

**CAMECO RESOURCES
CROW BUTTE OPERATION**



**86 Crow Butte Road
P.O. Box 169
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**(308) 665-2215
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August 3, 2020

40-8943

**CERTIFIED MAIL
RETURN RECEIPT REQUESTED**

Attn: Document Control Desk, Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Revision to December 9, 2019 Request for Alternate Decommissioning (Groundwater Restoration) Schedule
License SUA-1534 (November 2014)

Dear Director:

On February 5, 2018, Cameco Resources announced its plan to cease production at its U.S. operations due to continued low uranium prices. At that time, Cameco Resources, Crow Butte Operation (CBO), committed to providing NRC with an alternate decommissioning schedule for the full site. In order to meet this commitment and in accordance with 10 CFR 40.42 and 10 CFR 40.44, CBO submitted a license amendment request on NRC Form 313 for an alternate decommissioning (groundwater restoration) schedule for Mine Units (MU) 2-11. This submittal is dated December 9, 2019. The submittal remains under staff review.

The enclosed document is a revision to the request that was submitted on December 9, 2019. MUs 2-5 have been in stability monitoring since the third quarter of 2018, with the exception of MU 2, which has been in stability monitoring since 2013. Based on the sampling results collected since 2018, CBO has determined that MUs 2 and 4 require additional treatment. This reality also impacts the projected restoration schedule for both MUs 6 and 7, because some resources will need to be redirected from these mine units to MUs 2 and 4 in the near term. CBO does not project that the restoration schedule for MUs 8-11 will be impacted by these changes. The attached document provides more detail on these changes.

If there are any further questions or concerns feel free to contact me at (308) 665-2215 ext. 117.

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Sincerely,

A handwritten signature in black ink that reads "Walter D. Nelson". The signature is written in a cursive style with a long horizontal stroke extending to the right.

Walter D. Nelson
SHEQ Coordinator

Enclosure

cc: Deputy Director
Division of Decommissioning
Uranium Recovery and Waste Programs
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Mail Stop T-8F5
11545 Rockville Pike
Two White Flint North, Rockville, MD 20852-2738

CBO- File

ec: CR-Electronic File

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**Attachment to NRC Form 313
Request for License Amendment as revised August 3, 2020**

Request to Amend License Condition 10.6
Alternate Decommissioning (Groundwater Restoration) Schedule
License SUA-1534 (November 2014)

Based on the conditions that are included in the following summary of the restoration activities, CBO is requesting a revision to the approved restoration dates and an amendment to License Condition 10.6.

Mine Unit #2

History

The restoration plan for this mine unit was submitted to NDEQ on December 5, 1995 and was approved by NDEQ in a letter dated December 15, 1995. Injection of lixiviant into this mine unit ceased on January 2, 1996. Since that time period, the mine unit has been in IX and RO treatment and stability monitoring with the following exception.

On August 9, 2007 the entire restoration circuit was shut down so that changes could be made to increase the flow through IX and RO treatment. During this time period the mine unit was in recirculation to maintain a hydrologic bleed until April 1, 2009, when IX treatment resumed in this mine unit. On May 26, 2009, the RO circuit was restarted and this mine unit was placed back into RO treatment.

In February 2009, Crow Butte contracted with a third party hydrogeologist to develop a restoration flow model for Mine Units 2 through 5. The groundwater flow at the facility was simulated using MODFLOW2000, a three-dimensional groundwater flow model developed by the United States Geological Survey. The groundwater flow model was calibrated to pre-mining conditions using water level data collected prior to the mining activities in January 1983. Initial estimates of aquifer properties and boundary water levels were adjusted slightly as part of the model calibration process in order to achieve the best possible match between observed and simulated water levels. The calibrated groundwater flow model is currently being used to optimize restoration in Mine Units 2 through 5 given certain practical limitations on treatment rates, disposal capacity, and existing well injection and extraction rates. The model is calibrated periodically to reflect current mine conditions. Based on this model, eight additional restoration wells were installed to remediate the excursion of lixiviant along the perimeter monitor wells PR-8,

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PR-15, and IJ13-P. On February 1, 2010 the Safety Environmental Review Panel approved the startup of these additional wells.

Based on these conditions, it was estimated that Mine Unit 2 would be placed into stability monitoring by July 1, 2012. By letter dated August 20, 2009 and Technical Evaluation Report dated August 5, 2009, the NRC approved CBO's request to complete groundwater restoration in Mine Unit 2 by July 1, 2012.

Current Status

On May 23, 2013, CBO submitted to the Nebraska Department of Environmental Quality (NDEQ) data supporting the successful restoration of the groundwater in Mine Unit #2. By letter June 10, 2013, the NDEQ indicated that the data had been reviewed and determined that stabilization could begin. Stability monitoring and sampling was initiated in June 2013 and continued through September 2014. The data indicates that all the monitored constituents have stabilized and have been returned to the approved NDEQ restoration standards. However, a few of the monitored constituents do not meet the concentration limits under 10 CFR 40, Appendix A, Criterion 5B(5). As a result of this, CBO has collected coring data from this mine unit and anticipates submitting an application requesting an alternate concentration limit (ACL) for these constituents. CBO collected guideline-8 samples from the baseline restoration wells in Mine Unit 2 in November, 2019, and again in May, 2020. Based on these sample results, CBO has determined that additional treatment is required in Mine Unit 2. CBO anticipates initiating this treatment in the fourth quarter of 2020, and continuing treatment through the second quarter of 2021. Following completion of treatment, CBO projects stability monitoring will begin in the third quarter of 2021 and continue through the second quarter of 2023. If an ACL is required, CBO projects that this submittal will be submitted during the third quarter of 2023, with regulatory review completed by the third quarter of 2025.

Mine Unit #3

History

The restoration plan for this mine unit was submitted to NDEQ on March 24, 1999 and was amended and approved by NDEQ in a letter dated February 13, 2008. Injection of lixiviant into this mine unit ceased on July 22, 1999. Since that time period, the mine unit has been in IX and RO treatment and stability monitoring with the following exception.

On August 9, 2007 the entire restoration circuit was shut down so that changes could be made to increase the flow through IX and RO treatment. During this time period the mine unit was in recirculation to maintain a hydrologic bleed until April 1, 2009, when

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IX treatment resumed in this mine unit. On May 26, 2009, the RO circuit was restarted and this mine unit was placed back into RO treatment.

In February 2009, Crow Butte contracted with a third party hydrogeologist to develop a restoration flow model for Mine Units 2 through 5. The groundwater flow at the facility was simulated using MODFLOW2000, a three-dimensional groundwater flow model developed by the United States Geological Survey. The groundwater flow model was calibrated to pre-mining conditions using water level data collected prior to the mining activities in January 1983. Initial estimates of aquifer properties and boundary water levels were adjusted slightly as part of the model calibration process in order to achieve the best possible match between observed and simulated water levels. The calibrated groundwater flow model was used to optimize restoration in Mine Units 2 through 5 given certain practical limitations on treatment rates, disposal capacity, and existing well injection and extraction rates. Based on this model, eight additional restoration wells were installed to remediate the excursion of lixiviant along the perimeter monitor wells PR-8, PR-15, and IJ13-P. On February 1, 2010 the Safety Environmental Review Panel approved the startup of these additional wells.

Based on these conditions, it was estimated that Mine Unit 3 would be placed into stability monitoring by July 1, 2013. By letter dated August 20, 2009 and Technical Evaluation Report dated August 5, 2009, the NRC approved CBO's request to complete groundwater restoration in Mine Unit 3 by July 1, 2013.

On May 23, 2013, CBO submitted to the Nebraska Department of Environmental Quality (NDEQ) data supporting the successful restoration of the groundwater in Mine Unit #3. By letter June 10, 2013, the NDEQ indicated that the data had been reviewed and determined that stabilization could begin. Stability monitoring and sampling was initiated in June 2013 and continued through September 2014. The data indicates that all the monitored constituents have stabilized and have been returned to the approved NDEQ restoration standards. However, a few of the monitored constituents do not meet the concentration limits under 10 CFR 40, Appendix A, Criterion 5B(5). As a result of this, CBO has collected coring data from this mine unit and anticipates submitting an application requesting an ACL for these constituents.

Current Status

On September 15, 2017, spot treatment of P246 in Mine Unit 3 was reinitiated after in-house samples indicated that the uranium levels in the well had increased significantly. Additional sampling indicated that the likely source of the elevated uranium levels in the well was an incursion of solutions from neighboring Mine Unit 7. In addition to spot treating the well, CBO initiated a conductivity monitoring program utilizing downhole trolls around the Mine Unit 2 and 3 perimeters that interface with active Mine Units 4, 5,



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and 7. Spot treatment in this area was completed during the third quarter of 2018. The first stability samples following completion of spot treatment were collected on September 4, 2018. CBO projects that an ACL application will be submitted during the fourth quarter of 2021 with regulatory review finished during the fourth quarter of 2023.

Mine Unit #4

History

The restoration plan for this mine unit was submitted to NDEQ on March 4, 2003 and was approved by NDEQ in a letter dated August 26, 2003. Injection of lixiviant into this mine unit ceased on October 31, 2003. Since that time period the mine unit has been in IX and RO treatment with the same exceptions as Mine Unit 2. On April 1, 2009, IX and RO treatment was resumed in this mine unit. Based on these conditions, it was estimated that Mine Unit 4 would be placed into stability monitoring by January 1, 2015. By letter dated August 20, 2009 and Technical Evaluation Report dated August 5, 2009, the NRC approved CBO's request to complete groundwater restoration in Mine Unit 4 by January 1, 2015.

Current Status

The mine unit has been in stability monitoring since September, 2018. Based on the sampling results, CBO has identified several areas in the mine unit that are in need of additional treatment. CBO anticipates initiating treatment in the fourth quarter of 2020, and continuing through the second quarter of 2021. The mine unit will then be placed in stability monitoring from the third quarter of 2021 through the second quarter of 2023. CBO anticipates an ACL submittal in the third quarter of 2023, with regulatory review finished during the third quarter of 2025.

Mine Unit #5

History

The restoration plan for this mine unit was submitted to NDEQ on July 9, 2007 and was approved by NDEQ in a letter dated August 6, 2007. Injection of lixiviant into this mine unit ceased on August 14, 2007. Since that time period the mine unit has been in IX and RO treatment with the same exceptions as Mine Unit 2. On April 1, 2009, IX and RO treatment was resumed in this mine unit. Based on these conditions, it was estimated that Mine Unit 5 would be placed into stability monitoring by July 1, 2016. By letter dated August 20, 2009 and Technical Evaluation Report dated August 5, 2009, the NRC approved CBO's request to complete groundwater restoration in Mine Unit 5 by July 1, 2016.

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Current Status

The mine unit is currently in stability monitoring. Stability monitoring was initiated in the third quarter of 2018, slightly ahead of the MODFLOW2000 model projections. If an ACL is required, CBO anticipates submitting the application during the fourth quarter of 2022. It is estimated that the regulatory review will be completed during the fourth quarter of 2024.

Mine Unit #6

History

On October 28, 2010, CBO permanently ceased injection of lixiviant into the mine unit. By letter dated December 21, 2010, CBO provided notice of cessation of mining in Mine Unit #6. As specified in 10 CFR Part 40.42(h)(1), CBO must also complete mine unit restoration within 24 months after restoration is initiated. If the mine unit requires more than 24 months to complete, CBO must notify the NRC and request an alternate schedule for completion of decommissioning, along with adequate justification for the request. The following table was submitted displaying the schedule and timeline for the various phases of restoration for the mine unit.

<u>IX Treatment</u>	<u>Flow</u>
November 1, 2010 through June 30, 2014 (3 pore volumes)	100 GPM
<u>RO Treatment</u>	
July 1, 2014 through June 30, 2016 (6 pore volumes)	400 GPM
<u>Recirculation</u>	
July 1, 2016 through December 31, 2014 (2 pore volumes)	200 GPM
<u>Stability and Regulatory Approval</u>	
January 1, 2018 through December 31, 2019	N/A

Current Status

Mine Unit 6 is currently in IX and RO treatment. Based on the MODFLOW2000 model, stability monitoring of the mine unit should begin during the third quarter of 2021. If an ACL is required, CBO anticipates submitting the application during the third quarter of 2023. It is estimated that the regulatory review will be completed during the third quarter of 2025.

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Mine Unit #7

History

On September 6, 2018, CBO permanently ceased mining activities in the mine unit. By letter dated November 6, 2018, CBO provided notice of cessation of mining in Mine Unit #7.

Current Status

Mine Unit #7 is currently in reverse osmosis treatment. Based on the MODFLOW 2000 model for this mine unit, CBO projects that treatment and recirculation of Mine Unit # 7 will continue through the third quarter of 2022. It will enter stability monitoring in the fourth quarter of 2022. If an ACL is required, CBO anticipates submitting the application during the first quarter of 2025. It is estimated that the regulatory review will be completed during the fourth quarter of 2026.

Mine Unit #8

History

As referenced earlier, Cameco announced plans to cease production at its U.S. operations on February 5, 2018, and committed to providing an alternate decommissioning schedule for the remaining mine units within 24 months. Injection in Mine Unit #8 ceased at that time.

Current Status

At this time, a small bleed is maintained in Mine Unit #8 to control excursions. Based on operational capabilities and waste water disposal capacity, CBO projects that Mine Unit #8 will enter into treatment during the second quarter of 2021. Stability monitoring will be initiated during the first quarter of 2025. If an ACL is required, the application will be submitted during the first quarter of 2027. It is estimated that the regulatory review will be completed during the first quarter of 2029.

Mine Unit #9

History

As referenced earlier, Cameco announced plans to cease production at its U.S. operations on February 5, 2018, and committed to providing an alternate decommissioning schedule



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for the remaining mine units within 24 months. Injection in Mine Unit #9 ceased at that time.

Current Status

At this time, a small bleed is maintained in Mine Unit #9 to control excursions. Based on operational capabilities and waste water disposal capacity, CBO projects that Mine Unit #9 will enter into treatment during the third quarter of 2029. Stability monitoring will be initiated during the second quarter of 2032. If an ACL is required, the application will be submitted during the second quarter of 2034. It is estimated that the regulatory review will be completed during the second quarter of 2036.

Mine Unit #10

History

As referenced earlier, Cameco announced plans to cease production at its U.S. operations on February 5, 2018, and committed to providing an alternate decommissioning schedule for the remaining mine units within 24 months. Injection in Mine Unit #10 ceased at that time.

Current Status

At this time, a small bleed is maintained in Mine Unit #10 to control excursions. Based on operational capabilities and waste water disposal capacity, CBO projects that Mine Unit #10 will enter into treatment during the third quarter of 2024. Stability monitoring will be initiated during the first quarter of 2030. If an ACL is required, the application will be submitted during the first quarter of 2032. It is estimated that the regulatory review will be completed during the first quarter of 2034.

Mine Unit #11

History

As referenced earlier, Cameco announced plans to cease production at its U.S. operations on February 5, 2018, and committed to providing an alternate decommissioning schedule for the remaining mine units within 24 months. Injection in Mine Unit #11 ceased at that time.

Current Status

At this time, a small bleed is maintained in Mine Unit #11 to control excursions. Based on operational capabilities and waste water disposal capacity, CBO projects that Mine Unit #11 will enter into treatment during the fourth quarter of 2031. Stability monitoring

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will be initiated during the third quarter of 2036. If an ACL is required, the application will be submitted during the third quarter of 2038. It is estimated that the regulatory review will be completed during the third quarter of 2040.

Conclusion

Attached is a schedule that displays the timeline for the various phases of restoration for each mine unit. This schedule is based on the flow capacity through the IX and RO circuits, the volume of waste water generated in these circuits, the pore volume of each mine unit and regulatory review. The size of the mine units, flow and piping capacity of the restoration circuit, deepwell disposal capacity, and the need to maintain a hydrologic balance between the mining and restoration units creates a technical barrier for restoring each mine unit in a two year period. CBO believes that the alternate schedule is technically feasible and will not be detrimental to the public health and safety and is otherwise in the public interest.

