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

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| DATE: | 03/04/2021 |
| DOCKET: | 040-08943 |
| 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 December 9, 2019 (CBR, 2019a) and as supplemented on January 28, 2020 (CBR, 2020c), 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 and establish schedules for MUs 7-11. The NRC staff responded to CBR's submittals by letter dated July 9,2020, with a request for additional information (RAI) (NRC, 2020). CBR provided a response to the RAI on July 23, 2020 (CBR, 2020b), and a revision to the December 9, 2019, alternate decommissioning (groundwater restoration) schedule on August 3, 2020 (CBR, 2020a).

Based on the information provided in the application and the detailed review conducted of the proposed alternate decommissioning (restoration) schedule for CBR's Crow Butte Project, the NRC staff concludes that the proposed 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 11. This licensing action meets the categorical exclusion provisions in 10 CFR 51.22(c)(11). Therefore, no further environmental review is required for this action.

In addition, the NRC staff will update LC 9.5 to incorporate the most recent surety estimate amount previously verified by the NRC staff. This licensing action meets the categorical exclusion provisions in 10 CFR 51.22(c)(10). 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 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).

**Background**

By letter dated December 9, 2019 (CBR, 2019a) and as supplemented on January 28, 2020 (CBR, 2020c), CBR requested a license amendment request 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 and establishes schedules for MUs 7-11. MUs 8-11 are currently in standby mode (CBR, 2020a, 2020c) maintaining a small bleed to maintain an inward hydraulic gradient.

MUs 2 and 3 have been in stability monitoring since 2013 and MUs 4 and 5 have been in stability monitoring since 2018 (CBR, 2020a). CBR plans to initiate additional treatment in MUs 2 and 4 in the fourth quarter of 2020. CBR continues its restoration efforts of MUs 6 and 7 (CBR, 2020a). The additional treatment to MUs 2 and 4 has contributed to the restoration at MU 6 taking longer than previous projections. However, staff does not find this to be unusual for any groundwater restoration effort. MUs 8-11 are on standby during which a small bleed is being applied to maintain an inward hydraulic gradient throughout each of these MUs. The initiation of restoration in these MUs is forthcoming. As seen with the schedule for the restoration of MUs 2-6, the restoration schedule for MUs 7-11 is staggered in time as dictated by CBR's disposal capacity (CBR, 2020a, 2020c)

**Staff Review and Analysis of Alternate Decommissioning Schedule Request**

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 (3) through (5) above do not support extending the schedule.

Regarding considerations (3) and (4), 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 ($4.5 \times 10^9$ year half-life), uranium-234 ($2.4 \times 10^5$ 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.

Regarding consideration (5), there were no other site-specific factors identified by CBR or the NRC staff that were found to be an issue in this particular case. During the NRC staff's review of this license amendment request, the NRC staff requested additional information from CBR for the further evaluation of a potential site-specific factor (NRC, 2020). The potential factor was the effect of the relatively long standby periods for MUs 8-11 and their subsequent groundwater restoration. Specifically, the NRC staff requested CBR to provide additional information to demonstrate whether groundwater excursion parameter concentrations within the production zone will decrease to concentrations that do not allow for excursions to be detected at excursion monitoring wells. CBR's response (CBR, 2020b) provided concentration levels of excursion parameter constituents (alkalinity, chloride, and conductivity) in the trunk-line water for MUs 8-11, reported semi-annually from May, 2018, to May, 2020. The NRC staff found no apparent downward trends in these excursion constituent levels at this time. Therefore, the NRC staff finds that production zone excursion parameter concentrations during the initial standby of MU 8-11 have allowed for excursions to be detected at excursion monitoring wells.

In order to ensure effective groundwater monitoring in the future during the standby of MUs 8-11, LC 10.2.2 will be modified to require Semiannual Effluent and Environmental Monitoring Reports to include the table in the RAI response document dated July 23, 2020 (CBR, 2020b). The table shall be updated with the data from Mine Unit 8 to 11 trunk-line water samples collected during the semiannual period.

Considering that MUs 2-6 were previously addressed in License Amendment 4 (CBR, 2018), 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 of MUs 7-11 within a 24-month period. Table 1 summarizes the start dates and the recent phases of groundwater restoration at MUs 2-11 (CBR, 2020a). Table 2 summarizes the previously approved restoration schedule for MUs 2-6 (NRC, 2018) and the proposed completion of the restoration field activities for MUs 2-11 (CBR, 2020a).

Table 1 shows that groundwater restoration has required significantly more time than 24 months as prescribed in 10 CFR 40.42. Based on the NRC staff's assessment of the information presented by CBR, the NRC staff has determined that the capacity of deep well disposal and the restoration circuit make the restoration of each mine unit in a 24-month period technically infeasible (CBR, 2020a, 2020c). However, staff also acknowledges the efficiency of

restoration was improved at CBR after 2009 with the use of a model-based restoration plan[1], 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, 2020a). These model updates have allowed CBR to renew projections of mine unit restoration timeframes (CBR, 2020a).

**TABLE 1**
**Status of Groundwater Restoration at Mine Units 2 to 11**

| Mine Unit | Initiation of Groundwater Restoration* | Phase of Groundwater Restoration on August 3, 2020* |
|---|---|---|
| 2 | January 2, 1996 | Treatment and Stabilization Monitoring |
| 3 | July 22, 1999 | Stabilization Monitoring |
| 4 | October 31, 2003 | Treatment and Stabilization Monitoring |
| 5 | August 6, 2007 | Stabilization Monitoring |
| 6 | October 28, 2010 | RO Treatment |
| 7 | September 6, 2018 | RO Treatment |
| 8 | Second quarter of 2021** | Standby -Restoration Forthcoming |
| 9 | Third quarter of 2029** | Standby -Restoration Forthcoming |
| 10 | Third quarter of 2024** | Standby -Restoration Forthcoming |
| 11 | Second quarter of 2031** | Standby -Restoration Forthcoming |

*(CBR, 2020a)
**Projected (CBR, 2020a)
RO – Reverse Osmosis, Standby - Small bleed to maintain inward hydraulic gradient

CBR previously provided (CBR, 2018) an alternate schedule for the completion of various phases of future groundwater restoration for each of the mine units (i.e., MUs 2–6). However, based on sampling results since 2018, CBR has determined that additional treatment is needed for MUs 2 and 4. These treatments will also impact the restoration schedules of MUs 6 and 7 as some resources will need to be redirected. Therefore, CBR now projects that groundwater restoration field activities for MUs 2–11 will be completed as annotated in Table 2 (CBR, 2020a).

[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.

**TABLE 2**
**Groundwater Restoration Schedules at Mine Units 2 to 11**

| Mine Unit | Previously Approved Restoration Schedule* | Proposed Alternate Schedule for Completion of Restoration Field Activities** |
|---|---|---|
| 2 | December 31, 2020 | Second Quarter of 2023 |
| 3 | December 31, 2020 | Third Quarter of 2021 |
| 4 | March 31, 2021 | Second Quarter of 2023 |
| 5 | March 31, 2021 | Third Quarter of 2022 |
| 6 | March 31, 2023 | Second Quarter of 2023 |
| 7 | Not Applicable | Third Quarter of 2024 |
| 8 | Not Applicable | Fourth Quarter of 2026 |
| 9 | Not Applicable | First Quarter of 2034 |
| 10 | Not Applicable | Fourth Quarter of 2031 |
| 11 | Not Applicable | Second Quarter of 2038 |

*(NRC, 2018)
**(CBR, 2020a)

The NRC staff finds CBR's proposed 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 proposed alternate schedule provides reasonable assurance that restoration will be completed as soon as practicable for the subject mine units.

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. 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 11. LC 10.2.2 will be modified as follows:

The restoration schedule for Mine Units 2 through 11 shall be as described in the request dated August 3, 2020 (ADAMS Accession No. ML20234A424) and as approved in NRC staff's letter dated XXXX (ADAMS Accession No. ML20324A072).

While any of the Mine Units 8-11 are in standby, the Table in the document dated July 23, 2020 (ADAMS Accession No. ML20234A423) shall be provided in the Semiannual Effluent and Environmental Monitoring Report required by LC 11.1.1 D. The table shall be updated with the data from Mine Unit 8 to 11 trunk-line water samples collected during the semiannual period.

**License Condition 9.5**

LC 9.5 states, in part:

> Crow Butte Resources, Inc., shall continuously maintain an approved surety instrument for the Crow Butte Project, in favor of the State of Nebraska in the amount of no less than $47,740,447 for the purpose of complying with 10 CFR Part 40, Appendix A, Criterion 9, until a replacement is authorized by both the State of Nebraska and NRC.

**Staff Review and Analysis of LC 9.5**

By letter dated January 14, 2021 (NRC, 2021), the NRC staff transmitted its verification of the licensee's submittal (CBR, 2020e) related to LC 9.5 specifying the amount of financial assurance required for decommissioning. The amount verified by the NRC staff was $51,383,364. Therefore, the NRC staff will amend LC 9.5 to reflect this revised surety amount.

The revised portion of LC 9.5 states:

> Crow Butte Resources, Inc., shall continuously maintain an approved surety instrument for the Crow Butte Project, in favor of the State of Nebraska in the amount of no less than $51,383,364 for the purpose of complying with 10 CFR Part 40, Appendix A, Criterion 9, until a replacement is authorized by both the State of Nebraska and NRC.

**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 a recent annual report with measured emissions from the licensee's operations (refer to Section 2.2.4 of CBR, 2019b). 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, 2020d). Measured values from 1991 to 2007 (refer to Figures 5.8-10 through 5.8-16 of CBR, 2007) and the latest values available from 2016–2018 (refer to Table 17 of CBR, 2019b) 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 a recent (2016–2018) individual occupational radiation exposure data (CBR, 2019b). 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 2018 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.

In addition, the NRC staff has determined that an EA or EIS is not required for changing the surety amount. This action is categorically excluded under 10 CFR 51.22(c)(10)(i).

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.” Cameco Resources Crow Butte Operation, Source Materials License SUA-1534,

CBR, 2020a. Cameco Resources - Revision to December 9, 2019 Request for Alternate Decommissioning (Groundwater Restoration) Schedule - License SUA-1534, Source Materials License SUA-1534, August 3, 2020, ADAMS Accession No. ML20234A424.

CBR, 2020b. Cameco Resources - Request for Additional Information (RAI) Response Alternate Decommissioning (Groundwater Restoration) Schedule, Source Materials License SUA-1534, July 23, 2020, ADAMS Accession No. ML20234A423.

CBR, 2020c. Supplemental information to Alternate Decommissioning Schedule submitted on December 9, 2019, Cameco Resources Crow Butte Operation, Source Materials License SUA-1534, January 28, 2020, ADAMS Accession No. ML20035D684.

CBR, 2020d. Semiannual Radiological Effluent and Environmental Monitoring Report, Source Materials License No. SUA-1534, Docket No. 40-8943, August 27, 2020, ADAMS Accession No. ML20248H492.

CBR, 2020e. 2021 Surety Estimate, Cameco Resources Crow Butte Operation, Source Materials License SUA-1534, September 28, 2020, ADAMS Accession No. ML20290A466 (original) and ML20311A136 (corrected).

CBR, 2019a. Request for Alternate Decommissioning (Groundwater Restoration) Schedule, Cameco Resources Crow Butte Operation, Source Materials License SUA-1534, December 9, 2019, ADAMS Accession No. ML19353A473.

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NRC, 2018. Crow Butte Resources, Inc., Materials License SUA-1534, Amendment No. 4, December 14, 2018, ADAMS Accession No. ML18268A212.

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.