



**CAMECO RESOURCES
CROW BUTTE OPERATION**

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September 14, 2021

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

Semiannual Radiological Effluent and Environmental Monitoring Report Supplemental Submittal
Source Materials License No. SUA-1534, Docket No. 40-8943

Dear Document Control:

On August 26, 2021, Crow Butte Operation submitted the Semiannual Radiological Effluent and Environmental Monitoring Report. The radionuclide concentration air monitor station results for the second quarter were not available at the time the report was submitted due to rerun samples at the contract laboratory. CBO committed to providing these results when they became available. The results are attached to this supplemental submittal under the heading "Appendix I" as they would have been in the original report. The results are formatted as they would have been in the original report and include results for the first and second quarters. The results fall within the historical ranges for radionuclide concentration air monitoring

If you have any questions concerning the report, please feel free to call me at (308) 665-2215 Ext 117.

Sincerely,
CAMECO RESOURCES
CROW BUTTE OPERATION

Walter D. Nelson
SHEQ Coordinator

cc: Ron Burrows – NRC
CBO – File
ec: Amanda Jones – NDEQ Program Coordinator
CR – Electronic File

IE48
IE25
NM5520

NM55

Appendix I

Environmental Air Monitoring Results

First and Second Quarter, 2021

Crow Butte Resources, Inc.
Crow Butte Uranium Project

Track Etch Cup Ambient Radon Concentrations

*Air
Monitoring
Station No.*

Period: January 4, 2021 to July 1, 2021

| | Gross Count | Average Radon Concentration (x 10 ⁻⁹ μCi/ml) | Accuracy (x 10 ⁻⁹ μCi/ml) | Percent Effluent Concentration |
|---|-------------|---|---|-----------------------------------|
| AM-1 | 25.0 | 0.14 | 0.03 | 1.4% |
| AM-2 | 32.0 | 0.19 | 0.03 | 1.9% |
| AM-3 | 27.0 | 0.16 | 0.03 | 1.6% |
| AM-4 | 27.0 | 0.16 | 0.03 | 1.6% |
| AM-5 | 37.0 | 0.22 | 0.04 | 2.2% |
| AM-6A | 30.0 | 0.16 | 0.03 | 1.6% |
| AM-6B | 28.0 | 0.16 | 0.03 | 1.6% |
| AM-6C | 24.0 | 0.14 | 0.03 | 1.4% |
| AM-6D | 32.0 | 0.19 | 0.03 | 1.9% |
| AM-6E | 24.0 | 0.14 | 0.03 | 1.4% |
| AM-6F | 30.0 | 0.16 | 0.03 | 1.6% |
| AM-8 | 28.0 | 0.16 | 0.03 | 1.6% |
| AM-9A | 25.0 | 0.14 | 0.03 | 1.4% |
| AM-9B | 28.0 | 0.16 | 0.03 | 1.6% |
| AM-9C | 28.0 | 0.16 | 0.03 | 1.6% |
| AM-9D | 23.0 | 0.14 | 0.03 | 1.4% |
| AM-9E | 29.0 | 0.16 | 0.03 | 1.6% |
| AM-9F | 24.0 | 0.14 | 0.03 | 1.4% |
| LLD (x 10 ⁻⁹ μCi/ml) | | | | 0.2 |
| Effluent Concentration Limit, 10 CFR 20 App B Column 2: | | | | 10 |



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1673 Terra Avenue Sheridan, WY 82801

ph: (307) 672-8945

Air Filter Summary Report

Client: Cameco Resources, Crow Butte Operation

Client Sampler ID: AM-1

| Lab ID: S2107161-001 | | | | | Sample Air Volume: 6006958 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 80.0 | 10.7 | 1.3E-14 | 1.8E-15 | 2E-15 | 6 E-13 | Day | 2.2 |
| Radium 226 | 0.4 | 0.2 | 7.1E-17 | 3.3E-17 | 1E-16 | 9 E-13 | Week | 0.0079 |
| Thorium 230 | 0.18 | 0.2 | 0.0E+0 | 3.3E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.7 | | 1.2E-16 | | 1E-16 | 9 E-14 | Year | 0.13 |

| Lab ID: S2104097-001 | | | | | Sample Air Volume: 6217257 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 107 | 6.5 | 1.7E-14 | 1.0E-15 | 2E-15 | 6 E-13 | Day | 2.8 |
| Radium 226 | 0.22 | 0.1 | 3.6E-17 | 1.6E-17 | 1E-16 | 9 E-13 | Week | 0.0040 |
| Thorium 230 | 0.15 | 0.2 | 0.0E+0 | 3.2E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.2 | | 2.9E-17 | | 1E-16 | 9 E-14 | Year | 0.032 |

| Lab ID: S2107161-002 | | | | | Sample Air Volume: 6511646 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 96.5 | 12.1 | 1.5E-14 | 1.9E-15 | 2E-15 | 6 E-13 | Day | 2.5 |
| Radium 226 | 0.3 | 0.2 | 5.2E-17 | 3.1E-17 | 1E-16 | 9 E-13 | Week | 0.0058 |
| Thorium 230 | 0.5 | 0.3 | 8.0E-17 | 4.6E-17 | 1E-16 | 3 E-14 | Year | 0.27 |
| Uranium | 0.4 | | 6.7E-17 | | 1E-16 | 9 E-14 | Year | 0.074 |

| Lab ID: S2104097-002 | | | | | Sample Air Volume: 6227173 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 110 | 6.4 | 1.8E-14 | 1.0E-15 | 2E-15 | 6 E-13 | Day | 3.0 |
| Radium 226 | 0.3 | 0.1 | 4.9E-17 | 1.6E-17 | 1E-16 | 9 E-13 | Week | 0.0054 |
| Thorium 230 | 0.13 | 0.1 | 0.0E+0 | 1.6E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.2 | | 3.3E-17 | | 1E-16 | 9 E-14 | Year | 0.037 |



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Air Filter Summary Report

Client: Cameco Resources, Crow Butte Operation

Client Sampler ID: AM-3

| Lab ID: S2107161-003 | | | | | Sample Air Volume: 6494027 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 74.1 | 11.2 | 1.1E-14 | 1.7E-15 | 2E-15 | 6 E-13 | Day | 1.8 |
| Radium 226 | 0.14 | 0.2 | 2.3E-17 | 3.1E-17 | 1E-16 | 9 E-13 | Week | 0.0026 |
| Thorium 230 | 0.17 | 0.1 | 0.0E+0 | 1.5E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.6 | | 9.3E-17 | | 1E-16 | 9 E-14 | Year | 0.10 |

| Lab ID: S2104097-003 | | | | | Sample Air Volume: 6237090 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 118 | 6.7 | 1.9E-14 | 1.1E-15 | 2E-15 | 6 E-13 | Day | 3.2 |
| Radium 226 | 0.14 | 0.1 | 2.4E-17 | 1.6E-17 | 1E-16 | 9 E-13 | Week | 0.0027 |
| Thorium 230 | 0.0 | 0 | 0.0E+0 | 0.0E+0 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.2 | | 3.3E-17 | | 1E-16 | 9 E-14 | Year | 0.037 |

Client Sampler ID: AM-4

| Lab ID: S2107161-004 | | | | | Sample Air Volume: 6512621 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 84.5 | 16.9 | 1.3E-14 | 2.6E-15 | 2E-15 | 6 E-13 | Day | 2.2 |
| Radium 226 | 0.5 | 0.2 | 8.1E-17 | 3.1E-17 | 1E-16 | 9 E-13 | Week | 0.0090 |
| Thorium 230 | 0.21 | 0.2 | 3.3E-17 | 3.1E-17 | 1E-16 | 3 E-14 | Year | 0.11 |
| Uranium | 0.5 | | 7.5E-17 | | 1E-16 | 9 E-14 | Year | 0.083 |

| Lab ID: S2104097-004 | | | | | Sample Air Volume: 6233739 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 126 | 7.3 | 2.0E-14 | 1.2E-15 | 2E-15 | 6 E-13 | Day | 3.3 |
| Radium 226 | 0.16 | 0.1 | 2.7E-17 | 1.6E-17 | 1E-16 | 9 E-13 | Week | 0.0030 |
| Thorium 230 | 0.08 | 0.1 | 0.0E+0 | 1.6E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.3 | | 4.6E-17 | | 1E-16 | 9 E-14 | Year | 0.051 |



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Air Filter Summary Report

Client: Cameco Resources, Crow Butte Operation

Client Sampler ID: AM-5

| Lab ID: S2107161-005 | | | | | Sample Air Volume: 6514962 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 113 | 12.6 | 1.7E-14 | 1.9E-15 | 2E-15 | 6 E-13 | Day | 2.8 |
| Radium 226 | 0.04 | 0.1 | 0.0E+0 | 1.5E-17 | 1E-16 | 9 E-13 | Week | 0 |
| Thorium 230 | 0.06 | 0.1 | 0.0E+0 | 1.5E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.3 | | 4.9E-17 | | 1E-16 | 9 E-14 | Year | 0.054 |

| Lab ID: S2104097-005 | | | | | Sample Air Volume: 6227893 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 111 | 6.4 | 1.8E-14 | 1.0E-15 | 2E-15 | 6 E-13 | Day | 3.0 |
| Radium 226 | 0.19 | 0.1 | 3.2E-17 | 1.6E-17 | 1E-16 | 9 E-13 | Week | 0.0036 |
| Thorium 230 | 0.22 | 0.2 | 3.6E-17 | 3.2E-17 | 1E-16 | 3 E-14 | Year | 0.12 |
| Uranium | 0.2 | | 3.6E-17 | | 1E-16 | 9 E-14 | Year | 0.040 |

Client Sampler ID: AM-6

| Lab ID: S2107161-006 | | | | | Sample Air Volume: 6026450 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 111 | 10.8 | 1.8E-14 | 1.8E-15 | 2E-15 | 6 E-13 | Day | 3.0 |
| Radium 226 | 0.4 | 0.1 | 7.3E-17 | 1.7E-17 | 1E-16 | 9 E-13 | Week | 0.0081 |
| Thorium 230 | 0.08 | 0.1 | 0.0E+0 | 1.7E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | <0.3 | | 4.8E-17 | | 1E-16 | 9 E-14 | Year | 0.053 |

| Lab ID: S2104097-006 | | | | | Sample Air Volume: 5837632 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 187 | 9.2 | 3.2E-14 | 1.6E-15 | 2E-15 | 6 E-13 | Day | 5.3 |
| Radium 226 | 0.13 | 0.1 | 2.4E-17 | 1.7E-17 | 1E-16 | 9 E-13 | Week | 0.0027 |
| Thorium 230 | 0.09 | 0.1 | 0.0E+0 | 1.7E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.3 | | 4.3E-17 | | 1E-16 | 9 E-14 | Year | 0.048 |



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Air Filter Summary Report

Client: Cameco Resources, Crow Butte Operation

Client Sampler ID: AM-8

| Lab ID: S2107161-007 | | | | | Sample Air Volume: 6520564 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 87.7 | 11.7 | 1.3E-14 | 1.8E-15 | 2E-15 | 6 E-13 | Day | 2.2 |
| Radium 226 | 0.20 | 0.1 | 3.1E-17 | 1.5E-17 | 1E-16 | 9 E-13 | Week | 0.0034 |
| Thorium 230 | 0.22 | 0.2 | 3.4E-17 | 3.1E-17 | 1E-16 | 3 E-14 | Year | 0.11 |
| Uranium | 0.6 | | 9.6E-17 | | 1E-16 | 9 E-14 | Year | 0.11 |

| Lab ID: S2104097-007 | | | | | Sample Air Volume: 6230870 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 126 | 7.6 | 2.0E-14 | 1.2E-15 | 2E-15 | 6 E-13 | Day | 3.3 |
| Radium 226 | 0.19 | 0.1 | 3.2E-17 | 1.6E-17 | 1E-16 | 9 E-13 | Week | 0.0036 |
| Thorium 230 | 0.23 | 0.2 | 3.8E-17 | 3.2E-17 | 1E-16 | 3 E-14 | Year | 0.13 |
| Uranium | 0.2 | | 3.3E-17 | | 1E-16 | 9 E-14 | Year | 0.037 |

Client Sampler ID: AM-9

| Lab ID: S2107161-008 | | | | | Sample Air Volume: 6505447 Liters | | | |
|--------------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 4/1/21-7/1/21 (2021 2nd Qtr) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 87.6 | 11.4 | 1.3E-14 | 1.8E-15 | 2E-15 | 6 E-13 | Day | 2.2 |
| Radium 226 | 0.24 | 0.1 | 3.8E-17 | 1.5E-17 | 1E-16 | 9 E-13 | Week | 0.0042 |
| Thorium 230 | 0.23 | 0.2 | 3.5E-17 | 3.1E-17 | 1E-16 | 3 E-14 | Year | 0.12 |
| Uranium | 0.4 | | 5.5E-17 | | 1E-16 | 9 E-14 | Year | 0.061 |

| Lab ID: S2104097-008 | | | | | Sample Air Volume: 5912094 Liters | | | |
|---------------------------------|----------------------|---------------------------|------------------|-----------------------|-----------------------------------|--------------------------------|-------------------|---------------------|
| Sampled 1/4/21-4/1/21 (2021 Q1) | | | | | | | | |
| Analyte | Result pCi/filter | Precision ± pCi/filter | Result µCi/ml | Precision ± µCi/ml | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Conc. |
| Lead 210 | 117 | 9.9 | 2.0E-14 | 1.7E-15 | 2E-15 | 6 E-13 | Day | 3.3 |
| Radium 226 | 0.3 | 0.2 | 5.3E-17 | 3.4E-17 | 1E-16 | 9 E-13 | Week | 0.0059 |
| Thorium 230 | 0.16 | 0.1 | 0.0E+0 | 1.7E-17 | 1E-16 | 3 E-14 | Year | 0 |
| Uranium | 0.2 | | 3.6E-17 | | 1E-16 | 9 E-14 | Year | 0.040 |

Effluent Limits are from 10 CFR Part 20 Appendix B Table 2

ND - Not Detected at the Reporting Limit