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In the Matter of:	CROW BUTTE RESOURCES, INC. (License Renewal for the In Situ Leach Facility, Crawford, Nebraska)
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May 8, 2015

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:)	
)	Docket No. 40-8943
CROW BUTTE RESOURCES, INC.)	
)	ASLBP No. 08-867-02-OLA-BD01
(License Renewal))	

INITIAL WRITTEN TESTIMONY OF CROW BUTTE RESOURCES WITNESS
LARRY TEAHON ON CONTENTION 12

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**INITIAL WRITTEN TESTIMONY OF CROW BUTTE RESOURCES
WITNESS LARRY TEAHON ON CONTENTION 12**

EXPERT WITNESS

Q1. Please state your full name.

A1. Larry Teahon.

Q2. By whom are you employed and what is your position?

A2. I am employed by Crow Butte Resources as the Safety, Health, Environment, and Quality (SHEQ) Manager at the Crow Butte facility. I oversee radiation protection, health and safety, and environmental programs at the site and ensure compliance with all applicable regulatory requirements.

Q3. Please summarize your professional qualifications.

A3. A copy of my qualifications statement is attached to Exhibit CBR-006.

Q4. What is the purpose of your testimony?

A4. The purpose of my testimony is to address the issues raised in Contention 12.

Q5. What documents have you reviewed to prepare your testimony?

A5. I am fully familiar with the Crow Butte Resources, Inc. (“CBR”) license renewal application (“LRA”), the NRC Staff review documents, including the Environmental Assessment (“EA”) and the final Safety Evaluation Report

(“SER”), and the filings made to date by the Intervenors. I have also reviewed documents related to prior Crow Butte NRC licensing matters and permitting matters before the State of Nebraska.

BACKGROUND

Q6. What is your understanding of Contention 12?

A6. Contention 12 is entitled “[t]he EA omits a discussion of the impact of tornadoes on the license renewal area, and inadequately discusses the potential impacts from land application of ISL mining wastewater.” Contention 12 therefore involves two distinct issues. While the license renewal application and the Safety Evaluation Report both address the risks associated with tornados, the EA itself does not explicitly discuss them. The intervenors also argue that the NRC Staff failed to account for potential impacts from land application of wastewater, including selenium.

ASSESSMENT OF ISSUES

A. Tornados

1. Background

Q7. What does the LRA state with respect to tornados?

A7. The LRA states that:

Tornadoes are rare. In the USNRC “Draft Generic Environmental Impact Statement on Uranium Milling” (USNRC 1979), the authors calculated a mean annual frequency of 0.6 for tornadoes in intensity Category I at Rapid City. The annual probability of occurrence at this location is 4.8×10^{-4} . A tornado in intensity Category I has a rotational speed of 134 meters per second (m/s) and a translational speed of 26 m/s.¹

¹ LRA at 2-92 (Exh. CBR-011).

Q8. What did NRC staff conclude in the SER with respect to tornadoes?

A8. NRC staff concluded in the SER that:

Staff reviewed the applicant's information on natural events at the Crow Butte facility. In Section 2.5.5 of the LRA (CBR, 2009), the applicant identified the probability of a tornado in the region near the Crow Butte facility is approximately 4.8×10^{-4} per year. Staff previously concluded that the applicant had established emergency procedures related to natural disasters. These procedures identified personnel to contact, decontamination procedures, and area cleanup methods (NRC, 1998). Additionally, staff reviewed the Crow Butte facility's plans for emergency preparedness, fire protection, and emergency procedures during inspections in 2006 (NRC, 2006) and 2011 (NRC, 2011). During these inspections, staff determined that CBR's emergency procedures were adequate for emergencies that could involve natural events. . . .

Staff has found nothing to invalidate previous findings; therefore, the original findings stand and previous staff conclusions remain valid. In accordance with Appendix A of NUREG-1569 (NRC, 2003), staff is not re-examining the applicant's discussion of natural events.²

2. Assessment of Environmental Impacts

Q9. What is what is the likelihood of a tornado at the Crow Butte site?

A9. The annual probability of a tornado at the site is 4.8×10^{-4} . This probability translates to a 0.048% annual probability or approximately once every 2,083 years. The risk of a tornado at the site is therefore very low. The probability that a tornado would occur at the site *and* that it would occur at a particular location on the site where it could cause an actual environmental impact (*e.g.*, damaging a structure containing process fluids) is even lower.

Q10. Does CBR maintain emergency plans or procedures that would apply in case of a tornado at the site.

² SER at 158 (Exh. NRC-009).

A10. Yes, the site maintains appropriate emergency response plans and procedures in case of a natural disaster, such as a tornado. These Emergency Response Plans, which address the need to contain potential or uncontrolled releases and take other corrective actions as necessary and appropriate, would be used to avoid or mitigate impacts from a tornado or other natural hazards (e.g., wildfire).

Q11. What is your assessment as to the environmental impact of tornadoes at the Crow Butte site?

A11. Taken together, the very low probability of a tornado at the site and the emergency response procedures to be utilized in the event of a tornado provide a basis for concluding that the risk of an environmental impact at the site from a tornado is minimal. While the risk posed by tornadoes theoretically exists, it is nevertheless unduly speculative and not reasonably probable to occur at Crow Butte. In this regard, I agree with the statements and conclusions regarding tornadoes made by the NRC staff in the SER.

Q12. Did the Intervenors raise any specific risks related to the environmental impact from tornadoes which you can address?

A12. No. While the Intervenors claim that the EA improperly omitted discussion of tornadoes, they do not point to any affirmative evidence, facts, or expert opinion to suggest that tornadoes pose a significant risk of an environmental impact at the site, nor do they rebut any of CBR's statements about tornadoes in the LRA or the NRC Staff's discussion of tornadoes in the SER.

B. Land Application of Wastewater

1. Background

Q13. Does CBR use land application as a method of wastewater disposal?

A13. No, CBR does not use land application as a wastewater disposal method, has not constructed the necessary facilities for land application disposal of wastewater, and has no plans or intentions to start land application of wastewater in the future.

Q14. Does CBR's current NRC license allow for disposal of wastewater by land application?

A14. Yes, the current permit allows for disposal of wastewater by, among other methods, land application. The NRC approved the current land application provisions for Crow Butte in a 1993 license amendment. Among other things, the amendment allows for land application over two parcels of 40 and 60 acres, respectively. NRC Memorandum from J. Grimm, "Land Application of Restoration Waste Water – Ferret's Crow Butte ISL Facility," dated November 16, 1993 ("1993 Amendment Memo") at 1 (Exh. CBR-042).

Q15. If Crow Butte decides in the future to use land application, would there be any treatment applied prior to land application or other limits on its use?

A15. Yes. Prior to discharge, the wastewater is processed to remove uranium and radium, treated to adjust pH, and then passed through reverse osmosis equipment to remove metals and other contaminants, including selenium. *Id.* at 3. The limits for these substances are based on NRC, EPA, and State of Nebraska standards. The maximum limit for selenium is 0.05 mg/L, however, the reverse osmosis equipment is able to reduce selenium concentrations to <0.001 mg/L. *Id.* at 4. Water quality is tested prior to any discharge to ensure compliance with the water quality standards. *Id.* at 5-6. The areas subject to land application are also subject to periodic soil, ground-water, and surface-water testing to monitor potential

impacts. *Id.* at 5. Finally, the discharge rate for treated water is set at a specific rate which prevents soil saturation beyond two feet in depth (limiting groundwater impact), while also avoiding surface runoff. *Id.*

Q16. Has the NRC Staff previously evaluated the environmental impacts of land application at Crow Butte?

A16. Yes. In the 1998 EA prepared in connection with Crow Butte's prior licensing renewal (Exh. CBR-044 at 33), the NRC Staff determined that land application would not have an environmental impact and stated that:

While land application of treated process water has been approved by NRC as a waste disposal option for the Crow Butte Uranium Project, CBR has not employed this option to date. If, however, CBR chooses to employ this disposal option in the future, such land application will be restricted by license condition to two areas described in previous CBR submittals. . . . Up to 145.7 million L (38.5 million gal.) of treated water per year could be disposed through land application. This quantity includes water purged during the construction and development of wells at the project and water treated by reverse osmosis. The release limits for various ionic species, metals, and some radionuclides are established by appropriate NRC, EPA, and State of Nebraska standards. However, as stated, CBR has yet to implement land application of treated process water at the Crow Butte site.

The 2014 SER (Exh. NRC-009 at 59), relying on the 1998 EA, similarly determined that land application would not have an environmental impact and stated that:

The applicant has two other disposal options, which have not been used. In accordance with the license amendment dated November 16, 1993 (NRC, 1998), one option is for the disposal of liquid byproduct material is through on-site land irrigation (land application); however, the facilities have never been constructed. The second option is the discharge to surface water. This option requires an National Pollutant Discharge Elimination System (NPDES) permit by the State of Nebraska, which would require treatment to specific water quality standards before any water is

permitted to be discharged. NRC staff previously concluded that the above-referenced liquid waste disposal options proposed by the applicant were acceptable (NRC, 1998). Staff has found nothing to invalidate these previous findings; therefore, the original findings stand and previous staff conclusions remain valid.

Q17. Is land application of wastewater governed by any state-level permits or regulatory conventions?

A17. Yes. Crow Butte has an National Pollutant Discharge Elimination System (“NPDES”) permit from the Nebraska Department of Environmental Quality (“NDEQ”) that authorizes Crow Butte to conduct land application of wastewater. Among other things, the permit provides that “[d]ischarges shall not be permitted to enter waters of the State under any circumstance and without exception.” NPDES Permit, dated October 3, 2011, at 3 (Exh. CBR-043). Land application under the NPDES permit is also limited to times after certain weather conditions have occurred:

Process wastewater from active uranium mining may be diverted from the primary treatment facility for the purpose of land application at sites approved by the Department in the event that annual precipitation falling on the treatment facility and the drainage area contributing surface runoff to the treatment facility exceeds the amount of annual evaporation. In such cases, a volume of water equivalent to the annual precipitation falling on both the treatment facility and the drainage area contributing surface runoff to the treatment facility minus the amount of annual evaporation may be discharged subject to the monitoring and limitation requirements specified [in the permit].

1. Land application shall only be permitted during periods of excess discharges which may occur during and immediately after any precipitation or snowmelt event.
2. Land application shall only be permitted where the permittee takes all reasonable steps during and after each precipitation event to treat or contain the wastewater discharge and to limit the amount of overflow or excess discharges.

Further, the permit sets a number of site prohibitions:

1. The permittee shall insure that wastewater effluent is not applied beyond the approved land application site boundary at any time.
2. Land application sites shall have a slope of 12% or less.
3. Surface runoff of effluent shall be prohibited. Application of wastewater shall cease immediately or be redirected to another location if ponding or runoff from any source occurs.
4. Land application sites shall be free of perennial or intermittent streams, ponds, lakes or wetlands.
5. The total hydraulic application rate shall not exceed 2 inches per acre (54,304 gal.) per week.
6. There shall be restricted public access to all land application sites.
7. Treated wastewater shall not be applied to crops that are intended for distribution in their raw form for direct human consumption (e.g. fresh produce).

The permit also contains monitoring and recording requirements, and sets specific water quality limits on chemical oxygen demand, total suspended solids, zinc, radium-226, uranium, and pH. *Id.* at 4. Limits for other parameters are set by Nebraska regulations, including a limit for selenium of 0.05 mg/L.³

2. *Assessment of Environmental Impacts*

Q18. What is your assessment as to the environmental impact of land application of wastewater at the Crow Butte site?

A18. Since Crow Butte currently does not use land application, does not have the facilities to do so, and does not have plans to begin land application, there is no current or expected environmental impact. And, even if Crow Butte were to begin land application of wastewater as provided for in its NRC license and

³ Nebraska Administrative Code Title 118, chapter 4(002). To the extent that the levels for chemical oxygen demand, total suspended solids, zinc, radium-226, uranium, and pH in the NDEQ permit differ from those provided for in Title 118, this serves to conform the levels in the permit with those provided for in EPA regulations related to in-situ leach uranium mining. 40 C.F.R. § 440.32(a).

NDEQ permit (and there is no indication this will actually happen), the environmental impact would be minimal. The NRC license and NDEQ permit together impose stringent limits on the use of land application. Any land application wastewater is subject to water quality limits derived from NRC, EPA, and State of Nebraska rules. And, in practice, the pre-discharge processing and treatment results in water quality that is well below those limits. Water must be tested before discharge to ensure compliance with water quality limits, and the land application area is also subject to periodic post-discharge monitoring and testing to ensure that long-term environmental impacts, if any, are small. The rate and manner by which water may be discharged is also designed to prevent both ground-water impacts and surface runoff. Lastly, areas of the site where land application of treated water has been used are included in decommissioning surveys to ensure soil concentration limits are not exceeded.

Q19. Did the Intervenors raise any specific risks related to the environmental impact from land application of wastewater that you can address?

A19. Yes. Intervenors raised the issue of whether land application would result in increases in selenium concentrations due to bioaccumulation, which they posited could in turn cause toxicity in wildlife. In support of this point, Intervenors cite a 2000 U.S. Fish and Wildlife Service study and a 2007 letter from FWS to NRC commenting on NRC's then-proposed Generic Environmental Impact Statement for Uranium Mining Facilities.⁴ However, review of the FWS Report and FWS

⁴ OST Ex. O, Pedro Ramirez, Jr. & Brad Rogers, *Selenium in a Wyoming Grassland Community Receiving Wastewater from an In Situ Uranium Mine* (2000) (Exh. INT-019)

Letter shows that the concerns raised in the report and letter are not applicable to Crow Butte.

Q20. Can you explain?

A20. As an initial matter, as already stated, Crow Butte is not currently engaging in land application of wastewater and has no plans to do so. Thus, the findings in the FWS Report and FWS Letter are hypothetical and speculative as applied to Crow Butte. However, even assuming Crow Butte were to begin land application of wastewater per its NRC license and NDEQ permit, the situation described in the FWS Report and FWS Letter are not comparable to the potential land application at Crow Butte. First, in the FWS Report, the mining wastewater which was subject to land application had a selenium content of 1000-2000 µg/L (1-2 mg/L), and these concentrations were allowed under the site's relevant permit from the Wyoming Department of Environmental Quality. FWS Report at 1. At Crow Butte, the maximum level of selenium allowed in wastewater for land application is 0.5 mg/L, which is two to four times lower than that at the FWS Report site. Further, due to the required processing and treatment of wastewater before land application, the expected level of selenium in discharged wastewater at Crow Butte would be <0.001 mg/L, which is 1000 to 2000 times lower than levels at the FWS Report site. The FWS Report also noted that, per prior research, selenium concentrations of >2 µg/L (.002 mg/L) can be associated with toxicity harm to wildlife due to bioaccumulation, and that concentrations of >3 µg/L (.003 mg/L) exceed the bioaccumulation threshold for wildlife. *Id.* at 1.

("FWS Report"); OST Ex. N, Letter from USFWS to NRC (Sept. 5, 2007) (Exh. INT-018) ("FWS Letter").

Whereas the selenium concentrations at the FWS Report site of 1-2 mg/L were tens or even hundreds of times higher than those levels, the expected selenium concentrations of <0.001 mg/L in the wastewater that would actually be released at Crow Butte after treatment and processing is below those levels.

Q21. Did FWS Report only address land application?

A21. No. A large part of the FWS Report's concerns about toxicity revolve around selenium concentrations in evaporation ponds, bioaccumulation of selenium in vegetation in evaporation ponds, and consumption of this vegetation by wildlife. These aspects of the FWS Report are inapplicable to Contention 12, which deals with disposal of wastewater through land application and does not challenge Crow Butte's use of evaporation ponds. Further, Crow Butte's license and permit prohibit land application if it would result in pooling of water at the ground surface. To further highlight the differences between the FWS Report site and Crow Butte, I'll note that, based on my personal observations working at the Crow Butte site, there is minimal to no vegetation in the evaporation ponds at Crow Butte, and there is minimal to no use of the evaporation ponds by local wildlife as a source of food.

Q22. Does the FWS Letter contain any different information?

A22. The FWS Letter does not add anything as it primarily repeats information from the FWS Report and/or discusses selenium concentrations in contexts other than land application. Other concerns raised about land application in the FWS Letter are likewise already covered by Crow Butte's license and permit. For example, the FWS Letter states that "land application may result in the contamination of

groundwater which may reach surface waters” and that “selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.” FWS Letter at 1. However, the Crow Butte license and permit already prohibit land application which would result in discharge entering the waters of the state of Nebraska, prohibit discharge if it would result in pooling or runoff, and require discharge to occur at a rate which will both avoid seepage into ground-waters and prevent runoff.

Q23. Based on the above, do you have concerns about the potential for bioaccumulation of selenium from land application at Crow Butte?

A23. No. As noted above, Crow Butte has no plans for land application of wastewater. Therefore, no impact is expected. And, if land application did occur, it would be subject to restrictions imposed by the NRC and NDEQ that would limit or avoid environmental impacts from such land application. For these reasons and using the NRC’s impact categories, the environmental impacts to soil or wildlife from land application of treated wastewater, if any, would be SMALL — that is, the environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.

CONCLUSIONS

Q24. What are your overall conclusions regarding the environmental impact of tornados at Crow Butte?

A24. Based on my professional expertise, the materials I have reviewed, and my familiarity with the Crow Butte site, the risk posed by tornados is very small.

The probability of a tornado at the site, let alone of a tornado at a particular spot on the site where it could cause an environmental impact, is very low. Further, there are adequate emergency response plans and procedures in place in case of a natural hazards phenomenon, such as a tornado, that would mitigate the impact if a tornado did occur at the site.

Q25. What are your overall conclusions regarding the environmental impact of land application of wastewater at Crow Butte?

A25. Based on my professional expertise, the materials I have reviewed, and my familiarity with the Crow Butte site, the risk posed by land application of water at Crow Butte is very small. Indeed, since Crow Butte does not currently practice land application, does not have the appropriate facilities to do so, and has no plans to start doing so, there is currently no risk. If Crow Butte were to nevertheless begin land application as allowed under its NRC license and NDEQ permit, the impact would be small due to the strict water quality standards Crow Butte would need to abide by and the many other restrictions on how land application must be conducted. For these reasons, the impacts, if any, to soil or wildlife from land application of treated wastewater would be SMALL.