NUCLEAR FUEL SERVICES, INC.
a BWX Technologies, Inc. company

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www.nuclearfuelservices.com

21G-18-0027
GOV-01-55
ACF-18-0038
February 16, 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 July to December 2017**

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 2017. Attachment 2 reports the Radioactivity in Effluent Air for the period July to December 2017. 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 2017.

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-18-0027) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

Richard J. Freudenberger
Safety & Safeguards Director

IE48
NMSS20

NMSS

CJB/pj
Attachments
1) Report of Radioactivity in Effluent Liquid for the Period July to December 2017
2) Report of Radioactivity in Effluent Air for the Period July to December 2017
3) Report of Gaseous Effluent Dose and Activity Concentrations for the Maximally Exposed Off-Site Individual for the Release Period July to December 2017

Copy:

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

Attachment 1
To Letter Dated February 16, 2018

Report of Radioactivity in Effluent Liquid for the Period July to December 2017

(2 Pages to Follow)

Radioactivity in Effluent Liquid
July 1, 2017 to December 31, 2017

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	426,241,000	5.80E-11	1.13E-10	2.14E-10	2.47E-05	1.45E-06	2.90E-03
Pu-239/240	426,241,000	0.00E+00	1.01E-10	2.57E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	426,241,000	2.69E-09	2.99E-08	5.19E-08	1.15E-03	6.79E-02	4.49E-05
Th-228	426,241,000	2.04E-11	1.16E-10	2.36E-10	8.70E-06	1.06E-08	1.02E-04
Th-230	426,241,000	1.39E-10	1.73E-10	2.73E-10	5.92E-05	2.93E-03	1.39E-03
Th-232	426,241,000	3.19E-11	9.86E-11	1.67E-10	1.36E-05	1.25E+02	1.06E-03
U-233/234	426,241,000	4.62E-10	2.89E-10	2.73E-10	1.97E-04	3.16E-02	1.54E-03
U-235/236	426,241,000	1.25E-10	1.85E-10	2.41E-10	5.34E-05	2.47E+01	4.18E-04
U-238	426,241,000	1.05E-10	1.64E-10	2.61E-10	4.47E-05	1.34E+02	3.50E-04
						Total:	**7.81E-03**
Sewer							
Pu-238	23,501,679	2.41E-12	7.29E-11	1.58E-10	5.66E-08	3.31E-09	1.20E-05
Pu-239/240	23,501,679	0.00E+00	8.30E-11	1.86E-10	0.00E+00	0.00E+00	0.00E+00
Tc-99	23,501,679	5.35E-09	3.04E-08	5.25E-08	1.26E-04	7.44E-03	8.92E-06
Th-228	23,501,679	1.37E-11	1.36E-10	2.88E-10	3.22E-07	3.93E-10	6.85E-06
Th-230	23,501,679	1.08E-10	2.06E-10	3.55E-10	2.54E-06	1.26E-04	1.08E-04
Th-232	23,501,679	1.55E-11	1.06E-10	1.77E-10	3.64E-07	3.34E+00	5.17E-05
U-232	23,501,679	0.00E+00	1.07E-10	2.30E-10	0.00E+00	0.00E+00	0.00E+00
U-233/234	23,501,679	6.28E-09	7.42E-10	1.57E-10	1.48E-04	2.36E-02	2.09E-03
U-235/236	23,501,679	2.21E-10	1.51E-10	1.39E-10	5.19E-06	2.40E+00	7.37E-05
U-238	23,501,679	9.59E-10	2.96E-10	1.44E-10	2.25E-05	6.73E+01	3.20E-04
						Total:	**2.67E-03**
West Ditch							
Pu-238	118,638,000	0.00E+00	1.28E-10	3.07E-10	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	118,638,000	2.76E-12	1.57E-10	3.43E-10	3.27E-07	5.26E-06	1.38E-04
Tc-99	118,638,000	0.00E+00	3.10E-08	5.42E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	118,638,000	1.40E-11	1.16E-10	2.44E-10	1.66E-06	2.02E-09	6.99E-05
Th-230	118,638,000	1.66E-11	1.64E-10	3.52E-10	1.97E-06	9.76E-05	1.66E-04
Th-232	118,638,000	0.00E+00	8.86E-11	1.91E-10	0.00E+00	0.00E+00	0.00E+00
U-233/234	118,638,000	1.41E-08	1.41E-09	2.46E-10	1.67E-03	2.68E-01	4.70E-02
U-235/236	118,638,000	8.46E-10	3.94E-10	2.28E-10	1.00E-04	4.65E+01	2.82E-03
U-238	118,638,000	1.58E-09	4.75E-10	2.33E-10	1.87E-04	5.59E+02	5.26E-03
						Total:	**5.55E-02**
WWTF							
Am-241	3,565,706	1.65E-11	7.68E-11	1.23E-10	5.87E-08	1.71E-08	8.23E-04
Cs-137	3,565,706	1.65E-10	8.32E-10	1.41E-09	5.89E-07	6.77E-09	1.65E-04
Na-22	3,565,706	0.00E+00	9.92E-10	1.49E-09	0.00E+00	0.00E+00	0.00E+00
Np-237	3,565,706	1.08E-11	2.12E-10	4.36E-10	3.85E-08	5.46E-05	5.39E-04
Pb-212	3,565,706	1.27E-09	3.30E-09	2.73E-09	4.52E-06	3.27E-12	6.33E-04
Pu-238	3,565,706	0.00E+00	6.85E-11	1.49E-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, 2017 to December 31, 2017

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	3,565,706	3.12E-11	7.80E-11	1.39E-10	1.11E-07	1.79E-06	1.56E-03
Pu-241	3,565,706	0.00E+00	1.13E-08	1.98E-08	0.00E+00	0.00E+00	0.00E+00
Ra-224	3,565,706	7.62E-09	3.29E-09	5.95E-09	2.72E-05	1.71E-10	3.81E-02
Tc-99	3,565,706	3.12E-09	1.44E-07	2.47E-07	1.11E-05	6.58E-04	5.20E-05
Th-228	3,565,706	0.00E+00	1.37E-10	3.39E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	3,565,706	3.02E-11	1.85E-10	3.58E-10	1.08E-07	5.34E-06	3.02E-04
Th-231	3,565,706	6.07E-09	3.73E-08	3.75E-08	2.16E-05	4.07E-11	1.21E-04
Th-232	3,565,706	1.87E-12	1.15E-10	2.62E-10	6.67E-09	6.12E-02	6.23E-05
U-232	3,565,706	0.00E+00	8.74E-11	2.23E-10	0.00E+00	0.00E+00	0.00E+00
U-233/234	3,565,706	1.57E-08	1.14E-09	1.13E-10	5.61E-05	9.00E-03	5.25E-02
U-235/236	3,565,706	9.26E-10	2.80E-10	1.10E-10	3.30E-06	1.53E+00	3.09E-03
U-238	3,565,706	2.96E-10	1.66E-10	1.40E-10	1.06E-06	3.15E+00	9.87E-04
						Total:	**9.89E-02**

[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 16, 2018

Report of Radioactivity in Effluent Air for the Period
July to December 2017

(3 Pages to Follow)

Radioactivity in Effluent Air
July 1, 2017 to December 31, 2017

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		**1079.74 m^3/min**		**18.00 m^3/sec**			
Th-230	283,054,308	7.18E-16	1.49E-16	8.91E-17	2.03E-07	1.01E-05	3.59E-02
U-234	283,054,308	1.64E-13	3.39E-14	2.03E-14	4.63E-05	7.43E-03	3.27E+00
U-235	283,054,308	1.01E-14	2.08E-15	1.25E-15	2.85E-06	1.32E+00	1.68E-01
U-238	283,054,308	5.03E-15	1.04E-15	6.24E-16	1.42E-06	4.25E+00	8.38E-02
						Total:	**3.56E+00**
Stack 185 Bldg. 131		**101.57 m^3/min**		**1.69 m^3/sec**			
Pu-241	26,620,132	0.00E+00	8.28E-16	1.68E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	26,620,132	0.00E+00	2.68E-14	5.45E-14	0.00E+00	0.00E+00	0.00E+00
U-234	26,620,132	0.00E+00	8.08E-15	2.01E-14	0.00E+00	0.00E+00	0.00E+00
U-235	26,620,132	0.00E+00	2.50E-16	6.21E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	**0.00E+00**
Stack 234 Bldg. 234		**300.41 m^3/min**		**5.01 m^3/sec**			
Am-241	79,164,955	0.00E+00	2.13E-17	4.74E-17	0.00E+00	0.00E+00	0.00E+00
Pu-238	79,164,955	0.00E+00	2.60E-17	5.79E-17	0.00E+00	0.00E+00	0.00E+00
Pu-239/240	79,164,955	0.00E+00	9.21E-17	2.05E-16	0.00E+00	0.00E+00	0.00E+00
Pu-241	79,164,955	0.00E+00	4.01E-15	7.85E-15	0.00E+00	0.00E+00	0.00E+00
Th-228	79,164,955	0.00E+00	1.42E-17	3.16E-17	0.00E+00	0.00E+00	0.00E+00
Th-230	79,164,955	0.00E+00	1.77E-16	3.95E-16	0.00E+00	0.00E+00	0.00E+00
Th-232	79,164,955	0.00E+00	2.24E-16	5.00E-16	0.00E+00	0.00E+00	0.00E+00
U-234	79,164,955	0.00E+00	4.84E-16	1.08E-15	0.00E+00	0.00E+00	0.00E+00
U-238	79,164,955	0.00E+00	1.42E-16	3.16E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	**0.00E+00**
Stack 327 Bldg. 330		**1022.35 m^3/min**		**17.04 m^3/sec**			
Pu-241	267,968,640	1.81E-15	5.09E-16	7.51E-16	4.85E-07	4.70E-09	2.26E-03
Tc-99	267,968,640	5.85E-14	1.65E-14	2.43E-14	1.57E-05	9.27E-04	6.50E-05
U-234	267,968,640	8.71E-14	1.13E-14	8.84E-15	2.33E-05	3.74E-03	1.74E+00
U-235	267,968,640	2.69E-15	3.51E-16	2.73E-16	7.22E-07	3.34E-01	4.49E-02
						Total:	**1.79E+00**
Stack 421 Bldg. 100		**36.31 m^3/min**		**0.61 m^3/sec**			
Pu-241	9,573,696	2.88E-15	1.58E-15	2.31E-15	2.76E-08	2.68E-10	3.60E-03
Tc-99	9,573,696	9.31E-14	5.11E-14	7.48E-14	8.91E-07	5.27E-05	1.03E-04
U-234	9,573,696	1.82E-13	3.46E-14	2.65E-14	1.74E-06	2.80E-04	3.64E+00
U-235	9,573,696	5.63E-15	1.07E-15	8.19E-16	5.39E-08	2.50E-02	9.39E-02
						Total:	**3.74E+00**
Stack 424 Bldg. 100		**34.81 m^3/min**		**0.58 m^3/sec**			
Pu-241	9,164,221	1.12E-15	1.03E-15	1.69E-15	1.03E-08	9.99E-11	1.40E-03
Tc-99	9,164,221	3.63E-14	3.34E-14	5.46E-14	3.33E-07	1.97E-05	4.03E-05
U-234	9,164,221	6.58E-14	1.83E-14	2.02E-14	6.03E-07	9.66E-05	1.32E+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, 2017 to December 31, 2017

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		**34.81 m^3/min**	**0.58 m^3/sec**				
U-235	9,164,221	2.03E-15	5.65E-16	6.24E-16	1.86E-08	8.63E-03	3.39E-02
						Total:	**1.35E+00**
Stack 573 Bldg 306-W		**79.55 m^3/min**	**1.33 m^3/sec**				
Pu-241	20,858,690	0.00E+00	7.65E-16	1.51E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	20,858,690	0.00E+00	2.47E-14	4.88E-14	0.00E+00	0.00E+00	0.00E+00
U-234	20,858,690	3.57E-15	7.69E-15	1.83E-14	7.46E-08	1.20E-05	7.15E-02
U-235	20,858,690	1.11E-16	2.38E-16	5.65E-16	2.31E-09	1.07E-03	1.84E-03
						Total:	**7.33E-02**
Stack 600 Bldg. 110		**299.91 m^3/min**	**5.00 m^3/sec**				
Pu-241	78,604,282	2.75E-15	6.58E-16	1.01E-15	2.16E-07	2.10E-09	3.44E-03
Tc-99	78,604,282	8.90E-14	2.13E-14	3.27E-14	6.99E-06	4.14E-04	9.88E-05
U-234	78,604,282	9.69E-14	1.13E-14	1.25E-14	7.62E-06	1.22E-03	1.94E+00
U-235	78,604,282	3.00E-15	3.48E-16	3.88E-16	2.36E-07	1.09E-01	5.00E-02
						Total:	**1.99E+00**
Stack 615 Bldg. 306-W		**39.13 m^3/min**	**0.65 m^3/sec**				
Pu-241	10,265,669	0.00E+00	8.28E-16	1.69E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	10,265,669	0.00E+00	2.68E-14	5.47E-14	0.00E+00	0.00E+00	0.00E+00
U-234	10,265,669	2.99E-15	9.60E-15	2.02E-14	3.07E-08	4.92E-06	5.98E-02
U-235	10,265,669	9.24E-17	2.97E-16	6.25E-16	9.49E-10	4.39E-04	1.54E-03
						Total:	**6.13E-02**
Stack 646 Bldg. 110		**40.01 m^3/min**	**0.67 m^3/sec**				
Pu-241	10,462,700	0.00E+00	9.41E-16	1.93E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	10,462,700	0.00E+00	3.04E-14	6.22E-14	0.00E+00	0.00E+00	0.00E+00
U-234	10,462,700	0.00E+00	7.60E-15	2.28E-14	0.00E+00	0.00E+00	0.00E+00
U-235	10,462,700	0.00E+00	2.35E-16	7.06E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	**0.00E+00**
Stack 701 Bldg. 307		**115.48 m^3/min**	**1.92 m^3/sec**				
Pu-241	30,224,712	0.00E+00	9.36E-16	1.94E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	30,224,712	0.00E+00	3.03E-14	6.28E-14	0.00E+00	0.00E+00	0.00E+00
U-234	30,224,712	8.14E-15	1.01E-14	2.30E-14	2.46E-07	3.94E-05	1.63E-01
U-235	30,224,712	2.52E-16	3.12E-16	7.10E-16	7.61E-09	3.52E-03	4.19E-03
						Total:	**1.67E-01**
Stack 702 Bldg. 307		**168.35 m^3/min**	**2.81 m^3/sec**				
Pu-241	44,120,407	0.00E+00	8.56E-16	1.71E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	44,120,407	0.00E+00	2.77E-14	5.52E-14	0.00E+00	0.00E+00	0.00E+00
U-234	44,120,407	8.73E-15	1.06E-14	2.02E-14	3.85E-07	6.17E-05	1.75E-01
U-235	44,120,407	2.70E-16	3.27E-16	6.25E-16	1.19E-08	5.52E-03	4.50E-03
						Total:	**1.79E-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, 2017 to December 31, 2017

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		**770.64 m^3/min**		**12.84 m^3/sec**			
Pu-241	201,970,137	0.00E+00	2.46E-14	5.10E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	201,970,137	1.03E-16	7.65E-16	1.85E-15	2.07E-08	2.53E-11	5.13E-03
Th-230	201,970,137	5.91E-17	4.41E-16	1.07E-15	1.19E-08	5.91E-07	2.96E-03
Th-232	201,970,137	8.40E-17	6.26E-16	1.52E-15	1.70E-08	1.56E-01	2.10E-02
U-234	201,970,137	6.43E-16	4.79E-15	1.16E-14	1.30E-07	2.08E-05	1.29E-02
U-235	201,970,137	6.64E-17	4.95E-16	1.20E-15	1.34E-08	6.21E-03	1.11E-03
U-238	201,970,137	8.09E-17	6.03E-16	1.46E-15	1.63E-08	4.88E-02	1.35E-03
						Total:	**4.44E-02**
Stack 773 Bldg. 440		**185.31 m^3/min**		**3.09 m^3/sec**			
Pu-241	48,564,857	0.00E+00	3.36E-14	7.12E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	48,564,857	0.00E+00	1.20E-15	3.65E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	48,564,857	0.00E+00	1.55E-15	4.69E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	48,564,857	0.00E+00	1.03E-15	3.13E-15	0.00E+00	0.00E+00	0.00E+00
U-234	48,564,857	0.00E+00	3.18E-15	9.65E-15	0.00E+00	0.00E+00	0.00E+00
U-235	48,564,857	0.00E+00	5.59E-16	1.70E-15	0.00E+00	0.00E+00	0.00E+00
U-238	48,564,857	0.00E+00	1.12E-15	3.39E-15	0.00E+00	0.00E+00	0.00E+00
						Total:	**0.00E+00**
Stack 774 Bldg. 301		**334.68 m^3/min**		**5.58 m^3/sec**			
Th-228	87,697,837	1.02E-16	2.31E-16	4.53E-16	8.95E-09	1.09E-11	5.10E-03
Th-230	87,697,837	3.48E-16	7.86E-16	1.55E-15	3.05E-08	1.51E-06	1.74E-02
Th-232	87,697,837	2.06E-16	4.66E-16	9.16E-16	1.81E-08	1.66E-01	5.15E-02
U-234	87,697,837	9.28E-16	2.10E-15	4.13E-15	8.14E-08	1.30E-05	1.86E-02
U-235	87,697,837	6.04E-17	1.36E-16	2.68E-16	5.29E-09	2.45E-03	1.01E-03
U-238	87,697,837	4.37E-16	9.88E-16	1.94E-15	3.83E-08	1.14E-01	7.29E-03
						Total:	**1.01E-01**
Stack 796 Bldg. 100		**20.93 m^3/min**		**0.35 m^3/sec**			
Pu-241	5,499,332	2.05E-16	9.02E-16	1.69E-15	1.13E-09	1.10E-11	2.57E-04
Tc-99	5,499,332	6.64E-15	2.92E-14	5.46E-14	3.65E-08	2.16E-06	7.37E-06
U-234	5,499,332	0.00E+00	6.99E-15	2.01E-14	0.00E+00	0.00E+00	0.00E+00
U-235	5,499,332	0.00E+00	2.16E-16	6.21E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	**2.64E-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 16, 2018

Report of Gaseous Effluent Dose and Activity Concentrations for the Maximally Exposed Off-Site Individual for the Release Period July to December 2017

(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 2017

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 2017. 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 2.0E-03 mrem for gaseous effluents released during the second half of 2017. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 1.1E-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 2017)**
Adrenals	1.4E-04
Urinary Bladder Wall	1.6E-04
Bone Surface	5.2E-03
Brain	1.4E-04
Breasts	1.4E-04
Stomach Wall	2.4E-03
Small Intestine	1.6E-04
Upper Large Intestine Wall	7.3E-04
Lower Large Intestine Wall	1.8E-03
Kidneys	1.8E-03
Liver	4.4E-04
Muscle	1.4E-04
Ovaries	1.4E-04
Pancreas	1.4E-04
Red Bone Marrow	6.7E-04
Skin	3.9E-04
Spleen	1.4E-04
Testes	1.5E-04
Thymus	1.4E-04
Thyroid	1.2E-03
Gall Bladder Wall	1.4E-04
Heart Wall	1.4E-04
Uterus	1.4E-04
Extra-thoracic	9.2E-03
Lungs	1.1E-02
Total Effective Dose Equivalent	**2.0E-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 3.5E-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	9.9E-18	NNE	350	9.E-10	1.1E-08
^{228}Th	8.4E-21	NNE	450	2.E-14	4.2E-07
^{230}Th	3.2E-20	NNE	650	2.E-14	1.6E-06
^{231}Th	1.0E-21	NNE	950	9.E-09	1.1E-13
^{232}Th	9.1E-21	NNE	450	4.E-15	2.3E-06
^{234}U	1.7E-17	NNE	450	5.E-14	3.3E-04
^{235}U	6.3E-19	NNE	550	6.E-14	1.1E-05
^{238}U	1.7E-19	NNE	700	6.E-14	2.9E-06
^{241}Pu	3.1E-19	NNE	350	8.E-13	3.8E-07
^{241}Am	2.0E-27	NNE	550	2.E-14	1.0E-13
				Sum of Fractions:	**3.5E-04**

The TEDE to the MEI for gaseous effluents released during 2017 is provided in Table 3. The results for the 1st half of 2017 were previously reported in *Biannual Effluent Monitoring Report January through June 2017* (21G-17-0208). 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 2017

Period Covered	Direction	Distance (m)	TEDE (mrem)
2nd Half	NNE	400	2.0E-03
1st Half	NNE	400	1.9E-03
		Annual Total	**3.9E-03**