



Nuclear Fuel Services, Inc.

21G-19-0107
GOV-01-55
ACF-19-0183
August 26, 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 January to June 2019**

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 January to June 2019. Attachment 2 reports the Radioactivity in Effluent Air for the period January to June 2019. 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 2019.

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-19-0107) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

Richard J. Freudemberger
Safety & Safeguards Director

CJB/pj
Attachments

- 1) Report of Radioactivity in Effluent Liquid for the Period January to June 2019
- 2) Report of Radioactivity in Effluent Air for the Period January to June 2019
- 3) Report of Gaseous Effluent Dose and Activity Concentrations for the Maximally Exposed Off-Site Individual for the Release Period January to June 2019

NMSS20
NMSS01

Copy:

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

Attachment 1
To Letter Dated August 26, 2019

Report of Radioactivity in Effluent Liquid for the Period
January to June 2019

(2 Pages to Follow)

Radioactivity in Effluent Liquid January 1, 2019 to June 30, 2019

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	546,768,000	0.00E+00	1.33E-10	3.47E-10	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	546,768,000	0.00E+00	1.51E-10	3.74E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	546,768,000	0.00E+00	3.55E-08	6.26E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	546,768,000	0.00E+00	1.51E-10	3.54E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	546,768,000	3.10E-11	1.62E-10	3.43E-10	1.70E-05	8.40E-04	3.10E-04
Th-232	546,768,000	4.23E-11	1.26E-10	2.32E-10	2.31E-05	2.12E+02	1.41E-03
U-233/234	546,768,000	4.84E-10	2.97E-10	3.29E-10	2.65E-04	4.24E-02	1.61E-03
U-235/236	546,768,000	6.05E-11	1.51E-10	2.35E-10	3.31E-05	1.53E+01	2.02E-04
U-238	546,768,000	1.33E-10	1.88E-10	2.83E-10	7.28E-05	2.17E+02	4.44E-04
Total:							3.98E-03
Sewer							
Pu-238	31,394,000	0.00E+00	1.49E-10	3.26E-10	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	31,394,000	0.00E+00	1.16E-10	2.74E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	31,394,000	0.00E+00	4.04E-08	7.02E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	31,394,000	2.24E-11	1.99E-10	4.19E-10	7.02E-07	8.57E-10	1.12E-05
Th-230	31,394,000	8.80E-11	2.08E-10	3.71E-10	2.76E-06	1.37E-04	8.80E-05
Th-232	31,394,000	3.27E-11	1.57E-10	3.04E-10	1.03E-06	9.43E+00	1.09E-04
U-232	31,394,000	5.18E-11	1.46E-10	2.72E-10	1.63E-06	7.60E-08	8.63E-05
U-233/234	31,394,000	1.73E-08	1.22E-09	1.79E-10	5.44E-04	8.71E-02	5.77E-03
U-235/236	31,394,000	9.76E-10	2.98E-10	1.52E-10	3.06E-05	1.42E+01	3.25E-04
U-238	31,394,000	2.35E-09	4.53E-10	1.56E-10	7.37E-05	2.20E+02	7.83E-04
Total:							7.18E-03
West Ditch							
Pu-238	181,889,000	5.23E-12	1.28E-10	2.89E-10	9.51E-07	5.56E-08	2.61E-04
Pu-239/240	181,889,000	6.60E-12	1.34E-10	3.00E-10	1.20E-06	1.93E-05	3.30E-04
Tc-99	181,889,000	0.00E+00	3.61E-08	6.37E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	181,889,000	4.73E-12	1.64E-10	3.52E-10	8.60E-07	1.05E-09	2.36E-05
Th-230	181,889,000	2.42E-11	1.72E-10	3.66E-10	4.40E-06	2.18E-04	2.42E-04
Th-232	181,889,000	4.98E-11	1.27E-10	2.22E-10	9.06E-06	8.31E+01	1.66E-03
U-233/234	181,889,000	1.76E-08	1.77E-09	3.97E-10	3.19E-03	5.12E-01	5.85E-02
U-235/236	181,889,000	8.51E-10	4.47E-10	2.33E-10	1.55E-04	7.16E+01	2.84E-03
U-238	181,889,000	2.24E-09	6.43E-10	2.84E-10	4.07E-04	1.22E+03	7.46E-03
Total:							7.14E-02
WWTF							
Am-241	4,149,746	1.52E-11	7.07E-11	1.27E-10	6.32E-08	1.84E-08	7.61E-04
Cs-137	4,149,746	7.37E-10	1.09E-09	1.55E-09	3.06E-06	3.52E-08	7.37E-04
Na-22	4,149,746	0.00E+00	8.24E-10	1.47E-09	0.00E+00	0.00E+00	0.00E+00
Np-237	4,149,746	0.00E+00	1.41E-10	3.28E-10	0.00E+00	0.00E+00	0.00E+00
Pb-212	4,149,746	0.00E+00	3.08E-09	2.85E-09	0.00E+00	0.00E+00	0.00E+00
Pu-238	4,149,746	3.12E-11	8.36E-11	1.54E-10	1.30E-07	7.58E-09	1.56E-03

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

January 1, 2019 to June 30, 2019

Location	Total Volume (l)	Activity Concentration ($\mu\text{Ci/ml}$)	Error Estimate ($\mu\text{Ci/ml}$)	LLD ($\mu\text{Ci/ml}$)	Quantity Released (Ci)	Quantity Released (g)	Fraction of ECV ¹
WWTF							
Pu-239/240	4,149,746	0.00E+00	6.74E-11	1.57E-10	0.00E+00	0.00E+00	0.00E+00
Pu-241	4,149,746	0.00E+00	9.51E-09	1.65E-08	0.00E+00	0.00E+00	0.00E+00
Ra-224	4,149,746	1.31E-08	8.72E-09	1.61E-08	5.45E-05	3.43E-10	6.56E-02
Tc-99	4,149,746	6.62E-09	8.50E-08	1.47E-07	2.75E-05	1.62E-03	1.10E-04
Th-228	4,149,746	0.00E+00	1.49E-10	3.31E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	4,149,746	7.15E-11	1.87E-10	3.27E-10	2.97E-07	1.47E-05	7.15E-04
Th-231	4,149,746	5.31E-09	4.07E-08	3.99E-08	2.20E-05	4.14E-11	1.06E-04
Th-232	4,149,746	0.00E+00	1.17E-10	2.53E-10	0.00E+00	0.00E+00	0.00E+00
U-232	4,149,746	0.00E+00	1.03E-10	2.32E-10	0.00E+00	0.00E+00	0.00E+00
U-233/234	4,149,746	3.37E-08	1.65E-09	1.75E-10	1.40E-04	2.24E-02	1.12E-01
U-235/236	4,149,746	1.70E-09	3.66E-10	1.50E-10	7.05E-06	3.26E+00	5.66E-03
U-238	4,149,746	4.77E-10	1.94E-10	1.57E-10	1.98E-06	5.91E+00	1.59E-03
Total:							1.89E-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 August 26, 2019**

**Report of Radioactivity in Effluent Air for the Period
January to June 2019**

(3 Pages to Follow)

Radioactivity in Effluent Air

January 1, 2019 to June 30, 2019

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		1056.22 m³/min		17.60 m³/sec			
Th-230	272,250,800	4.77E-16	1.27E-16	8.83E-17	1.30E-07	6.43E-06	2.39E-02
U-234	272,250,800	1.09E-13	2.90E-14	2.01E-14	2.96E-05	4.75E-03	2.18E+00
U-235	272,250,800	6.68E-15	1.78E-15	1.24E-15	1.82E-06	8.42E-01	1.11E-01
U-238	272,250,800	3.34E-15	8.91E-16	6.18E-16	9.09E-07	2.71E+00	5.57E-02
Total:							2.37E+00
Stack 185 Bldg. 131		109.03 m³/min		1.82 m³/sec			
Pu-241	28,104,061	0.00E+00	8.73E-16	1.78E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	28,104,061	0.00E+00	2.82E-14	5.74E-14	0.00E+00	0.00E+00	0.00E+00
U-234	28,104,061	0.00E+00	7.16E-15	2.16E-14	0.00E+00	0.00E+00	0.00E+00
U-235	28,104,061	0.00E+00	2.21E-16	6.67E-16	0.00E+00	0.00E+00	0.00E+00
Total:							0.00E+00
Stack 234 Bldg. 234		293.87 m³/min		4.90 m³/sec			
Am-241	74,535,748	1.18E-16	3.14E-17	5.04E-17	8.77E-09	2.56E-09	5.88E-03
Pu-238	74,535,748	1.44E-16	3.83E-17	6.16E-17	1.07E-08	6.27E-10	7.19E-03
Pu-239/240	74,535,748	5.10E-16	1.36E-16	2.18E-16	3.80E-08	6.11E-07	2.55E-02
Pu-241	74,535,748	0.00E+00	4.34E-15	8.15E-15	0.00E+00	0.00E+00	0.00E+00
Th-228	74,535,748	7.84E-17	2.09E-17	3.36E-17	5.85E-09	7.14E-12	3.92E-03
Th-230	74,535,748	9.80E-16	2.61E-16	4.20E-16	7.31E-08	3.62E-06	4.90E-02
Th-232	74,535,748	1.24E-15	3.31E-16	5.32E-16	9.26E-08	8.49E-01	3.10E-01
U-234	74,535,748	2.68E-15	7.15E-16	1.15E-15	2.00E-07	3.20E-05	5.36E-02
U-238	74,535,748	7.84E-16	2.09E-16	3.36E-16	5.85E-08	1.75E-01	1.31E-02
Total:							4.69E-01
Stack 327 Bldg. 330		1035.87 m³/min		17.26 m³/sec			
Pu-241	267,024,629	1.22E-15	4.88E-16	7.73E-16	3.25E-07	3.15E-09	1.52E-03
Tc-99	267,024,629	3.93E-14	1.58E-14	2.50E-14	1.05E-05	6.21E-04	4.37E-05
U-234	267,024,629	8.83E-14	1.14E-14	9.44E-15	2.36E-05	3.78E-03	1.77E+00
U-235	267,024,629	2.73E-15	3.52E-16	2.92E-16	7.29E-07	3.38E-01	4.55E-02
Total:							1.81E+00
Stack 421 Bldg. 100		33.19 m³/min		0.55 m³/sec			
Pu-241	8,554,371	2.23E-15	1.48E-15	2.27E-15	1.91E-08	1.86E-10	2.79E-03
Tc-99	8,554,371	7.22E-14	4.78E-14	7.35E-14	6.18E-07	3.66E-05	8.02E-05
U-234	8,554,371	1.29E-13	2.86E-14	2.61E-14	1.11E-06	1.77E-04	2.58E+00
U-235	8,554,371	4.00E-15	8.84E-16	8.06E-16	3.42E-08	1.58E-02	6.66E-02
Total:							2.65E+00
Stack 424 Bldg. 100		33.41 m³/min		0.56 m³/sec			
Pu-241	8,612,762	3.72E-16	9.93E-16	1.79E-15	3.20E-09	3.11E-11	4.65E-04
Tc-99	8,612,762	1.20E-14	3.21E-14	5.79E-14	1.04E-07	6.13E-06	1.34E-05
U-234	8,612,762	8.66E-15	1.25E-14	2.18E-14	7.46E-08	1.20E-05	1.73E-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

January 1, 2019 to June 30, 2019

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		33.41 m³/min		0.56 m³/sec			
U-235	8,612,762	2.68E-16	3.86E-16	6.73E-16	2.31E-09	1.07E-03	4.47E-03
						Total:	1.78E-01
Stack 573 Bldg 306-W		80.93 m³/min		1.35 m³/sec			
Pu-241	20,860,403	0.00E+00	8.08E-16	1.66E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	20,860,403	0.00E+00	2.61E-14	5.36E-14	0.00E+00	0.00E+00	0.00E+00
U-234	20,860,403	0.00E+00	7.09E-15	2.02E-14	0.00E+00	0.00E+00	0.00E+00
U-235	20,860,403	0.00E+00	2.19E-16	6.25E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 600 Bldg. 110		309.02 m³/min		5.15 m³/sec			
Pu-241	79,653,455	4.80E-16	5.79E-16	1.04E-15	3.82E-08	3.71E-10	5.99E-04
Tc-99	79,653,455	1.55E-14	1.87E-14	3.37E-14	1.24E-06	7.31E-05	1.72E-05
U-234	79,653,455	2.42E-14	7.86E-15	1.32E-14	1.93E-06	3.09E-04	4.84E-01
U-235	79,653,455	7.48E-16	2.43E-16	4.07E-16	5.96E-08	2.76E-02	1.25E-02
						Total:	4.97E-01
Stack 615 Bldg. 306-W		48.67 m³/min		0.81 m³/sec			
Pu-241	12,546,082	0.00E+00	8.48E-16	1.78E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	12,546,082	0.00E+00	2.74E-14	5.75E-14	0.00E+00	0.00E+00	0.00E+00
U-234	12,546,082	0.00E+00	6.49E-15	2.16E-14	0.00E+00	0.00E+00	0.00E+00
U-235	12,546,082	0.00E+00	2.01E-16	6.68E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 646 Bldg. 110		38.62 m³/min		0.64 m³/sec			
Pu-241	9,955,770	0.00E+00	8.45E-16	1.78E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	9,955,770	0.00E+00	2.73E-14	5.75E-14	0.00E+00	0.00E+00	0.00E+00
U-234	9,955,770	0.00E+00	6.64E-15	2.16E-14	0.00E+00	0.00E+00	0.00E+00
U-235	9,955,770	0.00E+00	2.05E-16	6.68E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 701 Bldg. 307		123.21 m³/min		2.05 m³/sec			
Pu-241	31,757,737	0.00E+00	9.61E-16	2.02E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	31,757,737	0.00E+00	3.11E-14	6.53E-14	0.00E+00	0.00E+00	0.00E+00
U-234	31,757,737	0.00E+00	7.48E-15	2.45E-14	0.00E+00	0.00E+00	0.00E+00
U-235	31,757,737	0.00E+00	2.31E-16	7.58E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 702 Bldg. 307		161.26 m³/min		2.69 m³/sec			
Pu-241	41,567,527	0.00E+00	8.29E-16	1.78E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	41,567,527	0.00E+00	2.68E-14	5.74E-14	0.00E+00	0.00E+00	0.00E+00
U-234	41,567,527	0.00E+00	7.21E-15	2.16E-14	0.00E+00	0.00E+00	0.00E+00
U-235	41,567,527	0.00E+00	2.23E-16	6.68E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+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

January 1, 2019 to June 30, 2019

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		816.07 m³/min	13.60 m³/sec				
Pu-241	210,349,903	0.00E+00	2.51E-14	5.30E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	210,349,903	0.00E+00	7.89E-16	1.97E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	210,349,903	0.00E+00	4.54E-16	1.14E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	210,349,903	0.00E+00	6.45E-16	1.61E-15	0.00E+00	0.00E+00	0.00E+00
U-234	210,349,903	0.00E+00	4.94E-15	1.24E-14	0.00E+00	0.00E+00	0.00E+00
U-235	210,349,903	0.00E+00	5.10E-16	1.28E-15	0.00E+00	0.00E+00	0.00E+00
U-238	210,349,903	0.00E+00	6.21E-16	1.55E-15	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 773 Bldg. 440		182.40 m³/min	3.04 m³/sec				
Pu-241	46,914,845	0.00E+00	3.45E-14	6.91E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	46,914,845	0.00E+00	1.26E-15	3.64E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	46,914,845	0.00E+00	1.62E-15	4.69E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	46,914,845	0.00E+00	1.08E-15	3.12E-15	0.00E+00	0.00E+00	0.00E+00
U-234	46,914,845	0.00E+00	3.33E-15	9.63E-15	0.00E+00	0.00E+00	0.00E+00
U-235	46,914,845	0.00E+00	5.86E-16	1.69E-15	0.00E+00	0.00E+00	0.00E+00
U-238	46,914,845	0.00E+00	1.17E-15	3.38E-15	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 774 Bldg. 301		319.70 m³/min	5.33 m³/sec				
Th-228	82,380,001	0.00E+00	1.63E-16	4.54E-16	0.00E+00	0.00E+00	0.00E+00
Th-230	82,380,001	0.00E+00	5.56E-16	1.55E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	82,380,001	0.00E+00	3.30E-16	9.18E-16	0.00E+00	0.00E+00	0.00E+00
U-234	82,380,001	0.00E+00	1.49E-15	4.13E-15	0.00E+00	0.00E+00	0.00E+00
U-235	82,380,001	0.00E+00	9.66E-17	2.69E-16	0.00E+00	0.00E+00	0.00E+00
U-238	82,380,001	0.00E+00	7.00E-16	1.95E-15	0.00E+00	0.00E+00	0.00E+00
						Total:	0.00E+00
Stack 796 Bldg. 100		18.69 m³/min	0.31 m³/sec				
Pu-241	4,817,308	1.04E-16	9.40E-16	1.78E-15	5.01E-10	4.86E-12	1.30E-04
Tc-99	4,817,308	3.36E-15	3.04E-14	5.74E-14	1.62E-08	9.58E-07	3.73E-06
U-234	4,817,308	0.00E+00	7.32E-15	2.16E-14	0.00E+00	0.00E+00	0.00E+00
U-235	4,817,308	0.00E+00	2.26E-16	6.67E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	1.34E-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 August 26, 2019**

**Report of Gaseous Effluent Dose and Activity Concentrations
for the Maximally Exposed
Off-Site Individual for the Release Period
January to June 2019**

(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 2019

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 2019. 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 1.4E-03 mrem for gaseous effluents released during the first half of 2019. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 7.7E-03 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 first half of 2019)
Adrenals	9.6E-05
Urinary Bladder Wall	1.1E-04
Bone Surface	4.5E-03
Brain	9.7E-05
Breasts	1.0E-04
Stomach Wall	1.2E-03
Small Intestine	1.1E-04
Upper Large Intestine Wall	4.1E-04
Lower Large Intestine Wall	1.0E-03
Kidneys	1.3E-03
Liver	3.8E-04
Muscle	1.0E-04
Ovaries	1.1E-04
Pancreas	9.6E-05
Red Bone Marrow	5.7E-04
Skin	3.0E-04
Spleen	9.7E-05
Testes	1.2E-04
Thymus	9.7E-05
Thyroid	6.3E-04
Gall Bladder Wall	9.6E-05
Heart Wall	9.7E-05
Uterus	9.6E-05
Extra-thoracic	6.6E-03
Lungs	7.7E-03
Total Effective Dose Equivalent	1.4E-03 mrem
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 2.8E-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 ($\mu\text{Ci/mL}$)	Concentration Location		10 CFR 20, App. B, Table 2, Col. 1 Value ($\mu\text{Ci/mL}$)	Ratio of Maximum Concentration to 10 CFR 20 Value
		Sector	Dist. (m)		
^{99}Tc	4.7E-18	NNE	400	9.E-10	5.2E-09
^{228}Th	6.4E-21	NNE	200	2.E-14	3.2E-07
^{230}Th	7.9E-20	NNE	200	2.E-14	4.0E-06
^{232}Th	1.0E-19	NNE	200	4.E-15	2.5E-05
^{234}U	1.2E-17	NNE	450	5.E-14	2.4E-04
^{235}U	4.5E-19	NNE	500	6.E-14	7.4E-06
^{238}U	1.2E-19	NNE	650	6.E-14	2.1E-06
^{238}Pu	1.2E-20	NNE	200	2.E-14	5.8E-07
^{239}Pu	4.1E-20	NNE	200	2.E-14	2.1E-06
^{241}Pu	1.4E-19	NNE	350	8.E-13	1.8E-07
^{241}Am	9.5E-21	NNE	200	2.E-14	4.8E-07
Sum of Fractions:					2.8E-04