



Nuclear Fuel Services, Inc.

21G-19-0025
GOV-01-55
ACF-19-0052
February 20, 2019

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 July to December 2018**

Dear Sir:

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 July to December 2018. Attachment 2 reports the Radioactivity in Effluent Air for the period July to December 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 July to December 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-19-0025) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

R. Shuckelford/far

Richard J. Freudenberger
Safety & Safeguards Director

*IE48
NM5520*

CJB/pj
Attachments

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

Copy:

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Mr. Larry Harris
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U. S. Nuclear Regulatory Commission

**Attachment 1
To Letter Dated February 20, 2019**

**Report of Radioactivity in Effluent Liquid for the Period
July to December 2018**

(2 Pages to Follow)

Radioactivity in Effluent Liquid July 1, 2018 to December 31, 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 ¹
Banner Spring Down							
Pu-238	535,730,000	0.00E+00	1.10E-10	2.88E-10	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	535,730,000	2.85E-11	1.36E-10	2.51E-10	1.53E-05	2.46E-04	1.43E-03
Tc-99	535,730,000	0.00E+00	3.67E-08	6.47E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	535,730,000	0.00E+00	1.27E-10	3.10E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	535,730,000	2.24E-11	1.33E-10	2.72E-10	1.20E-05	5.93E-04	2.24E-04
Th-232	535,730,000	2.42E-11	1.03E-10	1.95E-10	1.29E-05	1.19E+02	8.06E-04
U-233/234	535,730,000	9.56E-10	3.61E-10	3.14E-10	5.12E-04	8.21E-02	3.19E-03
U-235/236	535,730,000	1.09E-10	1.70E-10	2.45E-10	5.82E-05	2.69E+01	3.62E-04
U-238	535,730,000	1.52E-10	1.92E-10	2.82E-10	8.16E-05	2.44E+02	5.08E-04
						Total:	6.51E-03
Sewer							
Pu-238	44,502,000	0.00E+00	8.37E-11	2.03E-10	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	44,502,000	0.00E+00	6.58E-11	1.84E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	44,502,000	0.00E+00	4.03E-08	7.05E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	44,502,000	0.00E+00	1.39E-10	3.10E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	44,502,000	2.35E-11	1.50E-10	3.07E-10	1.05E-06	5.18E-05	2.35E-05
Th-232	44,502,000	7.58E-11	1.43E-10	2.07E-10	3.37E-06	3.09E+01	2.53E-04
U-232	44,502,000	0.00E+00	7.29E-11	1.67E-10	0.00E+00	0.00E+00	0.00E+00
U-233/234	44,502,000	1.26E-08	9.89E-10	1.34E-10	5.60E-04	8.98E-02	4.20E-03
U-235/236	44,502,000	4.41E-10	1.89E-10	1.18E-10	1.96E-05	9.08E+00	1.47E-04
U-238	44,502,000	1.86E-09	3.83E-10	1.18E-10	8.30E-05	2.48E+02	6.22E-04
						Total:	5.24E-03
West Ditch							
Pu-238	177,171,000	2.42E-11	1.21E-10	2.38E-10	4.29E-06	2.51E-07	1.21E-03
Pu-239/240	177,171,000	0.00E+00	1.06E-10	2.51E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	177,171,000	0.00E+00	3.70E-08	6.51E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	177,171,000	0.00E+00	1.36E-10	3.43E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	177,171,000	6.48E-11	1.72E-10	3.32E-10	1.15E-05	5.69E-04	6.48E-04
Th-232	177,171,000	7.37E-11	1.48E-10	2.54E-10	1.31E-05	1.20E+02	2.46E-03
U-233/234	177,171,000	1.46E-08	1.47E-09	3.17E-10	2.58E-03	4.13E-01	4.85E-02
U-235/236	177,171,000	6.49E-10	3.54E-10	2.30E-10	1.15E-04	5.33E+01	2.16E-03
U-238	177,171,000	1.68E-09	5.12E-10	2.72E-10	2.97E-04	8.86E+02	5.59E-03
						Total:	6.06E-02
WWTF							
Am-241	3,743,014	2.27E-11	7.80E-11	1.31E-10	8.49E-08	2.48E-08	1.13E-03
Cs-137	3,743,014	0.00E+00	1.20E-09	1.51E-09	0.00E+00	0.00E+00	0.00E+00
Na-22	3,743,014	0.00E+00	7.63E-10	1.36E-09	0.00E+00	0.00E+00	0.00E+00
Np-237	3,743,014	5.64E-11	2.00E-10	3.89E-10	2.11E-07	3.00E-04	2.82E-03
Pb-212	3,743,014	7.97E-10	3.06E-09	2.68E-09	2.98E-06	2.16E-12	3.98E-04
Pu-238	3,743,014	0.00E+00	7.23E-11	1.62E-10	0.00E+00	0.00E+00	0.00E+00

¹ 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 July 1, 2018 to December 31, 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 ¹
WWTF							
Pu-239/240	3,743,014	0.00E+00	7.31E-11	1.84E-10	0.00E+00	0.00E+00	0.00E+00
Pu-241	3,743,014	0.00E+00	1.06E-08	1.86E-08	0.00E+00	0.00E+00	0.00E+00
Ra-224	3,743,014	1.09E-08	7.17E-09	1.22E-08	4.06E-05	2.56E-10	5.43E-02
Tc-99	3,743,014	0.00E+00	9.15E-08	1.57E-07	0.00E+00	0.00E+00	0.00E+00
Th-228	3,743,014	0.00E+00	1.25E-10	2.84E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	3,743,014	9.40E-11	1.78E-10	3.07E-10	3.52E-07	1.74E-05	9.40E-04
Th-231	3,743,014	0.00E+00	3.80E-08	3.91E-08	0.00E+00	0.00E+00	0.00E+00
Th-232	3,743,014	2.17E-11	1.11E-10	1.95E-10	8.13E-08	7.46E-01	7.24E-04
U-232	3,743,014	4.81E-12	8.24E-11	1.79E-10	1.80E-08	8.41E-10	8.01E-05
U-233/234	3,743,014	1.42E-08	9.66E-10	1.33E-10	5.30E-05	8.49E-03	4.72E-02
U-235/236	3,743,014	6.71E-10	2.21E-10	1.00E-10	2.51E-06	1.16E+00	2.24E-03
U-238	3,743,014	2.29E-10	1.29E-10	1.05E-10	8.58E-07	2.56E+00	7.64E-04
						Total:	1.11E-01

¹ 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 February 20, 2019**

**Report of Radioactivity in Effluent Air for the Period
July to December 2018**

(3 Pages to Follow)

Radioactivity in Effluent Air

July 1, 2018 to December 31, 2018

Location	Total Volume (m ³)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV ¹
Main Stack 416		1059.74 m³/min		17.66 m³/sec			
Th-230	282,444,540	5.50E-16	1.24E-16	8.20E-17	1.55E-07	7.69E-06	2.75E-02
U-234	282,444,540	1.25E-13	2.82E-14	1.87E-14	3.54E-05	5.68E-03	2.51E+00
U-235	282,444,540	7.70E-15	1.73E-15	1.15E-15	2.18E-06	1.01E+00	1.28E-01
U-238	282,444,540	3.85E-15	8.66E-16	5.74E-16	1.09E-06	3.25E+00	6.42E-02
						Total:	2.73E+00
Stack 185 Bldg. 131		109.13 m³/min		1.82 m³/sec			
Pu-241	29,073,068	0.00E+00	8.52E-16	1.71E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	29,073,068	0.00E+00	2.75E-14	5.53E-14	0.00E+00	0.00E+00	0.00E+00
U-234	29,073,068	1.32E-15	7.62E-15	2.01E-14	3.83E-08	6.14E-06	2.64E-02
U-235	29,073,068	4.08E-17	2.36E-16	6.22E-16	1.19E-09	5.49E-04	6.79E-04
						Total:	2.70E-02
Stack 234 Bldg. 234		296.51 m³/min		4.94 m³/sec			
Am-241	80,697,001	0.00E+00	1.96E-17	4.72E-17	0.00E+00	0.00E+00	0.00E+00
Pu-238	80,697,001	0.00E+00	2.40E-17	5.76E-17	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	80,697,001	0.00E+00	8.51E-17	2.04E-16	0.00E+00	0.00E+00	0.00E+00
Pu-241	80,697,001	0.00E+00	3.99E-15	7.86E-15	0.00E+00	0.00E+00	0.00E+00
Th-228	80,697,001	0.00E+00	1.31E-17	3.14E-17	0.00E+00	0.00E+00	0.00E+00
Th-230	80,697,001	0.00E+00	1.64E-16	3.93E-16	0.00E+00	0.00E+00	0.00E+00
Th-232	80,697,001	0.00E+00	2.07E-16	4.98E-16	0.00E+00	0.00E+00	0.00E+00
U-234	80,697,001	0.00E+00	4.47E-16	1.07E-15	0.00E+00	0.00E+00	0.00E+00
U-238	80,697,001	0.00E+00	1.31E-16	3.14E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 327 Bldg. 330		1035.80 m³/min		17.26 m³/sec			
Pu-241	275,937,668	1.20E-15	4.83E-16	7.82E-16	3.30E-07	3.20E-09	1.50E-03
Tc-99	275,937,668	3.87E-14	1.56E-14	2.53E-14	1.07E-05	6.31E-04	4.30E-05
U-234	275,937,668	7.39E-14	1.02E-14	9.24E-15	2.04E-05	3.27E-03	1.48E+00
U-235	275,937,668	2.29E-15	3.14E-16	2.86E-16	6.31E-07	2.92E-01	3.81E-02
						Total:	1.52E+00
Stack 421 Bldg. 100		34.35 m³/min		0.57 m³/sec			
Pu-241	9,174,415	3.18E-15	1.37E-15	2.11E-15	2.91E-08	2.83E-10	3.97E-03
Tc-99	9,174,415	1.03E-13	4.44E-14	6.82E-14	9.42E-07	5.57E-05	1.14E-04
U-234	9,174,415	1.90E-13	2.73E-14	2.30E-14	1.75E-06	2.80E-04	3.81E+00
U-235	9,174,415	5.89E-15	8.43E-16	7.11E-16	5.41E-08	2.50E-02	9.82E-02
						Total:	3.91E+00
Stack 424 Bldg. 100		33.20 m³/min		0.55 m³/sec			
Pu-241	8,839,805	1.31E-15	1.03E-15	1.67E-15	1.16E-08	1.13E-10	1.64E-03
Tc-99	8,839,805	4.24E-14	3.33E-14	5.40E-14	3.75E-07	2.22E-05	4.71E-05
U-234	8,839,805	8.78E-14	1.74E-14	1.95E-14	7.76E-07	1.24E-04	1.76E+00

¹ 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 July 1, 2018 to December 31, 2018

Location	Total Volume (m ³)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV ¹
Stack 424 Bldg. 100		33.20 m³/min		0.55 m³/sec			
U-235	8,839,805	2.71E-15	5.38E-16	6.04E-16	2.40E-08	1.11E-02	4.52E-02
						Total:	1.80E+00
Stack 573 Bldg 306-W		72.82 m³/min		1.21 m³/sec			
Pu-241	19,430,134	0.00E+00	8.47E-16	1.67E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	19,430,134	0.00E+00	2.74E-14	5.41E-14	0.00E+00	0.00E+00	0.00E+00
U-234	19,430,134	5.56E-16	7.97E-15	1.96E-14	1.08E-08	1.73E-06	1.11E-02
U-235	19,430,134	1.72E-17	2.46E-16	6.08E-16	3.34E-10	1.55E-04	2.87E-04
						Total:	1.14E-02
Stack 600 Bldg. 110		304.87 m³/min		5.08 m³/sec			
Pu-241	81,306,117	4.33E-15	6.90E-16	1.03E-15	3.52E-07	3.41E-09	5.41E-03
Tc-99	81,306,117	1.40E-13	2.23E-14	3.33E-14	1.14E-05	6.73E-04	1.55E-04
U-234	81,306,117	1.30E-13	1.24E-14	1.25E-14	1.06E-05	1.70E-03	2.61E+00
U-235	81,306,117	4.03E-15	3.82E-16	3.87E-16	3.28E-07	1.52E-01	6.72E-02
						Total:	2.68E+00
Stack 615 Bldg. 306-W		48.89 m³/min		0.81 m³/sec			
Pu-241	12,979,289	0.00E+00	7.97E-16	1.67E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	12,979,289	0.00E+00	2.58E-14	5.39E-14	0.00E+00	0.00E+00	0.00E+00
U-234	12,979,289	0.00E+00	7.46E-15	1.97E-14	0.00E+00	0.00E+00	0.00E+00
U-235	12,979,289	0.00E+00	2.31E-16	6.08E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 646 Bldg. 110		39.45 m³/min		0.66 m³/sec			
Pu-241	10,527,167	0.00E+00	7.99E-16	1.66E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	10,527,167	0.00E+00	2.58E-14	5.37E-14	0.00E+00	0.00E+00	0.00E+00
U-234	10,527,167	0.00E+00	6.94E-15	1.95E-14	0.00E+00	0.00E+00	0.00E+00
U-235	10,527,167	0.00E+00	2.15E-16	6.02E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 701 Bldg. 307		120.08 m³/min		2.00 m³/sec			
Pu-241	32,012,752	0.00E+00	9.06E-16	1.88E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	32,012,752	0.00E+00	2.93E-14	6.09E-14	0.00E+00	0.00E+00	0.00E+00
U-234	32,012,752	0.00E+00	7.89E-15	2.22E-14	0.00E+00	0.00E+00	0.00E+00
U-235	32,012,752	0.00E+00	2.44E-16	6.87E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 702 Bldg. 307		164.17 m³/min		2.74 m³/sec			
Pu-241	43,724,673	0.00E+00	8.14E-16	1.65E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	43,724,673	0.00E+00	2.63E-14	5.35E-14	0.00E+00	0.00E+00	0.00E+00
U-234	43,724,673	8.75E-15	9.30E-15	1.95E-14	3.83E-07	6.13E-05	1.75E-01
U-235	43,724,673	2.71E-16	2.88E-16	6.04E-16	1.18E-08	5.48E-03	4.51E-03
						Total:	1.80E-01

¹ 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 July 1, 2018 to December 31, 2018

Location	Total Volume (m ³)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV ¹
Stack 703 Exhaust Room Air		817.54 m³/min		13.63 m³/sec			
Pu-241	217,791,531	0.00E+00	2.35E-14	4.92E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	217,791,531	0.00E+00	7.08E-16	1.77E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	217,791,531	0.00E+00	4.08E-16	1.02E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	217,791,531	0.00E+00	5.79E-16	1.45E-15	0.00E+00	0.00E+00	0.00E+00
U-234	217,791,531	0.00E+00	4.43E-15	1.11E-14	0.00E+00	0.00E+00	0.00E+00
U-235	217,791,531	0.00E+00	4.58E-16	1.15E-15	0.00E+00	0.00E+00	0.00E+00
U-238	217,791,531	0.00E+00	5.58E-16	1.40E-15	0.00E+00	0.00E+00	0.00E+00
Total:						0.00E+00	
Stack 773 Bldg. 440		177.77 m³/min		2.96 m³/sec			
Pu-241	47,358,776	0.00E+00	3.37E-14	6.97E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	47,358,776	0.00E+00	1.11E-15	3.53E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	47,358,776	0.00E+00	1.43E-15	4.54E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	47,358,776	0.00E+00	9.54E-16	3.03E-15	0.00E+00	0.00E+00	0.00E+00
U-234	47,358,776	0.00E+00	2.94E-15	9.34E-15	0.00E+00	0.00E+00	0.00E+00
U-235	47,358,776	0.00E+00	5.17E-16	1.64E-15	0.00E+00	0.00E+00	0.00E+00
U-238	47,358,776	0.00E+00	1.03E-15	3.28E-15	0.00E+00	0.00E+00	0.00E+00
Total:						0.00E+00	
Stack 774 Bldg. 301		326.68 m³/min		5.44 m³/sec			
Th-228	87,049,739	0.00E+00	1.66E-16	4.55E-16	0.00E+00	0.00E+00	0.00E+00
Th-230	87,049,739	0.00E+00	5.66E-16	1.55E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	87,049,739	0.00E+00	3.35E-16	9.19E-16	0.00E+00	0.00E+00	0.00E+00
U-234	87,049,739	0.00E+00	1.51E-15	4.14E-15	0.00E+00	0.00E+00	0.00E+00
U-235	87,049,739	0.00E+00	9.83E-17	2.69E-16	0.00E+00	0.00E+00	0.00E+00
U-238	87,049,739	0.00E+00	7.12E-16	1.95E-15	0.00E+00	0.00E+00	0.00E+00
Total:						0.00E+00	
Stack 796 Bldg. 100		19.19 m³/min		0.32 m³/sec			
Pu-241	5,122,640	1.81E-16	9.00E-16	1.69E-15	9.29E-10	9.02E-12	2.27E-04
Tc-99	5,122,640	5.86E-15	2.91E-14	5.45E-14	3.00E-08	1.78E-06	6.51E-06
U-234	5,122,640	0.00E+00	7.12E-15	1.98E-14	0.00E+00	0.00E+00	0.00E+00
U-235	5,122,640	0.00E+00	2.20E-16	6.12E-16	0.00E+00	0.00E+00	0.00E+00
Total:						2.33E-04	

¹ 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 February 20, 2019

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

(4 Pages to Follow)

Report of Potential Gaseous Effluent Dose to the Maximally Exposed Offsite Individual and on the Maximum Radionuclide Concentrations for the Period: July to December 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 second 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 350 meters North-Northeast from the center of the plant site. The TEDE to the MEI was estimated to be 1.9E-03 mrem for gaseous effluents released during the second half of 2018. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 1.0E-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

Organ	Committed Dose Equivalent (mrem per second half of 2018)
Adrenals	1.3E-04
Urinary Bladder Wall	1.6E-04
Bone Surface	4.8E-03
Brain	1.3E-04
Breasts	1.4E-04
Stomach Wall	2.5E-03
Small Intestine	1.5E-04
Upper Large Intestine Wall	7.4E-04
Lower Large Intestine Wall	1.9E-03
Kidneys	1.7E-03
Liver	4.1E-04
Muscle	1.4E-04
Ovaries	1.3E-04
Pancreas	1.3E-04
Red Bone Marrow	6.1E-04
Skin	3.2E-04
Spleen	1.3E-04
Testes	1.4E-04
Thymus	1.3E-04
Thyroid	1.3E-03
Gall Bladder Wall	1.3E-04
Heart Wall	1.3E-04
Uterus	1.3E-04
Extra-thoracic	8.7E-03
Lungs	1.0E-02
Total Effective Dose Equivalent	1.9E-03 mrem
Location of MEI:	350 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 3.3E-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)		
⁹⁹ Tc	9.8E-18	NNE	350	9.E-10	1.1E-08
²²⁸ Th	0.0E+00	N/A	N/A	2.E-14	0.0E+00
²³⁰ Th	1.8E-20	NNE	700	2.E-14	8.8E-07
²³² Th	0.0E+00	N/A	N/A	4.E-15	0.0E+00
²³⁴ U	1.6E-17	NNE	400	5.E-14	3.2E-04
²³⁵ U	5.7E-19	NNE	500	6.E-14	9.5E-06
²³⁸ U	1.2E-19	NNE	700	6.E-14	2.1E-06
²³⁸ Pu	0.0E+00	N/A	N/A	2.E-14	0.0E+00
²³⁹ Pu	0.0E+00	N/A	N/A	2.E-14	0.0E+00
²⁴¹ Pu	3.1E-19	NNE	350	8.E-13	3.8E-07
²⁴¹ Am	2.0E-27	NNE	550	2.E-14	9.9E-14
				Sum of Fractions:	3.3E-04

N/A: Not Applicable due to 0.0 max. concentration.

The TEDE to the MEI for gaseous effluents released during 2018 is provided in Table 3. The results for the 1st half of 2018 were previously reported in *Biannual Effluent Monitoring Report January through June 2018* (21G-18-0098). The annual dose is well below the Environmental Radiological Monitoring Program action levels and applicable regulatory limits/ALARA constraints.

Table 3. Annual Dose to the MEI for Gaseous Effluents Released During 2018

Period Covered	Direction	Distance (m)	TEDE (mrem)
2 nd Half	NNE	350	1.9E-03
1 st Half	NNE	400	2.2E-03
Annual Total			4.1E-03