



Nuclear Fuel Services, Inc.

21G-18-0098  
GOV-01-55  
ACF-18-0188  
August 24, 2018

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

Reference: Docket No. 70-143; SNM License 124

Subject: **Biannual Effluent Monitoring Report January to June 2018**

In accordance with the requirements set forth in 10 CFR, Part 70.59, Nuclear Fuel Services, Inc. (NFS) submits the attached reports. Attachment 1 reports the Radioactivity in Effluent Liquid for the period January to June 2018. Attachment 2 reports the Radioactivity in Effluent Air for the period January to June 2018. Attachment 3 summarizes an evaluation of the dose and air activity concentrations for the maximally exposed offsite individual due to gaseous effluents during the period January to June 2018.

If you or your staff have any questions, require additional information, or wish to discuss this, please contact me, or Mr. R. Jason Faddis, Environmental Safety Unit Manager, at (423) 735-5438. Please reference our unique document identification number (21G-18-0098) in any correspondence concerning this letter.

Sincerely,

**NUCLEAR FUEL SERVICES, INC.**

Richard J. Freudenberger  
Safety & Safeguards Director

IE48  
NMSS20

CJB/pj

**Attachments**

- 1) Report of Radioactivity in Effluent Liquid for the Period January to June 2018
- 2) Report of Radioactivity in Effluent Air for the Period January to June 2018
- 3) Report of Gaseous Effluent Dose and Activity Concentrations for the Maximally Exposed Off-Site Individual for the Release Period January to June 2018

NMSS

Copy:

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Mr. Larry Harris  
Senior Resident Inspector  
U. S. Nuclear Regulatory Commission

**Attachment 1  
To Letter Dated August 24, 2018**

**Report of Radioactivity in Effluent Liquid for the Period  
January to June 2018**

**(2 Pages to Follow)**

## Radioactivity in Effluent Liquid January 1, 2018 to June 30, 2018

Location	Total Volume (l)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV <sup>1</sup>
<b>Banner Spring Down</b>							
Pu-238	461,080,000	0.00E+00	1.05E-10	2.61E-10	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	461,080,000	0.00E+00	1.36E-10	3.17E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	461,080,000	1.77E-11	3.58E-08	6.23E-08	8.17E-06	4.84E-04	2.95E-07
Th-228	461,080,000	5.07E-11	1.85E-10	3.69E-10	2.34E-05	2.85E-08	2.54E-04
Th-230	461,080,000	3.61E-11	1.99E-10	3.93E-10	1.67E-05	8.25E-04	3.61E-04
Th-232	461,080,000	1.76E-11	1.29E-10	2.39E-10	8.11E-06	7.44E+01	5.86E-04
U-233/234	461,080,000	3.75E-10	3.15E-10	3.77E-10	1.73E-04	2.77E-02	1.25E-03
U-235/236	461,080,000	1.81E-10	2.14E-10	2.66E-10	8.36E-05	3.87E+01	6.04E-04
U-238	461,080,000	1.74E-10	2.24E-10	2.51E-10	8.00E-05	2.39E+02	5.78E-04
						<b>Total:</b>	<b>3.63E-03</b>
<b>Sewer</b>							
Pu-238	29,946,000	7.86E-11	1.40E-10	2.57E-10	2.35E-06	1.38E-07	3.93E-04
Pu-239/240	29,946,000	6.86E-12	1.04E-10	2.22E-10	2.05E-07	3.30E-06	3.43E-05
Tc-99	29,946,000	7.69E-09	3.66E-08	6.34E-08	2.30E-04	1.36E-02	1.28E-05
Th-228	29,946,000	4.08E-11	1.90E-10	3.46E-10	1.22E-06	1.49E-09	2.04E-05
Th-230	29,946,000	1.37E-10	2.57E-10	4.38E-10	4.10E-06	2.03E-04	1.37E-04
Th-232	29,946,000	2.08E-11	1.63E-10	3.10E-10	6.22E-07	5.71E+00	6.92E-05
U-232	29,946,000	5.92E-11	1.39E-10	2.47E-10	1.77E-06	8.29E-08	9.87E-05
U-233/234	29,946,000	1.23E-08	1.09E-09	2.11E-10	3.68E-04	5.90E-02	4.10E-03
U-235/236	29,946,000	5.84E-10	2.45E-10	1.49E-10	1.75E-05	8.09E+00	1.95E-04
U-238	29,946,000	1.87E-09	4.29E-10	1.47E-10	5.59E-05	1.67E+02	6.22E-04
						<b>Total:</b>	<b>5.68E-03</b>
<b>West Ditch</b>							
Pu-238	154,049,000	6.71E-11	1.54E-10	2.60E-10	1.03E-05	6.04E-07	3.35E-03
Pu-239/240	154,049,000	0.00E+00	1.32E-10	2.62E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	154,049,000	0.00E+00	3.51E-08	6.18E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	154,049,000	3.21E-11	1.37E-10	2.61E-10	4.95E-06	6.04E-09	1.61E-04
Th-230	154,049,000	1.45E-10	2.05E-10	3.18E-10	2.24E-05	1.11E-03	1.45E-03
Th-232	154,049,000	1.07E-10	1.57E-10	2.08E-10	1.65E-05	1.51E+02	3.56E-03
U-233/234	154,049,000	1.82E-08	1.89E-09	4.72E-10	2.81E-03	4.50E-01	6.08E-02
U-235/236	154,049,000	1.05E-09	5.24E-10	3.50E-10	1.62E-04	7.50E+01	3.50E-03
U-238	154,049,000	2.16E-09	6.72E-10	3.60E-10	3.33E-04	9.94E+02	7.20E-03
						<b>Total:</b>	<b>8.00E-02</b>
<b>WWTF</b>							
Am-241	3,762,141	2.93E-11	8.12E-11	1.43E-10	1.10E-07	3.21E-08	1.46E-03
Cs-137	3,762,141	2.71E-10	8.43E-10	1.51E-09	1.02E-06	1.17E-08	2.71E-04
Na-22	3,762,141	1.95E-10	8.32E-10	1.51E-09	7.35E-07	1.18E-10	3.26E-05
Np-237	3,762,141	9.01E-11	2.12E-10	4.25E-10	3.39E-07	4.82E-04	4.51E-03
Pb-212	3,762,141	9.36E-10	3.38E-09	3.13E-09	3.52E-06	2.55E-12	4.68E-04
Pu-238	3,762,141	1.62E-11	9.76E-11	1.93E-10	6.08E-08	3.55E-09	8.08E-04

<sup>1</sup> ECV: Effluent Concentration Value from 10-CFR-20, Appendix B.  
Note: A value of "0" was substituted for negative analytical results.

## Radioactivity in Effluent Liquid January 1, 2018 to June 30, 2018

Location	Total Volume (l)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV <sup>1</sup>
<b>WWTF</b>							
Pu-239/240	3,762,141	2.29E-11	8.25E-11	1.58E-10	8.60E-08	1.38E-06	1.14E-03
Pu-241	3,762,141	3.67E-09	1.22E-08	2.10E-08	1.38E-05	1.34E-07	3.67E-03
Ra-224	3,762,141	9.14E-09	3.38E-09	6.49E-09	3.44E-05	2.16E-10	4.57E-02
Tc-99	3,762,141	1.49E-08	1.26E-07	2.15E-07	5.62E-05	3.33E-03	2.49E-04
Th-228	3,762,141	1.11E-11	9.17E-11	2.16E-10	4.18E-08	5.11E-11	5.56E-05
Th-230	3,762,141	9.15E-11	1.72E-10	3.02E-10	3.44E-07	1.70E-05	9.15E-04
Th-231	3,762,141	0.00E+00	4.08E-08	3.95E-08	0.00E+00	0.00E+00	0.00E+00
Th-232	3,762,141	2.15E-11	9.80E-11	1.72E-10	8.08E-08	7.42E-01	7.16E-04
U-232	3,762,141	1.74E-11	8.59E-11	1.80E-10	6.55E-08	3.06E-09	2.90E-04
U-233/234	3,762,141	3.48E-08	1.65E-09	1.47E-10	1.31E-04	2.10E-02	1.16E-01
U-235/236	3,762,141	1.77E-09	3.79E-10	1.27E-10	6.65E-06	3.08E+00	5.89E-03
U-238	3,762,141	6.68E-10	2.36E-10	1.31E-10	2.51E-06	7.51E+00	2.23E-03
						<b>Total:</b>	<b>1.85E-01</b>

<sup>1</sup> ECV: Effluent Concentration Value from 10-CFR-20, Appendix B.  
Note: A value of "0" was substituted for negative analytical results.

**Attachment 2  
To Letter Dated August 24, 2018**

**Report of Radioactivity in Effluent Air for the Period  
January to June 2018**

**(3 Pages to Follow)**

## Radioactivity in Effluent Air January 1, 2018 to June 30, 2018

Location	Total Volume (m <sup>3</sup> )	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV <sup>1</sup>
<b>Main Stack 416</b>		<b>1072.13 m<sup>3</sup>/min</b>		<b>17.87 m<sup>3</sup>/sec</b>			
Th-230	280,984,505	5.44E-16	1.34E-16	8.42E-17	1.53E-07	7.56E-06	2.72E-02
U-234	280,984,505	1.24E-13	3.05E-14	1.92E-14	3.48E-05	5.58E-03	2.48E+00
U-235	280,984,505	7.61E-15	1.87E-15	1.18E-15	2.14E-06	9.90E-01	1.27E-01
U-238	280,984,505	3.81E-15	9.36E-16	5.90E-16	1.07E-06	3.19E+00	6.34E-02
						<b>Total:</b>	<b>2.70E+00</b>
<b>Stack 185 Bldg. 131</b>		<b>101.95 m<sup>3</sup>/min</b>		<b>1.70 m<sup>3</sup>/sec</b>			
Pu-241	26,718,117	0.00E+00	8.56E-16	1.76E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	26,718,117	0.00E+00	2.77E-14	5.68E-14	0.00E+00	0.00E+00	0.00E+00
U-234	26,718,117	0.00E+00	7.58E-15	2.04E-14	0.00E+00	0.00E+00	0.00E+00
U-235	26,718,117	0.00E+00	2.34E-16	6.32E-16	0.00E+00	0.00E+00	0.00E+00
						<b>Total:</b>	<b>0.00E+00</b>
<b>Stack 234 Bldg. 234</b>		<b>298.59 m<sup>3</sup>/min</b>		<b>4.98 m<sup>3</sup>/sec</b>			
Am-241	78,726,040	2.24E-17	2.57E-17	4.72E-17	1.77E-09	5.15E-10	1.12E-03
Pu-238	78,726,040	2.74E-17	3.15E-17	5.77E-17	2.16E-09	1.26E-10	1.37E-03
Pu-239/240	78,726,040	9.72E-17	1.12E-16	2.05E-16	7.65E-09	1.23E-07	4.86E-03
Pu-241	78,726,040	0.00E+00	4.14E-15	7.84E-15	0.00E+00	0.00E+00	0.00E+00
Th-228	78,726,040	1.50E-17	1.72E-17	3.15E-17	1.18E-09	1.44E-12	7.48E-04
Th-230	78,726,040	1.87E-16	2.14E-16	3.94E-16	1.47E-08	7.28E-07	9.35E-03
Th-232	78,726,040	2.37E-16	2.72E-16	4.99E-16	1.86E-08	1.71E-01	5.92E-02
U-234	78,726,040	5.11E-16	5.86E-16	1.08E-15	4.02E-08	6.45E-06	1.02E-02
U-238	78,726,040	1.50E-16	1.72E-16	3.15E-16	1.18E-08	3.51E-02	2.49E-03
						<b>Total:</b>	<b>8.93E-02</b>
<b>Stack 327 Bldg. 330</b>		<b>1020.01 m<sup>3</sup>/min</b>		<b>17.00 m<sup>3</sup>/sec</b>			
Pu-241	267,374,122	2.28E-15	5.46E-16	7.67E-16	6.11E-07	5.93E-09	2.86E-03
Tc-99	267,374,122	7.39E-14	1.77E-14	2.48E-14	1.98E-05	1.17E-03	8.21E-05
U-234	267,374,122	1.80E-13	1.50E-14	9.12E-15	4.81E-05	7.71E-03	3.60E+00
U-235	267,374,122	5.57E-15	4.64E-16	2.82E-16	1.49E-06	6.89E-01	9.28E-02
						<b>Total:</b>	<b>3.70E+00</b>
<b>Stack 421 Bldg. 100</b>		<b>36.64 m<sup>3</sup>/min</b>		<b>0.61 m<sup>3</sup>/sec</b>			
Pu-241	9,603,136	1.39E-15	1.33E-15	2.21E-15	1.34E-08	1.30E-10	1.74E-03
Tc-99	9,603,136	4.50E-14	4.31E-14	7.16E-14	4.32E-07	2.56E-05	5.00E-05
U-234	9,603,136	6.48E-14	2.05E-14	2.40E-14	6.22E-07	9.97E-05	1.30E+00
U-235	9,603,136	2.00E-15	6.35E-16	7.42E-16	1.92E-08	8.91E-03	3.34E-02
						<b>Total:</b>	<b>1.33E+00</b>
<b>Stack 424 Bldg. 100</b>		<b>32.73 m<sup>3</sup>/min</b>		<b>0.55 m<sup>3</sup>/sec</b>			
Pu-241	8,579,000	4.75E-16	9.84E-16	1.76E-15	4.08E-09	3.96E-11	5.94E-04
Tc-99	8,579,000	1.54E-14	3.18E-14	5.68E-14	1.32E-07	7.80E-06	1.71E-05
U-234	8,579,000	1.46E-14	1.37E-14	2.04E-14	1.25E-07	2.01E-05	2.92E-01

<sup>1</sup> ECV: Effluent Concentration Value from 10-CFR-20, Appendix B. Fraction of ECV at the stack is provided for reference only. Concentrations at off-site locations are significantly less than those reported here (at stack) due to the atmospheric dispersion that occurs before the effluent exits the site.

Note: A value of "0" was substituted for negative analytical results.

## Radioactivity in Effluent Air January 1, 2018 to June 30, 2018

Location	Total Volume (m <sup>3</sup> )	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV <sup>1</sup>
<b>Stack 424 Bldg. 100</b>		<b>32.73 m<sup>3</sup>/min</b>		<b>0.55 m<sup>3</sup>/sec</b>			
U-235	8,579,000	4.52E-16	4.24E-16	6.32E-16	3.87E-09	1.79E-03	7.53E-03
						<b>Total:</b>	<b>3.00E-01</b>
<b>Stack 573 Bldg 306-W</b>		<b>78.87 m<sup>3</sup>/min</b>		<b>1.31 m<sup>3</sup>/sec</b>			
Pu-241	20,647,143	0.00E+00	7.93E-16	1.64E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	20,647,143	0.00E+00	2.56E-14	5.29E-14	0.00E+00	0.00E+00	0.00E+00
U-234	20,647,143	0.00E+00	6.26E-15	1.93E-14	0.00E+00	0.00E+00	0.00E+00
U-235	20,647,143	0.00E+00	1.94E-16	5.96E-16	0.00E+00	0.00E+00	0.00E+00
						<b>Total:</b>	<b>0.00E+00</b>
<b>Stack 600 Bldg. 110</b>		<b>297.81 m<sup>3</sup>/min</b>		<b>4.96 m<sup>3</sup>/sec</b>			
Pu-241	78,049,602	6.99E-16	5.83E-16	1.03E-15	5.46E-08	5.30E-10	8.74E-04
Tc-99	78,049,602	2.26E-14	1.89E-14	3.32E-14	1.77E-06	1.04E-04	2.51E-05
U-234	78,049,602	3.42E-14	9.08E-15	1.27E-14	2.67E-06	4.28E-04	6.84E-01
U-235	78,049,602	1.06E-15	2.81E-16	3.93E-16	8.26E-08	3.82E-02	1.76E-02
						<b>Total:</b>	<b>7.03E-01</b>
<b>Stack 615 Bldg. 306-W</b>		<b>38.60 m<sup>3</sup>/min</b>		<b>0.64 m<sup>3</sup>/sec</b>			
Pu-241	10,115,205	0.00E+00	8.63E-16	1.77E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	10,115,205	0.00E+00	2.79E-14	5.73E-14	0.00E+00	0.00E+00	0.00E+00
U-234	10,115,205	2.71E-15	9.65E-15	2.06E-14	2.74E-08	4.40E-06	5.43E-02
U-235	10,115,205	8.39E-17	2.98E-16	6.37E-16	8.49E-10	3.93E-04	1.40E-03
						<b>Total:</b>	<b>5.57E-02</b>
<b>Stack 646 Bldg. 110</b>		<b>41.09 m<sup>3</sup>/min</b>		<b>0.68 m<sup>3</sup>/sec</b>			
Pu-241	10,768,277	0.00E+00	8.82E-16	1.80E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	10,768,277	0.00E+00	2.85E-14	5.82E-14	0.00E+00	0.00E+00	0.00E+00
U-234	10,768,277	0.00E+00	7.11E-15	2.09E-14	0.00E+00	0.00E+00	0.00E+00
U-235	10,768,277	0.00E+00	2.20E-16	6.47E-16	0.00E+00	0.00E+00	0.00E+00
						<b>Total:</b>	<b>0.00E+00</b>
<b>Stack 701 Bldg. 307</b>		<b>117.54 m<sup>3</sup>/min</b>		<b>1.96 m<sup>3</sup>/sec</b>			
Pu-241	30,805,733	0.00E+00	9.75E-16	2.01E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	30,805,733	0.00E+00	3.15E-14	6.49E-14	0.00E+00	0.00E+00	0.00E+00
U-234	30,805,733	0.00E+00	8.36E-15	2.33E-14	0.00E+00	0.00E+00	0.00E+00
U-235	30,805,733	0.00E+00	2.59E-16	7.22E-16	0.00E+00	0.00E+00	0.00E+00
						<b>Total:</b>	<b>0.00E+00</b>
<b>Stack 702 Bldg. 307</b>		<b>168.40 m<sup>3</sup>/min</b>		<b>2.81 m<sup>3</sup>/sec</b>			
Pu-241	44,134,352	0.00E+00	8.55E-16	1.76E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	44,134,352	0.00E+00	2.77E-14	5.68E-14	0.00E+00	0.00E+00	0.00E+00
U-234	44,134,352	1.80E-15	8.94E-15	2.04E-14	7.97E-08	1.28E-05	3.61E-02
U-235	44,134,352	5.58E-17	2.76E-16	6.32E-16	2.46E-09	1.14E-03	9.30E-04
						<b>Total:</b>	<b>3.70E-02</b>

<sup>1</sup> ECV: Effluent Concentration Value from 10-CFR-20, Appendix B. Fraction of ECV at the stack is provided for reference only. Concentrations at off-site locations are significantly less than those reported here (at stack) due to the atmospheric dispersion that occurs before the effluent exits the site.

Note: A value of "0" was substituted for negative analytical results.



## Radioactivity in Effluent Air January 1, 2018 to June 30, 2018

Location	Total Volume (m <sup>3</sup> )	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV <sup>1</sup>
<b>Stack 703 Exhaust Room Air</b>		<b>772.96 m<sup>3</sup>/min</b>		<b>12.88 m<sup>3</sup>/sec</b>			
Pu-241	202,577,866	0.00E+00	2.50E-14	5.21E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	202,577,866	3.03E-17	7.45E-16	1.85E-15	6.15E-09	7.51E-12	1.52E-03
Th-230	202,577,866	1.75E-17	4.29E-16	1.07E-15	3.54E-09	1.75E-07	8.74E-04
Th-232	202,577,866	2.48E-17	6.10E-16	1.52E-15	5.03E-09	4.62E-02	6.21E-03
U-234	202,577,866	1.90E-16	4.67E-15	1.16E-14	3.85E-08	6.17E-06	3.80E-03
U-235	202,577,866	1.96E-17	4.82E-16	1.20E-15	3.97E-09	1.84E-03	3.27E-04
U-238	202,577,866	2.39E-17	5.87E-16	1.46E-15	4.84E-09	1.45E-02	3.99E-04
						<b>Total:</b>	<b>1.31E-02</b>
<b>Stack 773 Bldg. 440</b>		<b>181.73 m<sup>3</sup>/min</b>		<b>3.03 m<sup>3</sup>/sec</b>			
Pu-241	47,707,984	7.67E-16	3.51E-14	6.85E-14	3.66E-08	3.55E-10	9.59E-04
Th-228	47,707,984	0.00E+00	1.20E-15	3.47E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	47,707,984	0.00E+00	1.54E-15	4.46E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	47,707,984	0.00E+00	1.03E-15	2.97E-15	0.00E+00	0.00E+00	0.00E+00
U-234	47,707,984	0.00E+00	3.16E-15	9.17E-15	0.00E+00	0.00E+00	0.00E+00
U-235	47,707,984	0.00E+00	5.56E-16	1.61E-15	0.00E+00	0.00E+00	0.00E+00
U-238	47,707,984	0.00E+00	1.11E-15	3.22E-15	0.00E+00	0.00E+00	0.00E+00
						<b>Total:</b>	<b>9.59E-04</b>
<b>Stack 774 Bldg. 301</b>		<b>335.67 m<sup>3</sup>/min</b>		<b>5.59 m<sup>3</sup>/sec</b>			
Th-228	87,971,854	0.00E+00	1.57E-16	4.39E-16	0.00E+00	0.00E+00	0.00E+00
Th-230	87,971,854	0.00E+00	5.35E-16	1.50E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	87,971,854	0.00E+00	3.17E-16	8.88E-16	0.00E+00	0.00E+00	0.00E+00
U-234	87,971,854	0.00E+00	1.43E-15	4.00E-15	0.00E+00	0.00E+00	0.00E+00
U-235	87,971,854	0.00E+00	9.29E-17	2.60E-16	0.00E+00	0.00E+00	0.00E+00
U-238	87,971,854	0.00E+00	6.73E-16	1.88E-15	0.00E+00	0.00E+00	0.00E+00
						<b>Total:</b>	<b>0.00E+00</b>
<b>Stack 796 Bldg. 100</b>		<b>20.27 m<sup>3</sup>/min</b>		<b>0.34 m<sup>3</sup>/sec</b>			
Pu-241	5,313,637	1.70E-16	9.36E-16	1.76E-15	9.02E-10	8.75E-12	2.12E-04
Tc-99	5,313,637	5.49E-15	3.03E-14	5.68E-14	2.92E-08	1.72E-06	6.10E-06
U-234	5,313,637	0.00E+00	6.88E-15	2.04E-14	0.00E+00	0.00E+00	0.00E+00
U-235	5,313,637	0.00E+00	2.13E-16	6.32E-16	0.00E+00	0.00E+00	0.00E+00
						<b>Total:</b>	<b>2.18E-04</b>

<sup>1</sup> ECV: Effluent Concentration Value from 10-CFR-20, Appendix B. Fraction of ECV at the stack is provided for reference only. Concentrations at off-site locations are significantly less than those reported here (at stack) due to the atmospheric dispersion that occurs before the effluent exits the site.

Note: A value of "0" was substituted for negative analytical results.

**Attachment 3  
To Letter Dated August 24, 2018**

**Report of Gaseous Effluent Dose and Activity Concentrations  
for the Maximally Exposed  
Off-Site Individual for the Release Period  
January to June 2018**

**(3 Pages to Follow)**

## **Report of Potential Gaseous Effluent Dose to the Maximally Exposed Offsite Individual and on the Maximum Radionuclide Concentrations for the Period January to June 2018**

### **Introduction**

During this biannual period, NRC License SNM-124, Section 9.1.1.3, required NFS to assess the total effective dose equivalent (TEDE) to the maximally exposed offsite receptor and the maximum radioactive air concentrations at the site boundary attributable to NFS' air effluents. The required biannual assessment has been completed and the details of the assessment are provided in the subsequent sections.

### **Summary of Methods**

In accordance with SNM-124, Section 9.1.1.4, and internal procedure NFS-HS-A-27, the U.S. Department of Energy's CAP88-PC computer program was used to estimate off-site doses and activity concentrations for gaseous effluents. NFS operated sixteen (16) radiological stacks during the first half of 2018. Based on effluent types and stack physical characteristics, releases from these stacks were grouped into effective stacks for modeling purposes. To accommodate the co-location limitation of the model, the effective stacks were taken to be at the approximate center of the plant site. The distance to the site boundary (nearest model receptor distance) was conservatively taken to be 150 meters for all sectors.

Meteorological data was based on five-year average wind speed and direction frequencies as presented in NFS' 1996 Environmental Report. Atmospheric stability class D (neutral atmosphere) was used for all releases (default value recommended by the U.S. Environmental Protection Agency in "User's Guide for COMPLY"). The most conservative inhalation class was assumed for each radionuclide released. A particle size (activity median aerodynamic diameter or AMAD) of 1.0 micron was assumed for modeling purposes since no information on actual particle sizes exists.

Because CAP88-PC models releases over an entire year, the six-month source term (i.e., total curies of each radionuclide released over the period, given in Attachment 2) was annualized (i.e., transformed into a 12-month release) so that airborne activity concentrations would not be under-estimated during the release period.

### **Summary of Results**

Doses are reported in Table 1 below and are derived from the CAP88-PC "Synopsis Report." These doses are at the location of the maximally exposed (off-site) individual (MEI). The results include an adjustment (using the normalization factor mentioned above) to convert the "annualized" doses back to those doses that were actually received in the six-month release period. Activity concentrations reported in Table 2 come directly from the CAP88-PC "Concentration Tables" report; no adjustments are needed for these concentrations. The CAP88-PC output reports are available for review at NFS.

Table 1 summarizes the six-month dose to a hypothetical individual at the MEI location, which was determined to be approximately 400 meters North-Northeast from the center of the plant site. The TEDE to the MEI was estimated to be 2.2E-03 mrem for gaseous effluents released during the first half of 2018. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 1.3E-02 mrem to the lungs. These MEI doses are well below the Environmental Radiological Monitoring Program action levels and applicable regulatory limits/ALARA constraints.

**Table 1. Organ Doses and Total Effective Dose Equivalent at the MEI Location**

<b>Organ</b>	<b>Committed Dose Equivalent (mrem per first half of 2018)</b>
Adrenals	1.4E-04
Urinary Bladder Wall	1.6E-04
Bone Surface	5.9E-03
Brain	1.4E-04
Breasts	1.5E-04
Stomach Wall	2.0E-03
Small Intestine	1.7E-04
Upper Large Intestine Wall	6.7E-04
Lower Large Intestine Wall	1.7E-03
Kidneys	2.0E-03
Liver	4.9E-04
Muscle	1.5E-04
Ovaries	1.5E-04
Pancreas	1.4E-04
Red Bone Marrow	7.4E-04
Skin	3.5E-04
Spleen	1.4E-04
Testes	1.6E-04
Thymus	1.4E-04
Thyroid	1.1E-03
Gall Bladder Wall	1.4E-04
Heart Wall	1.4E-04
Uterus	1.4E-04
Extra-thoracic	1.1E-02
Lungs	1.3E-02
<b>Total Effective Dose Equivalent</b>	<b>2.2E-03 mrem</b>
Location of MEI:	400 meters North-Northeast

Table 2 summarizes the maximum radioactive air concentrations at or beyond the site boundary, as determined by CAP88-PC, for the radionuclides released. The total sum of fractions was estimated to be 4.3E-04 and indicates that exposures to the offsite public from gaseous effluents were much less than 1% of the 10 CFR 20, Appendix B, Table 2, Col. 1 values for all offsite receptors including the site boundary. It is noted that the location of the maximum airborne concentration for a given radionuclide does not necessarily correspond to the MEI location. This is due primarily to the fact that the maximum concentrations for individual nuclides can vary due to differences in values input into the dispersion model for each of the effective stacks - such inputs include stack height, stack diameter, flow rate, and total radionuclide activities released per stack. Another reason for the disparity is the fact that the MEI dose includes both inhalation and ingestion pathways.

**Table 2. Maximum Predicted Airborne Concentrations at or Beyond the Site Boundary**

Maximum Predicted Airborne Concentrations at or Beyond the Site Boundary					
Nuclide	Maximum Concentration (µCi/mL)	Concentration Location		10 CFR 20, App. B, Table 2, Col. 1 Value (µCi/mL)	Ratio of Maximum Concentration to 10 CFR 20 Value
		Sector	Dist. (m)		
<sup>99</sup> Tc	7.8E-18	NNE	400	9.E-10	8.7E-09
<sup>228</sup> Th	2.8E-21	NNE	350	2.E-14	1.4E-07
<sup>230</sup> Th	2.4E-20	NNE	600	2.E-14	1.2E-06
<sup>231</sup> Th	1.0E-21	NNE	850	9.E-09	1.1E-13
<sup>232</sup> Th	2.1E-20	NNE	200	4.E-15	5.1E-06
<sup>234</sup> U	2.0E-17	NNE	450	5.E-14	4.1E-04
<sup>235</sup> U	7.1E-19	NNE	500	6.E-14	1.2E-05
<sup>238</sup> U	1.3E-19	NNE	700	6.E-14	2.1E-06
<sup>238</sup> Pu	2.3E-21	NNE	200	2.E-14	1.2E-07
<sup>239</sup> Pu	8.2E-21	NNE	200	2.E-14	4.1E-07
<sup>241</sup> Pu	2.6E-19	NNE	400	8.E-13	3.2E-07
<sup>241</sup> Am	1.9E-21	NNE	200	2.E-14	9.5E-08
<b>Sum of Fractions:</b>					<b>4.3E-04</b>