



March 11, 2019  
YRS:19:002

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk (03-H8)  
Director, Office of Nuclear Material Safety and Safeguards  
One White Flint North  
11555 Rockville Pike  
Rockville, Maryland 20852-2738

**License SNM-1227**  
**Docket 70-1257**

**Subject: Required Reporting of Effluents per 10 CFR 70.59**

As required by 10 CFR 70.59, Framatome is reporting discharges of radioactive materials in the effluents from its nuclear fuels fabrication plant on Horn Rapids Road in Richland, Washington for the period from July 1 through December 31, 2018.

The total exposure from all stacks is 2.05E-05 mrem. Doses were determined using CAP88 Version 4.

If there are any questions, please contact me at (509) 375-8355

Very truly yours,

A handwritten signature in dark ink, appearing to read "Y.R. Sakach", written over a circular stamp or seal.

Y.R. Sakach  
Radiation Protection  
Attachments

cc: L. A. Dudes, U.S. Nuclear Regulatory Commission, Region II  
P. J. Martell, State of Washington Department of Health  
R. Gibson, U. S. Nuclear Regulatory Commission, Region II  
M. Elsen, Director, Office of Radiation Protection (WDOH)

**I. Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **UO<sub>2</sub> Building – Room 100 (K03)**  
Average Flow Rate: 15.90 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 8.00E-16  | 4.00E-15   | 3.00E-17                                      | 2.02E-01   | NA                                       |
| Gross beta          | 9.00E-15  | 1.00E-14   | 9.00E-17                                      | 2.15E+00   | NA                                       |
| U-232               | 2.00E-24  | 7.00E-24   | 6.00E-26                                      | 4.05E-10   | 2.64E-15                                 |
| U-234               | 2.00E-18  | 7.00E-18   | 6.00E-20                                      | 4.05E-04   | 2.64E-09                                 |
| U-235               | 4.00E-17  | 2.00E-16   | 1.00E-18                                      | 1.01E-02   | 6.60E-08                                 |
| U-236               | 2.00E-17  | 9.00E-17   | 7.00E-19                                      | 5.06E-03   | 3.30E-08                                 |
| U-238               | 8.00E-16  | 3.00E-15   | 3.00E-17                                      | 1.87E-01   | 1.22E-06                                 |

Stack: **SF Building – NAF(K06)**  
Average Flow Rate: 5.94 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 6.00E-16  | 5.00E-15   | 8.00E-17                                      | 5.98E-02   | NA                                       |
| Gross beta          | 7.00E-15  | 2.00E-14   | 2.00E-16                                      | 6.60E-01   | NA                                       |
| U-232               | 1.00E-24  | 1.00E-23   | 2.00E-25                                      | 1.20E-10   | 8.48E-16                                 |
| U-234               | 1.00E-18  | 1.00E-17   | 2.00E-19                                      | 1.20E-04   | 8.48E-10                                 |
| U-235               | 3.00E-17  | 3.00E-16   | 4.00E-18                                      | 2.99E-03   | 2.12E-08                                 |
| U-236               | 2.00E-17  | 1.00E-16   | 2.00E-18                                      | 1.50E-03   | 1.06E-08                                 |
| U-238               | 6.00E-16  | 5.00E-15   | 7.00E-17                                      | 5.52E-02   | 3.91E-07                                 |

Stack: **UO<sub>2</sub> Building – Room 182 (K21)**  
Average Flow Rate: 3.94 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 2.00E-15  | 1.00E-14   | 1.00E-16                                      | 1.34E-01   | NA                                       |
| Gross beta          | 5.00E-14  | 6.00E-14   | 4.00E-16                                      | 2.80E+00   | NA                                       |
| U-232               | 4.00E-24  | 2.00E-23   | 2.00E-25                                      | 2.68E-10   | 2.88E-15                                 |
| U-234               | 4.00E-18  | 2.00E-17   | 2.00E-19                                      | 2.68E-04   | 2.88E-09                                 |
| U-235               | 1.00E-16  | 6.00E-16   | 6.00E-18                                      | 6.71E-03   | 7.20E-08                                 |
| U-236               | 5.00E-17  | 3.00E-16   | 3.00E-18                                      | 3.35E-03   | 3.60E-08                                 |
| U-238               | 2.00E-15  | 1.00E-14   | 1.00E-16                                      | 1.24E-01   | 1.33E-06                                 |

**I. Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **ELO Building – Shop (K25)**

Average Flow Rate: 1.24 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 7.00E-16  | 1.00E-14   | 4.00E-16                                      | 1.55E-02   | NA                                       |
| Gross beta          | 1.00E-14  | 5.00E-14   | 1.00E-15                                      | 1.90E-01   | NA                                       |
| U-232               | 1.00E-24  | 3.00E-23   | 8.00E-25                                      | 3.10E-11   | 1.63E-15                                 |
| U-234               | 1.00E-18  | 3.00E-17   | 8.00E-19                                      | 3.10E-05   | 1.63E-09                                 |
| U-235               | 4.00E-17  | 7.00E-16   | 2.00E-17                                      | 7.75E-04   | 4.09E-08                                 |
| U-236               | 2.00E-17  | 3.00E-16   | 9.00E-18                                      | 3.87E-04   | 2.04E-08                                 |
| U-238               | 7.00E-16  | 1.00E-14   | 3.00E-16                                      | 1.43E-02   | 7.54E-07                                 |

Stack: **UO<sub>2</sub> Building – ADU (K31)**

Average Flow Rate: 3.69 cubic meters/second

\* There are several sampled effluent streams discharged via this stack.

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 9.00E-15  | 7.00E-15   | 1.00E-16                                      | 1.40E-01   | NA                                       |
| Gross beta          | 4.00E-14  | 2.00E-14   | 4.00E-16                                      | 1.63E+00   | NA                                       |
| U-232               | 2.00E-23  | 1.00E-23   | 3.00E-25                                      | 2.79E-10   | 1.20E-15                                 |
| U-234               | 2.00E-17  | 1.00E-17   | 3.00E-19                                      | 2.79E-04   | 1.20E-09                                 |
| U-235               | 4.00E-16  | 3.00E-16   | 6.00E-18                                      | 6.98E-03   | 3.00E-08                                 |
| U-236               | 2.00E-16  | 2.00E-16   | 3.00E-18                                      | 3.49E-03   | 1.50E-08                                 |
| U-238               | 8.00E-15  | 6.00E-15   | 1.00E-16                                      | 1.29E-01   | 5.53E-07                                 |

Stack: **UO<sub>2</sub> Building – U<sub>3</sub>O<sub>8</sub> (K37)**

Average Flow Rate: 6.47 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 9.00E-16  | 6.00E-15   | 7.00E-17                                      | 8.93E-02   | NA                                       |
| Gross beta          | 9.00E-15  | 2.00E-14   | 2.00E-16                                      | 9.32E-01   | NA                                       |
| U-232               | 2.00E-24  | 1.00E-23   | 1.00E-25                                      | 1.79E-10   | 1.55E-15                                 |
| U-234               | 2.00E-18  | 1.00E-17   | 1.00E-19                                      | 1.79E-04   | 1.55E-09                                 |
| U-235               | 4.00E-17  | 3.00E-16   | 4.00E-18                                      | 4.46E-03   | 3.87E-08                                 |
| U-236               | 2.00E-17  | 2.00E-16   | 2.00E-18                                      | 2.23E-03   | 1.93E-08                                 |
| U-238               | 8.00E-16  | 6.00E-15   | 7.00E-17                                      | 8.24E-02   | 7.13E-07                                 |

**I. Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **Laundry Facility (K42)**  
Average Flow Rate: 1.85 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 4.00E-16  | 8.00E-15   | 3.00E-16                                      | 1.14E-02   | NA                                       |
| Gross beta          | 8.00E-15  | 3.00E-14   | 8.00E-16                                      | 2.29E-01   | NA                                       |
| U-232               | 8.00E-25  | 2.00E-23   | 5.00E-25                                      | 2.29E-11   | 8.26E-16                                 |
| U-234               | 8.00E-19  | 2.00E-17   | 5.00E-19                                      | 2.29E-05   | 8.26E-10                                 |
| U-235               | 2.00E-17  | 4.00E-16   | 1.00E-17                                      | 5.72E-04   | 2.07E-08                                 |
| U-236               | 1.00E-17  | 2.00E-16   | 6.00E-18                                      | 2.86E-04   | 1.03E-08                                 |
| U-238               | 4.00E-16  | 7.00E-15   | 2.00E-16                                      | 1.06E-02   | 3.81E-07                                 |

Stack: **ELO Building – Labs (K46)**  
Average Flow Rate: 6.15 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 5.00E-15  | 1.00E-14   | 8.00E-17                                      | 4.78E-01   | NA                                       |
| Gross beta          | 3.00E-14  | 4.00E-14   | 2.00E-16                                      | 3.42E+00   | NA                                       |
| U-232               | 1.00E-23  | 3.00E-23   | 2.00E-25                                      | 9.56E-10   | 1.52E-14                                 |
| U-234               | 1.00E-17  | 3.00E-17   | 2.00E-19                                      | 9.56E-04   | 1.52E-08                                 |
| U-235               | 2.00E-16  | 7.00E-16   | 4.00E-18                                      | 2.39E-02   | 3.81E-07                                 |
| U-236               | 1.00E-16  | 4.00E-16   | 2.00E-18                                      | 1.20E-02   | 1.91E-07                                 |
| U-238               | 4.00E-15  | 1.00E-14   | 7.00E-17                                      | 4.41E-01   | 7.03E-06                                 |

Stack: **ARF (K47)**  
Average Flow Rate: 1.05 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 6.00E-15  | 4.00E-14   | 4.00E-16                                      | 9.76E-02   | NA                                       |
| Gross beta          | 7.00E-14  | 1.00E-13   | 1.00E-15                                      | 1.20E+00   | NA                                       |
| U-232               | 1.00E-23  | 8.00E-23   | 9.00E-25                                      | 1.95E-10   | 2.80E-15                                 |
| U-234               | 1.00E-17  | 8.00E-17   | 9.00E-19                                      | 1.95E-04   | 2.80E-09                                 |
| U-235               | 3.00E-16  | 2.00E-15   | 2.00E-17                                      | 4.88E-03   | 7.00E-08                                 |
| U-236               | 1.00E-16  | 1.00E-15   | 1.00E-17                                      | 2.44E-03   | 3.50E-08                                 |
| U-238               | 5.00E-15  | 4.00E-14   | 4.00E-16                                      | 9.01E-02   | 1.29E-06                                 |

**I. Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **SF Building – SWUR Room (K49)**  
Average Flow Rate: 4.11 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 8.00E-16  | 7.00E-15   | 1.00E-16                                      | 5.24E-02   | NA                                       |
| Gross beta          | 4.00E-15  | 2.00E-14   | 3.00E-16                                      | 3.07E-01   | NA                                       |
| U-232               | 2.00E-24  | 1.00E-23   | 2.00E-25                                      | 1.05E-10   | 9.74E-16                                 |
| U-234               | 2.00E-18  | 1.00E-17   | 2.00E-19                                      | 1.05E-04   | 9.74E-10                                 |
| U-235               | 4.00E-17  | 4.00E-16   | 6.00E-18                                      | 2.62E-03   | 2.44E-08                                 |
| U-236               | 2.00E-17  | 2.00E-16   | 3.00E-18                                      | 1.31E-03   | 1.22E-08                                 |
| U-238               | 8.00E-16  | 7.00E-15   | 1.00E-16                                      | 4.84E-02   | 4.50E-07                                 |

Stack: **SF Building – SWUR POG (K50)**  
Average Flow Rate: 0.00 cubic meters/second  
\*\* Stack did not operate during the second half of 2018

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 0.00E+00  | 0.00E+00   | 0.00E+00                                      | 0.00E+00   | NA                                       |
| Gross beta          | 0.00E+00  | 0.00E+00   | 0.00E+00                                      | 0.00E+00   | NA                                       |

Stack: **Building 9 (K52)**  
Average Flow Rate: 2.73 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 7.00E-16  | 8.00E-15   | 2.00E-16                                      | 2.86E-02   | NA                                       |
| Gross beta          | 6.00E-15  | 2.00E-14   | 5.00E-16                                      | 2.53E-01   | NA                                       |
| U-232               | 1.00E-24  | 2.00E-23   | 3.00E-25                                      | 5.73E-11   | 9.30E-16                                 |
| U-234               | 1.00E-18  | 2.00E-17   | 3.00E-19                                      | 5.73E-05   | 9.30E-10                                 |
| U-235               | 3.00E-17  | 4.00E-16   | 9.00E-18                                      | 1.43E-03   | 2.33E-08                                 |
| U-236               | 2.00E-17  | 2.00E-16   | 4.00E-18                                      | 7.16E-04   | 1.16E-08                                 |
| U-238               | 6.00E-16  | 8.00E-15   | 2.00E-16                                      | 2.64E-02   | 4.29E-07                                 |

**I. Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **SF Building – SWUR Shroud (K55)**

Average Flow Rate: 0.00 cubic meters/second

\*\* Stack did not operate during the second half of 2018

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 0.00E+00  | 0.00E+00   | 0.00E+00                                      | 0.00E+00   | NA                                       |
| Gross beta          | 0.00E+00  | 0.00E+00   | 0.00E+00                                      | 0.00E+00   | NA                                       |

Stack: **ELO Building – GSUR (K56)**

Average Flow Rate: 0.30 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 1.00E-15  | 3.00E-14   | 2.00E-15                                      | 5.31E-03   | NA                                       |
| Gross beta          | 8.00E-15  | 9.00E-14   | 5.00E-15                                      | 3.73E-02   | NA                                       |
| U-232               | 2.00E-24  | 7.00E-23   | 3.00E-24                                      | 1.06E-11   | 1.09E-16                                 |
| U-234               | 2.00E-18  | 7.00E-17   | 3.00E-18                                      | 1.06E-05   | 1.09E-10                                 |
| U-235               | 5.00E-17  | 2.00E-15   | 8.00E-17                                      | 2.66E-04   | 2.73E-09                                 |
| U-236               | 3.00E-17  | 8.00E-16   | 4.00E-17                                      | 1.33E-04   | 1.37E-09                                 |
| U-238               | 1.00E-15  | 3.00E-14   | 1.00E-15                                      | 4.90E-03   | 5.04E-08                                 |

Stack: **UO<sub>2</sub> Building – Labs (K58)**

Average Flow Rate: 7.72 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 4.00E-16  | 4.00E-15   | 6.00E-17                                      | 5.50E-02   | NA                                       |
| Gross beta          | 5.00E-15  | 1.00E-14   | 2.00E-16                                      | 6.20E-01   | NA                                       |
| U-232               | 9.00E-25  | 8.00E-24   | 1.00E-25                                      | 1.10E-10   | 9.94E-16                                 |
| U-234               | 9.00E-19  | 8.00E-18   | 1.00E-19                                      | 1.10E-04   | 9.94E-10                                 |
| U-235               | 2.00E-17  | 2.00E-16   | 3.00E-18                                      | 2.75E-03   | 2.49E-08                                 |
| U-236               | 1.00E-17  | 1.00E-16   | 2.00E-18                                      | 1.38E-03   | 1.24E-08                                 |
| U-238               | 4.00E-16  | 4.00E-15   | 6.00E-17                                      | 5.08E-02   | 4.59E-07                                 |

**I. Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **SF Building – NAF Furnace (K60)**  
Average Flow Rate: 6.96 cubic meters/second

| <b>Radionuclide</b> | <b>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</b> | <b>Estimated<br/>Exposure<br/>(mrem)</b> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 9.00E-16  | 6.00E-15   | 7.00E-17                                      | 1.08E-01   | NA                                       |
| Gross beta          | 9.00E-15  | 2.00E-14   | 2.00E-16                                      | 9.67E-01   | NA                                       |
| U-232               | 2.00E-24  | 1.00E-23   | 1.00E-25                                      | 2.17E-10   | 1.95E-15                                 |
| U-234               | 2.00E-18  | 1.00E-17   | 1.00E-19                                      | 2.17E-04   | 1.95E-09                                 |
| U-235               | 5.00E-17  | 3.00E-16   | 3.00E-18                                      | 5.41E-03   | 4.87E-08                                 |
| U-236               | 2.00E-17  | 2.00E-16   | 2.00E-18                                      | 2.71E-03   | 2.43E-08                                 |
| U-238               | 9.00E-16  | 6.00E-15   | 6.00E-17                                      | 1.00E-01   | 8.98E-07                                 |

Stack: **Dry Conversion Facility (K62)**  
Average Flow Rate: 23.30 cubic meters/second

| <b>Radionuclide</b> | <b>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</b> | <b>Estimated<br/>Exposure<br/>(mrem)</b> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 9.00E-16  | 3.00E-15   | 2.00E-17                                      | 3.15E-01   | NA                                       |
| Gross beta          | 7.00E-15  | 9.00E-15   | 6.00E-17                                      | 2.71E+00   | NA                                       |
| U-232               | 2.00E-24  | 6.00E-24   | 4.00E-26                                      | 6.30E-10   | 2.44E-15                                 |
| U-234               | 2.00E-18  | 6.00E-18   | 4.00E-20                                      | 6.30E-04   | 2.44E-09                                 |
| U-235               | 4.00E-17  | 2.00E-16   | 1.00E-18                                      | 1.57E-02   | 6.10E-08                                 |
| U-236               | 2.00E-17  | 8.00E-17   | 5.00E-19                                      | 7.87E-03   | 3.05E-08                                 |
| U-238               | 8.00E-16  | 3.00E-15   | 2.00E-17                                      | 2.91E-01   | 1.13E-06                                 |

Stack: **BDU Facility (K65)**  
Average Flow Rate: 0.94 cubic meters/second

| <b>Radionuclide</b> | <b>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</b> | <b>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</b> | <b>Estimated<br/>Exposure<br/>(mrem)</b> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 7.00E-16  | 1.00E-14   | 5.00E-16                                      | 1.00E-02   | NA                                       |
| Gross beta          | 5.00E-15  | 4.00E-14   | 2.00E-15                                      | 7.04E-02   | NA                                       |
| U-232               | 1.00E-24  | 3.00E-23   | 1.00E-24                                      | 2.00E-11   | 2.34E-16                                 |
| U-234               | 1.00E-18  | 3.00E-17   | 1.00E-18                                      | 2.00E-05   | 2.34E-10                                 |
| U-235               | 3.00E-17  | 7.00E-16   | 2.00E-17                                      | 5.01E-04   | 5.85E-09                                 |
| U-236               | 2.00E-17  | 4.00E-16   | 1.00E-17                                      | 2.51E-04   | 2.93E-09                                 |
| U-238               | 6.00E-16  | 1.00E-14   | 5.00E-16                                      | 9.25E-03   | 1.08E-07                                 |

**I. Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **Cylinder Recertification Facility (K67)**  
Average Flow Rate: 0.44 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 8.00E-16  | 2.00E-14   | 1.00E-15                                      | 5.08E-03   | NA                                       |
| Gross beta          | 8.00E-15  | 8.00E-14   | 3.00E-15                                      | 6.35E-02   | NA                                       |
| U-232               | 2.00E-24  | 4.00E-23   | 2.00E-24                                      | 1.02E-11   | 3.16E-16                                 |
| U-234               | 2.00E-18  | 4.00E-17   | 2.00E-18                                      | 1.02E-05   | 3.16E-10                                 |
| U-235               | 4.00E-17  | 1.00E-15   | 5.00E-17                                      | 2.54E-04   | 7.90E-09                                 |
| U-236               | 2.00E-17  | 5.00E-16   | 3.00E-17                                      | 1.27E-04   | 3.95E-09                                 |
| U-238               | 7.00E-16  | 2.00E-14   | 1.00E-15                                      | 4.69E-03   | 1.46E-07                                 |

Stack: **MERF Building (K69)**  
Average Flow Rate: 1.77 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 6.00E-16  | 9.00E-15   | 3.00E-16                                      | 1.59E-02   | NA                                       |
| Gross beta          | 7.00E-15  | 3.00E-14   | 8.00E-16                                      | 1.94E-01   | NA                                       |
| U-232               | 1.00E-24  | 2.00E-23   | 5.00E-25                                      | 3.17E-11   | 7.56E-16                                 |
| U-234               | 1.00E-18  | 2.00E-17   | 5.00E-19                                      | 3.17E-05   | 7.56E-10                                 |
| U-235               | 3.00E-17  | 5.00E-16   | 1.00E-17                                      | 7.94E-04   | 1.89E-08                                 |
| U-236               | 1.00E-17  | 2.00E-16   | 7.00E-18                                      | 3.97E-04   | 9.45E-09                                 |
| U-238               | 5.00E-16  | 9.00E-15   | 2.00E-16                                      | 1.46E-02   | 3.49E-07                                 |

Stack: **UO<sub>2</sub> Building – BLEU Facility (K72)**  
Average Flow Rate: 12.59 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Uncertainty<br/>Estimate<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>MDC<br/>(<math>\mu\text{Ci/ml}</math>)</u> | <u>Quantity<br/>Released<br/>(<math>\mu\text{Ci}</math>)</u> | <u>Estimated<br/>Exposure<br/>(mrem)</u> |
|---------------------|---|--|---|--|--|
| Gross alpha         | 1.00E-15  | 5.00E-15   | 4.00E-17                                      | 1.96E-01   | NA                                       |
| Gross beta          | 9.00E-15  | 1.00E-14   | 1.00E-16                                      | 1.85E+00   | NA                                       |
| U-232               | 2.00E-24  | 9.00E-24   | 7.00E-26                                      | 3.92E-10   | 2.58E-15                                 |
| U-234               | 2.00E-18  | 9.00E-18   | 7.00E-20                                      | 3.92E-04   | 2.58E-09                                 |
| U-235               | 5.00E-17  | 2.00E-16   | 2.00E-18                                      | 9.79E-03   | 6.45E-08                                 |
| U-236               | 2.00E-17  | 1.00E-16   | 9.00E-19                                      | 4.90E-03   | 3.23E-08                                 |
| U-238               | 9.00E-16  | 4.00E-15   | 3.00E-17                                      | 1.81E-01   | 1.19E-06                                 |



I. **Gaseous Effluents (Continuously Sampled Stacks)**  
**Reporting Period: July 1 – December 31, 2018**

Stack: **UNB Building (K75)**  
Average Flow Rate: 0.47 cubic meters/second

| <u>Radionuclide</u> | <u>Concentration</u><br><u>(<math>\mu</math>Ci/ml)</u> | <u>Uncertainty</u><br><u>Estimate</u><br><u>(<math>\mu</math>Ci/ml)</u> | <u>MDC</u><br><u>(<math>\mu</math>Ci/ml)</u> | <u>Quantity</u><br><u>Released</u><br><u>(<math>\mu</math>Ci)</u> | <u>Estimated</u><br><u>Exposure</u><br><u>(mrem)</u> |
|---------------------|--|---|--|---|--|
| Gross alpha         | 3.00E-16   | 1.00E-14  | 1.00E-15                                     | 2.20E-03  | NA   |
| Gross beta          | 3.00E-15   | 5.00E-14  | 3.00E-15                                     | 2.61E-02  | NA   |
| U-232               | 6.00E-25   | 3.00E-23  | 2.00E-24                                     | 4.40E-12  | 4.56E-17   |
| U-234               | 6.00E-19   | 3.00E-17  | 2.00E-18                                     | 4.40E-06  | 4.56E-11   |
| U-235               | 1.00E-17   | 7.00E-16  | 5.00E-17                                     | 1.10E-04  | 1.14E-09   |
| U-236               | 7.00E-18   | 3.00E-16  | 2.00E-17                                     | 5.50E-05  | 5.70E-10   |
| U-238               | 3.00E-16   | 1.00E-14  | 9.00E-16                                     | 2.03E-03  | 2.10E-08   |

**II. Liquid Effluent**  
**Reporting Period: July 1 – December 31, 2018**

| <u>Constituent</u> | <u>Concentration</u><br><u>(<math>\mu</math>Ci/ml)</u> | <u>LLD</u><br><u>(<math>\mu</math>Ci/ml)</u> | <u>Quantity (Ci)</u> | <u>Liquid Volume</u><br><u>(m<sup>3</sup>)</u> |
|--------------------|--|--|----------------------|--|
| Soluble U          | 8.60E-08   | ***  | 0.0026               | 3.02E+04                                       |
| Insoluble U**      | 1.44E-07   | ***  | 0.0043               |  |
| Tc-99              | 1.23E-07   | ***  | 0.0037               |  |
| Total Ci           |  |  | 0.0106               |  |

\* Combined liquid effluent released to City of Richland sewer system.

\*\* The average concentration of insoluble uranium for the 6-month period was less than 50 ppb.

\*\*\* These constituents are analyzed chemically via Inductively Coupled Plasma/Mass Spectroscopy (ICP/MS) as opposed to radiation counting. Laboratory detection limits for uranium and Tc-99 are generally 1 ppb and 5 ppt, respectively

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