NUCLEAR FUEL SERVICES, INC.
a subsidiary of The Babcock & Wilcox Company

▪ 1205 banner hill road ▪ erwin, tn 37650 ▪ phone 423.743.9141
▪ www.nuclearfuelservices.com

21G-13-0035
GOV-01-55
ACF-13-0051

February 18, 2013

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 through December 2012**

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 A reports the Radioactivity in Effluent Liquid for the period July through December 2012. This report includes two additional liquid effluent sampling locations identified as Banner Spring Down and West Ditch. Flow proportional samplers were installed at these locations to provide continuous monitoring of storm water run-off. Attachment B reports the Radioactivity in Effluent Air for the period July through December 2012. Attachment C summarizes an evaluation of the dose and air activity concentrations for the maximally exposed offsite individual due to gaseous effluents, during the period July through December 2012.

If you or your staff have any questions, require additional information, or wish to discuss this, please contact me or Mr. Robert Holley, Environmental Safety Unit Manager, at (423) 743-1777. Please reference our unique document identification number (21G-13-0035) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

Mark P. Elliott
Quality, Safety, & Safeguards
Director

CJB/rrm
Attachments

- *A- Report of Radioactivity in Effluent Liquid for the Period July - December 2012*
- *B- Report of Radioactivity in Effluent Air for the Period of July - December 2012*
- *C- Report of Gaseous Effluent Dose and Activity Concentrations for the Maximally Exposed Off-Site Individual for the Release Period July - December 2012*

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xc: Mr. Manuel Crespo, Project Inspector
U. S. Nuclear Regulatory Commission
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Suite 1200
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Regional Administrator
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Mr. Kevin Ramsey, Project Manager
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U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Mr. Mark Chitty
Acting Senior Resident Inspector
U. S. Nuclear Regulatory Commission

21G-13-0035
GOV-01-55
ACF-13-0051

Attachment A
To Letter Dated February 18, 2013

Report of Radioactivity in Effluent Liquid for the Period
July - December 2012

(Two Pages to Follow)

Radioactivity in Effluent Liquid
July 1, 2012 to December 31, 2012

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	390,371,268	5.57E-11	9.59E-11	1.91E-10	2.17E-05	1.27E-06	2.78E-03
Pu-239/240	390,371,268	4.49E-11	1.04E-10	1.80E-10	1.75E-05	2.82E-04	2.25E-03
Tc-99	390,371,268	0.00E+00	3.52E-08	6.21E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	390,371,268	0.00E+00	1.21E-10	2.62E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	390,371,268	7.26E-11	1.36E-10	2.47E-10	2.83E-05	1.40E-03	7.26E-04
Th-232	390,371,268	1.60E-11	9.19E-11	1.78E-10	6.26E-06	5.74E+01	5.34E-04
U-233/234	390,371,268	2.33E-10	2.61E-10	4.03E-10	9.11E-05	1.46E-02	7.78E-04
U-235/236	390,371,268	8.23E-11	1.33E-10	2.50E-10	3.21E-05	1.49E+01	2.74E-04
U-238	390,371,268	5.99E-11	1.56E-10	2.51E-10	2.34E-05	6.98E+01	2.00E-04
						Total:	**7.54E-03**
BLEU Sewer							
Pu-238	579,871	5.23E-11	8.13E-11	1.09E-10	3.04E-08	1.78E-09	2.62E-04
Pu-239/240	579,871	1.27E-11	7.44E-11	1.54E-10	7.39E-09	1.19E-07	6.37E-05
Tc-99	579,871	0.00E+00	3.57E-08	6.22E-08	0.00E+00	0.00E+00	0.00E+00
Th-228	579,871	7.00E-11	2.21E-10	4.41E-10	4.06E-08	4.95E-11	3.50E-05
Th-230	579,871	7.87E-11	2.02E-10	3.69E-10	4.56E-08	2.26E-06	7.87E-05
Th-232	579,871	6.75E-13	9.19E-11	1.57E-10	3.91E-10	3.59E-03	2.25E-06
U-232	579,871	1.23E-11	9.35E-11	1.94E-10	7.13E-09	3.33E-10	2.05E-05
U-233/234	579,871	1.81E-10	1.48E-10	1.83E-10	1.05E-07	1.68E-05	6.02E-05
U-235/236	579,871	2.79E-11	6.53E-11	1.19E-10	1.62E-08	7.50E-03	9.32E-06
U-238	579,871	9.77E-11	1.09E-10	1.23E-10	5.67E-08	1.69E-01	3.26E-05
						Total:	**5.64E-04**
Sewer							
Pu-238	12,890,802	2.19E-11	7.40E-11	1.34E-10	2.82E-07	1.65E-08	1.09E-04
Pu-239/240	12,890,802	1.61E-11	8.51E-11	1.37E-10	2.08E-07	3.35E-06	8.07E-05
Tc-99	12,890,802	1.18E-08	3.65E-08	6.28E-08	1.52E-04	8.97E-03	1.96E-05
Th-228	12,890,802	4.08E-11	2.39E-10	4.64E-10	5.26E-07	6.42E-10	2.04E-05
Th-230	12,890,802	4.17E-11	1.94E-10	3.80E-10	5.37E-07	2.66E-05	4.17E-05
Th-232	12,890,802	4.97E-13	1.17E-10	2.45E-10	6.40E-09	5.87E-02	1.66E-06
U-232	12,890,802	5.64E-11	1.20E-10	2.10E-10	7.27E-07	3.40E-08	9.40E-05
U-233/234	12,890,802	8.16E-09	8.67E-10	2.45E-10	1.05E-04	1.69E-02	2.72E-03
U-235/236	12,890,802	3.30E-10	1.88E-10	1.39E-10	4.26E-06	1.97E+00	1.10E-04
U-238	12,890,802	1.35E-09	3.56E-10	1.21E-10	1.74E-05	5.20E+01	4.50E-04
						Total:	**3.65E-03**
West Ditch							
Pu-238	152,591,745	7.71E-11	8.27E-11	1.27E-10	1.18E-05	6.88E-07	3.86E-03
Pu-239/240	152,591,745	3.27E-11	9.02E-11	1.67E-10	5.00E-06	8.03E-05	1.64E-03
Tc-99	152,591,745	8.82E-10	3.60E-08	6.33E-08	1.35E-04	7.97E-03	1.47E-05
Th-228	152,591,745	0.00E+00	2.21E-10	4.94E-10	0.00E+00	0.00E+00	0.00E+00
Th-230	152,591,745	9.05E-11	2.12E-10	3.84E-10	1.38E-05	6.84E-04	9.05E-04

[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, 2012 to December 31, 2012

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]
West Ditch							
Th-232	152,591,745	1.32E-11	1.19E-10	2.35E-10	2.01E-06	1.85E+01	4.40E-04
U-233/234	152,591,745	1.71E-08	1.56E-09	3.54E-10	2.61E-03	4.18E-01	5.70E-02
U-235/236	152,591,745	9.88E-10	4.19E-10	2.16E-10	1.51E-04	6.98E+01	3.29E-03
U-238	152,591,745	2.89E-09	6.46E-10	2.38E-10	4.41E-04	1.32E+03	9.64E-03
						Total:	**7.68E-02**
WWTF							
Am-241	3,686,009	5.09E-11	2.69E-10	5.19E-10	1.88E-07	5.47E-08	2.54E-03
Cs-137	3,686,009	1.32E-08	2.08E-09	1.44E-09	4.88E-05	5.60E-07	1.32E-02
Na-22	3,686,009	7.76E-11	7.91E-10	1.41E-09	2.86E-07	4.59E-11	1.29E-05
Np-237	3,686,009	5.89E-11	1.96E-10	3.44E-10	2.17E-07	3.09E-04	2.95E-03
Pb-212	3,686,009	7.60E-10	2.84E-09	3.03E-09	2.80E-06	2.03E-12	3.80E-04
Pu-238	3,686,009	2.29E-10	2.45E-10	4.88E-10	8.45E-07	4.94E-08	1.15E-02
Pu-239/240	3,686,009	2.26E-10	2.49E-10	4.89E-10	8.34E-07	1.34E-05	1.13E-02
Pu-241	3,686,009	0.00E+00	3.49E-08	6.05E-08	0.00E+00	0.00E+00	0.00E+00
Ra-224	3,686,009	5.63E-09	4.14E-09	7.40E-09	2.08E-05	1.31E-10	2.82E-02
Tc-99	3,686,009	2.90E-08	1.00E-07	1.73E-07	1.07E-04	6.33E-03	4.84E-04
Th-228	3,686,009	4.45E-11	1.58E-10	3.03E-10	1.64E-07	2.00E-10	2.22E-04
Th-230	3,686,009	6.04E-11	2.03E-10	3.71E-10	2.23E-07	1.10E-05	6.04E-04
Th-231	3,686,009	9.73E-09	3.62E-08	4.13E-08	3.59E-05	6.74E-11	1.95E-04
Th-232	3,686,009	0.00E+00	9.61E-11	2.30E-10	0.00E+00	0.00E+00	0.00E+00
U-232	3,686,009	0.00E+00	7.46E-11	1.73E-10	0.00E+00	0.00E+00	0.00E+00
U-233/234	3,686,009	2.49E-08	1.44E-09	1.94E-10	9.17E-05	1.47E-02	8.29E-02
U-235/236	3,686,009	1.02E-09	2.93E-10	1.23E-10	3.75E-06	1.74E+00	3.39E-03
U-238	3,686,009	1.99E-10	1.46E-10	1.33E-10	7.35E-07	2.19E+00	6.65E-04
						Total:	**1.58E-01**

[1] ECV: Effluent Concentration Value from 10-CFR-20, Appendix B.

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

21G-13-0035
GOV-01-55
ACF-13-0051

Attachment B
To Letter Dated February 18, 2013

Report of Radioactivity in Effluent Air for the Period
July - December 2012

(Four Pages to Follow)

Radioactivity in Effluent Air
July 1, 2012 to December 31, 2012

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		**1063.32 m^3/min**		**17.72 m^3/sec**			
Th-228	283,284,327	2.67E-16	6.23E-17	3.81E-17	7.57E-08	9.25E-11	1.34E-02
Th-230	283,284,327	5.35E-16	1.25E-16	7.62E-17	1.51E-07	7.50E-06	2.67E-02
Th-232	283,284,327	2.67E-16	6.23E-17	3.81E-17	7.57E-08	6.95E-01	6.68E-02
U-234	283,284,327	1.26E-13	2.94E-14	1.80E-14	3.58E-05	5.73E-03	2.53E+00
U-235	283,284,327	4.68E-15	1.09E-15	6.67E-16	1.33E-06	6.14E-01	7.80E-02
U-238	283,284,327	1.60E-15	3.74E-16	2.29E-16	4.54E-07	1.36E+00	2.67E-02
						Total:	**2.74E+00**
Stack 185 Bldg. 131		**108.05 m^3/min**		**1.80 m^3/sec**			
Pu-241	28,790,000	1.77E-15	9.98E-16	1.62E-15	5.10E-08	4.95E-10	2.21E-03
Tc-99	28,790,000	5.73E-14	3.23E-14	5.23E-14	1.65E-06	9.76E-05	6.36E-05
U-234	28,790,000	6.07E-14	1.45E-14	1.96E-14	1.75E-06	2.80E-04	1.21E+00
U-235	28,790,000	1.88E-15	4.48E-16	6.07E-16	5.41E-08	2.50E-02	3.13E-02
						Total:	**1.25E+00**
Stack 234 Bldg. 234		**296.22 m^3/min**		**4.94 m^3/sec**			
Am-241	80,193,374	7.86E-19	2.18E-17	4.49E-17	6.30E-11	1.84E-11	3.93E-05
Pu-238	80,193,374	9.60E-19	2.67E-17	5.48E-17	7.70E-11	4.50E-12	4.80E-05
Pu-239/240	80,193,374	3.41E-18	9.46E-17	1.94E-16	2.73E-10	4.39E-09	1.70E-04
Pu-241	80,193,374	0.00E+00	3.86E-15	7.53E-15	0.00E+00	0.00E+00	0.00E+00
Th-228	80,193,374	5.24E-19	1.46E-17	2.99E-17	4.20E-11	5.13E-14	2.62E-05
Th-230	80,193,374	6.55E-18	1.82E-16	3.74E-16	5.25E-10	2.60E-08	3.27E-04
Th-232	80,193,374	8.29E-18	2.31E-16	4.73E-16	6.65E-10	6.10E-03	2.07E-03
U-234	80,193,374	1.79E-17	4.97E-16	1.02E-15	1.44E-09	2.30E-07	3.58E-04
U-238	80,193,374	5.24E-18	1.46E-16	2.99E-16	4.20E-10	1.25E-03	8.73E-05
						Total:	**3.13E-03**
Stack 327 Bldg. 330		**915.34 m^3/min**		**15.26 m^3/sec**			
Pu-241	212,569,619	1.39E-15	7.44E-16	1.25E-15	2.96E-07	2.87E-09	1.74E-03
Tc-99	212,569,619	4.50E-14	2.40E-14	4.05E-14	9.56E-06	5.66E-04	5.00E-05
U-234	212,569,619	3.37E-14	1.21E-14	1.67E-14	7.17E-06	1.15E-03	6.75E-01
U-235	212,569,619	1.04E-15	3.73E-16	5.16E-16	2.22E-07	1.03E-01	1.74E-02
						Total:	**6.94E-01**
Stack 421 Bldg. 100		**18.57 m^3/min**		**0.31 m^3/sec**			
Pu-241	4,943,551	8.41E-15	1.67E-15	2.04E-15	4.16E-08	4.04E-10	1.05E-02
Tc-99	4,943,551	2.72E-13	5.41E-14	6.60E-14	1.34E-06	7.96E-05	3.02E-04
U-234	4,943,551	8.08E-13	5.73E-14	2.29E-14	3.99E-06	6.40E-04	1.62E+01
U-235	4,943,551	2.50E-14	1.77E-15	7.08E-16	1.24E-07	5.72E-02	4.16E-01
						Total:	**1.66E+01**
Stack 424 Bldg. 100		**26.53 m^3/min**		**0.44 m^3/sec**			
Pu-241	7,069,055	7.54E-16	9.27E-16	1.60E-15	5.33E-09	5.17E-11	9.42E-04
Tc-99	7,069,055	2.44E-14	3.00E-14	5.18E-14	1.72E-07	1.02E-05	2.71E-05

[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, 2012 to December 31, 2012

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		**26.53 m^3/min**		**0.44 m^3/sec**			
U-234	7,069,055	5.61E-14	1.40E-14	1.91E-14	3.96E-07	6.35E-05	1.12E+00
U-235	7,069,055	1.73E-15	4.34E-16	5.90E-16	1.23E-08	5.68E-03	2.89E-02
						Total:	**1.15E+00**
Stack 501 Bldg. 510		**75.60 m^3/min**		**1.26 m^3/sec**			
Pu-241	20,104,166	2.20E-14	1.68E-14	2.57E-14	4.42E-07	4.29E-09	2.75E-02
Th-228	20,104,166	0.00E+00	2.56E-15	5.64E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	20,104,166	0.00E+00	3.29E-15	7.25E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	20,104,166	0.00E+00	2.19E-15	4.83E-15	0.00E+00	0.00E+00	0.00E+00
U-234	20,104,166	0.00E+00	6.76E-15	1.49E-14	0.00E+00	0.00E+00	0.00E+00
U-235	20,104,166	0.00E+00	1.19E-15	2.62E-15	0.00E+00	0.00E+00	0.00E+00
U-238	20,104,166	0.00E+00	2.38E-15	5.24E-15	0.00E+00	0.00E+00	0.00E+00
						Total:	**2.75E-02**
Stack 502 OCB		**211.89 m^3/min**		**3.53 m^3/sec**			
Pu-241	55,512,316	5.29E-15	4.64E-15	7.31E-15	2.93E-07	2.85E-09	6.61E-03
Th-228	55,512,316	6.43E-16	8.29E-16	1.36E-15	3.57E-08	4.36E-11	3.21E-02
Th-230	55,512,316	8.26E-16	1.07E-15	1.74E-15	4.59E-08	2.27E-06	4.13E-02
Th-232	55,512,316	5.51E-16	7.11E-16	1.16E-15	3.06E-08	2.81E-01	1.38E-01
U-234	55,512,316	1.70E-15	2.19E-15	3.59E-15	9.43E-08	1.51E-05	3.40E-02
U-235	55,512,316	2.98E-16	3.85E-16	6.30E-16	1.66E-08	7.67E-03	4.97E-03
U-238	55,512,316	5.97E-16	7.70E-16	1.26E-15	3.31E-08	9.89E-02	9.95E-03
						Total:	**2.67E-01**
Stack 573 Bldg 306-W		**74.18 m^3/min**		**1.24 m^3/sec**			
Pu-241	18,997,131	0.00E+00	7.91E-16	1.59E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	18,997,131	0.00E+00	2.56E-14	5.13E-14	0.00E+00	0.00E+00	0.00E+00
U-234	18,997,131	0.00E+00	7.14E-15	1.99E-14	0.00E+00	0.00E+00	0.00E+00
U-235	18,997,131	0.00E+00	2.21E-16	6.16E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	**0.00E+00**
Stack 600 Bldg. 110		**313.33 m^3/min**		**5.22 m^3/sec**			
Pu-241	83,511,338	6.37E-15	7.29E-16	9.58E-16	5.32E-07	5.16E-09	7.96E-03
Tc-99	83,511,338	2.06E-13	2.36E-14	3.10E-14	1.72E-05	1.02E-03	2.29E-04
U-234	83,511,338	1.17E-13	1.25E-14	1.25E-14	9.75E-06	1.56E-03	2.33E+00
U-235	83,511,338	3.61E-15	3.86E-16	3.86E-16	3.01E-07	1.40E-01	6.02E-02
						Total:	**2.40E+00**
Stack 615 Bldg. 306-W		**40.24 m^3/min**		**0.67 m^3/sec**			
Pu-241	10,736,594	0.00E+00	7.43E-16	1.57E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	10,736,594	0.00E+00	2.40E-14	5.07E-14	0.00E+00	0.00E+00	0.00E+00
U-234	10,736,594	0.00E+00	7.02E-15	1.87E-14	0.00E+00	0.00E+00	0.00E+00
U-235	10,736,594	0.00E+00	2.17E-16	5.78E-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
July 1, 2012 to December 31, 2012

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 646 Bldg. 110		**48.10 m^3/min**		**0.80 m^3/sec**			
Pu-241	12,787,396	0.00E+00	7.69E-16	1.58E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	12,787,396	0.00E+00	2.49E-14	5.11E-14	0.00E+00	0.00E+00	0.00E+00
U-234	12,787,396	1.02E-16	7.22E-15	1.90E-14	1.30E-09	2.09E-07	2.04E-03
U-235	12,787,396	3.15E-18	2.23E-16	5.87E-16	4.03E-11	1.87E-05	5.26E-05
						Total:	**2.09E-03**
Stack 649 Bldg. 330		**10.02 m^3/min**		**0.17 m^3/sec**			
Pu-241	562,957	1.79E-16	4.88E-16	8.94E-16	1.01E-10	9.79E-13	2.24E-04
Tc-99	562,957	5.79E-15	1.58E-14	2.89E-14	3.26E-09	1.93E-07	6.43E-06
U-234	562,957	0.00E+00	4.46E-15	1.14E-14	0.00E+00	0.00E+00	0.00E+00
U-235	562,957	0.00E+00	1.38E-16	3.53E-16	0.00E+00	0.00E+00	0.00E+00
						Total:	**2.30E-04**
Stack 701 Bldg. 307		**144.59 m^3/min**		**2.41 m^3/sec**			
Pu-241	38,467,553	0.00E+00	7.44E-16	1.57E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	38,467,553	0.00E+00	2.41E-14	5.07E-14	0.00E+00	0.00E+00	0.00E+00
U-234	38,467,553	2.70E-15	7.92E-15	1.87E-14	1.04E-07	1.66E-05	5.40E-02
U-235	38,467,553	8.35E-17	2.45E-16	5.79E-16	3.21E-09	1.49E-03	1.39E-03
						Total:	**5.54E-02**
Stack 702 Bldg. 307		**158.19 m^3/min**		**2.64 m^3/sec**			
Pu-241	42,144,308	0.00E+00	7.51E-16	1.55E-15	0.00E+00	0.00E+00	0.00E+00
Tc-99	42,144,308	0.00E+00	2.43E-14	5.02E-14	0.00E+00	0.00E+00	0.00E+00
U-234	42,144,308	7.15E-15	9.09E-15	1.85E-14	3.01E-07	4.83E-05	1.43E-01
U-235	42,144,308	2.21E-16	2.81E-16	5.74E-16	9.32E-09	4.32E-03	3.69E-03
						Total:	**1.47E-01**
Stack 703 Exhaust Room Air		**715.09 m^3/min**		**11.92 m^3/sec**			
Pu-241	190,498,754	0.00E+00	2.27E-14	4.72E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	190,498,754	1.10E-15	8.67E-16	1.71E-15	2.10E-07	2.57E-10	5.52E-02
Th-230	190,498,754	6.36E-16	4.99E-16	9.85E-16	1.21E-07	6.00E-06	3.18E-02
Th-232	190,498,754	9.04E-16	7.09E-16	1.40E-15	1.72E-07	1.58E+00	2.26E-01
U-234	190,498,754	6.92E-15	5.43E-15	1.07E-14	1.32E-06	2.11E-04	1.38E-01
U-235	190,498,754	7.14E-16	5.60E-16	1.11E-15	1.36E-07	6.30E-02	1.19E-02
U-238	190,498,754	8.70E-16	6.83E-16	1.35E-15	1.66E-07	4.95E-01	1.45E-02
						Total:	**4.78E-01**
Stack 704 Process Exhaust (H2)		**62.08 m^3/min**		**1.03 m^3/sec**			
Pu-241	14,921,503	0.00E+00	2.63E-14	5.32E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	14,921,503	5.39E-16	9.31E-16	1.94E-15	8.05E-09	9.83E-12	2.70E-02
Th-230	14,921,503	3.10E-16	5.36E-16	1.12E-15	4.63E-09	2.29E-07	1.55E-02
Th-232	14,921,503	4.41E-16	7.62E-16	1.59E-15	6.58E-09	6.04E-02	1.10E-01
U-234	14,921,503	3.38E-15	5.83E-15	1.22E-14	5.04E-08	8.08E-06	6.75E-02
U-235	14,921,503	3.49E-16	6.02E-16	1.25E-15	5.20E-09	2.41E-03	5.81E-03

[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, 2012 to December 31, 2012

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 704 Process Exhaust (H2)		**62.08 m^3/min**		**1.03 m^3/sec**			
U-238	14,921,503	4.25E-16	7.33E-16	1.53E-15	6.34E-09	1.89E-02	7.08E-03
						Total:	**2.33E-01**
Stack 773 Bldg. 440		**183.01 m^3/min**		**3.05 m^3/sec**			
Pu-241	48,754,344	0.00E+00	3.16E-14	6.60E-14	0.00E+00	0.00E+00	0.00E+00
Th-228	48,754,344	0.00E+00	1.23E-15	3.39E-15	0.00E+00	0.00E+00	0.00E+00
Th-230	48,754,344	0.00E+00	1.59E-15	4.36E-15	0.00E+00	0.00E+00	0.00E+00
Th-232	48,754,344	0.00E+00	1.06E-15	2.91E-15	0.00E+00	0.00E+00	0.00E+00
U-234	48,754,344	0.00E+00	3.26E-15	8.96E-15	0.00E+00	0.00E+00	0.00E+00
U-235	48,754,344	0.00E+00	5.73E-16	1.57E-15	0.00E+00	0.00E+00	0.00E+00
U-238	48,754,344	0.00E+00	1.15E-15	3.15E-15	0.00E+00	0.00E+00	0.00E+00
						Total:	**0.00E+00**
Stack 774 Bldg. 301		**335.12 m^3/min**		**5.59 m^3/sec**			
Th-228	89,288,519	1.28E-15	1.02E-16	8.61E-17	1.15E-07	1.40E-10	6.42E-02
Th-230	89,288,519	1.65E-15	1.31E-16	1.11E-16	1.47E-07	7.30E-06	8.26E-02
Th-232	89,288,519	1.28E-15	1.02E-16	8.61E-17	1.15E-07	1.05E+00	3.21E-01
U-234	89,288,519	1.68E-13	1.34E-14	1.13E-14	1.50E-05	2.41E-03	3.37E+00
U-235	89,288,519	6.97E-15	5.54E-16	4.68E-16	6.23E-07	2.88E-01	1.16E-01
U-238	89,288,519	4.04E-15	3.21E-16	2.71E-16	3.60E-07	1.08E+00	6.73E-02
						Total:	**4.02E+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.

21G-13-0035
GOV-01-55
ACF-13-0051

Attachment C
To Letter Dated February 18, 2013

Report of Gaseous Effluent Dose and Activity Concentrations
for the Maximally Exposed
Off-Site Individual for the Release Period
July - December 2012

(Three Pages to Follow)

21G-13-0035
GOV-01-55
ACF-13-0051

Report of Potential Gaseous Effluent Dose to the Maximally Exposed Offsite Individual and on the Maximum Radionuclide Concentrations for the Period: July through December 2012

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 nineteen (19) radiological stacks during the 2nd half of 2012. 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 were 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 microns 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 B) 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 3.0E-03 mrem for gaseous effluents released during the 2nd half of 2012. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 1.1E-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 2nd half of 2012)
Adrenals	9.4E-06
Bone Surface	4.2E-04
Breasts	9.5E-06
Stomach Wall	3.6E-04
Upper Large Intestine Wall	2.3E-04
Kidneys	3.6E-05
Lungs	1.1E-03
Ovaries	1.2E-05
Red Bone Marrow	2.6E-05
Spleen	9.4E-06
Thymus	9.4E-06
Uterus	9.4E-06
Bladder Wall	2.9E-05
Brain	9.4E-06
Esophagus	5.2E-04
Small Intestine Wall	3.3E-05
Lower Large Intestine Wall	6.5E-04
Liver	2.6E-05
Muscle	9.5E-06
Pancreas	9.4E-06
Skin	1.1E-05
Testes	1.2E-05
Thyroid	1.7E-04
Total Effective Dose Equivalent	**3.0E-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 4.1E-04 and indicates that exposures to 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	1.8E-17	NNE	300	9.E-10	2.0E-08
^{228}Th	1.1E-19	NNE	450	2.E-14	5.7E-06
^{230}Th	1.0E-19	NNE	500	2.E-14	5.0E-06
^{231}Th	2.4E-21	NNE	400	9.E-09	2.7E-13
^{232}Th	9.9E-20	NNE	450	4.E-15	2.5E-05
^{234}U	1.8E-17	NNE	400	5.E-14	3.6E-04
^{235}U	6.5E-19	NNE	400	6.E-14	1.1E-05
^{238}U	1.9E-19	NNE	500	6.E-14	3.1E-06
^{238}Pu	0.0E+00	NNE	n/a	2.E-14	0.0E+00
^{239}Pu	0.0E+00	NNE	n/a	2.E-14	0.0E+00
^{240}Pu	0.0E+00	NNE	n/a	2.E-14	0.0E+00
^{241}Pu	7.7E-19	NNE	300	8.E-13	9.7E-07
^{241}Am	0.0E+00	NNE	n/a	2.E-14	0.0E+00
				Sum of Fractions:	**4.1E-04**

The TEDE to the MEI for gaseous effluents released during 2012 is provided in Table 3. The results for the 1st half of 2012 were previously reported in *Biannual Effluent Monitoring Report January through June 2012* (21G-12-0167). 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 2012

Period Covered	Direction	Distance (m)	TEDE (mrem)
2nd Half	NNE	400	3.0E-03
1st Half	NNE	500	2.9E-03
		Annual Total	**5.9E-03**