Nuclear Fuel Services, Inc.
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AIRBORNE EXPRESS

21G-03-0050
GOV-01-55
ACF-03-0063

February 27, 2003

Mr. Luis A. Reyes, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II, Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, GA 30303

References: 1) Docket No. 70-143; SNM License 124

Subject: **Biannual Effluent Monitoring Report July through December 2002**

Dear Mr. Reyes:

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 2002. Attachment B summarizes an evaluation of the dose for the maximally exposed offsite individual due to liquid effluents, during the period July through December 2002. Attachment C reports the Radioactivity in Effluent Air for the period July through December 2002. Attachment D 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 2002.

If you or your staff have any questions, require additional information, or wish to discuss this, please contact me or Ms. Janice Greene, Environmental Safety Manager, at (423) 743-1730. Please reference our unique document identification number (21G-03-0050) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

B. Marie Moore
Vice President
Safety and Regulatory

BPG/rrm
Attachments

xc: Mr. William Gloersen, Project Inspector
U. S. Nuclear Regulatory Commission
Region II, Atlanta Federal Center
61 Forsyth Street, SW
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B. M. Moore to Mr. Luis Reyes (NRC)

21G-03-0050
GOV-01-55
ACF-03-0063

Attachment A
To Letter Dated February 27, 2003
B. M. Moore to Mr. Luis A. Reyes (NRC)

Report of Radioactivity in Effluent Liquid for the Period
July – December 2002

(One Page to Follow)

Radioactivity in Effluent Liquid
July 1, 2002 to December 31, 2002

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	265,983,892	1.40E-11	5.42E-11	1.57E-10	3.73E-06	2.18E-07	7.02E-04
Pu-239/240	265,983,892	1.35E-10	1.13E-10	1.67E-10	3.60E-05	5.79E-04	6.77E-03
Tc-99	265,983,892	2.80E-09	1.01E-08	2.40E-08	7.44E-04	4.40E-02	4.66E-05
Th-228	265,983,892	8.55E-11	1.21E-10	2.39E-10	2.28E-05	2.78E-08	4.28E-04
Th-230	265,983,892	1.78E-10	1.08E-10	1.39E-10	4.75E-05	2.35E-03	1.78E-03
Th-232	265,983,892	3.19E-11	4.74E-11	1.03E-10	8.49E-06	7.79E+01	1.06E-03
U-234	265,983,892	1.28E-08	1.92E-09	1.19E-10	3.39E-03	5.44E-01	4.25E-02
U-235/236	265,983,892	8.20E-10	2.42E-10	1.03E-10	2.18E-04	1.01E+02	2.73E-03
U-238	265,983,892	1.83E-09	4.09E-10	1.22E-10	4.87E-04	1.45E+03	6.11E-03
						Total:	**6.22E-02**
Sewer							
Pu-238	55,774,938	6.57E-13	3.17E-11	1.45E-10	3.67E-08	2.14E-09	3.29E-06
Pu-239/240	55,774,938	-6.35E-12	5.26E-11	2.05E-10	-3.54E-07	-5.70E-06	-3.18E-05
Tc-99	55,774,938	4.80E-09	1.05E-08	2.46E-08	2.68E-04	1.58E-02	8.00E-06
Th-228	55,774,938	6.53E-11	1.41E-10	3.26E-10	3.64E-06	4.45E-09	3.26E-05
Th-230	55,774,938	1.81E-10	1.46E-10	2.15E-10	1.01E-05	5.00E-04	1.81E-04
Th-232	55,774,938	4.16E-11	7.60E-11	1.62E-10	2.32E-06	2.13E+01	1.39E-04
U-234	55,774,938	9.92E-09	1.54E-09	1.22E-10	5.53E-04	8.87E-02	3.31E-03
U-235/236	55,774,938	4.29E-10	1.71E-10	8.34E-11	2.39E-05	1.11E+01	1.43E-04
U-238	55,774,938	1.33E-09	3.33E-10	7.99E-11	7.43E-05	2.22E+02	4.44E-04
						Total:	**4.23E-03**
WWTF							
Cs-137	3,561,682	2.80E-10	1.94E-09	3.17E-09	9.97E-07	1.15E-08	2.80E-04
Na-22	3,561,682	3.94E-10	2.05E-09	3.88E-09	1.40E-06	2.25E-10	6.57E-05
Pu-238	3,561,682	-2.96E-11	2.91E-11	1.38E-10	-1.06E-07	-6.17E-09	-1.48E-03
Pu-239/240	3,561,682	-2.86E-11	4.31E-11	1.64E-10	-1.02E-07	-1.64E-06	-1.43E-03
Ra-224	3,561,682	4.74E-08	9.66E-09	1.46E-08	1.69E-04	1.06E-09	2.37E-01
Tc-99	3,561,682	2.73E-06	7.34E-08	3.39E-08	9.72E-03	5.75E-01	4.55E-02
Th-228	3,561,682	4.52E-11	1.29E-10	2.42E-10	1.61E-07	1.96E-10	2.26E-04
Th-230	3,561,682	2.46E-10	1.41E-10	1.26E-10	8.75E-07	4.33E-05	2.46E-03
Th-232	3,561,682	2.75E-11	4.26E-11	8.12E-11	9.81E-08	9.00E-01	9.18E-04
U-234	3,561,682	1.62E-07	2.04E-08	3.67E-10	5.77E-04	9.25E-02	5.40E-01
U-235/236	3,561,682	9.65E-09	1.60E-09	2.78E-10	3.44E-05	1.59E+01	3.22E-02
U-238	3,561,682	3.90E-09	8.14E-10	2.87E-10	1.39E-05	4.15E+01	1.30E-02
						Total:	**8.69E-01**

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

Attachment B
To Letter Dated February 27, 2003
B. M. Moore to Mr. Luis A. Reyes (NRC)

Report of Liquid Effluent Dose for the Maximally Exposed Off-Site Individual for the Release Period July - December 2002

(One Page to Follow)

B. M. Moore to Mr. Luis Reyes (NRC)
February 27, 2003

21G-03-0050
GOV-01-55
ACF-03-0063

Report of Potential Liquid Effluent Dose to the Maximally Exposed Offsite Receptor for the Period: July through December 2002

Introduction

During this biannual period, NRC License SNM-124, Part I, Section 5.1.2.3 required NFS to assess the effective dose equivalent (EDE) to the maximally exposed offsite receptor attributable to liquid effluents from NFS' Waste Water Treatment Facility. The required biannual assessment has been completed and the details of the assessment are provided in the subsequent sections.

Summary of Methods

The potential dose to the maximally exposed offsite receptor was estimated in accordance with SNM-124, Section 5.1.2.4 and internal procedure NFS-HS-A-66. The method used to perform this dose assessment is based on the National Council on Radiation Protection and Measurements' method provided in NCRP Report 123, Parts I and II.

The maximally exposed offsite receptor location is the nearest point of water usage downstream of the WWTF outfall. The nearest point of water usage is the nearest location downstream of the WWTF Outfall where members of the public use the river water for irrigation and/or as a drinking water source. Following the river, this is approximately 13,000 meters (8 miles) downstream of the WWTF Outfall, at the City of Jonesborough's water intake. The City of Jonesborough water intake is located approximately 9,250 meters (5.7miles) north of the NFS site, which is different from the downstream distance on the river.

Summary of Results

Table 1 summarizes the potential six-month dose to a hypothetical individual at the maximally exposed offsite receptor location. The total effective dose equivalent (TEDE) to the maximally exposed offsite receptor was estimated to be 0.019 mrem for radioactive liquid effluents released during the 2nd half of 2002. The maximally exposed offsite receptor dose is well below SNM-124 license action levels, applicable regulatory limits, and ALARA goals.

Table 1. Potential Total Effective Dose Equivalent to the Maximally Exposed Offsite Receptor

Period of Interest	Total Effective Dose Equivalent
2nd Half of 2002	1.9E-02 mrem
Location of maximally exposed offsite receptor:	9,250 meters North

Attachment C
To Letter Dated February 27, 2003
B. M. Moore to Mr. Luis A. Reyes (NRC)

Report of Radioactivity in Effluent Air for the Period
July – December 2002

(Four Pages to Follow)

Radioactivity in Effluent Air
July 1, 2002 to December 31, 2002

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		**1240.08 m^3/min**	**20.67 m^3/sec**				
Tc-99	305,357,253	3.58E-13	3.05E-14	3.60E-14	1.09E-04	6.47E-03	3.98E-04
Th-230	305,357,253	5.43E-18	9.20E-19	1.05E-18	1.66E-09	8.21E-08	2.72E-04
Thorium-231	305,357,253	4.59E-15	3.91E-16	4.62E-16	1.40E-06	2.63E-12	5.10E-07
U-234	305,357,253	1.21E-13	2.06E-14	2.36E-14	3.71E-05	5.94E-03	2.43E+00
U-235	305,357,253	2.04E-15	3.46E-16	3.97E-16	6.24E-07	2.89E-01	3.41E-02
U-238	305,357,253	2.35E-18	3.97E-19	4.56E-19	7.16E-10	2.14E-03	3.91E-05
						Total:	**2.46E+00**
Stack 185 Bldg. 131		**83.85 m^3/min**	**1.40 m^3/sec**				
Tc-99	21,129,241	1.87E-14	2.69E-14	4.59E-14	3.95E-07	2.34E-05	2.08E-05
Th-230	21,129,241	2.50E-19	6.75E-19	1.36E-18	5.29E-12	2.62E-10	1.25E-05
Thorium-231	21,129,241	2.40E-16	3.45E-16	5.89E-16	5.06E-09	9.52E-15	2.66E-08
U-234	21,129,241	5.59E-15	1.51E-14	3.04E-14	1.18E-07	1.89E-05	1.12E-01
U-235	21,129,241	9.41E-17	2.54E-16	5.12E-16	1.99E-09	9.21E-04	1.57E-03
U-238	21,129,241	1.08E-19	2.91E-19	5.87E-19	2.28E-12	6.82E-06	1.80E-06
						Total:	**1.13E-01**
Stack 234 Bldg. 234		**274.11 m^3/min**	**4.57 m^3/sec**				
Am-241	69,469,705	-1.43E-16	4.02E-16	8.78E-16	-9.92E-09	-2.89E-09	-7.14E-03
Pu-238	69,469,705	-2.89E-17	8.13E-17	1.78E-16	-2.01E-09	-1.17E-10	-1.45E-03
Pu-239	69,469,705	-2.42E-16	6.80E-16	1.49E-15	-1.68E-08	-2.70E-07	-1.21E-02
Pu-240	69,469,705	-8.50E-17	2.39E-16	5.23E-16	-5.91E-09	-2.59E-08	-4.25E-03
Pu-241	69,469,705	-2.43E-16	2.82E-15	5.06E-15	-1.69E-08	-1.64E-10	-3.03E-04
						Total:	**-2.52E-02**
Stack 27 Bldg. 234		**152.91 m^3/min**	**2.55 m^3/sec**				
Am-241	38,753,761	1.88E-15	7.02E-16	8.78E-16	7.27E-08	2.12E-08	9.38E-02
Pu-238	38,753,761	3.80E-16	1.42E-16	1.78E-16	1.47E-08	8.61E-10	1.90E-02
Pu-239	38,753,761	3.18E-15	1.19E-15	1.49E-15	1.23E-07	1.98E-06	1.59E-01
Pu-240	38,753,761	1.12E-15	4.18E-16	5.23E-16	4.33E-08	1.90E-07	5.59E-02
Pu-241	38,753,761	5.70E-15	3.24E-15	5.06E-15	2.21E-07	2.14E-09	7.12E-03
						Total:	**3.35E-01**
Stack 28 Bldg. 234		**59.27 m^3/min**	**0.99 m^3/sec**				
Am-241	15,020,671	2.53E-16	4.89E-16	8.78E-16	3.80E-09	1.11E-09	1.26E-02
Pu-238	15,020,671	5.12E-17	9.90E-17	1.78E-16	7.69E-10	4.50E-11	2.56E-03
Pu-239	15,020,671	4.28E-16	8.28E-16	1.49E-15	6.43E-09	1.03E-07	2.14E-02
Pu-240	15,020,671	1.51E-16	2.91E-16	5.23E-16	2.26E-09	9.92E-09	7.53E-03
Pu-241	15,020,671	2.47E-15	3.02E-15	5.06E-15	3.71E-08	3.61E-10	3.09E-03
						Total:	**4.72E-02**
Stack 332 Bldg. 120		**54.62 m^3/min**	**0.91 m^3/sec**				
Tc-99	13,765,047	3.04E-14	2.85E-14	4.59E-14	4.18E-07	2.47E-05	3.37E-05
Th-230	13,765,047	3.44E-19	7.09E-19	1.36E-18	4.73E-12	2.34E-10	1.72E-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.

Radioactivity in Effluent Air
July 1, 2002 to December 31, 2002

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 332 Bldg. 120		**54.62 m^3/min**		**0.91 m^3/sec**			
Thorium-231	13,765,047	3.89E-16	3.65E-16	5.88E-16	5.35E-09	1.01E-14	4.32E-08
U-234	13,765,047	7.68E-15	1.58E-14	3.04E-14	1.06E-07	1.69E-05	1.54E-01
U-235	13,765,047	1.29E-16	2.67E-16	5.11E-16	1.78E-09	8.24E-04	2.15E-03
U-238	13,765,047	1.48E-19	3.06E-19	5.87E-19	2.04E-12	6.10E-06	2.47E-06
						Total:	**1.56E-01**
Stack 376 Bldg. 301		**198.67 m^3/min**		**3.31 m^3/sec**			
Tc-99	48,920,752	-8.96E-17	1.69E-14	3.33E-14	-4.38E-09	-2.59E-07	-9.95E-08
Th-230	48,920,752	2.49E-19	4.59E-19	9.80E-19	1.22E-11	6.04E-10	1.25E-05
Thorium-231	48,920,752	-1.15E-18	2.17E-16	4.27E-16	-5.61E-11	-1.06E-16	-1.28E-10
U-234	48,920,752	5.57E-15	1.03E-14	2.19E-14	2.73E-07	4.37E-05	1.11E-01
U-235	48,920,752	9.38E-17	1.73E-16	3.69E-16	4.59E-09	2.12E-03	1.56E-03
U-238	48,920,752	1.08E-19	1.98E-19	4.23E-19	5.27E-12	1.57E-05	1.79E-06
						Total:	**1.13E-01**
Stack 421 Bldg. 100		**23.25 m^3/min**		**0.39 m^3/sec**			
Tc-99	5,724,620	4.69E-14	2.09E-14	3.34E-14	2.69E-07	1.59E-05	5.21E-05
Th-230	5,724,620	4.45E-18	9.49E-19	9.83E-19	2.55E-11	1.26E-09	2.23E-04
Thorium-231	5,724,620	6.01E-16	2.67E-16	4.28E-16	3.44E-09	6.47E-15	6.68E-08
U-234	5,724,620	9.95E-14	2.12E-14	2.20E-14	5.70E-07	9.13E-05	1.99E+00
U-235	5,724,620	1.68E-15	3.57E-16	3.70E-16	9.59E-09	4.44E-03	2.79E-02
U-238	5,724,620	1.92E-18	4.10E-19	4.24E-19	1.10E-11	3.29E-05	3.21E-05
						Total:	**2.02E+00**
Stack 547 Bldg. 100		**46.64 m^3/min**		**0.78 m^3/sec**			
Tc-99	11,484,105	2.48E-14	2.83E-14	4.68E-14	2.84E-07	1.68E-05	2.75E-05
Th-230	11,484,105	2.99E-19	7.03E-19	1.39E-18	3.44E-12	1.70E-10	1.50E-05
Thorium-231	11,484,105	3.17E-16	3.62E-16	5.99E-16	3.64E-09	6.84E-15	3.52E-08
U-234	11,484,105	6.69E-15	1.57E-14	3.10E-14	7.68E-08	1.23E-05	1.34E-01
U-235	11,484,105	1.13E-16	2.65E-16	5.21E-16	1.29E-09	5.98E-04	1.88E-03
U-238	11,484,105	1.29E-19	3.04E-19	5.98E-19	1.48E-12	4.43E-06	2.15E-06
						Total:	**1.36E-01**
Stack 573 Bldg 306-W		**69.18 m^3/min**		**1.15 m^3/sec**			
Tc-99	17,034,407	1.22E-15	1.73E-14	3.37E-14	2.08E-08	1.23E-06	1.35E-06
Th-230	17,034,407	6.07E-19	5.18E-19	9.91E-19	1.03E-11	5.12E-10	3.03E-05
Thorium-231	17,034,407	1.56E-17	2.21E-16	4.32E-16	2.66E-10	5.00E-16	1.74E-09
U-234	17,034,407	1.36E-14	1.16E-14	2.22E-14	2.31E-07	3.70E-05	2.71E-01
U-235	17,034,407	2.28E-16	1.95E-16	3.73E-16	3.89E-09	1.80E-03	3.80E-03
U-238	17,034,407	2.62E-19	2.23E-19	4.28E-19	4.46E-12	1.33E-05	4.37E-06
						Total:	**2.75E-01**
Stack 600 Bldg. 110		**286.62 m^3/min**		**4.78 m^3/sec**			
Tc-99	70,578,086	4.59E-13	2.44E-14	3.37E-14	3.24E-05	1.92E-03	5.10E-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.

Radioactivity in Effluent Air
July 1, 2002 to December 31, 2002

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 600 Bldg. 110		**286.62 m^3/min**		**4.78 m^3/sec**			
Th-230	70,578,086	1.89E-18	6.42E-19	9.91E-19	1.33E-10	6.61E-09	9.46E-05
Thorium-231	70,578,086	5.88E-15	3.13E-16	4.32E-16	4.15E-07	7.81E-13	6.54E-07
U-234	70,578,086	4.23E-14	1.43E-14	2.22E-14	2.98E-06	4.78E-04	8.45E-01
U-235	70,578,086	7.11E-16	2.41E-16	3.73E-16	5.02E-08	2.32E-02	1.19E-02
U-238	70,578,086	8.17E-19	2.77E-19	4.28E-19	5.76E-11	1.72E-04	1.36E-05
						Total:	**8.58E-01**
Stack 615 Bldg. 306-W		**30.16 m^3/min**		**0.50 m^3/sec**			
Tc-99	7,425,969	1.02E-14	1.75E-14	3.33E-14	7.54E-08	4.46E-06	1.13E-05
Th-230	7,425,969	1.90E-18	6.04E-19	9.80E-19	1.41E-11	7.00E-10	9.52E-05
Thorium-231	7,425,969	1.30E-16	2.24E-16	4.27E-16	9.66E-10	1.82E-15	1.45E-08
U-234	7,425,969	4.26E-14	1.35E-14	2.19E-14	3.16E-07	5.06E-05	8.51E-01
U-235	7,425,969	7.16E-16	2.27E-16	3.69E-16	5.32E-09	2.46E-03	1.19E-02
U-238	7,425,969	8.22E-19	2.61E-19	4.23E-19	6.11E-12	1.82E-05	1.37E-05
						Total:	**8.63E-01**
Stack 646 Bldg. 110		**67.73 m^3/min**		**1.13 m^3/sec**			
Tc-99	16,678,797	-2.98E-15	2.18E-14	4.42E-14	-4.98E-08	-2.94E-06	-3.31E-06
Th-230	16,678,797	1.14E-18	7.01E-19	1.29E-18	1.90E-11	9.41E-10	5.70E-05
Thorium-231	16,678,797	-3.82E-17	2.79E-16	5.66E-16	-6.37E-10	-1.20E-15	-4.25E-09
U-234	16,678,797	2.55E-14	1.57E-14	2.89E-14	4.25E-07	6.80E-05	5.09E-01
U-235	16,678,797	4.28E-16	2.64E-16	4.87E-16	7.15E-09	3.31E-03	7.14E-03
U-238	16,678,797	4.92E-19	3.03E-19	5.59E-19	8.20E-12	2.45E-05	8.20E-06
						Total:	**5.16E-01**
Stack 649 Bldg. 330		**9.85 m^3/min**		**0.16 m^3/sec**			
Tc-99	2,426,514	1.27E-14	1.82E-14	3.37E-14	3.09E-08	1.83E-06	1.41E-05
Th-230	2,426,514	4.07E-19	4.99E-19	9.93E-19	9.89E-13	4.89E-11	2.04E-05
Thorium-231	2,426,514	1.63E-16	2.33E-16	4.32E-16	3.96E-10	7.44E-16	1.81E-08
U-234	2,426,514	9.11E-15	1.11E-14	2.22E-14	2.21E-08	3.54E-06	1.82E-01
U-235	2,426,514	1.53E-16	1.88E-16	3.73E-16	3.72E-10	1.72E-04	2.55E-03
U-238	2,426,514	1.76E-19	2.15E-19	4.29E-19	4.27E-13	1.27E-06	2.93E-06
						Total:	**1.85E-01**
Stack 667 Bldg. 410		**1060.07 m^3/min**		**17.67 m^3/sec**			
Actinium-228	261,031,537	1.02E-14	1.72E-15	2.44E-15	2.66E-06	1.19E-12	5.09E-04
Am-241	261,031,537	8.17E-16	1.44E-16	1.66E-16	2.13E-07	6.22E-08	4.09E-02
Protactinium-23	261,031,537	3.02E-14	5.11E-15	7.25E-15	7.88E-06	1.15E-14	
Pu-238	261,031,537	1.44E-16	2.53E-17	2.92E-17	3.76E-08	2.20E-09	7.19E-03
Pu-239	261,031,537	1.67E-15	2.95E-16	3.40E-16	4.37E-07	7.03E-06	8.37E-02
Pu-240	261,031,537	5.62E-16	9.91E-17	1.14E-16	1.47E-07	6.44E-07	2.81E-02
Pu-241	261,031,537	6.03E-15	1.02E-15	1.45E-15	1.57E-06	1.53E-08	7.54E-03
Ra-224	261,031,537	6.21E-15	1.09E-15	1.26E-15	1.62E-06	1.02E-11	3.10E-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.

Radioactivity in Effluent Air
July 1, 2002 to December 31, 2002

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 667 Bldg. 410		**1060.07 m^3/min**	**17.67 m^3/sec**				
Radium-228	261,031,537	1.02E-14	1.72E-15	2.44E-15	2.66E-06	9.73E-09	5.09E-03
Th-228	261,031,537	6.21E-15	1.09E-15	1.26E-15	1.62E-06	1.98E-09	3.10E-01
Th-230	261,031,537	3.05E-15	5.38E-16	6.20E-16	7.97E-07	3.95E-05	1.53E-01
Th-232	261,031,537	6.21E-15	1.09E-15	1.26E-15	1.62E-06	1.49E+01	1.55E+00
Th-234	261,031,537	3.02E-14	5.11E-15	7.25E-15	7.88E-06	3.41E-10	1.51E-04
Thorium-231	261,031,537	3.24E-15	5.48E-16	7.78E-16	8.46E-07	1.59E-12	3.60E-07
U-234	261,031,537	2.01E-14	3.55E-15	4.08E-15	5.25E-06	8.42E-04	4.02E-01
U-235	261,031,537	1.97E-15	3.48E-16	4.01E-16	5.16E-07	2.39E-01	3.29E-02
U-238	261,031,537	1.84E-14	3.24E-15	3.74E-15	4.81E-06	1.43E+01	3.07E-01
						Total:	**2.93E+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.

Attachment D
To Letter Dated February 27, 2003
B. M. Moore to Mr. Luis A. Reyes (NRC)

Report of Gaseous Effluent Dose and Activity Concentrations for the Maximally Exposed Off-Site Individual for the Release Period July - December 2002

(Three Pages to Follow)

B. M. Moore to Mr. Luis Reyes (NRC)
February 27, 2003

21G-03-0050
GOV-01-55
ACF-03-0063

Report of Potential Gaseous Effluent Dose to the Maximally Exposed Offsite Individual and on the Maximum Radionuclide Concentrations for the Period: July through December 2002

Introduction

During this biannual period, NRC License SNM-124, Part I, Section 5.1.1.3 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 5.1.1.4 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. CAP88-PC accommodates up to six stacks and considers stacks to be co-located (i.e., at the same physical location on the site). NFS operated fifteen (15) radiological stacks during the 2nd half of 2002. Based on effluent types and stack physical characteristics, releases from these stacks were grouped into four effective stacks for modeling purposes. To accommodate the co-location limitation of the model, the four 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 taken to be 100 meters for all sectors and is conservative. 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; this size is consistent with assumptions used in EPA Federal Guidance Report 11.

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 C) 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 a table 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 below 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 250 meters North Northeast from the center of the plant site. The TEDE to the MEI was estimated to be 0.014 mrem for gaseous effluents released during the 2nd half of 2002. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 0.11 mrem to the endosteal tissue (bone surfaces). These MEI doses are well below SNM-124 license action levels and applicable regulatory limits/ALARA constraints.

Table 2 summarizes the maximum radioactive air concentrations at or beyond the site boundary, as determined by CAP88-PC, for radionuclides released. The total sum of fractions based on maximum values 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 on out. 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 large 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 1. Organ Doses and Total Effective Dose Equivalent at the MEI Location

Organ	**Committed Dose Equivalent (mrem per 2nd half of 2002)**
Gonads	5.8E-04
Breast	1.5E-04
Red Bone Marrow	9.0E-03
Lungs	6.8E-02
Thyroid	5.8E-04
Endosteal Tissue (Bone Surfaces)	1.1E-01
Remainder Organs	2.9E-03
Total Effective Dose Equivalent	**1.4E-02 mrem**
Location of MEI:	250 meters North Northeast

Notes: Dose results are from the CAP88-PC "Synopsis Report". CAP88-PC uses organ dose weighting factors equal to those in 10 CFR Part 20.1003 to compute the effective dose equivalent.

Table 2. Maximum Predicted Air Concentrations for Receptors at or Beyond the Site Boundary

Nuclide	Maximum Concentration (uCi/mL)	Concentration Location		10 CFR 20, App. B, Table 2, Col. 1 Value (uCi/mL)	Ratio of Maximum Concentration to 10 CFR 20 Value
		Sector	Dist. (m)		
Tc-99	2.5E-17	NNE	250	9.E-10	2.8E-08
Ra-224	1.4E-18	NNE	250	2.E-12	7.0E-07
Ra-228	2.3E-18	NNE	250	2.E-12	1.2E-06
Ac-228	2.3E-18	NNE	250	2.E-11	1.2E-07
Th-228	1.4E-18	NNE	250	2.E-14	7.0E-05
Th-230	6.9E-19	NNE	250	2.E-14	3.5E-05
Th-231	1.1E-18	NNE	250	9.E-09	1.2E-10
Th-232	1.4E-18	NNE	250	4.E-15	3.5E-04
Th-234	6.8E-18	NNE	250	2.E-10	3.4E-08
Pa-234m	3.7E-18	NNE	200	not available	
U-234	8.4E-18	NNE	250	5.E-14	1.7E-04
U-235	5.1E-19	NNE	250	6.E-14	8.5E-06
U-238	4.2E-18	NNE	250	6.E-14	7.0E-05
Pu-238	3.4E-20	NNE	250	2.E-14	1.7E-06
Pu-239	4.9E-19	NNE	250	2.E-14	2.5E-05
Pu-240	1.7E-19	NNE	250	2.E-14	8.5E-06
Pu-241	1.6E-18	NNE	250	8.E-13	2.0E-06
Am-241	2.5E-19	NNE	250	2.E-14	1.3E-05
				Sum of Fractions:	**7.5E-04**

Notes: The maximum concentration values were extracted from the CAP88-PC computer code's "Concentration" output report generated for this semiannual period. Appendix B of 10 CFR 20 does not provide any values for Pa-234m.