



Nuclear Fuel Services, Inc.
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Erwin, TN 37650

(423) 743-9141

**CERTIFIED MAIL
RETURN RECEIPT REQUESTED**

21G-99-0102
GOV-01-55-03
ACF-99-0178
August 27, 1999

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
2) NRC Inspection Report No. 99-04, Paragraph 8.b.(2), Dated June 30, 1999
3) Letter Dated February 25, 1999 (21G-99-0032),
T. S. Baer (NFS) to L. A. Reyes (NRC)

Subject: Bi-Annual Effluent Monitoring Report January - June 1999

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 January-June 1999. Attachment B reports the Radioactivity in Effluent Air for the period January-June 1999. Attachment C summarizes an evaluation of the dose and air activity concentration for the maximally exposed offsite individual, due to effluents during the period January - June 1999.

In response to Reference 2, NFS submits, as Attachment D, a revised dose and air activity concentration summary report for the release period of July - December 1998. This report was previously submitted with Reference 3. The resulting doses and air concentrations in the revised report are slightly less than those previously reported due to a correction in the effective stack diameter for the Building 410 vents (labeled as stack #667). The effective diameter was decreased from 3.66 meters to 2.38 meters. This change resulted in an increase in the calculated air exit velocity from these vents and a subsequent increase in the momentum plume rise. Also, in the revised assessment, the source term used as the input to the plume dispersion model was normalized to a one-year period for all stacks to correctly predict air concentrations at the maximally exposed individual location. Finally, in the revised assessment, the inhalation class of Th-230 and Th-232 were both changed from "Y" to "W" since this is more conservative than the previous assessment.

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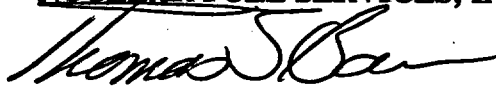
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If you or your staff have any questions, require additional information, or wish to discuss this, please contact me or Ms. Janice Greene, Environmental Safety Manager at (423) 743-1730. Please reference our unique document identification number (21G-99-0102) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.



Thomas S. Baer, PhD
Vice President
Safety and Regulatory

TEH/rcy

Attachments

xc: Mr. William Gloersen, Project Inspector
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Attachment A
To Letter Dated August 27, 1999
T. S. Baer to Mr. Luis A. Reyes (NRC)

Report of Radioactivity in Effluent Liquid for the Period
January - June 1999

(One Page to Follow)

Radioactivity in Effluent Liquid

January 1, 1999 to June 30, 1999

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)	Percent of ECL ¹
Banner Spring Down							
Pu-238	494,978,893	1.62E-10	1.75E-10	2.65E-10	8.01E-05	4.68E-06	0.8%
Pu-239/240	494,978,893	9.12E-11	1.11E-10	1.95E-10	4.51E-05	7.26E-04	0.5%
Tc-99	494,978,893	-4.35E-09	8.95E-09	1.75E-08	-2.15E-03	-1.27E-01	-0.0%
Th-228	494,978,893	2.08E-10	2.42E-10	4.41E-10	1.03E-04	1.26E-07	0.1%
Th-230	494,978,893	1.39E-10	1.35E-10	1.86E-10	6.89E-05	3.41E-03	0.1%
Th-232	494,978,893	9.99E-12	3.24E-11	1.14E-10	4.94E-06	4.54E+01	0.0%
U-233/234	494,978,893	1.24E-08	1.63E-09	1.53E-10	6.16E-03	9.87E-01	4.1%
U-235/236	494,978,893	5.18E-10	2.06E-10	1.23E-10	2.56E-04	1.19E+02	0.2%
U-238	494,978,893	2.73E-09	5.22E-10	1.12E-10	1.35E-03	4.04E+03	0.9%
							6.8%
Sewer							
Pu-238	21,347,078	6.06E-11	1.27E-10	3.21E-10	1.29E-06	7.57E-08	0.0%
Pu-239/240	21,347,078	4.00E-11	8.63E-11	2.17E-10	8.54E-07	1.37E-05	0.0%
Tc-99	21,347,078	4.73E-08	1.20E-08	1.83E-08	1.01E-03	5.97E-02	0.0%
Th-228	21,347,078	1.64E-10	2.64E-10	5.38E-10	3.51E-06	4.28E-09	0.0%
Th-230	21,347,078	6.53E-11	1.34E-10	2.79E-10	1.39E-06	6.90E-05	0.0%
Th-232	21,347,078	5.34E-11	6.73E-11	1.59E-10	1.14E-06	1.05E+01	0.0%
U-233/234	21,347,078	1.75E-07	1.82E-08	1.89E-10	3.73E-03	5.97E-01	5.8%
U-235/236	21,347,078	8.52E-09	1.21E-09	1.81E-10	1.82E-04	8.42E+01	0.3%
U-238	21,347,078	4.23E-08	4.75E-09	1.69E-10	9.03E-04	2.70E+03	1.4%
							7.6%
WWTF							
Ce-144	2,947,312	1.29E-09	1.31E-08	2.24E-08	3.80E-06	1.19E-09	0.0%
Co-60	2,947,312	3.63E-10	1.96E-09	3.72E-09	1.07E-06	9.46E-10	0.0%
Cs-137	2,947,312	2.11E-08	5.25E-09	3.54E-09	6.23E-05	7.15E-07	2.1%
Mn-54	2,947,312	-8.87E-12	1.92E-09	3.32E-09	-2.62E-08	-3.38E-12	-0.0%
Na-22	2,947,312	2.71E-08	5.08E-09	3.83E-09	7.98E-05	1.28E-08	0.5%
Pu-238	2,947,312	4.25E-11	5.99E-11	1.32E-10	1.25E-07	7.32E-09	0.2%
Pu-239/240	2,947,312	1.21E-11	4.94E-11	1.18E-10	3.55E-08	5.71E-07	0.1%
Ra-224	2,947,312	1.10E-08	1.10E-09	2.29E-09	3.24E-05	2.04E-10	5.5%
Ra-226	2,947,312	1.38E-09	5.06E-10	1.47E-10	4.07E-06	4.12E-06	2.3%
Tc-99	2,947,312	3.91E-06	8.14E-08	2.73E-08	1.15E-02	6.81E-01	6.5%
Th-228	2,947,312	2.69E-10	2.04E-10	3.41E-10	7.94E-07	9.69E-10	0.1%
Th-230	2,947,312	2.37E-10	1.43E-10	1.80E-10	7.00E-07	3.46E-05	0.2%
Th-232	2,947,312	1.87E-11	4.95E-11	1.30E-10	5.51E-08	5.06E-01	0.1%
U-233/234	2,947,312	3.49E-08	3.97E-09	1.56E-10	1.03E-04	1.65E-02	11.6%
U-235/236	2,947,312	1.28E-09	3.47E-10	1.32E-10	3.78E-06	1.75E+00	0.4%
U-238	2,947,312	2.49E-09	5.46E-10	1.49E-10	7.35E-06	2.19E+01	0.8%
							30.5%

¹ ECL: Effluent Concentration Limit from 10-CFR-20, Appendix B.

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Attachment B
To Letter Dated August 27, 1999
T. S. Baer to Mr. Luis A. Reyes (NRC)

Report of Radioactivity in Effluent Air for the Period
January - June 1999

(Four Pages to Follow)

Radioactivity in Effluent Air

January 1, 1999 to June 30, 1999

Location	Total Volume (m ³)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Percent of ECL ¹
Main Stack 416	932.87 m³/min	15.55 m³/sec					
Tc-99	243,143,317	1.84E-12	6.29E-14	3.78E-14	4.47E-04	2.64E-02	0.2%
Th-228	243,143,317	4.54E-16	3.30E-17	2.16E-17	1.10E-07	1.35E-10	2.3%
U-232	243,143,317	1.84E-15	1.31E-16	8.81E-17	4.46E-07	2.08E-08	18.4%
U-234	243,143,317	3.32E-13	2.37E-14	1.59E-14	8.06E-05	1.29E-02	663.1%
U-235	243,143,317	4.78E-15	3.42E-16	2.29E-16	1.16E-06	5.38E-01	8.0%
U-236	243,143,317	7.34E-14	5.21E-15	3.53E-15	1.78E-05	2.75E-01	122.3%
U-238	243,143,317	3.80E-16	2.94E-17	1.75E-17	9.25E-08	2.76E-01	0.6%
							814.9%
Stack 185 Bldg. 131	70.37 m³/min	1.17 m³/sec					
Tc-99	17,935,236	1.03E-14	2.16E-14	3.97E-14	1.85E-07	1.10E-05	0.0%
U-234	17,935,236	1.26E-15	3.45E-15	7.07E-15	2.26E-08	3.62E-06	2.5%
U-238	17,935,236	2.44E-15	6.69E-15	1.37E-14	4.39E-08	1.31E-01	4.1%
							6.6%
Stack 224 Bldg. 234	7.22 m³/min	0.12 m³/sec					
Am-241	1,746,855	1.55E-16	4.48E-16	9.78E-16	2.70E-10	7.87E-11	0.8%
Pu-238	1,746,855	3.03E-17	8.77E-17	1.92E-16	5.29E-11	3.09E-12	0.2%
Pu-239	1,746,855	3.34E-16	9.67E-16	2.11E-15	5.83E-10	9.37E-09	1.7%
Pu-240	1,746,855	1.12E-16	3.25E-16	7.10E-16	1.96E-10	8.60E-10	0.6%
Pu-241	1,746,855	2.32E-15	2.46E-15	4.09E-15	4.05E-09	3.94E-11	0.3%
							3.4%
Stack 27 Bldg. 234	138.67 m³/min	2.31 m³/sec					
Am-241	37,739,778	8.55E-16	7.26E-16	1.04E-15	3.23E-08	9.41E-09	4.3%
Pu-238	37,739,778	1.68E-16	1.42E-16	2.03E-16	6.32E-09	3.70E-10	0.8%
Pu-239	37,739,778	1.85E-15	1.57E-15	2.24E-15	6.97E-08	1.12E-06	9.2%
Pu-240	37,739,778	6.21E-16	5.27E-16	7.54E-16	2.34E-08	1.03E-07	3.1%
Pu-241	37,739,778	3.43E-15	2.84E-15	4.37E-15	1.30E-07	1.26E-09	0.4%
							17.9%
Stack 28 Bldg. 234	86.37 m³/min	1.44 m³/sec					
Am-241	23,505,477	1.11E-16	4.51E-16	1.04E-15	2.62E-09	7.63E-10	0.6%
Pu-238	23,505,477	2.18E-17	8.83E-17	2.03E-16	5.13E-10	3.00E-11	0.1%
Pu-239	23,505,477	2.40E-16	9.73E-16	2.24E-15	5.65E-09	9.09E-08	1.2%
Pu-240	23,505,477	8.09E-17	3.27E-16	7.54E-16	1.90E-09	8.34E-09	0.4%
Pu-241	23,505,477	1.62E-15	2.46E-15	4.37E-15	3.81E-08	3.70E-10	0.2%
							2.5%
Stack 332 Bldg. 120	50.18 m³/min	0.84 m³/sec					
Tc-99	12,789,231	1.82E-14	2.33E-14	3.97E-14	2.33E-07	1.38E-05	0.0%
Th-228	12,789,231	4.82E-16	6.80E-16	1.21E-15	6.17E-09	7.53E-12	2.4%
Th-230	12,789,231	2.24E-16	3.16E-16	5.61E-16	2.87E-09	1.42E-07	1.1%
Th-232	12,789,231	4.74E-16	6.68E-16	1.18E-15	6.06E-09	5.56E-02	11.8%
U-234	12,789,231	3.82E-15	5.38E-15	9.54E-15	4.88E-08	7.82E-06	7.6%
U-235	12,789,231	6.24E-16	8.79E-16	1.56E-15	7.98E-09	3.69E-03	1.0%

¹ ECL: Effluent Concentration Limit from 10-CFR-20, Appendix B, percentage 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

January 1, 1999 to June 30, 1999

Location	Total Volume (m ³)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Percent of ECL ¹
Stack 332 Bldg. 120		50.18 m³/min	0.84 m³/sec				
U-238	12,789,231	2.70E-15	3.81E-15	6.75E-15	3.46E-08	1.03E-01	4.5%
							28.6%
Stack 376 Bldg. 301		118.34 m³/min	1.97 m³/sec				
Tc-99	30,331,913	9.17E-15	1.56E-14	3.02E-14	2.78E-07	1.65E-05	0.0%
U-234	30,331,913	6.43E-15	7.75E-15	1.55E-14	1.95E-07	3.12E-05	12.9%
U-235	30,331,913	9.79E-17	1.18E-16	2.36E-16	2.97E-09	1.37E-03	0.2%
U-236	30,331,913	3.26E-18	3.94E-18	7.88E-18	9.90E-11	1.52E-06	0.0%
U-238	30,331,913	1.96E-18	2.36E-18	4.73E-18	5.94E-11	1.77E-04	0.0%
							13.0%
Stack 421 Bldg. 100		20.65 m³/min	0.34 m³/sec				
Tc-99	5,282,565	2.96E-14	1.79E-14	3.01E-14	1.56E-07	9.25E-06	0.0%
Th-228	5,282,565	1.68E-17	1.00E-17	1.68E-17	8.90E-11	1.09E-13	0.1%
U-232	5,282,565	6.42E-17	4.20E-17	7.17E-17	3.39E-10	1.58E-11	0.6%
U-234	5,282,565	1.17E-14	7.55E-15	1.28E-14	6.19E-08	9.92E-06	23.4%
U-235	5,282,565	1.69E-16	1.09E-16	1.85E-16	8.92E-10	4.13E-04	0.3%
U-236	5,282,565	2.53E-15	1.70E-15	2.90E-15	1.34E-08	2.06E-04	4.2%
U-238	5,282,565	1.69E-17	7.23E-18	1.12E-17	8.95E-11	2.67E-04	0.0%
							28.7%
Stack 547 Bldg. 100		54.93 m³/min	0.92 m³/sec				
Tc-99	14,001,754	2.72E-14	2.50E-14	3.95E-14	3.81E-07	2.26E-05	0.0%
Th-228	14,001,754	1.08E-17	1.27E-17	2.25E-17	1.51E-10	1.84E-13	0.1%
U-232	14,001,754	4.83E-17	5.36E-17	9.21E-17	6.76E-10	3.16E-11	0.5%
U-234	14,001,754	8.57E-15	9.61E-15	1.66E-14	1.20E-07	1.92E-05	17.1%
U-235	14,001,754	1.23E-16	1.38E-16	2.39E-16	1.73E-09	8.00E-04	0.2%
U-236	14,001,754	1.97E-15	2.16E-15	3.69E-15	2.77E-08	4.26E-04	3.3%
U-238	14,001,754	5.49E-18	9.14E-18	1.80E-17	7.69E-11	2.29E-04	0.0%
							21.2%
Stack 573 Bldg 306-W		92.57 m³/min	1.54 m³/sec				
Tc-99	18,928,260	1.45E-14	2.01E-14	3.80E-14	2.74E-07	1.62E-05	0.0%
U-234	18,928,260	7.43E-15	9.99E-15	2.02E-14	1.41E-07	2.25E-05	14.9%
U-235	18,928,260	1.13E-16	1.52E-16	3.08E-16	2.14E-09	9.91E-04	0.2%
U-236	18,928,260	3.77E-18	5.07E-18	1.03E-17	7.14E-11	1.10E-06	0.0%
U-238	18,928,260	2.26E-18	3.04E-18	6.16E-18	4.28E-11	1.28E-04	0.0%
							15.1%
Stack 583 Bldg. 234		10.14 m³/min	0.17 m³/sec				
Am-241	2,759,004	6.15E-16	6.94E-16	1.07E-15	1.70E-09	4.95E-10	3.1%
Pu-238	2,759,004	1.20E-16	1.36E-16	2.11E-16	3.32E-10	1.94E-11	0.6%
Pu-239	2,759,004	1.33E-15	1.50E-15	2.32E-15	3.66E-09	5.89E-08	6.6%
Pu-240	2,759,004	4.47E-16	5.04E-16	7.81E-16	1.23E-09	5.41E-09	2.2%
Pu-241	2,759,004	1.58E-14	4.64E-15	4.50E-15	4.36E-08	4.23E-10	2.0%
							14.5%

¹ ECL: Effluent Concentration Limit from 10-CFR-20, Appendix B, percentage 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

January 1, 1999 to June 30, 1999

Location	Total Volume (m ³)	Activity Concentration (μCi/ml)	Error Estimate (μCi/ml)	LLD (μCi/ml)	Quantity Released (Ci)	Quantity Released (g)	Percent of ECL ¹
Stack 600 Bldg. 110							
	290.45 m ³ /min	4.84 m ³ /sec					
Tc-99	75,701,827	9.56E-13	2.97E-14	3.74E-14	7.23E-05	4.28E-03	0.1%
Th-228	72,774,132	4.30E-17	1.42E-17	1.98E-17	3.13E-09	3.82E-12	0.2%
U-232	75,701,827	1.89E-16	6.31E-17	8.75E-17	1.43E-08	6.69E-10	1.9%
U-234	75,701,827	3.40E-14	1.14E-14	1.58E-14	2.58E-06	4.13E-04	68.1%
U-235	75,701,827	4.90E-16	1.64E-16	2.28E-16	3.71E-08	1.72E-02	0.8%
U-236	75,701,827	7.61E-15	2.52E-15	3.50E-15	5.76E-07	8.87E-03	12.7%
U-238	75,701,827	3.51E-17	1.30E-17	1.79E-17	2.66E-09	7.93E-03	0.1%
							83.8%
Stack 615 Bldg. 306-W							
	46.61 m ³ /min	0.78 m ³ /sec					
Tc-99	11,007,308	1.08E-14	1.91E-14	3.75E-14	1.19E-07	7.06E-06	0.0%
U-234	11,039,317	6.07E-15	9.38E-15	1.95E-14	6.70E-08	1.07E-05	12.1%
U-235	11,039,317	9.33E-17	1.43E-16	2.98E-16	1.03E-09	4.77E-04	0.2%
U-236	11,039,317	3.10E-18	4.78E-18	9.93E-18	3.42E-11	5.28E-07	0.0%
U-238	11,039,317	7.69E-18	6.71E-18	1.23E-17	8.49E-11	2.53E-04	0.0%
							12.3%
Stack 646 Bldg. 110							
	63.80 m ³ /min	1.06 m ³ /sec					
Tc-99	16,260,799	5.46E-15	2.03E-14	3.97E-14	8.89E-08	5.26E-06	0.0%
Th-228	16,260,799	3.33E-18	1.07E-17	2.26E-17	5.41E-11	6.61E-14	0.0%
U-232	16,260,799	1.48E-17	4.46E-17	9.27E-17	2.41E-10	1.13E-11	0.1%
U-234	16,260,799	2.63E-15	8.02E-15	1.67E-14	4.28E-08	6.86E-06	5.3%
U-235	16,260,799	3.79E-17	1.16E-16	2.41E-16	6.17E-10	2.86E-04	0.1%
U-236	16,260,799	6.05E-16	1.79E-15	3.72E-15	9.84E-09	1.52E-04	1.0%
U-238	16,260,799	1.78E-18	8.11E-18	1.80E-17	2.89E-11	8.63E-05	0.0%
							6.5%
Stack 649 Bldg. 330							
	24.52 m ³ /min	0.41 m ³ /sec					
Tc-99	6,250,267	3.89E-14	1.79E-14	2.98E-14	2.43E-07	1.44E-05	0.0%
U-234	6,250,267	1.10E-14	6.70E-15	1.20E-14	6.85E-08	1.10E-05	21.9%
U-235	6,250,267	3.71E-16	2.27E-16	4.04E-16	2.32E-09	1.07E-03	0.6%
U-238	6,250,267	2.92E-15	1.79E-15	3.19E-15	1.83E-08	5.45E-02	4.9%
							27.4%
Stack 667 Bldg. 410							
	1648.72 m ³ /min	27.48 m ³ /sec					
Am-241	396,484,252	2.31E-15	2.97E-16	2.88E-16	9.17E-07	2.67E-07	11.6%
Pu-238	396,484,252	4.14E-16	5.31E-17	5.16E-17	1.64E-07	9.59E-09	2.1%
Pu-239	396,484,252	4.74E-15	6.09E-16	5.91E-16	1.88E-06	3.02E-05	23.7%
Pu-240	396,484,252	1.60E-15	2.05E-16	1.99E-16	6.33E-07	2.77E-06	8.0%
Pu-241	396,484,252	9.48E-14	1.61E-14	2.12E-14	3.76E-05	3.65E-07	11.8%
Ra-224	396,484,252	8.70E-15	1.12E-15	1.08E-15	3.45E-06	2.17E-11	0.4%
Th-228	396,484,252	8.70E-15	1.12E-15	1.08E-15	3.45E-06	4.21E-09	43.5%
Th-230	396,484,252	4.42E-15	5.68E-16	5.51E-16	1.75E-06	8.68E-05	22.1%
Th-232	396,484,252	8.70E-15	1.12E-15	1.08E-15	3.45E-06	3.16E+01	217.4%
U-234	396,484,252	2.17E-14	2.79E-15	2.71E-15	8.62E-06	1.38E-03	43.5%

¹ ECL: Effluent Concentration Limit from 10-CFR-20, Appendix B, percentage 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 **January 1, 1999 to June 30, 1999**

Location	Total Volume (m ³)	Activity Concentration (μ Cl/ml)	Error Estimate (μ Cl/ml)	LLD (μ Cl/ml)	Quantity Released (Cl)	Quantity Released (g)	Percent of ECL ¹
Stack 667 Bldg. 410		1648.72 m ³ /min	27.48 m ³ /sec				
U-235	396,484,252	3.39E-15	4.36E-16	4.23E-16	1.35E-06	6.23E-01	5.7%
U-238	396,484,252	1.97E-14	2.53E-15	2.46E-15	7.81E-06	2.33E+01	32.8%
							422.6%

¹ ECL: Effluent Concentration Limit from 10-CFR-20, Appendix B, percentage 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.

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Attachment C
To Letter Dated August 27, 1999
T. S. Baer to Mr. Luis A. Reyes (NRC)

***Report of Dose and Activity Concentration for the Maximally Exposed
Off-Site Individual for the Release Period
January - June 1999***

(Two Pages to Follow)

**Summary of Dose and Activity Concentrations
from Radioactive Air Effluents Released
January to June 1999**

Introduction

Average radionuclide concentrations in air effluents from stacks 416 and 667 (measured at the point of release) exceeded values listed in 10 CFR Part 20, Appendix B, Table 2, Column 1 during the release period. For this reason, an evaluation was performed in accordance with SNM-124, Part I, Section 5.1.1.3 to estimate the potential dose and activity concentration in air at the location of the maximally exposed off-site individual (MEI). The maximum concentration at the plant boundary is less than the concentration at the MEI. The source term for this evaluation included gaseous effluents released by NFS stacks and vents from January 1, 1999 to June 30, 1999 (given in Attachment B of this correspondence). Methods and results used in this evaluation are summarized below.

Summary of Methods

In accordance with SNM-124, Section 5.1.1.4, the U.S. Department of Energy's CAP88-PC computer program (version 2.0) 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 sixteen radiological stacks during the 1st half of 1999. Releases from these stacks were grouped into four effective stacks for modeling purposes. The location of the four effective stacks for purposes of predicting off-site doses/airborne activity concentrations was taken to be 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 and particle size were assumed for modeling purposes.

Because CAP88-PC models releases over an entire year, the six-month source term (i.e., total Ci of each radionuclide released over the six-month period, given in Attachment B) had to be annualized (i.e., transformed into a 12-month release) in order to generate airborne activity concentrations that correctly represent average levels present during the effluent release period. A normalization factor, NF, of 365/181 was multiplied into the six-month source term to annualize releases. Activity concentrations reported below come directly from the CAP88-PC concentration output file (available on-site for inspection). The dose results reported below are equal to the CAP88-PC dose output divided by the normalization factor above (this adjusts the annualized results back to the six-month release period).

Summary of Results

The maximally exposed individual (MEI) was determined to be located 400 meters to the North Northeast of the center of the plant site.

Table 1 below summarizes the air activity concentration at the MEI location. The sum of fractions indicates that the exposure at the MEI location was much less than 1% of the limit that applies to the public. The sum of fractions at the boundary to the NFS unrestricted area would be even lower than this since the MEI is the maximum exposure point.

Table 2 below summarizes the dose to a hypothetical individual at the MEI location. The effective dose equivalent (EDE) to the maximally exposed individual (MEI) was estimated to be 0.022 mrem from airborne radioactivity releases during the 1st half of 1999. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 0.200 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 1. Air Concentration at the MEI Location

Radionuclide	CAP88-PC Estimated Activity Concentration ($\mu\text{Ci/ml}$)	Regulatory Limit* ($\mu\text{Ci/ml}$)	Fraction of Regulatory Limit
U-232	3.9E-20	1E-14	3.9E-6
U-234	1.2E-17	5E-14	2.4E-4
U-235	8.5E-19	6E-14	1.4E-5
U-236	1.6E-18	6E-14	2.7E-5
U-238	4.4E-18	6E-14	7.3E-5
Th-228	1.9E-18	2E-14	9.5E-5
Ra-224	1.9E-18	2E-12	9.5E-5
Th-230	9.7E-19	2E-14	4.9E-5
Th-232	1.9E-18	4E-15	4.8E-4
Am-241	5.3E-19	2E-14	2.7E-5
Pu-238	9.6E-20	2E-14	4.8E-6
Pu-239	1.1E-18	2E-14	5.5E-5
Pu-240	3.7E-19	2E-14	1.9E-5
Pu-241	2.1E-17	8E-13	2.6E-5
Tc-99	6.8E-17	9E-10	7.6E-8
Sum of Fractions =			1.2E-3 (0.12%)

*Regulatory Limit is from 10 CFR Part 20, Appendix B, Table 2, Column 1. Most conservative inhalation classes were assumed. Sum of fractions at the off-site boundary is less than the value stated above.

Table 2. Organ Dose Equivalents and Effective Dose Equivalent at the MEI Location

Organ	Committed Dose Equivalent (mrem per 1 st Half of 1999)
Gonads	1.39E-3
Breast	2.55E-4
Red Bone Marrow	1.60E-2
Lungs	9.72E-2
Thyroid	1.45E-3
Endosteal Tissue (Bone Surfaces)	2.00E-1
Remainder Organs	6.40E-3
Effective Dose Equivalent	2.19E-2 mrem

Dose results are from the CAP88-PC "Synopsis Report" for 1st Half of 1999. CAP88-PC uses organ dose weighting factors from 10 CFR Part 20.1003 to compute the effective dose equivalent.

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Attachment D
To Letter Dated August 27, 1999
T. S. Baer to Mr. Luis A. Reyes (NRC)

Report of Dose and Activity Concentration for the Maximally Exposed
Off-Site Individual for the Release Period
July - December 1998
(Revised)

(Two Pages to Follow)

**Summary of Dose and Activity Concentrations
from Radioactive Air Effluents Released
July to December 1998
(Revised August 27, 1999)**

Introduction

Average radionuclide concentrations in air effluents from several stacks (measured at the point of release) exceeded values listed in 10 CFR Part 20, Appendix B, Table 2, Column 1 during the release period. For this reason, an evaluation was performed to estimate the potential dose and activity concentration in air at the location of the maximally exposed off-site individual (MEI). The maximum concentration at the plant boundary is less than the concentration at the MEI. The source term for this evaluation included gaseous effluents released by NFS stacks and vents from July 1, 1998 to December 31, 1998 (see Reference 3 cited in the cover letter for this submittal). Methods and results used in this evaluation are summarized below.

Summary of Methods

The U.S. Department of Energy's CAP88-PC computer program (version 2.0) 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 fourteen radiological stacks during the 2nd half of 1998. Releases from these stacks were grouped into four effective stacks for modeling purposes. The location of the four effective stacks for purposes of predicting off-site doses/airborne activity concentrations was taken to be 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 and particle size were assumed for modeling purposes.

Because CAP88-PC models releases over an entire year, the six-month source term (i.e., total Ci of each radionuclide released over the six-month period, given in Attachment B to Reference 3 cited in the cover letter) had to be annualized (i.e., transformed into a 12-month release) in order to generate airborne activity concentrations that correctly represent average levels present during the effluent release period. A normalization factor, NF, of 1.98 (365/184) was multiplied into the six-month source term to annualize activity releases.

Activity concentrations reported below come directly from the CAP88-PC concentration output file (available on-site for inspection). The dose results reported below are equal to the CAP88-PC dose output divided by the normalization factor above (to adjust annualized dose results back to the six-month release period).

Summary of Results

The maximally exposed individual (MEI) was determined to be located 200 meters to the North Northeast from the center of the plant site.

Table 1 below summarizes the air activity concentration at the MEI location. The sum of ratios indicates that the exposure at the MEI location was much less than 1% of the limit that applies to the public.

Table 2 below summarizes the dose to a hypothetical individual at the MEI location. The effective dose equivalent (EDE) to the maximally exposed individual (MEI) was estimated to be 0.021 mrem from airborne radioactivity releases during the 2nd half of 1998. The highest organ committed dose equivalent (CDE) to the MEI was estimated to be 0.186 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 1. Air Concentration at the MEI Location (2nd Half of 1998)

Radionuclide	CAP88-PC Estimated Activity Concentration (μCi/ml)	Regulatory Limit* (μCi/ml)	Fraction of Regulatory Limit
U-232	5.6E-21	1E-14	5.6E-7
U-234	5.4E-18	5E-14	1.1E-4
U-235	6.9E-19	6E-14	1.2E-5
U-236	2.2E-19	6E-14	3.7E-6
U-238	3.8E-18	6E-14	6.3E-5
Th-228	2.4E-18	2E-14	1.2E-4
Ra-224	2.4E-18	2E-12	1.2E-6
Th-230	1.2E-18	2E-14	6.0E-5
Th-232	2.4E-18	4E-15	6.0E-4
Am-241	3.6E-19	2E-14	1.8E-5
Pu-238	7.2E-20	2E-14	3.6E-6
Pu-239	7.7E-19	2E-14	3.9E-5
Pu-240	2.5E-19	2E-14	1.3E-5
Pu-241	3.6E-19	8E-13	4.5E-7
Tc-99	3.5E-17	9E-10	3.9E-8
Sum of Fractions =			1.0E-3 (0.1%)

*Regulatory Limit is from 10 CFR Part 20, Appendix B, Table 2, Column 1. Most conservative inhalation classes were assumed. Sum of fractions at the off-site boundary is less than the value stated above.

Table 2. Organ Dose Equivalents and Effective Dose Equivalent at the MEI Location

Organ	Committed Dose Equivalent (mrem per 2 nd Half of 1998)
Gonads	1.63E-3
Breast	9.65E-4
Red Bone Marrow	1.55E-2
Lungs	6.46E-2
Thyroid	2.07E-2
Endosteal Tissue (Bone Surfaces)	1.86E-1
Remainder Organs	1.68E-2
Effective Dose Equivalent	2.14E-2 mrem

Dose results are from the CAP88-PC "Synopsis Report" for 2nd Half of 1998. CAP88-PC uses organ dose weighting factors from 10 CFR Part 20.1003 to compute the effective dose equivalent.