January 4, 2019

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket No. 40-8943-MLA2
CROW BUTTE RESOURCES, INC.	)	
	)	ASLBP No. 13-926-01-MLA-BD01
(Marsland Expansion Area)	)	
	)	

NRC STAFF'S REPLY FINDINGS OF FACT AND CONCLUSIONS OF LAW

I. INTRODUCTION

In accordance with 10 C.F.R. § 2.1209 and the Atomic Safety and Licensing Board's (Board's) scheduling order in this proceeding,[1] the NRC Staff ("Staff") hereby submits its reply findings of fact and conclusions of law ("Reply Findings" or "RFF") regarding Contention 2.[2] In these Reply Findings, the Staff sets forth its reply to the proposed findings of fact and conclusions of law submitted by the Oglala Sioux Tribe (OST) concerning the adequacy of Crow Butte Resources, Inc's (CBR's) application to amend NRC license SUA-1534 to authorize the construction and operation of the Marsland Expansion Area (MEA) in Dawes County, Nebraska, and the Staff's environmental review of the MEA application.[3] For the reasons set forth in the

[1] Memorandum and Order (License Amendment Effectiveness Stay Application, In Limine Motions, and Site Visit/Limited Appearance Session/Evidentiary Hearing Scheduling), Appendix A at 3 (May 21, 2018) (unpublished).

[2] The Staff filed its Proposed Findings on December 3, 2018. *See* NRC Staff's Proposed Findings of Fact and Conclusions of Law (Dec. 3, 2018) ("Staff Proposed Findings" or "Staff PFF"). In these Reply Findings, the Staff continues the paragraph numbering sequence from Sections V, VI, and VII of the Staff's PFF in Sections II, III and IV below.

[3] *See* Oglala Sioux Tribe's Proposed Findings of Fact and Conclusions of Law (Dec. 3, 2018) ("OST Proposed Findings" or "OST PFF"). Because the Staff PFF addresses in detail why the record supports a decision in favor of the Staff and CBR on Contention 2, the Staff does not respond to every statement in the OST Proposed Findings. For those statements that are not addressed herein, the Staff maintains its

Staff's Proposed Findings and in the Reply Findings below, the Board should decide Contention 2 in favor of CBR and the Staff and affirm that CBR and the Staff have met their burdens of demonstrating that the MEA application and final Environmental Assessment (EA) comply with applicable law.[4]

II. RULINGS ON LEGAL ISSUES

5.8. On pages 11-18 of its Proposed Findings, the OST quotes from several federal cases in support of its assertions that the Staff's EA is deficient. Upon detailed examination, however, this case law does not support the OST's position. For example, the OST asserts that "NEPA prohibits reliance upon conclusions or assumptions that are not supported by scientific or objective data," citing *Citizens Against Toxic Sprays, Inc. v. Bergeland.*[5] The OST likewise quotes *Seattle Audubon Society v. Moseley* for the proposition that "[a] conclusory statement unsupported by empirical or experimental data, scientific authorities, or explanatory information of any kind not only fails to crystallize the issues, but affords no basis for a comparison of the problems involved with the proposed project and the difficulties involved in the alternatives."[6] *Bergeland*, *Moseley*, and the cases they rely upon, however, concern the adequacy of an environmental impact statement (EIS), not an EA, the type of environmental review document under review in this proceeding.[7]

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objections to the OST's positions as set forth in the Staff's previous legal and evidentiary filings in this matter, as well as its oral testimony at the hearing.

[4] The Staff does not address CBR's proposed findings of fact and conclusions of law herein, having identified no substantial disagreement with those findings. *See* Crow Butte Resources' Proposed Findings of Fact and Conclusions of Law (Dec. 3, 2018).

[5] OST PFF at 12 (citing *Bergeland*, 428 F. Supp. 908 (1977)).

[6] OST PFF at 14-15 (quoting *Moseley*, 798 F. Supp. 1473, 1479 (W.D. Wash. 1992) (internal citations omitted)).

[7] *See Bergeland*, 428 F. Supp. at 922-23 (citing *Trout Unlimited v. Morton*, 509 F.2d 1276, 1283, 1284 (9th Cir. 1974); *Natural Resources Defense Council, Inc. v. Grant*, 355 F. Supp. 280, 287 (E.D.N.C. 1973)); *Moseley*, 798 F. Supp. at 1479 (quoting *Silva v. Lynn*, 482 F.2d 1282, 1285 (1st Cir. 1973)).

5.9. In addition, *Bergeland* acknowledges that even where an agency must prepare a more detailed environmental review document in the form of an EIS, "[t]he adequacy of any particular EIS necessarily depends . . . upon the facts and circumstances surrounding the proposed federal action to which it is directed."[8] *Bergeland* did not hold that every conclusion in an EA or an EIS must rest upon a full elucidation of scientific or objective data.

5.10. Unlike an EIS, which is subject to a number of specified regulatory requirements,[9] there is no "universal formula for what an EA must contain and consider."[10] In its Proposed Findings, the OST cites to several specific regulatory requirements that govern the preparation of an EIS, including 40 C.F.R. §§ 1502.14(f), 1502.16(h), 1502.22, and 1502.24.[11] However, those regulatory requirements do not apply to an EA, which is governed by the provisions in 40 C.F.R. § 1508.9.[12] According to 10 C.F.R. § 51.30(a), an EA must "identify the proposed action" and include a "brief discussion" of the need for the proposed action, alternatives, the environmental impacts of the proposed action and alternatives, as appropriate, and a list of agencies and persons consulted and identification of sources used.

5.11. For the reasons stated above, *Bergeland*, *Moseley*, and the other EIS-based cases cited by the OST do not directly govern the specific type, level, and amount of information that an EA must contain. Therefore, while the principles expounded in these cases may inform our review of the Staff's final EA for the MEA, we look to the standards established by the NRC, the Council on Environmental Quality (CEQ), and relevant EA-based case law to govern our

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[8] *Id.* at 922 (citing *Sierra Club v. Froehlke*, 534 F.2d 1289, 1299 (8th Cir. 1976); *Trout Unlimited*, 509 F.2d at 1282-83).

[9] *See, e.g.*, 10 C.F.R. §§ 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).

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

[11] OST PFF at 12-13, 15-16.

[12] The NRC's NEPA regulation governing EAs (10 C.F.R. § 51.30) mirrors this requirement.

decision. And, in any event, as explained in detail in our initial findings and the findings below, the bases for the technical analysis and conclusions in the Staff's EA are well-supported in the record.

III. FINDINGS OF FACT[13]

A. Concern 1

1. Groundwater flow

6.171. On pages 30 and 32 of its PFF, the OST asserts that recharge in the Basal Chadron Sandstone (BCS) aquifer "occurs in select locations" and that CBR's conceptual model ignores the recharge.[14] We considered the adequacy of the description of recharge and discharge areas for the BCS aquifer in ¶¶ 6.16 and 6.17 *supra* and concluded that the description was sufficient. In addition to that discussion, we note that CBR's former geologist performed a field check of geologic maps of the area and determined that recharge areas for the BCS aquifer occur at significant distances to the southeast and to the west.[15] The OST has not provided any evidence of other, unidentified recharge areas for the BCS aquifer in the vicinity of the MEA.

6.172. On page 33 of its PFF, the OST claims that "[CBR's] conceptual model does not take into account discharge of the [BCS] aquifer." The OST cites Mr. Wireman's statement questioning whether two wells flowing at 40 gallons per minute (gpm) represent all the

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[13] Both the Staff and the OST organized their findings around the four concerns identified by the Board in Contention 2. However, in many cases the OST's findings were placed under a different heading (i.e., concern) than the Staff's. Accordingly, for consistency with the Staff PFF, these Reply Findings follow a topical order and grouping similar to those used in the Staff PFF.

[14] The OST states in its PFF that CBR ignores recharge indicated by the aquifer test, but the testimony OST cites in support of this statement makes no mention of the aquifer test. Rather, OST refers to Mr. Wireman's statement that "there has to be some recharge within this valley or syncline that contains this part of the Chamberlain Pass." Tr. at 612.

[15] Tr. at 609-10 (Lewis).

discharge.[16] However, in response to Mr. Wireman, CBR's hydrogeologist, Mr. Lewis, specifically stated that the discharge from the BCS aquifer occurs not only in the two flowing wells but also in operating wells at the existing CBR facility.[17] On page 29 of its PFF, the OST further asserts that the BCS flows primarily to the White River. Although Mr. Wireman stated that he "suspects" that the BCS discharges into the White River,[18] Mr. Lewis of CBR testified that the potentiometric surface of the BCS aquifer is "below the White River substantially," that there is no discharge from the BCS aquifer to the White River, and that the BCS does not subcrop in the White River.[19] For these reasons, as well as the reasons in ¶¶ 6.16 to 6.17 *supra*, we find that the descriptions of discharge areas in the MEA technical report (TR) and EA are sufficient.

6.173. In response to the Staff's and CBR's testimony that the BCS aquifer is continuous beneath the Pine Ridge escarpment and was not affected by uplift or other past geological activity,[20] the OST asserts on pages 44-45 of its PFF that the Staff and CBR "reach conclusions that are contrary to 70 years of research and study literature." This assertion is based on testimony by Dr. LaGarry[21] that we addressed specifically in ¶¶ 6.18 to 6.20 *supra*. We found that the record evidence, particularly CBR's regional cross-sections and the undisputed direction of groundwater flow, supported the Staff's and CBR's conclusion that the BCS is continuous beneath the Pine Ridge escarpment.[22]

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[16] *Id*. (citing Tr. at 617 (Wireman)).

[17] Tr. at 620-21 (Lewis). Mr. Lewis estimated the total discharge to be 280-300 gallons per minute. *Id*.

[18] Tr. at 732 (Wireman). Mr. Wireman provided no supporting evidence for his suspicion.

[19] Tr. at 608-09 (Lewis).

[20] *See* Tr. at 617-620 (Shriver); Tr. at 624-626 (Striz).

[21] Tr. at 626 (LaGarry).

[22] Staff PFF at ¶¶ 6.18 to 6.20. The fact that operations at the existing CBR facility have resulted in 20 feet of drawdown in the BCS aquifer at the MEA also supports this conclusion. Tr. at 395-96 (Lewis).

6.174. On page 32 of its PFF, the OST asserts that CBR's conceptual model does not evaluate whether "piston flow" impacts the MEA site. This assertion is based on Mr. Wireman's opinion that piston flow is occurring.[23] The OST further asserts that an evaluation of average residence time in aquifers is necessary, again citing Mr. Wireman's testimony about piston flow.[24] In the EA, the Staff provided an estimate of travel time from the MEA to the location of the reported Pine Ridge fault, stating that it would take about 500 years for water to travel the five-mile distance.[25] The OST did not dispute that estimate, and the OST fails to explain how an evaluation of piston flow based on average residence time would materially change the analysis and conclusions in the MEA application and the EA. For these reasons, we find there is no need to evaluate piston flow at the MEA.

2. Surface water hydrology

6.175. On page 34 of its PFF, the OST asserts that "[CBR] failed to sample ephemeral streams and has no plan in place to collect such samples." We addressed these specific issues in ¶¶ 6.24 to 6.29 *supra*, and concluded that, although such sampling is not required, CBR has attempted to obtain samples from ephemeral drainages and has committed to do so, if possible, prior to operations at the MEA. The OST has not pointed to any additional evidence in the record to change this conclusion.

3. Geology – Deep Disposal Well (DDW) Formations

6.176. On page 46 of its PFF, the OST asserts that the Staff and CBR "assume without support there is no USDW [Underground Source of Drinking Water] under the Sundance Formation." We addressed the DDW geologic formations in ¶¶ 6.30 to 6.33 *supra* and found that in its TR and environmental report (ER), as well as in its testimony, CBR stated that there is

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[23] Tr. at 611 (Wireman).

[24] OST PFF at 32 (citing Tr. at 611 (Wireman)).

[25] Ex. NRC006 at 3-14; Ex. NRC001 at 32-33.

no USDW beneath the BCS aquifer at the MEA.[26] The Staff also testified that CBR is operating two DDWs in the same formations at the main facility just 11 miles away.[27] We find no basis to doubt these sworn statements, and the OST has not cited any record evidence to contradict them.

4. Groundwater Restoration

a. Baseline Data Collection

6.177. On pages 34-35 of its PFF, the OST reiterates statements made by Mr. Wireman at the hearing concerning the collection of baseline data. The OST claims that CBR will not be collecting sufficient baseline data to evaluate restoration performance because ISR operations will change the water quality and will not reflect baseline conditions.[28] We addressed the collection of baseline water quality data for groundwater restoration in ¶¶ 6.43 to 6.46 *supra*, and concluded that the planned post-licensing establishment of groundwater protection standards for the MEA, as described in License Condition 11.1.3, is consistent with industry practice and NRC methodology and does not violate NEPA.[29]

6.178. On page 45 of its PFF, the OST further asserts, based on statements made by Mr. Wireman at the hearing,[30] that the Staff and CBR "incorrectly assume without support that activities within adjacent mine units will not impact baseline in mine units coming into operation." But Dr. Striz testified that, because of the requirements to maintain an inward hydraulic gradient in each mine unit and to monitor for excursions, the scenario Mr. Wireman suggested is

[26] Staff PFF at ¶ 6.33.

[27] Tr. at 711 (Striz). In addition, because the Nebraska Department of Environmental Quality (NDEQ) has licensing authority over the DDWs, if the state determines that there is a lower USDW at the MEA, they would not grant the permit and CBR would not be able to operate. *Id*.

[28] OST PFF at 34-35 (citing Tr. at 660-667 (Wireman)).

[29] Staff PFF at ¶ 6.46 (citing *Strata Energy, Inc*. (Ross In Situ Recovery Project), LBP-15-3, 81 NRC 65, 90-92 (2015), *aff'd*, CLI-16-13, 83 NRC 566 (2016)).

[30] Tr. at 662 (Wireman).

"implausible."[31] Dr. Striz also emphasized that under an inward gradient, all of the water flow is into the mine unit, and chemical transport phenomena such as diffusion will not overcome a very strong inward hydraulic gradient.[32] And finally, Mr. Nelson of CBR stated that he was unaware of a situation at the existing CBR facility where baseline values for a mine unit have been affected by previous operations in other mine units.[33]

6.179. In addition, we noted in ¶ 6.45 *supra* that the NRC Staff can adjust the approved background standard for groundwater restoration if necessary.[34] As an example of that capability, Dr. Striz described a pilot study that was initially operated on one well pattern prior to moving into commercial operation.[35] Because that single well pattern had an elevated uranium value compared with other measurements within the larger proposed commercial mine unit, the Staff considered the elevated value to be an outlier and did not include it when determining the baseline water quality for restoration standards.[36]

6.180. For the reasons discussed above, we find that there is ample support for the conclusion that water quality samples collected to establish groundwater restoration standards

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[31] Tr. at 666 (Striz).

[32] Tr. at 667 (Striz). CBR agreed with the Staff's position. Tr. at 667 (Pavlick).

[33] Tr. at 657 (Nelson).

[34] Staff PFF at ¶ 6.45 n. 212 (citing Tr. at 660, 666 (Striz)).

[35] Tr. at 660, 683-84 (Striz). On pages 37-38 of its PFF, the OST asserts that "small samples found at ISL mining sites are not always able to be extrapolated to larger areas" and, thus, that "the small one pump test cannot be extrapolated with scientific confidence." On page 45, the OST similarly claims that the Staff "incorrectly assumes that the Crow Butte MEA site will perform on the large scale as is indicated by the one pump test." In both cases, the OST cites Dr. Striz's testimony regarding the pilot study. The OST's claims reflect a fundamental misunderstanding of Dr. Striz's testimony, which simply provided an example of a situation where the Staff would consider adjusting the approved background restoration standard based on statistical analysis of the water quality data collected. That testimony had nothing whatsoever to do with the aquifer pumping test. We addressed the OST's criticisms of the use of a single aquifer test at the MEA in ¶¶ 6.88 to 6.90 *supra* and explained why we found those concerns unpersuasive.

[36] Tr. at 684 (Striz).

will sufficiently represent baseline conditions and will not be affected by operations in adjacent mine units.

b. "Post-Closure" Conditions

6.181. The OST asserts in its PFF that "[r]estoration efforts will not be 100% effective," and that "the description of the affected environment must consider post-closure conditions such as when the inward gradient is no longer being maintained."[37] The OST cites Mr. Wireman's concern that if restoration is not 100 percent effective, concentrations of contaminants will increase as water flows downgradient from the MEA towards discharge points.[38]

6.182. For each specified constituent, CBR is required to restore groundwater to either the approved background concentration or a maximum concentration limit (MCL).[39] Mr. Wireman testified that he was satisfied knowing that CBR must meet these limits.[40] If CBR cannot meet these standards after making best practicable efforts, CBR may submit a license amendment request proposing an alternate concentration limit (ACL).[41] Such a request must address all of the factors in Criterion 5B(6),[42] which include the potential for contaminant migration, hydrogeological characteristics of the facility and surrounding land, quantity and direction of groundwater flow, proximity of groundwater users, potential health risks, and

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[37] OST PFF at 31, 22; *see also id*. at 35.

[38] *Id*. at 25, 31 (citing Tr. at 606 (Wireman)).

[39] 10 C.F.R. Part 40, Appendix A, Criterion 5B(5); *see also* Ex. NRC006 at 2-9, Ex. NRC009 at PDF 11, Ex. NRC014 at 11-12. Under License Condition 10.1.5, CBR is also required to conduct stability monitoring until data from four consecutive quarters shows no statistically significant trends. Ex. NRC008 at 150; Ex. NRC009 at PDF 11.

[40] Tr. at 693 (Wireman).

[41] The OST also asserts that CBR's conceptual model "should contemplate that alternate concentration levels [sic] (ACLs) will be required." OST PFF at 38. CBR testified that it is required to begin restoration with the goal of achieving background. Tr. at 694. The Staff confirmed that a licensee can propose an ACL only after making best efforts to meet background or the MCL (if applicable). For these reasons, we find that it would be inconsistent with the regulatory framework to assume at this point that an ACL will be required.

[42] Ex. NRC014 at 12; Tr. at 697 (Striz).

potential damage to wildlife, crops and vegetation.[43] If CBR seeks NRC approval of an ACL, that request will be the subject of a separate licensing action, with a separate Staff review and opportunity to request a hearing.[44]

6.183. Because the TR and the EA identify the standards in Criterion 5B(5) as the applicable requirements for groundwater restoration, and because the regulatory framework described above defines all of the potential post-restoration scenarios for the MEA, we find that no further description is needed.

6.184. The OST also asserts on pages 39-40 of its PFF that "[t]here are substantial differences between evaluation of data for commercial production purposes compared to environmental safety and contaminant transport purposes." The OST cites several of Dr. Kreamer's statements from the hearing in which he attempted to distinguish between operations (or production) and "contaminant hydrology."[45] In several of those statements, Dr. Kreamer focuses on "closure" (e.g., the ability to achieve "closure levels" for contaminant concentrations).[46] However, while the regulations require CBR to meet the standards in Criterion 5B(5) for groundwater restoration, they do not prescribe how CBR is to do so. In the context of achieving restoration, therefore, we find these statements to be immaterial.

B. Concern 2

6.185. As stated in ¶¶ 6.54 and 6.55 *supra*, Concern 2 alleges that a description of certain aquifer parameters is absent from the TR. None of the OST's proposed findings

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[43] 10 C.F.R. Part 40, Appendix A, Criteria 5B(5) and 5B(6).

[44] Tr. at 697 (Striz).

[45] OST PFF at 39-40 (citing Tr. at 866-67, 909-910, 924-25, 997-98, and 459-60 (Kreamer)). Most of these statements were made in the context of the aquifer pumping test. To the extent that the OST is asserting that more rigorous or sophisticated analysis or models, or stricter adherence to assumptions, were necessary for the aquifer pumping test, we considered those arguments in ¶¶ 6.81 to 6.102 and 6.109 to 6.118 *supra*.

[46] Tr. at 909-10 (Kreamer); Tr. at 459-60 (Kreamer).

addresses the absence of those parameters. Accordingly, we rely on our findings in ¶¶ 6.54 to 6.60 *supra*, which conclude that CBR provided descriptions of effective porosity, hydraulic conductivity, hydraulic gradient, storativity, and transmissivity in the TR, and that the OST did not provide any analysis or evidence demonstrating that these parameters are not sufficiently representative of the site to allow for safe operation.

C. Concern 3

1. Site Characterization

a. Geology

6.186. On page 30 of its PFF, the OST asserts that "there is demonstrated uncertainty about the composition of the [BCS] aquifer" and states its belief that the BCS is a "coarse grained sandstone interbedded with thin silt and clay beds."[47] The OST also cites Mr. Wireman's testimony that the BCS outcrop at Orella Bridge is "solid sandstone."[48] In the EA, the Staff described the BCS as "relatively uncemented sand," citing the work of Gjelsteen and Collings.[49] At the hearing, CBR's geologist, Mr. Shriver, testified that the BCS is "semi-consolidated in places, sand in most places" and that it "comes apart just like a sand you would see in a fluvial environment."[50] Mr. Shriver also testified that he has observed drill cuttings of material from the BCS and has encountered difficulty recovering intact core samples from the BCS.[51]

6.187. Based on the above evidence, and particularly CBR's site-specific observations of the material, we find that the BCS at the MEA consists of "relatively uncemented" sand, as

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[47] Ex. BRD001 at 7.

[48] Tr. at 600 (Wireman).

[49] Ex. NRC006 at 3-10.

[50] Tr. at 414 (Shriver).

[51] *Id*.

described in the EA. But in any event, the OST has not demonstrated how the composition of the BCS is material to the analysis or conclusions in the TR or the EA. The aquifer pumping test demonstrated that there is connectivity within the BCS aquifer at the MEA.[52] The OST has not demonstrated why it makes any difference whether groundwater within the BCS flows through connected pores in sandstone or in uncemented sands. And finally, as discussed in ¶¶ 6.155 to 6.158 *supra*, we found that the potential for lateral migration (horizontal excursions) within the BCS aquifer at the MEA is highly unlikely based on license conditions requiring an inward hydraulic gradient during operations and restoration, excursion monitoring, and corrective actions if excursion indicators exceed specified limits.[53] The OST has not pointed to any information in the record that would alter that finding.

6.188. On pages 38 and 46 of its PFF, the OST asserts that CBR's conceptual model was inadequate due to lack of sufficient field work, and that "Staff and [CBR] conclusions made without field work or fracture analysis are presumptive and without support." In ¶¶ 6.72 to 6.74, we addressed the sufficiency of CBR's subsurface investigation based on borehole geophysical logs and drill cuttings and concluded that the stratigraphic information is based on reliable data. In ¶¶ 6.32 to 6.40 and 6.145 to 6.149 *supra*, we considered the evidence of faults at the MEA, and in ¶¶ 6.150 to 6.154 *supra* we addressed Dr. LaGarry's criticism of the use of borehole techniques and his recommendation that surface methods should be used. We concluded that the Staff and CBR adequately described and evaluated the two reported faults at the MEA, that there is no evidence of specific, field-verified faults that can serve as preferential pathways, and that it is highly unlikely that a preferential pathway consisting of a single fault or a connected

[52] Ex. NRC014 at 14; *see also* Ex. NRC008 at 53 (observed drawdown in all BCS aquifer observation wells supports conclusion of hydraulic continuity).

[53] *See also* Ex. NRC014 at 6; Ex. NRC006 at 2-8, 4-21 to 4-22; Ex. NRC008 at 71; Ex. NRC009 at PDF 11, 17.

pathway of faults and fractures exists in the upper confining layers at the MEA.[54] We also found that the use of borehole logs was sufficient to identify faults at the MEA.[55] The OST has not pointed to any evidence in the record that would cause us to reconsider those findings.

b. Aquifer Pumping Test Assumptions

6.189. On pages 24-25, 27-28, and 40 of its PFF, the OST generally asserts that heterogeneities can have "large consequences" in terms of contaminant transport and "could lead to catastrophic contamination." These assertions, which repeat statements made by OST witnesses at the hearing, are not supported by citations to supporting record evidence indicating that such consequences would occur at the MEA. As such, the OST has not demonstrated how these general statements are material to our specific findings regarding CBR's ability to contain ISR fluid migration at the MEA.

6.190. In the context of the aquifer pumping test, we addressed the assumption of homogeneity (lack of heterogeneity) in ¶¶ 6.95 to 6.97 *supra*. We found that the assumptions inherent in CBR's analysis methods, including the assumption of homogeneity, were reasonably satisfied, and that Dr. Kreamer did not demonstrate that more rigorous or extensive methods were necessary or would have resulted in materially different conclusions.[56]

6.191. On pages 28-29 and 44 of its PFF, the OST asserts that CBR did not perform an analysis "to demonstrate that anisotropy doesn't exist." The OST cites differing values of hydraulic conductivity and transmissivity as evidence of anisotropy.[57] We addressed the assumption of isotropy in ¶¶ 6.95 to 6.97 *supra* and found that the assumption was reasonably

[54] Staff PFF at ¶¶ 6.40, 6.154.

[55] *Id*. at ¶ 6.154.

[56] Staff PFF at ¶ 6.102.

[57] OST PFF at 29.

satisfied at the MEA.[58] In addition, CBR did not claim that there is no anisotropy at the MEA. Rather, as the Staff and CBR testified, and as Dr. Kreamer agreed, at some scale all systems are heterogeneous and anisotropic.[59] CBR showed and testified that drawdown was circular, indicating no significant anisotropy.[60] The OST did not provide any evidence or cite any evidence in the record showing that significant anisotropy exists within the BCS aquifer at the MEA or that any anisotropy which might exist would materially affect the MEA aquifer pumping test analysis or conclusions presented in the MEA application and the EA. Thus, we find there was no need for CBR to perform an analysis to demonstrate lack of anisotropy.

c. Aquifer Pumping Test Analysis

6.192. On page 37 of its PFF, the OST asserts that CBR's hydrogeological analyses are "too simplistic for evaluating contaminant pathways." The OST cites Mr. Wireman's statement that the Theis method is a starting point to see if more sophisticated analysis is needed.[61] In context, Mr. Wireman was responding to a question about whether he agreed that the Theis method is well established and often used as a starting point for evaluating pumping tests.[62] Mr. Wireman agreed that the Theis equation and analysis "is used very commonly" and added the statement that the Theis method is a starting point.[63] Mr. Wireman's statement does not indicate that CBR's use of the Theis method was inappropriate.

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[58] Staff PFF at ¶ 6.102.

[59] Ex. NRC014 at 25; Tr. at 491-93 (Kreamer).

[60] Ex. CBR016 at 48 (Figure 16); Ex. CBR033 at 12. Mr. Lewis of CBR testified that the contours in Figure 16 were generated by software and thus there was no inherent bias in how they were drawn. Tr. at 538-39 (Lewis). Dr. Kreamer indicated that the plot, as drawn, "looks fairly isotropic." Tr. at 540.

[61] Tr. at 682 (Wireman).

[62] Tr. at 681-82 (Wardwell).

[63] Tr. at 682 (Wireman).

6.193. Dr. Kreamer asserted in his testimony that the Theis method was inappropriate because its underlying assumptions were not met.[64] We addressed those assertions in ¶¶ 6.94 to 6.100 *supra*, finding that the assumptions in the method were reasonably satisfied and the OST did not demonstrate that more rigorous methods would have resulted in materially different conclusions.[65]

6.194. On page 27 of its PFF, the OST asserts that "the purpose of the pumping test is commercial uranium production, not identifying contaminant pathways." However, the record demonstrates that one purpose of the MEA aquifer test was assessing the degree of vertical confinement at the site.[66] This purpose is clearly documented in the TR and the EA, as well as the written and oral testimony of CBR and Staff witnesses.[67]

6.195. On page 28 of its PFF, the OST asserts that CBR failed to perform a leaky aquifer analysis as part of the aquifer pumping test. We considered and rejected that claim in ¶¶ 6.116 to 6.118 *supra*, concluding that such an analysis was unnecessary and would not have yielded additional useful information.[68] Furthermore, on pages 28 and 44 of its PFF, the OST

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[64] *See, e.g.*, Ex. OST003 at 6, Ex. OST014 at 2, Tr. at 400-402.

[65] Staff PFF at ¶ 6.102.

[66] Although an aquifer pumping test does not identify contaminant pathways, the information obtained in the test is an indicator of the adequacy of vertical confinement, and the parameters obtained from the test results are used to select bleed rates needed to maintain an inward hydraulic gradient. Ex. NRC001 at 20. The inward gradient prevents the migration of ISR production fluids outside of a mine unit. *See* Tr. at 667 (Striz).

[67] Ex. CBR006 at 2-82; Ex. NRC006 at 3-33; Ex. NRC008 at 53; Ex. NRC014 at 13. The OST cites testimony by CBR's hydrogeologist, Mr. Lewis, stating that the primary purpose of the aquifer pumping test was to characterize the hydraulic properties and characteristics of the first four mine units to be developed at the MEA. Tr. at 357 (Lewis). However, Mr. Lewis later stated that "more detailed purposes would include identifying any boundaries to the system, leakage characteristics, degree of confinement, and the radius of influence. Tr. at 357-58 (Lewis).

[68] *Id*. at ¶ 6.118.

asserts that CBR failed to perform a sensitivity analysis "to test [its] conceptual model."[69] However, the sensitivity analysis that was being discussed was, in essence, a leakage analysis.[70] CBR's hydrogeologist testified that he did not consider an analysis that adds leakage to the production aquifer because there is a significant amount of information indicating it is a confined system.[71] The OST did not cite any evidence in the record supporting the need for a sensitivity analysis, nor did the OST witnesses provide any evidence that such an analysis would have materially changed the conclusions of the test. For the reasons described above, we conclude that no sensitivity analysis was needed.

6.196. On page 33 of its PFF, the OST asserts that CBR's conceptual model "is based on selectively evaluated data which ignored 19 hours of pump test data." We addressed the issues raised in this assertion in ¶¶ 6.85 and 6.86 *supra* and found that the aquifer pumping test was adequate to demonstrate confinement and to estimate hydraulic parameters.[72]

2. Bases for Confinement

6.197. Several statements in the OST PFF question the aquifer pumping test results as a basis for concluding that there is adequate confinement at the MEA. On page 33, the OST states that the heterogeneous nature of the Brule "means that it's unlikely that with their place of the 3 monitoring wells that you would find anything."[73] And on pages 40-41, the OST states that

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[69] Although the OST's assertion refers to the conceptual model for the MEA, the testimony that the OST cites in support refers to a sensitivity analysis for the aquifer pumping test. OST PFF at 28 (citing Tr. at 499 (Wardwell), Tr. at 500-01 (Lewis)); *id*. at 44 (citing Tr. at 500-502 (Lewis)).

[70] See Tr. at 499 (Wardwell).

[71] Tr. at 499-500, 501-02 (Lewis).

[72] Staff PFF at ¶ 6.102. With respect to claim that 19 hours of test data from the first, failed test were ignored, we agree with CBR and the Staff that the results would not have provided useful information and the second test was essentially a repeat of the first under better conditions. *Id*. at ¶ 6.85.

[73] OST PFF at 33 (citing Tr. at 389-90 (Kreamer)). In the cited statement, Dr. Kreamer asserted that the parties "agreed" that the Brule is heterogeneous, presumably referring to the parties' joint stipulation (Ex. BRD001). But that document states only that the Brule "consists of an uppermost Brown Siltstone member underlain by siltstones with isolated beds of sandstone and volcanic ash (the Whitney member)," and that "thick, fine to medium-grained sandstones" at the base of the Brown Siltstone "constitute the first

there is leakage through overlying strata and the Theis drawdown curve for Monitor Well 3 is a "textbook example" of a curve showing a recharge boundary. We considered these issues in ¶¶ 6.109 to 6.118 *supra* and found that the aquifer pumping test results support the conclusion that there is adequate vertical confinement at the MEA. The OST has not pointed to any record evidence not already considered in those findings.

6.198. On page 41 of its PFF, the OST suggests that "one possible explanation for this recharge boundary is potential fracturing or faulting evidenced by coincident troughs through the different aquifers in the vicinity of Monitor Well 3." The OST claims that "[n]either CBR nor NRC Staff presented any analysis of this offset and its potential explanation for the apparent recharge boundary."[74]

6.199. The "recharge boundary" that the OST refers to is the late-time deviation in the Theis curve for Monitoring Well 3. We considered the possible explanations for the late-time deviations, including the possibility of recharge or leakage, in ¶¶ 6.111 through 6.115 *supra*, and concluded that the OST's explanation—that the deviations are the result of leakage—is implausible given the other evidence of confinement as well as the plausible alternative explanations advanced by the Staff and CBR.[75]

6.200. The OST's explanation of leakage based on coincident troughs was not provided to explain the late-time deviations in the Theis curves, but rather to explain the existence of a recharge boundary. Because we did not find that the record evidence supports the conclusion

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overlying aquifer above the production zone." Ex. BRD001 at 7. There is no further discussion or detail about the homogeneity or heterogeneity of the Brule aquifer. In addition, as noted in ¶ 6.109 *supra*, Dr. LaGarry testified that the Brown Siltstone member is uniform, consistent, and homogeneous. Tr. at 748, 767 (LaGarry).

[74] OST PFF at 41. Dr. Kreamer proposed this explanation on the last day of the hearing. It was not previously advanced by any OST witness in written or oral testimony, or in any other evidence in the record. As a result, CBR and the Staff did not have an opportunity to thoroughly review or consider it earlier.

[75] Staff PFF at ¶ 6.115.

that a recharge boundary exists, this explanation is immaterial to our findings and provides no basis for altering our conclusions.

6.201. In addition, both CBR and the Staff disagree that the structure contour maps show evidence of faulting or fracturing that would affect confinement. Mr. Shriver of CBR explained that the structure contour maps show an erosional surface in the Pierre Shale, where the ancestral stream channel was meandering through the area, and stacked channel sands characteristic of the BCS formation.[76] Mr. Back of the Staff agreed that this is a depositional environment. He stated further that there is no other evidence to suggest that the apparent coincidence is a result of faulting and that this explanation is contrary to everything the Staff looked at.[77]

6.202. In any event, the OST has not pointed to any evidence in the record demonstrating the existence of faults extending upward through 360-450 feet of the Chadron Formation and the lower portion of the Brule Formation (the Whitney member) to the Brule aquifer.[78] We addressed the existence of faults at and near the MEA in ¶¶ 6.32 to 6.40 and 6.145 to 6.154 *supra* and found that the existence of faults, and preferential pathways due to faults or fractures, is highly unlikely. Moreover, the multiple bases for confinement cited by CBR and the Staff, which we considered in ¶¶ 6.104 to 6.131 *supra*, further support the finding that there are no such faults.

6.203. For the reasons discussed above, we find that the OST's suggestion that apparent troughs in Pierre Shale and BCS aquifer are evidence of a recharge boundary or leakage is implausible.

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[76] Tr. at 979-80. CBR also referred to cross-section D-D', located near Monitor Well 3, which shows variation in thickness of the BCS but no abrupt changes. Ex. CBR016 at PDF 34, 38 (Figures 2 and 6).

[77] Tr. at 1026 (Back).

[78] In the vicinity of Monitor Well 3, the top of the BCS aquifer is at least 850 feet below ground surface. Ex. BRD001 at 7.

3. Potential Migration Pathways – Spills and Leaks

6.204. On page 23 of its PFF, the OST asserts that the High Plains Aquifer is vulnerable to contamination from the proposed operations at the MEA.[79] On pages 38-39, the OST also claims that CBR's failure to do seepage analysis indicates "that its mitigation plans are based on unsupported speculation."[80]

6.205. We considered the potential effects of spills and leaks on surface water and surficial aquifers, and CBR's plans for preventing and mitigating such events, in ¶¶ 6.135 to 6.142 *supra*. In those findings, we acknowledged that the High Plains Aquifer and Niobrara River are near the MEA but found it highly unlikely that CBR's operations would result in spills or leaks that would affect those water bodies.[81] The OST has not identified any record evidence that materially alters this finding.

6.206. With regard to seepage analysis, CBR acknowledged that it did not perform an analysis to estimate the rate at which a spill would seep into the ground.[82] However, the OST has not pointed to any evidence in the record indicating that such analysis is necessary, or to any analysis by an OST witness that demonstrates that a spill would have significant effects. As noted in ¶ 6.141 *supra*, Dr. LaGarry admitted that the safety precautions in place would "likely catch most things." Rather than suggesting that CBR's mitigation plans are based on "unsupported speculation," the record shows that CBR's spill prevention and mitigation plans

[79] The OST cites a statement by Dr. LaGarry referring to a large deep pocket of water in the High Plains Aquifer in the "Marsland vicinity." OST PFF at 23. Dr. LaGarry made this statement in the context of attempting to justify including a cross-section located 30 miles away from the MEA in his testimony (Figure 1 of Ex. OST010). Tr. at 727. At no point did Dr. LaGarry identify a specific location for this "large deep pocket of water" nor did he state that it is located within the boundary of the MEA.

[80] The OST makes a similar claim on pages 46-47 of its PFF, stating that "the NRC Staff and [CBR] assume without support that no seepage analysis is required to determine that their spill protection plans will be effective."

[81] Staff PFF at ¶ 6.142.

[82] At the hearing CBR explained the actions that would be taken if such a spill occurred, which include excavation of material from a spill area. Tr. at 774-775 (Pavlick).

are based on design features, procedures and controls that have been successfully implemented at the existing CBR facility.[83]

D. Concern 4

6.207. As stated in ¶ 6.163 *supra*, the issue in Concern 4 is "whether the TR and final EA contains unsubstantiated assumptions as to the isolation of aquifers in the ore-bearing zones." In ¶ 6.164 *supra*, we noted that the OST did not identify any specific "unsubstantiated assumptions concerning the isolation of aquifers." We also stated in that paragraph that we addressed the bases for the Staff's and CBR's conclusions about vertical confinement (i.e., isolation of the BCS aquifer from the overlying Brule aquifer) in our findings on Concern 3.

6.208. Our findings in ¶¶ 6.164 and 6.197 to 6.206 *supra* regarding Concern 3 have likewise addressed the claims in the OST's PFF related to confinement of the BCS aquifer. We find that there are no unsubstantiated assumptions in the TR or the EA related to isolation of the BCS aquifer, and we resolve Concern 4 in favor of the Staff and CBR.

IV. CONCLUSIONS OF LAW

7.7. For the reasons stated above, and in the Staff's Proposed Findings of Fact and Conclusions of Law, the Board affirms that the MEA application and the Staff's final EA comply with the requirements of applicable law. Accordingly, the Board resolves Contention 2 in favor of the Staff and CBR.

[83] *See* Staff PFF at ¶ 6.108.

Respectfully submitted,

/Signed (electronically) by/

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/Executed in Accord with 10 C.F.R. 2.204(d)/

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Dated at Rockville, Maryland
This 4th day of January, 2019.

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)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "NRC Staff's Reply Findings of Fact and Conclusions of Law" in the above-captioned proceeding have been served via the Electronic Information Exchange ("EIE"), the NRC's E-Filing System, this 4th day of January, 2019, which to the best of my knowledge resulted in transmittal of the foregoing to those on the EIE Service List for the above-captioned proceeding.

/Signed (electronically) by/
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