

**TECHNICAL EVALUATION REPORT
REQUEST FOR ALTERNATE DECOMMISSIONING (GROUNDWATER RESTORATION)
SCHEDULE**

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LICENSE NO.: SUA-1534

LICENSEE: Crow Butte Resources, Inc.

SITE: Crow Butte Project

PROJECT MANAGER: Ronald A. Burrows

TECHNICAL REVIEWER: Tom Lancaster

Summary and Conclusions:

By letter dated April 3, 2018 (CBR, 2018a) and email dated July 3, 2018 (CBR, 2018b), Cameco Resources, Crow Butte Operation (CBR, or the licensee) requested a license amendment for an alternate decommissioning (groundwater restoration) schedule for the Crow Butte Project. In conformance with Title 10 of the *Code of Federal Regulations* (10 CFR) 40.42 and License Condition (LC) 10.2.2, CBR seeks U.S. Nuclear Regulatory Commission (NRC) approval to extend the period of groundwater restoration beyond currently approved schedules for Mine Units (MUs) 2–6. Based on the information provided in the application and the detailed review conducted of the alternate decommissioning (restoration) schedule for CBR's Crow Butte Project, the NRC staff concludes that the alternate decommissioning (restoration) schedule is acceptable and in the public interest. Therefore, the NRC staff will modify LC 10.2.2 to incorporate the revised alternate decommissioning (restoration) schedule for Mine Units 2 through 6.

The license amendment reviewed herein meets the categorical exclusion provisions in 10 CFR 51.22(c)(11). Therefore, no further environmental review is required for this action.

Request for alternate decommissioning (groundwater restoration) schedule

LC 10.2.2 (NRC, 2018) states:

The restoration schedule for Mine Units 2 through 6 shall be as described in the request dated July 27, 2016, Agencywide Documents Access and Management System (ADAMS) (ADAMS Accession No. ML16222A356) and June 21, 2017 (ADAMS Accession No. ML17173A388) and as approved in NRC staff's letter dated October 5, 2017 (ADAMS Accession No. ML17013A659).

Background

By letter dated April 3, 2018 (CBR, 2018a) and email dated July 3, 2018 (CBR, 2018b), CBR requested a license amendment for an alternate decommissioning (groundwater restoration) schedule for the Crow Butte Project. In conformance with 10 CFR 40.42 and LC 10.2.2, CBR seeks NRC approval to extend the period of groundwater restoration beyond currently

approved schedules for MUs 2–6 (refer to LC 10.2.2 above). MUs 7-11 are currently in standby mode (CBR, 2018c) maintaining a small bleed to maintain an inward hydraulic gradient.

Since CBR's previous request for an alternate decommissioning (groundwater restoration) schedule for the Crow Butte Project (CBR, 2016), CBR has been conducting spot treatment of uranium in groundwater at well P246 within MU 3 and continues its restoration efforts of MU 4-6 (CBR, 2018a,b). Although the restoration at MU 4-6 is taking longer than previous projections, staff does not find this to be unusual for any groundwater restoration effort.

Regarding MU 2, CBR states that stability monitoring has been conducted and plans to submit an application requesting an alternate concentration limit (ACL). Because of the small size, geographic proximity, and similar water quality between Mine Unit 2 and Mine Unit 3, CBR plans to prepare and submit the ACL application for these mine units together. (CBR, 2018a,b)

Staff Review and Analysis

NRC staff reviewed CBR's above-referenced submittal with considerations listed in 10 CFR 40.42(i). These considerations are as follows:

- (1) Whether it is technically feasible to complete decommissioning within the allotted 24- month period;
- (2) Whether sufficient waste disposal capacity is available to allow completion of decommissioning within the allotted 24-month period;
- (3) Whether a significant volume reduction in wastes requiring disposal will be achieved by allowing short-lived radionuclides to decay;
- (4) Whether a significant reduction in radiation exposure to workers can be achieved by allowing short-lived radionuclides to decay;
- (5) Other site-specific factors which the Commission may consider appropriate on a case-by-case basis, such as the regulatory requirements of other government agencies, lawsuits, groundwater treatment activities, monitored natural groundwater restoration, actions that could result in more environmental harm than deferred cleanup, and other factors beyond the control of the licensee.

For the following reasons, considerations 2 through 5 above do not support extending the schedule.

First, based on the NRC Crow Butte Renewal SER (NRC, 2014), NRC previously determined that sufficient waste disposal capacity is available to allow for the completion of restoration. Considering that the waste stream is expected to remain relatively the same or less during the deferred restoration, there are no waste disposal issues that would impact CBR's ability to complete the restoration.

Second, the radioactive component of the restoration wastes generated for disposal from the remediation activities at the Crow Butte facility will be characterized predominantly by the long- lived radionuclides uranium-238 (4.5×10^9 year half-life), uranium 234 (2.4×10^5 year half-life), and radium-226 (1600 year half-life) (refer to Tables 6.1-3 through 6.1-6 of CBR,

2007, and LC 11.1.3(C) of NRC, 2018). Therefore, there are no volume reduction benefits that would be achieved by allowing short-lived radionuclides to decay, and there is no significant reduction in radiation exposure to workers that would be achieved by allowing short-lived radionuclides to decay.

Finally, there were no other site-specific factors identified by CBR or NRC staff that were appropriate to consider in this particular case.

Therefore, the NRC staff focused on the first consideration in 10 CFR 40.42(i): whether it is technically feasible for CBR to complete aquifer restoration within the currently approved schedule. Table 1 summarizes the start dates and the recent phases of groundwater restoration at Mine Units 2-6 (CBR, 2018 a, b). Table 2 summarizes the previously approved restoration schedule (NRC, 2017) and the proposed alternate restoration for Mine Units 2-6.

Table 1 shows that groundwater restoration has required significantly more time than 24 months as prescribed in 10 CFR 40.42. Based on NRC staff's assessment of the information presented by CBR, the NRC staff agrees with CBR that the capacity of deep well disposal and the restoration circuit, as well as the need to maintain a hydrologic balance between the production and restoration mine units, make the restoration of each mine unit in a 24-month period technically infeasible (CBR, 2018a, b). However, staff also observes the efficiency of restoration was improved at CBR after 2009 with the use of a model-based restoration plan¹, sequencing of the mine units, and system infrastructure upgrades for increased restoration flow rates (NRC, 2010). This improved restoration efficiency was demonstrated in CBR's 2013 documentation of the restoration status for MUs 2 and 3 (CBR, 2013). Relative to historical groundwater restoration monitoring data for MUs 2 and 3 prior to 2009, CBR's restoration monitoring data in the 2013 document showed higher rates of decline for groundwater analytes of concern at MUs 2 and 3 after 2009. CBR continues to update its groundwater restoration model periodically with current performance data (CBR, 2018a). These model updates have allowed CBR to renew projections of mine unit restoration timeframes (CBR, 2018a, b).

CBR provided (CBR, 2018a) an alternate schedule for the completion of various phases of future groundwater restoration for each of the mine units (i.e., MUs 2–6). CBR now projects (CBR, 2018a, b) that groundwater restoration at Mine Units 2–6 will be completed and approved by NRC as annotated in Table 2.

CBR has completed restoration field activities for MU-2 and is in the process completing the restoration of MU-3 with the spot treatment and monitoring of groundwater with increased uranium at Well P246 in MU-3. CBR has determined that the concentrations of some of the constituents in MUs 2 and 3 cannot be fully restored to background and therefore an application for alternate concentration limits (ACLs), as allowed in 10 CFR Part 40, Appendix A Criterion 5B(6)², is being prepared. Since MUs 4-6 are in the same hydrogeologic conditions

¹ MODFLOW2000 three-dimensional groundwater restoration flow modelling (calibrated to reflect current mine unit conditions) was used to project injection and extraction flow rates to optimize restoration by maximizing the flow paths through the affected groundwater zone.

² 10 CFR Part 40, Appendix A Criteria 5B(6) states, "Licensees must provide the basis for any proposed limits including consideration of practicable corrective actions that limits are as low as reasonably achievable, and information on the factors the Commission must consider. The Commission will establish a site specific alternate concentration limit for a hazardous constituent as provided in paragraph 5B(5) of this criterion if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded."

as MUs 2 and 3, ACLs may also be needed in Mus 4-6. This assumption has been incorporated into the schedules in Table 2.

Mine Unit	Initiation of Groundwater Restoration	Phase of Groundwater Restoration on July 3, 2018
2	January 2, 1996	Preparing an Alternate Concentration Limit Application
3	July 22, 1999	Spot Treatment and Groundwater Monitoring* followed by the Preparation of an Alternate concentration Limit Application
4	October 31, 2003	Recirculation
5	August 6, 2007	Recirculation
6	October 28, 2010	IX and RO Treatment
IX – Ion Exchange, RO – Reverse Osmosis		

*Following the spot treatment of groundwater with increased uranium levels at Well P246, a monitoring period that will include four consecutive quarters of groundwater quality monitoring will be conducted to ensure the monitored constituents in the area around P246 are stable.

The NRC staff finds CBR's alternate schedule is reflective of the above-referenced gains in restoration efficiency. Specifically, the alternate schedule is based on MODFLOW2000 three-dimensional groundwater restoration flow modelling (calibrated to reflect current mine unit conditions), which takes into account the flow capacity of the IX and RO circuits, wastewater volume, and mine unit pore volume. Thus, in accordance with NRC timely decommissioning requirements (NRC, 2008), staff finds CBR's alternate schedule provides reasonable assurance that restoration will be completed as soon as practicable for the subject mine units.

Mine Unit	Previously Approved Restoration Schedule*	Proposed Alternate Schedule for Submission of ACL Request**	Proposed Alternate Schedule for Completion of NRC Review of ACL Request**
2	December 31, 2020	December 31, 2020	December 31, 2022
3	December 31, 2020	December 31, 2020	December 31, 2022
4	March 31, 2021	March 31, 2021***	March 31, 2023
5	July 1, 2022	March 31, 2021***	March 31, 2023
6	October 1, 2021	March 31, 2023***	December 31, 2024

*(NRC, 2017; CBR, 2016, 2017a), **(CBR, 2018 a, b), ***Assumes an ACL is required

In addition, consistent with NRC guidance for other material licensees (e.g., NUREG-1757, Section 5.1), the NRC staff also evaluated whether this request is in the public interest and observed that nothing has changed concerning this evaluation since NRC's review of CBR's previous request for an alternate restoration schedule (NRC, 2017). In evaluating whether this request is in the public interest, the NRC staff notes that allowing the licensee to extend the groundwater restoration period will reduce the overall health risk to the public by bringing the mine units closer to conditions that existed prior to the start of uranium recovery operations in those mine units. The NRC staff finds that allowing the licensee to extend the groundwater restoration period will not result in any significant change in the types, or significant increase in the amounts, of any effluents that may be released offsite. Therefore, the NRC staff concludes that approving this request is in the public interest.

Conclusion

Based on the information provided in the application and the detailed review conducted of the alternate decommissioning (restoration) schedule for CBR's Crow Butte Project, the NRC staff concludes that the alternate decommissioning (restoration) schedule is acceptable and in the public interest.

Therefore, the NRC staff will modify LC 10.2.2 to incorporate the revised alternate decommissioning (restoration) schedule for MUs 2 through 6. LC 10.2.2 will be modified as follows:

The restoration schedule for Mine Units 2 through 6 shall be as described in the request dated April 3, 2018, (ADAMS Accession No. ML18102A539) and July 3, 2018 (ADAMS Accession No. ML18191B238) and as approved in NRC staff's letter dated December 14, 2018 (ADAMS Accession No. ML18268A211).

Environmental Review and Consultations

In accordance with 10 CFR 51.22(b), the NRC staff has determined that an environmental assessment (EA) or an environmental impact statement (EIS) is not required for modifying the alternate decommissioning (restoration) schedule in LC 10.2.2, which results in a schedule change as a result of a change in process operations. This action is categorically excluded under 10 CFR 51.22(c)(11) from the requirement to prepare an EA or EIS, based on the following NRC staff findings with respect to the criteria in 10 CFR 51.22(c)(11):

- the modification of the LC discussed above will not result in a significant change in the types or significant increase in the amounts of any effluents that may be released offsite;

The purpose of granting an extension to the licensee's restoration schedule as described in this review is to extend restoration to enable the licensee to complete decommissioning of individual mine units. There is no change in the restoration process previously approved and evaluated by the NRC staff.

Therefore, there will be no change in the types of effluents that may be released offsite.

The NRC staff evaluated the most recent annual report with measured emissions from the licensee's operations (refer to Section 2.7.4 of CBR, 2017b). According to these monitoring results, facility effluents are comprised almost exclusively of radon and its progeny.

The NRC staff reviewed historical radon concentrations measured at the licensee's environmental monitoring stations AM-1 through AM-6 and AM-8 (for sampling locations, refer to Appendix I of CBR, 2018d). Measured values from 1991–2007 (refer to Figures 5.8-10 through 5.8-16 of CBR, 2007) and the latest values available from 2015–2017 (refer to Table 17 of CBR, 2017b) indicate no discernable upward trend of effluents that may be released offsite.

Therefore, this action will not result in a significant increase in the amounts of any effluents that may be released offsite.

- there will be no significant increase in individual or cumulative occupational radiation exposure as a result of the modification of the LC discussed above;

The NRC staff evaluated historical individual and cumulative occupational radiation exposure data from 1994–2006 (refer to Sections 5.8.2–5.8.4 of CBR, 2007) as well as the most recent (2015–2017) individual occupational radiation exposure data (CBR, 2017b). Based on this evaluation, the NRC staff concludes that there are no discernable upward trends in individual or cumulative occupational radiation exposure attributable to restoration activities. In addition, the 2017 data indicates that occupational radiation exposures at the licensee's facility remain below levels that require individual monitoring in accordance with 10 CFR 20.1502.

Therefore, this action will not result in a significant increase in individual or cumulative occupational radiation exposure.

- the modification of the LC discussed above will not result in a significant construction impact;

Granting an extension to the licensee's restoration schedule as described in this review will not involve construction activities.

Therefore, this action will not result in a significant construction impact

- there is no significant increase in the potential for or consequences from radiological accidents.

The purpose of granting an extension to the licensee's restoration schedule as described in this review is to extend restoration to enable the licensee to complete decommissioning of individual mine units. There is no change in the restoration process previously approved and evaluated by the NRC staff.

Therefore, this action will not result in a significant increase in the potential for or consequences from radiological accidents.

Section 7 of the Endangered Species Act (Act) [16 U.S.C. 1531 et seq.] outlines the procedures for Federal interagency cooperation to conserve Federally listed species and

designated critical habitats. Section 7(a)(2) states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The NRC staff has determined that a Section 7 consultation is not required because the proposed action is administrative/procedural in nature and will not affect listed species or critical habitat. The NRC staff has also determined that the proposed action is not a type of activity that have potential to cause effects on historic properties because they are administrative/procedural actions. Therefore, no additional consultation is required under Section 106 of the National Historic Preservation Act.

REFERENCES

10 CFR Part 40. *Code of Federal Regulations*, Title 10, Energy, Part 40, "Domestic Licensing of Source Material."

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CBR, 2018b. E-mail from W. Nelson, Cameco Resources Crow Butte Operation, to T. Lancaster and R. Burrows, US NRC, Alternate Decommissioning Schedule RAI Response, July 3, 2018, ADAMS Accession No. ML18191B238.

CBR, 2018c. Letter from W. Nelson, Cameco Resources, Crow Butte Operations, to U.S. NRC, Notification of Cessation of Production at the Crow Butte Mine, April 2, 2018, ADAMS Accession No. ML18093A183.

CBR, 2018d. Letter from W. Nelson, Cameco Resources, Crow Butte Operations, to U.S. NRC, Semiannual Radiological Effluent and Environmental Monitoring Report, February 27, 2018, ADAMS Accession No. ML18066A570.

CBR, 2017a. Email from Larry Teahon, Cameco Resources, Crow Butte Operation, to R. Burrows, NRC, Alternate Decommissioning Schedule, June 21, 2017, ADAMS Accession No. ML17173A388.

CBR, 2017b. Letter from W. Nelson, Cameco Resources, Crow Butte Operations, to U.S. NRC, 2017 Annual ALARA Report, July 3, 2017, ADAMS Accession No. ML18192C006.

CBR, 2016. Letter from B. Tiensvold, Cameco Resources, Crow Butte Operations, to U.S. NRC, Request for Alternate Decommissioning (Groundwater Restoration) Schedule License SUA-1534 (November 2014), July 27, 2016, ADAMS Accession No. ML16222A356.

CBR, 2013. Restoration Status for Mine Units 2 and 3 to support 2012 Surety Estimate , Cameco Resources Crow Butte Operation, Source Materials License SUA-1534, May 9, 2013, ADAMS Accession No. ML15159B198.

CBR, 2007. Application for Renewal of Source Material License No. SUA-1534, Crow Butte Resources, Inc., November 27, 2007, ADAMS Accession No. ML073480264.

NRC, 2018. Crow Butte Resources, Inc. Material License SUA-1534, Amendment No. 3, May 23, 2018, ADAMS Accession No. ML18117A295.

NRC, 2017. Letter from R. Burrows, US NRC, to L. Teahon, Crow Butte Resources, Inc., Amendment No. 2 to Source Materials License SUA-1534, October 5, 2017, ADAMS Accession No. ML17013A659.

NRC, 2014. Safety Evaluation Report (Revised) License Renewal of the Crow Butte Resources ISR Facility Dawes County, Nebraska. Materials License No. SUA-1534. Washington, DC. ADAMS Accession No. ML14149A433.

NRC, 2010. Letter from R. Burrows, US NRC, to L. Teahon, Crow Butte Resources, Inc., Request for Alternate Decommissioning (Groundwater Restoration) Schedule, Crow Butte Resources, Inc., February 18, 2010, ADAMS Accession No. ML092510030.

NRC, 2008. Letter from K. McConnell, US NRC, to S. Collings, Crow Butte Resources, Inc., Compliance with 10 CFR 40.42's Timely Decommissioning requirements, July 7, 2008, ADAMS Accession No. ML081480259.

NRC, 2003. NUREG–1569, "Standard Review Plan for In Situ Leach Uranium Extraction License Applications—Final Report." June 2003.