submitted a Technical Report (TR) to show that it meets NRC safety requirements for granting a license. These safety requirements include certain criteria in Appendix A to Part 40, which provides specific standards for the operation of conventional uranium mills, including standards for tailings and waste disposal and protection of groundwater and surface water. Because an ISR facility like the MEA is not a conventional uranium mill, CBR need not satisfy all the criteria in Appendix A in order to receive an NRC license.[3]

CBR also submitted an Environmental Report (ER) addressing the proposed MEA's impact on the environment. The ER, which is required by NRC regulations in 10 C.F.R. Part 51, serves to inform the Staff's independent environmental review of the license application and thereby assists the Staff in meeting the requirements of the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. §§ 4321 *et seq.*

B. The Staff's Safety Review

Following receipt of the MEA application, the Staff conducted a safety review of CBR's application. The Staff conducted its review to determine whether CBR met the relevant criteria in 10 C.F.R. Parts 20 and 40. After evaluating CBR's application, as supplemented by its responses to Staff Requests for Additional Information (RAIs), the Staff found that CBR met these criteria. The Staff documented its findings in a Safety Evaluation Report (SER) for the CBR MEA application. The Staff issued its SER in January 2018.[4]

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and TR text, references, figures, and tables as exhibits in this proceeding. *See* Exs. CBR005 to CBR009).

[3] *See Hydro Resources, Inc*. (2929 Coors Road Suite 101 Albuquerque, New Mexico 87120), CLI-99-22, 50 NRC 3, 9 (1999) ("We agree that those requirements in Part 40, such as many of the provisions in Appendix A, that, by their own terms, apply only to conventional uranium milling activities, cannot sensibly govern ISL mining.")

[4] Safety Evaluation Report for the Marsland Expansion Area of the Crow Butte Resources ISR Facility, Dawes County, Nebraska, Materials License No. SUA-1534 (January 2018) (Ex. NRC008).

C. The Staff's NEPA Review

In accordance with NEPA and the NRC's NEPA implementing regulations in 10 C.F.R. Part 51, the Staff conducted an environmental review of CBR's application. After reviewing the application, as supplemented by responses to Staff RAIs, the Staff prepared an environmental assessment in connection with the MEA application. The Staff issued the final EA and for the MEA application in April 2018.[5] The EA describes the proposed action and the affected environment, and assesses the potential impacts from the construction, operation, aquifer restoration, and decommissioning of the MEA.

II. The Staff's Expert Witnesses

A. David Back

Mr. Back is a consultant with Sanford Cohen and Associates (SC&A) and a subject matter expert for the CBR MEA application EA. As stated in his resume (Ex. NRC002), he holds a Master of Science degree in Geology (hydrogeology concentration) from the Oklahoma State University and a Bachelor of Science degree in geology from the College of William and Mary. Mr. Back has over 30 years of professional experience conducting numerical and analytical simulations of surface water and groundwater interaction. His expertise includes site hydrogeological characterization; conceptual model formation; application of numerical models for assessing groundwater movement and fate and transport of contaminants in fractured and porous media; reviewing and evaluating hazardous and nuclear waste disposal methods; supporting hydrogeologic assessments of environmental impact statements; and developing and reviewing performance assessments. Mr. Back served as the subject matter expert for

[5] Final Environmental Assessment for the Marsland Expansion Area License Amendment Application (April 2018) (Ex. NRC006). On May 3, 2018, the Staff Finding of No Significant Impact (FONSI) was published in the *Federal Register*. *See* 83 Fed. Reg. 19,576 (May 3, 2018) (Ex. NRC007). Prior to issuing the Final EA, the Staff prepared a draft EA and issued it for public review and comment in December 2017. *See* note 12 *infra*.

matters related to geology and hydrology for the CBR license renewal EA and the CBR MEA application EA.

B. Thomas Lancaster

Mr. Lancaster is a Hydrogeologist with the Uranium Recovery Licensing Branch in the NRC's Office of Nuclear Material Safety and Safeguards. As stated in his resume (Ex. NRC003), he holds a Master of Business Administration degree from George Mason University and a Bachelor of Science degree in Geophysical Sciences from Juniata College. He is a Certified Professional Geologist in Virginia and completed graduate studies in geophysical and hydrogeology sciences at Old Dominion University. Mr. Lancaster has more than 28 years of experience as a hydrogeologist and project manager and has extensive knowledge of uranium recovery licensing. He has nearly 10 years of experience as a project manager and hydrogeologist for uranium recovery licensing reviews at the NRC. He served as the alternate Safety Project Manager and one of the hydrogeology technical reviewers for the safety review of the CBR license renewal application. He is the Safety Project Manager for the CBR MEA application and served as the primary hydrogeology technical reviewer for the safety review of the CBR MEA application.

C. Elise Striz

Dr. Elise Striz is a Hydrogeologist in the NRC's Office of Nuclear Materials Safety and Safeguards, Uranium Recovery Licensing Branch. As stated in her resume (Ex. NRC004), Dr. Striz has a Ph.D. in Petroleum Engineering from the University of Oklahoma, a Master of Science in Civil Engineering from the University of Oklahoma, and a Bachelor of Science in Interdisciplinary Engineering (environmental) from Purdue University. Dr. Striz has more than 20 years of experience in both the private and public sectors. Prior to joining the NRC, Dr. Striz was a contractor to the U.S. Environmental Protection Agency (EPA), where she managed and supported a team which provided groundwater flow and contaminant transport modeling for Superfund sites. She then joined EPA as a hydrologist, where she conducted basic and applied

research including field investigations of groundwater and surface water behavior and groundwater flow and contaminant transport modeling. In 2007, Dr. Striz joined NRC, where she has been a principal hydrogeology safety reviewer for numerous uranium recovery licensing actions. Dr. Striz served as one of the hydrogeology technical reviewers for the safety and environmental reviews of the CBR license renewal application.

Dr. Striz also serves as an NRC technical expert in hydrogeology at ISRs. She has made several presentations on ISR hydrogeology issues at the annual National Mining Association workshops and to EPA. She has been, and continues to be, the hydrogeology technical contact for EPA to assist with the recent 40 CFR Part 192 rulemaking addressing groundwater protection at ISR facilities. Dr. Striz also serves as a technical expert and report author on two International Atomic Energy Association (IAEA) consultancies addressing ISR uranium recovery environmental impact and groundwater contamination remediation issues.

D. Jean Trefethen

Ms. Trefethen is an Environmental Project Manager with the Environmental Review Branch in the NRC's Office of Nuclear Material Safety and Safeguards. As stated in her resume (Ex. NRC005), she holds a Bachelor of Arts degree in Biology from Carroll College. Her responsibilities at the NRC have included the environmental reviews of the Fort St. Vrain Independent Spent Fuel Storage Installation (ISFSI) license amendment application; the Prairie Island ISFSI license renewal application; the North Anna ISFSI license amendment and license renewal applications; the Trojan ISFSI license renewal application; and the decommissioning of the Centrus Lead Cascade Facility. Ms. Trefethen's expertise includes implementation of NRC environmental regulations, NEPA requirements, and consultation under Section 106 of the National Historic Preservation Act. Since October 2017, Ms. Trefethen has served as the Environmental Project Manager for the CBR MEA application.

III. Procedural History of Admitted Contentions

On January 29, 2013, the OST filed a petition to intervene and request for a hearing containing six contentions.[6] In LBP-13-6, the Board admitted two of the OST's contentions.[7] The contentions, as admitted by the Board, challenged the MEA application's description of the affected environment and assessment of impacts of the project on archaeological, historical, and traditional cultural resources (Contention 1) and the sufficiency of information regarding the geological setting of the area and the information needed to establish potential effects of the project on adjacent surface water and groundwater resources (Contention 2).[8] As admitted in LBP-13-6, Contention 1 challenged the MEA application's compliance with NEPA, the National Historic Preservation Act (NHPA), and NUREG-1569, Section 2.4, and Contention 2 challenged the MEA application's compliance with NEPA, with certain regulations in 10 CFR Parts 40 and 51, and with NUREG-1569, Sections 2.6 and 2.7.[9] On August 6, 2014, the Staff submitted a motion for summary disposition of OST Contention 1.[10] On October 22, 2014, the Board granted the Staff's motion and dismissed Contention 1 from the proceeding.[11]

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[6] Petition to Intervene and Request for Hearing of the Oglala Sioux Tribe (January 29, 2013) (OST Petition).

[7] *Crow Butte Resources, Inc*. (Marsland Expansion Area), LBP-13-6, 77 NRC 253, 304-05 (2013). Consolidated Petitioners, a group of individuals and organizations, also filed a petition to intervene and request for a hearing. The Board held that the Consolidated Petitioners failed to establish standing to participate in this proceeding, and did not admit their proffered contentions. *Id*. at 304.

[8] *Id.* at 306. On appeal, the Commission upheld the Board's decision. *Crow Butte Resources, Inc.* (Marsland Expansion Area), CLI-14-2, 79 NRC 11, 26 (2014).

[9] LBP-13-6, 77 NRC at 306.

[10] NRC Staff's Motion for Summary Disposition of Contention 1 (Aug. 6, 2014). CBR filed a response in support of the Staff's motion. Crow Butte Response in Support of NRC Staff Motion for Summary Disposition of Contention 1 (Aug. 18, 2014). The OST did not file a response to the Staff's motion. Memorandum and Order (Ruling on Motion for Summary Disposition Regarding Oglala Sioux Contention 1) at 2 (October 22, 2014) (unpublished).

[11] *Id*.

On December 15, 2017, the NRC issued the complete draft EA and a draft FONSI for the MEA application for public review and comment.[12] The OST submitted comments on the draft EA but did not file new or amended contentions on the information in the draft EA or seek to migrate Contention 2 to the draft EA. On January 26, 2018, the Staff filed a motion to deny migration of the environmental portion of Contention 2 as a challenge to the draft EA.[13] In LBP-18-2, the Board granted the Staff's motion in part and denied it in part, finding that one aspect of Contention 2 would not be subject to further consideration as a challenge to the EA.[14]

On April 30, 2018, the Staff issued the final EA for the MEA application.[15] On May 30, 2018, the OST timely filed a declaration to migrate Contention 2 as a challenge to the final EA and submitted 14 new and "renewed" contentions challenging the final EA.[16] On July 20, 2018, in LBP-18-3, the Board denied the OST's new and renewed contentions and found that the environmental portions of Contention 2 migrated as a challenge from the draft EA to the final EA.[17]

As a result of the Board's rulings, the scope of this hearing is limited to those issues that have been pled with particularity in Contention 2. The admitted contention, as framed by the Board in LBP-18-3, is as follows:

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[12] 82 Fed. Reg. 59,665, 59,666 (Dec. 15, 2017).

[13] NRC Staff's Motion to Deny Migration of Environmental Portion of Contention 2 (Jan. 26, 2018).

[14] Crow Butte Resources, Inc. (Marsland Expansion Area), LBP-18-2, 87 NRC __, __ (slip op. at 12-13) (March 16, 2018). The Board granted the Staff's motion with respect to the portion of Contention 2 asserting that the MEA application failed to describe certain hydraulic properties of the affected aquifers. *Id*. Accordingly, this issue remains solely as a safety concern. *Id.* at 14.

[15] Ex. NRC006.

[16] The Oglala Sioux Tribe's Migrated, Renewed, and New Marsland Expansion Final Environmental Assessment Contentions (May 30, 2018) (New Contentions).

[17] *Crow Butte Resources, Inc*. (Marsland Expansion Area), LBP-18-3, 88 NRC ___ (slip op. at 44) (July 20, 2018).

> Contention 2: Failure to Include Adequate Hydrogeological Information to Demonstrate Ability to Contain Fluid Migration
>
> The application and final environmental assessment fail to provide sufficient information regarding the geological setting of the area to meet the requirements of 10 C.F.R. Part 40, Appendix A, Criteria 4(e) and G(2); the National Environmental Policy Act; and NUREG-1569 section 2.6.
> The application and final environmental assessment similarly fail to provide sufficient information to establish potential effects of the project on the adjacent surface water and ground-water resources, as required by NUREG-1569 section 2.7, and the National Environmental Policy Act.[18]

The Board clarified the scope of the contention, finding that the safety and environmental concerns encompassed in Contention 2 include the following: (1) the adequacy of the descriptions of the affected environment for establishing the potential effects of the proposed MEA operation on the adjacent surface water and groundwater resources; (2) exclusively as a safety concern, the absence in the applicant's technical report, in accord with NUREG-1569 section 2.7, of a description of the effective porosity, hydraulic porosity, hydraulic conductivity, and hydraulic gradient of site hydrogeology, along with other information relative to the control and prevention of excursions; (3) the failure to develop, in accord with NUREG-1569 section 2.7, an acceptable conceptual model of site hydrology that is adequately supported by site characterization data so as to demonstrate with scientific confidence that the area hydrogeology, including horizontal and hydraulic conductivity, will result in the confinement of extraction fluids and expected operational and restoration performance; and (4) whether the draft EA contains unsubstantiated assumptions as to the isolation of the aquifers in the ore-bearing zones.[19]

[18] LBP-18-3 (slip op. at 43).

[19] *Id.*

IV. Applicable Legal Standards

The following general legal standards apply to the Board's review of the merits of the OST's environmental- and safety-related claims.

A. Legal Standards under NEPA

When preparing an EA pursuant to NEPA, the Staff must take a hard look at the environmental impacts of the proposed action.[20] This standard is, however, subject to a "rule of reason." Under NEPA's rule of reason, the Staff need not address every environmental effect that could potentially result from the proposed action.[21] Rather, the Staff need only provide "[a] reasonably thorough discussion of the significant aspects of the probable environmental consequences[.]"[22]

NRC case law follows Circuit Court precedent in defining the scope of the Staff's NEPA review. "NEPA does not call for certainty or precision, but an *estimate* of anticipated (not unduly speculative) impacts."[23] The proper inquiry is not whether an effect is "theoretically possible," but whether it is "reasonably probable that the situation will obtain."[24] The Staff "need not address every impact that could possibly result, but rather only those that are reasonably foreseeable or have some likelihood of occurring."[25]

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[20] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).

[21] *Ground Zero Ctr. for Non-Violent Action v. U.S. Dept. of the Navy*, 383 F.3d 1082, 1089-90 (9th Cir. 2004) (citing *NoGWEN Alliance of Lane County, Inc. v. Aldridge*, 855 F.2d 1380, 1385 (9th Cir. 1988)).

[22] *Trout Unlimited v. Morton*, 509 F.2d 1276, 1283 (9th Cir. 1974); *Warm Springs Dam Task Force v. Gribble,* 621 F.2d 1017, 1026–27 (9th Cir. 1980).

[23] *Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-05-20, 62 NRC 523, 536 (2005) (emphasis in original).

[24] *Northern States Power Co.* (Prairie Island Nuclear Generating Plant, Units 1 and 2), ALAB-455, 7 NRC 41, 49 (1978).

[25] *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), LBP-09-07, 69 NRC 613, 631 (2009).

Further, as the Commission has emphasized, "[a]n environmental impact statement is not intended to be 'a research document.'"[26] NEPA does not require the Staff to analyze every conceivable aspect of proposed project.[27] NEPA also does not require that the Staff commit virtually infinite study and resources to a proposed project.[28] Although the Staff can always gather more data in a particular area, it "must have some discretion to draw the line and move forward with decisionmaking."[29]

Additional considerations apply where an EA, rather than an EIS, is prepared. Unlike an EIS, which is subject to a number of specified regulatory requirements,[30] there is no "universal formula for what an EA must contain and consider."[31] The NRC's NEPA regulations state that an EA must "identify the proposed action" and include a "brief discussion" of the need for the proposed action, alternatives to the proposed action, the environmental impacts of the proposed action and alternatives, as appropriate, and a list of agencies and persons consulted and identification of sources used.[32] The Council on Environmental Quality (CEQ) NEPA regulations define an EA as follows:

> An EA is a "concise public document" which serves to:
>
> (1) Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.
>
> (2) Aid an agency's compliance with the Act when no environmental impact

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[26] *Entergy Nuclear Generation Co.* (Pilgrim Nuclear Power Station), CLI-10-22, 72 NRC 202, 208 (2010) (citing *Town of Winthrop v. FAA*, 533 F.3d 1, 13 (1st Cir. 2008)).

[27] *Private Fuel Storage*, CLI-02-25, 56 NRC at 349.

[28] *Entergy Nuclear Generation Co.* (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 315 (2010) (footnote omitted).

[29] *Id.* at 315.

[30] *See, e.g.*, 10 CFR §§ 51.70 and 51.71 (draft EIS), 10 C.F.R. §§ 51.90 and 51.91 (final EIS), 40 C.F.R. §§ 1502.15 and 1502.16 (all EISs).

[31] *Friends of Congaree Swamp v. Fed. Highway Admin.,* 786 F.Supp.2d 1054, 1062 (D.S.C.2011).

[32] 10 C.F.R. 51.30(a); *see also* 40 C.F.R. § 1508.9(b).

statement is necessary.

(3) Facilitate preparation of a statement when one is necessary.[33]

NRC regulations also require that after completing an EA, the Staff must determine whether to prepare an EIS or a FONSI on the proposed action.[34]

Whether issuing an EA or an EIS, the agency's "hard look" must encompass "a thorough investigation into the environmental impacts of [the] agency's action and a candid acknowledgment of the risks that those impacts entail."[35] Because of the variety of possible factual variations in NEPA cases, an agency's obligations under NEPA are case-specific. The level of detail required "depends upon the nature and scope of the proposed action."[36] An EA requires less depth of consideration and less detail than an EIS.[37]

Finally, when reviewing an EA for compliance with NEPA, a court must "take a holistic view of what the agency has done to assess environmental impact[s]," and must not "flyspeck" the agency's environmental analysis."[38] In the context of NRC proceedings, the Commission has specifically stated that NRC hearings are not intended to fine-tune, add details or nuances, or edit Staff NEPA documents to meet an intervenor's preferred language or emphasis.[39]

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[33] 40 C.F.R. § 1508.9(a).

[34] 10 C.F.R. 51.31(a).

[35] *Nat'l Audubon Soc'y v. Dep't of Navy,* 422 F.3d 174, 185 (4th Cir.2005).

[36] *California v. Block,* 690 F.2d 753, 761 (9th Cir.1982)

[37] *See Pa'ina Hawaii, L.L.C.*, CLI-10-18, 72 NRC 56, 75 (2010).

[38] *See, e.g.*, *Fuel Safe Washington v. FERC*, 389 F.3d 1313, 1323 (10th Cir.2004) (describing the inquiry as "deciding whether claimed deficiencies in a FEIS are merely flyspecks, or are significant enough to defeat the goals of informed decision making and informed public comment") (quotation marks omitted); *Half Moon Bay Fishermans' Mktg. Ass'n v. Carlucci*, 857 F.2d 505, 508 (9th Cir.1988) ("The reviewing court may not 'flyspeck' an EIS.").

[39] *Exelon Generation Co.*, LLC (Early Site Permit for Clinton ESP Site), CLI-05-29, 62 NRC 801, 811 (2005) (boards "do not sit to 'flyspeck' environmental documents or to add details or nuances."); *see also System Energy Resources, Inc.* (Early Site Permit for Grand Gulf ESP Site), CLI-05-4, 61 NRC 10, 19 (2005) (internal citations omitted) (editing Staff NEPA documents to meet an intervenor's preferred language or emphasis "is not a function of [the NRC] hearing process," and "boards do not sit to parse and fine-tune" the staff's NEPA documents).

B. Staff Guidance

The Staff conducted its environmental review of the MEA in accordance with the applicable standards in 10 C.F.R. Part 51 and NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs."[40] Section 3.4.5 of NUREG-1748 states that the description of the affected environment in an EA "provides a framework for the discussion of impacts" and should describe current environmental conditions that could be impacted by the proposed action.[41] As relevant to Contention 2, Sections 6.3.3 and 6.3.4 of NUREG-1748 provides general guidance on information about geologic setting and surface water and groundwater resources that an applicant should provide in its environmental report.

Certain areas of the Staff's environmental review of an ISR application, such as hydrology and geology, overlap significantly with the Staff's safety review. Therefore, the Staff also uses NUREG-1569, "Standard Review Plan for In Situ Uranium Recovery Facilities,"[42] as additional guidance to inform its environmental review of ISR facilities. As relevant to Contention 2, Sections 2.6 and 2.7 of NUREG-1569 provide guidance on geology and hydrology, respectively.[43]

C. Safety Review

An applicant for an ISR license must provide sufficient information to demonstrate that it will be able to comply with applicable regulations in 10 C.F.R. Parts 20 and 40, including applicable criteria in Appendix A of Part 40. The Staff conducts its safety review of the MEA

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[40] NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs" (August 2003) (Ex. NRC011).

[41] Ex. NRC011 at 3-9.

[42] NUREG-1569, "Standard Review Plan for In Situ Uranium Recovery Facilities" (June 2003) (Ex. NRC010).

[43] Ex. NRC010 at 2-16 to 2-19, 2-20 to 2-26. As the Staff later explains in its testimony, in the context of an environmental review, NUREG-1569 can provide the Staff with additional guidance regarding the types of information that would be useful in describing the affected environment at an ISR facility and evaluating its potential environmental impacts. Ex. NRC001 at A.6, A.8.

application in accordance with those regulations and consistent with the guidance in NUREG-1569.[44] The Staff uses NUREG-1569 "to determine whether the proposed activities will be protective of public health and safety and the environment and will be environmentally acceptable."[45] However, the acceptance criteria in NUREG-1569 are not requirements,[46] and applicants may propose alternative approaches to demonstrating compliance with the regulations.[47] The adequacy of the applicant's license application, not the Staff's safety evaluation, is the safety issue in any licensing proceeding, and under longstanding decisions of the agency, contentions on the adequacy of the Staff's SER are not cognizable in a proceeding.[48]

V. The Staff's Position on Contention 2

The Staff addresses OST Contention 2 below and in its attached testimony (Ex. NRC001). As the Staff explains, it prepared the EA for the MEA Application consistent with the requirements of applicable law and guidance. The record, including the Staff's supporting testimony, demonstrates that the OST's claims in Contention 2 lack merit. Because the MEA application and the Staff's environmental review complied with NRC regulations and applicable law, the Board should resolve the contention in favor of the Staff and CBR.

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[44] Ex. NRC008 at 9-10. For the purposes of Contention 2, the applicable regulatory requirement is 10 C.F.R. 40.41(c), which requires licensees to "confine [its] possession and use of source or byproduct material to the locations and purposes authorized in the license."

[45] Ex. NRC010 at xv.

[46] CLI-14-2 at 23 n.70 (stating that NUREG-1569 does not itself impose requirements but provides guidance for the Staff's review of an application).

[47] Ex. NRC010 at xxiv.

[48] *Curators of the Univ. of Mo*., CLI-95-1, 41 NRC 71, 121-22 (1995), affirmed on motion for reconsideration, CLI-95-8, 41 NRC 386, 396 (1995), *La. Power & Light Co*. (Waterford Steam Electric Station, Unit 3), ALAB-812, 22 NRC 5, 55-56 (1985); *Pac. Gas Electric Co*. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-728, 17 NRC 777, 807 (1983), review denied, CLI-83-32, 18 NRC 1309 (1983).

The Board characterized the overarching issue in Contention 2 as whether there is adequate hydrogeological information in the application and EA to demonstrate that ISR production fluids will not migrate offsite and contaminate surface water or groundwater resources.[49] Within that context, the Board identified four specific asserted deficits in CBR's application and the Staff's EA: (1) insufficient description of the affected environment to establish potential effects on surface water and groundwater resources, (2) the absence of a description of certain aquifer properties in CBR's application (exclusively as a safety concern), (3) failure to develop an acceptable, adequately supported conceptual model of site hydrology to demonstrate confinement of ISR production fluids, and (4) reliance on unsubstantiated assumptions regarding isolation of aquifers.

Below, the Staff initially addresses why the documents submitted with the OST Petition do not support the OST's claims in Contention 2. The Staff then summarizes its position on each of the issues specified by the Board's ruling in turn below, with specific references to portions of the Staff's detailed expert testimony.

A. <u>The Staff's EA provides a thorough description of the affected environment with respect to geologic setting and water resources that allowed evaluation of potential effects on surface water and groundwater quality.</u>

The OST first asserts that the description of the affected environment in the EA is insufficient to establish the potential effects of the MEA on adjacent surface water and groundwater resources. This claim combines two general assertions that the OST makes in Contention 2.[50] First, the OST asserts that the EA does not provide sufficient information about the geologic setting of the area, contrary to the requirements of NEPA; Criteria 4(e) and 5G(2)

[49] *See* LBP-13-6, 77 NRC at 293.

[50] In Contention 2 as originally pled, the OST did not identify any specific aspect of the discussions of affected environment in the MEA application that it considered insufficient. And after the Staff issued the EA, the OST did not amend Contention 2 to challenge any specific aspect of the discussions of affected environment in the EA.

of 10 CFR Part 40, Appendix A; and Section 2.6 of NUREG-1569.[51] Second, the OST asserts that the EA does not provide sufficient information to establish potential effects on adjacent surface water and groundwater resources, contrary to the requirements of NEPA and Section 2.7 of NUREG-1569.[52]

In its petition to intervene, the OST relied on two documents as support for Contention 2: a 2013 opinion from Dr. Hannan LaGarry ("Lagarry Opinion") and a 2010 letter from EPA Region 8 to the NRC ("2010 EPA Letter"). As the Staff explains in its testimony, the LaGarry Opinion contains general descriptions of stratigraphy in northwestern Nebraska and general descriptions of potential contamination pathways, but does not identify any specific concern with the MEA application.[53] And the 2010 EPA Letter provided comments on Staff environmental review documents for other ISR facilities located in Wyoming related to topics outside the scope of Contention 2 in this proceeding.[54] Furthermore, both documents were written well before the draft EA was issued, and thus do not address the Staff's analysis in either the draft EA or the final EA.[55] As explained below and in the Staff's testimony, contrary to the OST's assertions, the EA provides extensive descriptions of the geologic setting, along with descriptions of surface water resources and groundwater resources, which were sufficient to establish potential effects on surface water and groundwater quality.

The Staff's environmental review is governed by the NRC's NEPA regulations in 10 CFR Part 51, while the safety review (as relevant to this contention) is governed by 10 CFR Part 40,

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[51] OST Petition at 17.

[52] *Id*.

[53] Ex. NRC001 at A.13. In Section V.C.3 *infra*, the Staff discusses its position on Dr. LaGarry's general assertions about contamination pathways, to the extent that they relate to confinement and migration of ISR production fluids at the MEA.

[54] Ex. NRC001 at A.13. The topics discussed in the 2010 EPA Letter are wastewater disposal and waste management, air pollutants, establishment of alternate concentration limits as restoration targets, and climate change and greenhouse gas emissions. *Id*.

[55] *Id*. The 2010 EPA Letter also predates the application by several years. *Id*.

including Appendix A of Part 40.[56] As stated in the SER, the Staff's safety reviews of geology and hydrology, the topics relevant to this contention, assess CBR's ability to confine ISR production fluids to areas authorized in the license, as required by 10 CFR § 40.41(c).[57]

The NRC's NEPA regulations do not contain requirements for descriptions of the affected environment in an EA,[58] but 10 C.F.R. § 51.45(c) states that an applicant's ER "should provide sufficient data to aid the Commission in its development of an independent analysis."[59] And the CEQ regulations state only that an EA should "briefly provide sufficient evidence and analysis" to determine whether an EIS is needed or a finding of no significant impact (FONSI) can be made.[60]

The Intervenors assert that the EA and MEA application fail to meet "requirements" in NUREG-1569, the Staff's standard review plan for ISR facilities. In its testimony, the Staff explains the role of this guidance document, as well as NUREG-1748, which provides guidance on environmental reviews of materials facilities (including ISR facilities). NUREG-1569 does not contain requirements, and applicants may use approaches other than those laid out in the acceptance criteria in NUREG-1569.[61] According to NUREG-1748, the description of the affected environment in an EA "provides a framework for the discussion of impacts" and should describe current environmental conditions that could be impacted by the proposed action.[62] In

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[56] Ex. NRC001 at A.7. Although the OST claims that the EA and the application must meet the requirements of Criteria 4(e) and 5G(2) of 10 C.F.R. Part 40, Appendix A, the Staff explains in its testimony why those criteria do not apply to the Staff's environmental or safety reviews of the MEA application. *Id*.

[57] Ex. NRC008 at 27, 45.

[58] *See* 10 C.F.R. § 51.30.

[59] Ex. NRC001 at A.6; 10 C.F.R § 51.45(c).

[60] 40 C.F.R. § 1508.9(a).

[61] Ex. NRC001 at A.8; Ex. NRC010 at xxiv.

[62] Ex. NRC011 at 3-9.

addition, Sections 6.3.3 and 6.3.4 of NUREG-1748 contain general guidance on topics related to geology and water resources that an applicant should discuss in its ER, and these topic areas are consistent with those in Sections 2.6 and 2.7 of NUREG-1569.[63] Therefore, the Staff looks to NUREG-1569 for additional guidance on information to consider in its environmental review.[64]

1. The Staff's EA thoroughly described the regional and local geologic setting.

There are no statutory or regulatory requirements specifying information that must be provided in a description of the geologic setting for the review of an ISR facility.[65] According to guidance in Section 2.6 of NUREG-1569, an applicant's description of geologic setting (within the scope of this contention) should include regional and local stratigraphy, the geology and geochemistry of the mineralized zone and surrounding units, and local and regional geologic structure.[66] As the Staff explains in its testimony, the EA addresses all of these topics. Section 3.2.1 the EA describes regional geology, including regional topography, regional stratigraphy, and regional structural features.[67] Section 3.2.2 describes local stratigraphy and lithology, the hydrostratigraphic roles (e.g., aquifer, aquitard) of stratigraphic units, the production zone aquifer and ore body, and local structural features.[68] Finally, in Section 3.2.2.2, the EA discusses in detail the Staff's independent evaluation of the reported Niobrara River and Pine

[63] Ex. NRC001 at A.6; *see* Ex. NRC011 at 6-7 to 6-10; Ex. NRC010 at 2-16 to 2-19 and 2-20 to 2-26.

[64] Ex. NRC001 at A.6, A.8.

[65] Ex. NRC001 at A.6. As the Staff states in its testimony, the applicable regulatory requirements are more general: 10 CFR 40.41(c) requires that a licensee "confine [its] possession and use of source and byproduct material to the locations and purposes authorized in the license," and 10 CFR 51.45(c) states that an applicant "should provide sufficient data to aid the Commission in its development of an independent [environmental] analysis." *Id*.

[66] Ex. NRC001 at A.6; Ex. NRC010 at 2-16 to 2-19.

[67] Ex. NRC001 at A.9; Ex. NRC006 at 3-5 to 3-7.

[68] Ex. NRC001 at A.9; Ex. NRC006 at 3-8 to 3-11.

Ridge faults near the MEA.[69] In summary, the extensive discussion of geologic setting in the EA describes current environmental conditions that could be affected by the MEA and provides a framework for discussing impacts, consistent with the guidance in NUREG-1748.[70]

The Staff's discussion of geologic setting in the EA is based on its review of the descriptions and supporting information provided in the MEA application, and the MEA application addresses the same topic areas described above.[71] Furthermore, the supporting information in the MEA application is consistent with guidance in NUREG-1569. According to NUREG-1569, typical supporting information that an applicant would provide includes geologic maps, structure contour maps, stratigraphic maps and cross sections, lithological logs from core and drill cuttings, representative core and geophysical well-log data, and isopach maps.[72] CBR provided such support. CBR conducted an extensive subsurface investigation of the MEA site, which formed the basis for much of the supporting information in the MEA application. As part of that investigation, CBR drilled numerous boreholes and used standard techniques such as geophysical logs and observations of drill cuttings to obtain information about stratigraphy and properties of stratigraphic units, including their thickness, continuity, and areal extent. CBR used the logs and drill cuttings to construct detailed stratigraphic cross-sections, structure

[69] Ex. NRC001 at A.9; Ex. NRC006 at 3-11 to 3-14.

[70] Ex. NRC001 at A.9.

[71] *Id*.

[72] Ex. NRC001 at A.6; Ex. NRC010 at 2-16 to 2-19.

contour maps, and isopach maps.[73] CBR also obtained and analyzed core samples for physical and chemical properties such as grain size, mineralogy, and hydraulic conductivity.[74]

Finally, in its safety review of geology at the MEA, the Staff found that CBR presented a thorough evaluation of geologic setting and that the MEA application met the acceptance criteria in Section 2.6.3 of NUREG-1569.[75] In its testimony, the Staff summarizes the bases for this finding: the description of regional geology was consistent with published information; comprehensive data to support CBR's discussion of site stratigraphy; adequate documentation of site lithologic and stratigraphic characteristics of geologic units; and an adequate demonstration, based on site-specific data, of no significant offsets due to faulting.[76]

2. The EA provides sufficient information to establish potential impacts on surface water and groundwater quality.

The Intervenors assert that the EA and MEA application do not contain sufficient description of the affected environment to establish potential impacts on surface water and groundwater quality.[77] Contrary to this assertion, as discussed below, the Staff's testimony demonstrates that the EA and the MEA application provide extensive information on the

[73] Ex. NRC001 at A.9. In its testimony, the Staff addresses the assertion on page 4 of the LaGarry Opinion that simplifications used in pre-1990's mapping of area geology led to overestimation of thickness and areal extent of many units. As the Staff explains, Dr. LaGarry's statement is not relevant to the MEA because CBR's extensive subsurface investigation and stratigraphic interpretation based on borehole data accurately depicts the thickness and areal extent of stratigraphic units at the MEA. Ex. NRC001 at A.10.

[74] Ex. NRC001 at A.9.

[75] *Id*.; Ex. NRC008 at 28-38.

[76] Ex. NRC001 at A.9; Ex. NRC008 at 28-29, 30-36.

[77] OST Petition at 17. The Board characterized the overarching issue in Contention 2 as whether CBR has demonstrated that ISR production fluids will migrate offsite and contaminate adjacent surface water and groundwater. *See* LBP-13-6, 77 NRC at 289. Therefore, although the Intervenors use the phrase "surface and groundwater resources," the scope of Contention 2 is properly limited to surface water and groundwater quality. This is reinforced by the Board's decisions in LBP-13-6 and LBP-18-3, where contentions related to groundwater quantity impacts were rejected. LBP-13-6, 77 NRC at 296; LBP-18-3 (slip op. at 30).

affected environment that is sufficient to establish impacts of the project on surface water and groundwater quality.

As the Staff explains in its testimony, information on geologic setting, surface water hydrology, and groundwater hydrology is needed to establish potential effects on surface water and groundwater quality.[78] The descriptions of geologic setting in the EA and MEA application are sufficient for the reasons summarized above in Section V.A.1. The Staff testimony explains why, for similar reasons, the descriptions of surface water hydrology and groundwater hydrology are also sufficient.

Next, the Staff explains that Section 2.7 of NUREG-1569 provides guidance on information that should be used to characterize hydrology at ISR facilities.[79] According to Sections 2.7.1 to 2.7.3 of NUREG-1569, information on surface water hydrology relevant to Contention 2 includes information about surface water features (location, type, size, hydrologic characteristics, and uses), the potential for erosion and flooding, and surface water quality.[80] Relevant information on groundwater hydrology includes a description of hydrostratigraphy, the hydraulic properties of aquifers and aquitards, and subsurface water quality and use.[81]

The EA discusses all of these topics.[82] With respect to surface water hydrology, Section 3.3.1 of the EA describes the Niobrara River basin (the watershed that contains the MEA), and the characteristics of the major surface water features near the MEA (the Niobrara River and Box Butte Reservoir).[83] Section 3.11.3 contains additional information on surface water characteristics, while Section 4.2.2 discusses flooding and erosion control studies that CBR

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[78] Ex. NRC001 at A.11.

[79] *Id*.

[80] *Id*.; Ex. NRC010 at 2-20 to 2-26.

[81] Ex. NRC001 at A.11; Ex. NRC010 at 2-20 to 2-26.

[82] Ex. NRC001 at A.12.

[83] Ex. NRC006 at 3-18 to 3-23.

conducted at the MEA.[84] With respect to groundwater hydrology, Section 3.3.2 of the EA describes regional and local hydrostratigraphy; regional and local groundwater flow characteristics (velocities and flow directions) in overlying aquifers and the production zone aquifer; hydraulic properties and other characteristics of the production zone aquifer; local groundwater quality; and the bases for vertical confinement of the production zone aquifer, including the thickness and continuity of the upper and lower confining layers.[85] Sections 3.3.3 and 3.11.2 provide additional information on local groundwater use and groundwater quality.[86] These discussions in the EA mirror the surface water and groundwater hydrology topics identified in Section 2.7 of NUREG-1569.[87] In summary, the extensive discussion of surface water hydrology and groundwater hydrology in the EA describes current environmental conditions that could be affected by the MEA and provides a framework for discussing impacts, consistent with the guidance in NUREG-1748.[88]

As with geologic setting, the Staff's descriptions of surface water and groundwater hydrology in the EA are based on descriptions and supporting data provided in the MEA application.[89] Information from CBR's subsurface geological investigations, such as stratigraphic cross sections and results of core sample analyses (discussed in Section V.A.1 above), also supports the discussion of groundwater hydrology.[90] In addition, CBR provided other supporting information consistent with the guidance in Section 2.7 of NUREG-1569, including potentiometric surface contour maps indicating hydraulic gradients and flow directions;

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[84] Ex. NRC006 at 3-72, 4-6 to 4-9.

[85] Ex. NRC006 at 3-23 to 3-34.

[86] Ex. NRC006 at 3-34 to 3-36, 3-70.

[87] Ex. NRC010 at 2-20 to 2-26.

[88] Ex. NRC001 at A.12; Ex. NRC011 at 3-9.

[89] Ex. NRC001 at A.12.

[90] Ex. NRC001 at A.12; *see also* Ex. NRC010 at 2-16.

the results of an aquifer pumping test in the Basal Chadron Sandstone aquifer, and water quality data from onsite monitoring wells and neighboring private wells.[91]

Finally, in its safety review of hydrology at the MEA, the Staff found that CBR thoroughly characterized surface water and groundwater hydrology at the MEA, and that the MEA application met the acceptance criteria in Section 2.7.3 of NUREG-1569.[92] In its testimony, the Staff summarizes the bases for this finding: CBR characterized the location, size, characteristics and uses of surface water on and near the MEA; CBR conducted studies to assess the potential for erosion and flooding; CBR's description of hydrostratigraphy is consistent with descriptions of others; CBR described properties of the overlying aquifers, confining units, and Basal Chadron Sandstone aquifer based on site-specific data; CBR's aquifer pumping test sufficiently defined properties of the production zone aquifer and demonstrated adequate confinement; and CBR provided sufficient information on water use to evaluate potential risks to nearby users.[93]

B. The MEA application contains information on the hydraulic properties of aquifers identified by the OST.

The second asserted deficiency identified by the Board is that certain parameters relating to hydraulic properties of aquifers are absent from the MEA application. As the Board has stated, this portion of Contention 2 is solely a safety concern and asserts an omission from the MEA application, rather than a challenge to the adequacy of the application.[94] Although this issue originally involved the asserted omission of three parameters (effective porosity, hydraulic

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[91] Ex. NRC001 at A.12. As the Staff testifies, the aquifer pumping test was designed to assess the connectivity of the production zone aquifer, to assess its hydraulic properties, and to assess the degree of confinement between the production zone and overlying aquifers. *Id*.

[92] *Id*.; Ex. NRC008 at 45-57.

[93] Ex. NRC001 at A.12; Ex. NRC008 at 45-57.

[94] *See* LBP-18-2 (slip op. at 12) (identifying this issue as an omission that was cured with respect to the environmental aspects of the contention by inclusion of the missing information in the Staff's EA); LBP-18-3 (slip op. at 4 n.6) (identifying this issue as one involving "an omission of various hydrogeological parameters" and noting that "the challenge to the omission, as it relates to the safety aspects, remains.").

conductivity, and hydraulic gradient), the Board held in LBP-18-3 that two additional parameters related to the aquifer pumping test, transmissivity and storativity, are also within its scope.[95] As discussed below, the information asserted to be missing was provided in the MEA application, and was sufficient for the Staff's safety review.

In its testimony, the Staff first discusses the significance of these parameters. As the Staff explains, hydraulic gradient, hydraulic conductivity, and transmissivity (the product of hydraulic conductivity and aquifer thickness) are used to determine various operational settings, such as wellfield patterns, injection and extraction rates, and bleed rates.[96] Vertical hydraulic conductivity and vertical hydraulic gradients are used, in conjunction with other evidence, to demonstrate confinement.[97] Effective porosity can be used to calculate groundwater velocity in certain situations, and is used in groundwater flow and transport modeling, but such modeling is not required for the Staff's safety review.[98] Furthermore, an applicant need not provide a value for effective porosity to demonstrate its ability to prevent and control excursions.[99]

The Staff then identifies the sections of the TR in which CBR provides the parameters that were asserted to be missing.[100] CBR provides potentiometric contour maps (which show

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[95] The Board's statement of the contention in LBP-18-2 and LBP-18-3 also includes "hydraulic porosity," a term that was not originally included in the OST's discussion of Contention 2 in its petition, or in the Board's original statement of the contention in LBP-13-6. *Compare* LBP-18-2 (slip op. at 14) and LBP-18-3 (slip op. at 43) *with* OST Petition at 17-18 and LBP-13-6, 77 NRC at 289. Therefore, the inclusion of hydraulic porosity appears to be an error. In any event, as the Staff testifies, hydraulic porosity applies to turbulent flow in porous media, which is not significant in the context of ISR operations. Ex. NRC001 at A.10.

[96] Ex. NRC001 at A.15.

[97] *Id*.

[98] *Id*.

[99] *Id*. As the Staff explains, its safety finding that an applicant has demonstrated its ability to control and prevent excursions is based on an evaluation of the applicant's ability to maintain an inward hydraulic gradient and to conduct excursion monitoring procedures, both of which are required by license conditions. *Id*. In CBR's license, the applicable license conditions are 10.1.6 (inward gradient) and 11.1.5 (excursion monitoring). Ex. NRC009 at PDF 11, 17.

[100] Ex. NRC001 at A.16.

hydraulic gradients) in TR Figures 2.9-4a-d, 2.9-5a-d, and 2.9-6a-d, and CBR discusses average lateral hydraulic gradients in Section 2.9.3.2 of the TR.[101] In Section 2.7.2.1 of the TR, CBR discusses hydraulic conductivities of the overlying and underlying confining layers, and in Section 2.7.2.2 (including Tables 2.7-2 through 2.7-4), CBR discusses hydraulic conductivity, storativity, and transmissivity of the Basal Chadron Sandstone aquifer.[102] Finally, in Section 3.1.7 of the TR, CBR provides a value for effective porosity of the Basal Chadron Sandstone aquifer, a value which is used in an analysis of CBR's ability to contain fluid migration in the event of an extended power loss.[103]

C. The hydrologic conceptual model for the MEA is supported by extensive site characterization data and demonstrates that ISR production fluids at the MEA will be adequately confined.

The OST asserts in its petition that the EA and MEA application fail to develop an acceptable hydrologic conceptual model that is adequately supported by site characterization data, and therefore, that the EA and MEA application fail to demonstrate confinement of ISR production fluids at the MEA. As discussed below, the Staff explains in its testimony that the EA (and application) describe all of the components of a hydrologic conceptual model; that the hydrologic conceptual model is supported by extensive site characterization data collected using standard or established methods, and that the conceptual model and supporting information demonstrate that there will be adequate confinement of ISR production fluids at the MEA.

1. The EA describes the hydrologic conceptual model for the MEA.

In its testimony, the Staff describes the elements of a site hydrologic conceptual model, which consists of surface water and groundwater conceptual models.[104] A surface water

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[101] Ex. CBR008 at 105-116; Ex.CBR006 at 2-116 to 2-117.

[102] Ex. CBR006 at 2-79 to 2-84; Ex. CBR009 at 72-74.

[103] Ex. CBR006 at 3-26.

[104] Ex. NRC001 at A.17.

hydrology conceptual model includes watersheds and drainages; types, sizes, and morphology of surface water features; peak flow rates and flooding potential; seasonal variation in water levels and quality; and water use.[105] A groundwater hydrology conceptual model includes the hydrostratigraphy, hydraulic properties of aquifers and aquitards; potentiometric surfaces and hydraulic gradients; flow directions and magnitudes; preferential flow pathways; recharge and discharge areas; groundwater quality; and groundwater use.[106] These descriptions are consistent with the guidance in Section 2.7.1 to 2.7.3 of NUREG-1569.[107]

The surface water conceptual model is described in Sections 3.3.1 and 3.11.3 of the EA, which describe the Niobrara River basin, characteristics of the Niobrara River, local surface water features at the MEA (including the lack of perennial drainages), and information on local surface water characteristics.[108] Sections 3.3.3.2 through 3.3.2.5, which describe site hydrostratigraphy, groundwater flow characteristics, characteristics of the production zone aquifer, local groundwater quality, and the bases for vertical confinement of the production zone aquifer, are the primary sections of the EA that describe the groundwater conceptual model.[109]

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[105] *Id*.

[106] *Id*.

[107] *Id*. These descriptions are similar to those described in A.11 of the Staff's testimony, which explains the information about surface and groundwater that should be provided to establish potential effects.

[108] Ex. NRC001 at A.18.

[109] *Id*. Additional information on the groundwater conceptual model is found in Sections 3.3.3.2 (information on private water supply wells), 3.2.2.2 (lack of preferential pathways due to faults), and 3.11.2 (groundwater quality). In addition, for purposes of its safety review, the Staff testifies that the surface water and groundwater conceptual models are primarily discussed in Section 2.4.3 of the SER, with additional relevant discussion of geologic aspects of groundwater hydrology, such as stratigraphy and the existence of reported faults, in Sections 2.3.3.2 and 2.3.3.3. Ex. NRC001 at A.18, Ex. NRC008 at 29-37.

2. The hydrologic conceptual model for the MEA is supported by extensive and reliable site characterization data.

In its testimony, the Staff describes CBR's comprehensive subsurface investigation of the MEA. [110] CBR drilled numerous boreholes and used geophysical logs and observations of drill cuttings to obtain data on the thickness, extent, and continuity of stratigraphic units.[111] CBR used data from 57 boreholes to construct 14 stratigraphic cross-sections that cover the entire site,[112] and data from over 100 boreholes to create isopach maps and structure contour maps.[113] In addition, CBR used drill cuttings and analysis of core samples to assess the physical and chemical properties of the overlying aquifers, upper and lower confining layers, and production zone aquifer.[114]

The site characterization data in the MEA application are not only extensive, but reliable. CBR collected and analyzed subsurface data using standard methods and industry practices, such as geophysical logs, observation of drill cuttings, and an aquifer pumping test conducted according to a state-approved plan.[115] CBR performed grain size analysis and hydraulic conductivity testing on core samples using standard methods (ASTM D4464 and D5084, respectively), performed mineralogical analyses using X-ray diffraction, and estimated hydraulic conductivity from grain-size analysis results using the well-established and widely used Kozeny-Carman equation.[116] CBR obtained additional data using standard procedures for

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[110] Ex. NRC001 at A.19.

[111] *Id*.

[112] Ex. CBR008 at 48 (Figure 2.6-2).

[113] Ex. CBR008 at 72-79 (Figure 2.6-6 to 2.6-13).

[114] Ex. NRC001 at A.19.

[115] *Id*. The aquifer pumping test plan approved by the Nebraska Department of Environmental Quality (NDEQ), was consistent with industry practice, and CBR used accepted methods to analyze the aquifer pumping test data. Ex. NRC001 at A.19; Ex. CBR006 at 2-82.

[116] Ex. NRC001 at A.19.

measurement of static water levels in wells to construct potentiometric contour surfaces which show groundwater hydraulic gradients and flow directions; for chemical analyses to assess surface water and groundwater quality; and for evaluation of watershed and drainage characteristics in flooding and erosion studies.[117] The techniques employed by CBR are appropriate and widely used in developing hydrologic conceptual models, and the site characterization data obtained are consistent with the types of information discussed in Section 2.7 of NUREG-1569.[118]

3. The conceptual model demonstrates that ISR production fluids will be adequately confined.

As described in Section 3.3.2.5 of the EA, and discussed further in the Staff's testimony, there are six lines of evidence, based on measurable and reproducible data, that support the conclusion that ISR production fluids will be adequately confined at the MEA.[119] First, the overlying (Upper and Middle Chadron Formations) and underlying (Pierre Shale) confining units are thick, continuous layers with extremely low hydraulic conductivities comparable to those used in clay landfill liners.[120] The Upper and Middle Chadron Formations are 360 to 450 feet thick and are composed of silty clays with hydraulic conductivities of 10^{-5} to 10^{-7} cm/sec,[121] while

[117] *Id*. As the Staff testifies, CBR provided water quality data for the Niobrara River, based on its own testing and testing by NDEQ, along with groundwater quality data based on tests of monitoring wells and neighboring private water supply wells within 2 km of the MEA. *Id*.

[118] *Id*.; Ex. NRC010 at 2-20 to 2-26.

[119] As the Staff explains in its testimony, confinement is generally understood to mean the ability to contain migration in a vertical direction. Ex. NRC001 at A.20.

[120] Ex. NRC001 at A.21.

[121] *Id*.

the Pierre Shale is over 750 feet thick and continuous over the entire MEA, with hydraulic conductivity on the order of 10^{-10} cm/sec.[122]

Second, the results of the aquifer pumping test showed no discernable drawdown in the overlying aquifer wells, indicating that there is adequate confinement between the Basal Chadron Sandstone aquifer and the overlying Brule aquifer.[123]

Third, the potentiometric surface of the Basal Chadron Sandstone aquifer (roughly 3700 feet above sea level) rises hundreds of feet above its top (roughly 3210 to 3290 feet above sea level).[124] This situation can only occur in a confined aquifer with effective overlying confining units.[125]

Fourth, the potentiometric surface of the overlying Brule aquifer (4050 to 4230 feet above sea level) is several hundred feet higher than the potentiometric surface of the Basal Chadron Sandstone aquifer (roughly 3700 feet above sea level).[126] This creates a strong downward gradient that would direct groundwater movement downward from the Brule aquifer to the Basal Chadron Sandstone aquifer.[127]

Fifth, the Brule and Basal Chadron Sandstone aquifers show distinct differences in geochemistry, which indicates hydraulic isolation between the aquifers.[128] And sixth, a review of isotopic age data from the existing Crow Butte facility indicates that the Brule and Basal

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[122] Ex. NRC001 at A.21.

[123] *Id*.

[124] *Id*.

[125] *Id*.

[126] *Id*.

[127] *Id*.

[128] *Id*.

Chadron Sandstone aquifers show distinct groundwater age differences. These ages would be more similar if the aquifers were not hydraulically isolated.[129]

4. The Staff thoroughly considered reported faults as preferential pathways.

In Section 3.2.2.2 of the EA, the Staff documented its detailed consideration of the existence of two reported faults (the Niobrara River fault and the Pine Ridge fault) and whether they would impact surface water and groundwater quality.[130] After reviewing the relevant literature and CBR's site-specific and regional cross-sections,[131] the Staff concluded there is no evidence of vertical offsets indicative of faults within the MEA.[132] Moreover, as explained in the EA, even if these faults existed, the hydrogeological characteristics at the site (direction of groundwater flow, downward gradient) and the operational requirement to maintain an inward hydraulic gradient would prevent significant adverse impacts on surface water or groundwater.[133]

In its testimony, the Staff also demonstrates why assertions in the LaGarry Opinion related to faults lack merit, in particular Dr. LaGarry's assertions about "known faults" identified by Diffendal and Swinehart et al. The purported faults identified by Diffendal were based on analysis of lineaments using large-scale maps, and faults identified by Swinehart et al. were based on interpretation of regional cross-sections covering the entire Nebraska panhandle (hundreds of square miles).[134] Also, as the Staff explains, subsurface structural features identified from lineaments must be field-verified, and Dr. LaGarry's figure showing a fault near

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[129] Ex. NRC001 at A.21.

[130] Ex. NRC001 at A.23.

[131] *Id*.

[132] *Id*.

[133] *Id*.

[134] Ex. NRC001 at A.25; Ex. NRC012 at PDF 1; Ex. NRC013 at PDF 1.

the Niobrara River is based on a cross-section from Swinehart's work that is located 25 miles west of the MEA. [135]

Finally, while faults and joints exist in northwestern Nebraska, the Staff found no evidence of structural features at the MEA site that are capable of acting as pathways for ISR production fluids to migrate upward from the Basal Chadron Sandstone aquifer to the overlying Brule aquifer.[136] The multiple lines of evidence demonstrating confinement at the MEA, discussed in detail in Section V.C.3 above, refute Dr. LaGarry's implication that unknown faults are affecting vertical confinement.[137]

5. The Staff thoroughly considered other contamination pathways.

As noted in Section V.A supra, the LaGarry Opinion contains several general assertions about potential contamination pathways. Dr. LaGarry generally asserts that spills and leaks, vertical excursions, and horizontal excursions (lateral migration within the production zone) could lead to impacts to surface water and groundwater near the MEA.[138] The Staff analyzed each of these potential pathways in its environmental review.[139]

First, the Staff's conclusion that spills and leaks are unlikely to cause significant impacts to surface water or the surficial aquifer is based on several considerations, including the surface water characteristics at the MEA site; design features to prevent and contain spills; instrumentation, monitoring, and wellfield inspections; preoperational testing of piping systems

[135] Ex. NRC001 at A.25. The Staff explains that Figure 1 in the LaGarry Opinion is based on the cross-section in Swinehart's paper that is located 25 miles west of the MEA. Id.

[136] Ex. NRC001 at A.26.

[137] Ex. NRC001 at A.26, A.21.

[138] LaGarry Opinion at 4-5.

[139] Ex. NRC001 at A.27 to A.29.

and mechanical integrity testing of wells; procedures for addressing spills and leaks; and operating experience demonstrating the ability to mitigate spills satisfactorily.[140]

Next, the multiple bases for confinement, particularly the strong downward gradient and the thick, continuous upper confining layer with low hydraulic conductivity, make a vertical excursion from the Basal Chadron Sandstone to the overlying Brule and Arikaree aquifers extremely unlikely.[141] In addition, CBR will be required to install excursion monitoring wells in the Arikaree aquifer, and if an excursion is detected, CBR would be required to implement more frequent sampling and corrective actions.[142]

Finally, horizontal excursions, and potential impacts from them, are unlikely for several reasons. These reasons include a license condition requiring CBR to operate under an inward hydraulic gradient, which will contain movement of ISR production fluids, as well as another license condition requiring CBR to install monitoring wells, conduct regular sampling and testing for excursions, and take corrective actions if an excursion is detected.[143] In addition, the Staff notes that CBR has been able to control and correct excursions that have occurred at the existing Crow Butte license area without impacts on surrounding surface water or groundwater.[144]

D. The discussions in the EA related to isolation of aquifers are substantiated by extensive supporting information and data.

Contrary to the OST's assertion that the EA and the MEA application contain "unsubstantiated assumptions as to the isolation of the aquifers in the ore-bearing zones,"[145] the

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[140] Ex. NRC001 at A.27.

[141] Ex. NRC001 at A.28.

[142] *Id*.

[143] Ex. NRC001 at A.29.

[144] *Id*.

[145] OST Petition at 18.

statements in the EA and the MEA application related to isolation of aquifers are substantiated by extensive and reliable supporting information and data. For example, the descriptions of stratigraphy and hydrostratigraphy in the EA are based on cross-sections, isopach maps, and structure contour maps created from site-specific subsurface data.[146] Similarly, statements in the EA related to the properties of confining layers are based on the same site-specific cross sections and maps, as well as the results of core sample analyses using established methods.[147] Statements in the EA related to hydraulic properties of the Basal Chadron Sandstone aquifer and overlying aquifers are based on potentiometric surface contour maps (based on measurements of static water levels in wells) and results of an aquifer pumping test.[148]

The EA's description of the evidence for confinement of the Basal Chadron Sandstone aquifer is supported by all of the data described above, as well as water quality analyses and groundwater age estimates.[149] The EA's evaluation of faults as a potential pathway, which found no evidence of vertical offsets indicative of faulting at the MEA, is based on the Staff's independent evaluation of relevant literature, site-specific cross-sections, and regional cross-sections.[150] And finally, the discussion of vertical excursions in the EA is supported by cross-sections and core analysis results, as well as operational requirements imposed by license condition.[151]

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[146] Ex. NRC001 at A.30.

[147] *Id*.

[148] *Id*.

[149] *Id*.

[150] *Id*.

[151] *Id*.

VI. Conclusion

For the foregoing reasons, the MEA application and the Staff's environmental review complied with NRC regulations and applicable law, and the Board should therefore resolve Contention 2 in favor of the Staff and CBR.

Respectfully submitted,

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/Executed in Accord with 10 C.F.R. 2.304(d)/
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Dated at Rockville, Maryland
this 17th day of August, 2018.