Westinghouse

Westinghouse Electric Company LLC
Nuclear Fuel
Columbia Fuel Site
5801 Bluff Road
Hopkins, South Carolina 29061
USA

Document Control Desk, Director
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Direct tel: 803-647-1000

Our ref: LTR-RAC-14-42

August 28, 2014

Subject: SNM-1107/70-1151
NRC Semi-annual Discharge Report
January - June 2014

Dear Sir:
The following report fulfills regulatory requirements as listed in 10 CFR 40.65 and 10 CFR 70.59 "Effluent Monitoring Requirements." For the six-month period January 1, 2014 through June 30, 2014, the following quantities of radionuclides were released to the unrestricted area by the Westinghouse Electric Company's Columbia, South Carolina Nuclear Fuel Plant:

A. Gaseous	192.3	uCi	Uranium (Analyzed as gross alpha)
B. Liquid Effluent	1,680.1	uCi	U-234
	64.9	uCi	U-235
	226.2	uCi	U-238
	5,294.7	uCi	Tc-99

Gaseous effluent results were obtained from point source gross alpha analysis of stack gas effluent, and the individual radionuclide activity composition (84.8% U-234, 3.3% U-235, and 11.9% U-238) is inferred from the calculated average enrichment. A detailed summary report by stack is provided as Attachment "A."

Liquid effluent values were obtained by analysis of composite proportional samples prior to discharge to the Congaree River and basing the activity on the calculated average enrichment. All liquid discharges are pumped through a single discharge line to the Congaree River. A detailed summary liquid discharge report is provided as Attachment "B."

Also, to meet the requested dosage information outlined in Regulatory Guide 4.16, section 6.1, the internal Westinghouse letter LTR-EHS-14-59 entitled "Semi-Annual Assessment of Public Dose from Liquid and Gaseous Effluents" has been provided as Attachment "C."

Sincerely,

Carl Snyder, Manager Nuclear Criticality Safety and Environmental Engineering

cc: USNRC, Region II
245 Peachtree Center Ave, NE, Suite 1200
Atlanta, Georgia 30303-1257

NMSS01

SEMI ANNUAL AVERAGE STACK EFFLUENT REPORT

Westinghouse Electric Company Nuclear Fuel, Columbia 01/01/2014 to 06/30/2014

SAMPLING STATION	LOCATION DESCRIPTION	GRS ALPHA CONCTR uCi/ml	QUANTITY RELEASED uCi URANIUM	ERROR	LLD. uCi/ml	FLOW RATE METERS/SEC	DERIVED ISOTOPIC CONCENTRATION uCi/ml			DERIVED ISOTOPIC DISCHARGE uCi			
							U234	U235	U238	U234	U235	U238	sum 1st
1201	FURNACE EX LINE 1	8.07E-14	3.49	+/-	8.00E-14	2.78	6.86E-14	2.42E-15	9.69E-15	2.96	0.1	0.42	3.48
1202	FURNACE EX LINE 2	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1203	FURNACE EX LINE 3	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1204	FURNACE EX LINE 4	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1205	FURNACE EX LINE 5	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1206	NEW DECON ROOM	5.70E-13	14.53	+/-	8.00E-14	1.64	4.85E-13	1.71E-14	6.84E-14	12.35	0.44	1.74	14.53
1207	MET LAB EXHAUST	1.96E-13	1.69	+/-	8.00E-14	0.56	1.66E-13	5.87E-15	2.35E-14	1.44	0.05	0.2	1.69
1208	INCINERATOR EX	1.78E-13	5.23	+/-	8.00E-14	1.89	1.51E-13	5.34E-15	2.14E-14	4.45	0.16	0.63	5.24
1209	SUPPL INCIN EX	8.12E-14	1.19	+/-	8.00E-14	0.94	6.90E-14	2.44E-15	9.74E-15	1.01	0.04	0.14	1.19
1210	CONV 1-A EX	1.02E-13	6.58	+/-	8.00E-14	4.17	8.64E-14	3.05E-15	1.22E-14	5.6	0.2	0.79	6.59
1211	CONV 1-B EX	3.06E-13	0	+/-	8.00E-14	4.17	2.60E-13	9.17E-15	3.67E-14	0	0	0	0
1212	S1030 A	1.17E-13	13.11	+/-	8.00E-14	7.56	9.96E-14	3.51E-15	1.41E-14	11.14	0.39	1.57	13.1
1213	S1030 B	2.84E-13	1.58	+/-	8.00E-14	7.56	2.41E-13	8.51E-15	3.40E-14	1.35	0.05	0.19	1.59
1216	MAINT ENCL EX 4-B	8.46E-13	0	+/-	8.00E-14	3.89	7.19E-13	2.54E-14	1.02E-13	0	0	0	0
1217	CONV ENCL EX 4-C	1.01E-13	6.12	+/-	8.00E-14	3.89	8.60E-14	3.03E-15	1.21E-14	5.2	0.18	0.73	6.11
1218	CONV ENCL EX 4-D	2.45E-13	0	+/-	8.00E-14	3.89	2.08E-13	7.34E-15	2.94E-14	0	0	0	0
1219	CONV EMERG EX 4E	2.65E-13	0.76	+/-	8.00E-14	3.89	2.26E-13	7.96E-15	3.18E-14	0.65	0.02	0.09	0.76
1220	CHEM LAB FILT EX	8.81E-14	7.62	+/-	8.00E-14	5.56	7.49E-14	2.64E-15	1.06E-14	6.47	0.23	0.91	7.61
1221	DECON ROOM EX	2.43E-13	5.36	+/-	8.00E-14	1.42	2.07E-13	7.29E-15	2.92E-14	4.55	0.16	0.64	5.35
1222	CALC COMB GAS LN 1	2.70E-13	0.69	+/-	8.00E-14	0.16	2.29E-13	8.09E-15	3.24E-14	0.58	0.02	0.08	0.68
1223	CALC COMB GAS LN 2	3.77E-13	0.96	+/-	8.00E-14	0.16	3.20E-13	1.13E-14	4.52E-14	0.82	0.03	0.12	0.97
1224	CALC COMB GAS LN 3	1.38E-13	0.35	+/-	8.00E-14	0.16	1.18E-13	4.15E-15	1.66E-14	0.3	0.01	0.04	0.35
1225	CALC COMB GAS LN 4	1.42E-13	0.36	+/-	8.00E-14	0.16	1.20E-13	4.25E-15	1.70E-14	0.31	0.01	0.04	0.36
1226	CALC COMB GAS LN 5	1.62E-13	0.41	+/-	8.00E-14	0.16	1.38E-13	4.86E-15	1.94E-14	0.35	0.01	0.05	0.41
1227	CHEM LAB EX #2	2.46E-13	2.23	+/-	8.00E-14	0.58	2.09E-13	7.38E-15	2.95E-14	1.9	0.07	0.27	2.24
1228	CHEM LAB EX #3	3.89E-13	1.93	+/-	8.00E-14	0.64	3.31E-13	1.17E-14	4.67E-14	1.64	0.06	0.23	1.93
1229	HP LAB EX	9.28E-14	0.84	+/-	8.00E-14	0.58	7.89E-14	2.78E-15	1.11E-14	0.72	0.03	0.1	0.85
1230	DEV LAB EX #1	1.75E-13	2.57	+/-	8.00E-14	0.94	1.49E-13	5.25E-15	2.10E-14	2.18	0.08	0.31	2.57
1231	DEV LAB EX #2	2.57E-13	3.77	+/-	8.00E-14	0.94	2.18E-13	7.71E-15	3.08E-14	3.21	0.11	0.45	3.77
1232	PELLET COMBINED EX	8.79E-14	6.45	+/-	8.00E-14	4.72	7.47E-14	2.64E-15	1.05E-14	5.49	0.19	0.77	6.45
1233	SOLVENT EXT N EX	8.88E-14	3.95	+/-	8.00E-14	3.33	7.55E-14	2.67E-15	1.07E-14	3.36	0.12	0.47	3.95
1234	SOLVENT EXT S EX	2.46E-13	1.82	+/-	8.00E-14	3.33	2.09E-13	7.38E-15	2.95E-14	1.55	0.05	0.22	1.82
1236	MAP COMBINED	1.65E-13	0	+/-	8.00E-14	2.78	1.40E-13	4.94E-15	1.98E-14	0	0	0	0
1237	ABF HOOD TORIT EX	8.45E-14	1.86	+/-	8.00E-14	1.42	7.18E-14	2.53E-15	1.01E-14	1.58	0.06	0.22	1.86
1238	IFBA EXHAUST	8.22E-14	6.03	+/-	8.00E-14	4.72	6.98E-14	2.46E-15	9.86E-15	5.13	0.18	0.72	6.03
1239	MAINT WELD EX	2.19E-13	3.21	+/-	8.00E-14	0.94	1.86E-13	6.56E-15	2.62E-14	2.73	0.1	0.39	3.22
1240	AC-3	8.48E-14	4.98	+/-	8.00E-14	3.78	7.21E-14	2.54E-15	1.02E-14	4.23	0.15	0.6	4.98
1241	PELLET LINE 6	8.11E-14	3.5	+/-	8.00E-14	2.78	6.89E-14	2.43E-15	9.73E-15	2.98	0.11	0.42	3.51
1242	AC-5	8.08E-14	4.75	+/-	8.00E-14	3.78	6.87E-14	2.42E-15	9.70E-15	4.04	0.14	0.57	4.75
1243	AC-8	8.86E-14	5.21	+/-	8.00E-14	3.78	7.53E-14	2.66E-15	1.06E-14	4.42	0.16	0.62	5.2
1244	AMMON FUME SCR 1008A	9.80E-14	2.88	+/-	8.00E-14	1.89	8.33E-14	2.94E-15	1.18E-14	2.45	0.09	0.35	2.89
1245	AMMON FUME SCR 1008B	2.00E-13	0	+/-	8.00E-14	1.89	1.70E-13	6.01E-15	2.41E-14	0	0	0	0
1246	AC-4	9.06E-14	5.48	+/-	8.00E-14	3.89	7.70E-14	2.72E-15	1.09E-14	4.66	0.16	0.66	5.48
1247	HOT OIL RM EX	4.71E-13	28.49	+/-	8.00E-14	3.89	4.00E-13	1.41E-14	5.65E-14	24.21	0.85	3.42	28.48
1248	ERBIA FURNACE EX	8.02E-14	10.19	+/-	8.00E-14	8.17	6.82E-14	2.41E-15	9.63E-15	8.66	0.31	1.22	10.19
1249	ERBIA SCRUBBER EX	8.24E-14	5.55	+/-	8.00E-14	4.33	7.00E-14	2.47E-15	9.89E-15	4.72	0.17	0.67	5.56
1250	ERBIA CHANGE ROOM	9.38E-14	2.77	+/-	8.00E-14	1.9	7.97E-14	2.81E-15	1.13E-14	2.35	0.08	0.33	2.76
													Total
	ATTACHMENT A					Total derived isotopic release				163.5	5.77	23	192.3

7.39E-12 2.61E-13 1.04E-12

Jan-Jun 14 sum iso U uCi/mL 8.70E-12

Jan-Jun 14 avg iso U uCi/mL 4.80E-14 per day

Our ref: LTR-RAC-14-42
August 28, 2014

ATTACHMENT "B"
LIQUID EFFLUENT DISCHARGES
FIRST HALF 2014

A. Report Period: January 1, 2014 through June 30, 2014
B. Sample Location: Composite Sampler at Waste Treatment, prior to discharge to Congaree River
C. Total Liquid Flow: 6.463 E+07 liters
D. Sample Collection: Effluent Composite Sampler

Radioisotope	Concentration	LLD, uCi/mL	Quantity Released, uCi
	uCi/mL Error		
U-234	26.0 E-09 +/- 3.03 E-09	6.00 E-10	1,680.1
U-235	1.00 E-09 +/- 0.746 E-09	6.00 E-10	64.9
U-238	3.50 E-09 +/- 1.14 E-09	6.00E-10	226.2
Tc-99	81.9 E-09 +/- 136 E-09	6.00E-10	5,294.7
Total			7,265.9

Note:

1. Liquid effluent composites were analyzed by alpha spectroscopy, and significant quantities of U-236 were not detected using this method.

2. Tc-99 is not reported for gaseous effluents, as significant quantities of Tc-99 were not detected during benchmark testing of gaseous emissions.

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Your ref:
Our ref: LTR-EHS-14-59 Rev.1

Cc: Wayne Sepitko, Carl Snyder, Nancy Parr

August 27, 2014

Subject: Semi-Annual Assessment of Public Dose from Liquid and Gaseous Effluents

Effluents released from plant operations are monitored to determine the quantities of radionuclides discharged into the environment. The cumulative radioactivity released is summarized semi-annually and annually and input into dose models developed by the NRC/EPA to estimate the dose to the public.

The whole body and organ dose via the following pathways is determined in this assessment:

- Dose due to Gaseous Effluents by Direct Inhalation
  - The whole body dose was estimated using EPA's COMPLY Code at level 2 complexity. The organ dose was estimated by calculating the X/Q factor using the results of the COMPLY analysis for stack number 1247, the measured release quantity, and the dose conversion factors from Federal Guidance Report No 11, "Limiting Values of Radionuclide Intake and Air concentration Factors for Inhalation, Submersion, and Ingestion" (FGR 11).
- Dose due to Liquid Effluents by Ingestion of Potable Water
  - Estimated using equations and recommended values in Regulatory Guide 1.109, Doses from Liquid Effluent Pathways (RG1.109). Dose conversion factors were taken from FGR 11.
- Dose due to Liquid Effluents by Ingestion of Fish
  - Estimated using equations and recommended values in RG 1.109. Dose conversion factors were taken from FGR 11.
- Dose due to Liquid Effluents by Irradiation from Shoreline Deposition
  - Estimated using equations and recommended values in RG 1.109. Dose conversion factors were taken from Federal Guidance report No 12, "External Exposure to Radionuclides in Air, Water, and Soil"

The inhalation dose is determined at the nearest site boundary at a distance of 595 meters. The ingestion dose from liquid and external dose from sediment deposition is determined at the point at which the liquid effluent leaves the diffuser in the Congaree River.

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The release rates for gaseous effluent are determined by gross alpha measurements performed on daily air samples, one per stack for 47 stacks (Attachment 1). The release rates for liquid effluent are determined by isotopic analysis of liquid effluent samples taken monthly (Attachment 3). Based on these results, the following quantities were released in the 1st half of calendar year 2014:

- 192.3 µCi of Uranium in gaseous effluent
- 2.0 mCi of Uranium in liquid effluent
- 5 3 mCi of Technetium in liquid effluent

Using these results and the methods previously mentioned the whole body dose, dose to the bone, and dose to the lung were determined for an individual present at the nearest site boundary. Table 1 provides a summary of the results for each pathway. The gaseous and liquid effluents released during the 1st half of 2014 resulted in a potential whole body dose of 0.08 mrem and a lung dose of 0.61 mrem to an individual present at the nearest site boundary. The dose to the bone is negligible. These doses are well below the 12.5 mrem (1/2 of the 25 mrem annual dose limit) and the 5 mrem ALARA limit (1/2 of 10 mrem annual ALARA limit) for a member of the public.

Table 1. 2014 Semi-Annual Dose to the Public from Liquid and Gaseous Effluents

	Whole Body Dose (mrem/6 months)	**Organ Dose - Bone (mrem/6 months)**	**Organ Dose - Lung (mrem/6 months)**
Gaseous Effluents			
Direct inhalation*	0.08	2.30E-03	0.61
Liquid Effluents			
Potable Water	2.39E-05	3.47E-04	-
Aquatic Food (Fish)	1.50E-06	2.00E-05	-
Shoreline Deposition	8.04E-10	-	-
Total (mrem/6 months)	*0.08*	*2.67E-03*	*0.61*

* Assumes 80 % residence time

There were no significant changes in our process, compounds, or release points between 2013 and the 1st half of 2014. The attachments below illustrate the method used to calculate each result listed in Table 1. The annual dose calculation will be completed when the data is available for the entire calendar year.

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Attachment 1:	1st Half 2014 Gaseous Effluent Discharges
Attachment 2:	Lung/Bone Organ Dose due to Gaseous Effluent
Attachment 3:	1st Half 2014 Liquid Effluent Discharges
Attachment 4:	Whole Body Dose from Liquid Effluent Pathways - Potable Water
Attachment 5:	Dose to the Bone Surface from Liquid Effluent Pathways - Potable Water
Attachment 6:	Whole Body Dose from Liquid Effluent Pathways - Aquatic Foods
Attachment 7:	Dose to the Bone Surface from Liquid Effluent Pathways - Aquatic Foods
Attachment 8:	Whole Body Dose from Liquid Effluent Pathways – Shoreline Deposits
Attachment 9:	2014 Isotopic Fractions

David Wagoner
Radiation Safety Engineer
EH&S Operations

Review by: Anna Pearson
Manager, RSO
EH&S Operations

Attachment 1

1st Half 2014 Gaseous Effluent Discharges

SAMPLING STATION	LOCATION DESCRIPTION	Stack Height (meters)	GRS ALPHA CONCTR	QUANTITY RELEASED	ERROR	LLD.	FLOW RATE METERS/SEC	DERIVED ISOTOPIC CONCENTRATION uCi/ml			DERIVED ISOTOPIC DISCHARGE uCi			
			uCi/ml	uCi URANIUM		uCi/ml		U234	U235	U238	U234	U235	U238	sum 1st
1207	MET LAB EXHAUST	10	1.96E-13	1.69	+/-	8.00E-14	0.56	1.66E-13	5.87E-15	2.35E-14	1.44	0.05	0.2	1.69
1238	IFBA EXHAUST	10	8.22E-14	6.03	+/-	8.00E-14	4.72	6.98E-14	2.46E-15	9.86E-15	5.13	0.18	0.72	6.03
1239	MAINT WELD EX	11	2.19E-13	3.21	+/-	8.00E-14	0.94	1.86E-13	6.56E-15	2.62E-14	2.73	0.1	0.39	3.22
1243	AC-8	11	8.86E-14	5.21	+/-	8.00E-14	3.78	7.53E-14	2.66E-15	1.06E-14	4.42	0.16	0.62	5.2
1222	CALC COMB GAS LN 1	12	2.70E-13	0.69	+/-	8.00E-14	0.16	2.29E-13	8.09E-15	3.24E-14	0.58	0.02	0.08	0.68
1223	CALC COMB GAS LN 2	12	3.77E-13	0.96	+/-	8.00E-14	0.16	3.20E-13	1.13E-14	4.52E-14	0.82	0.03	0.12	0.97
1224	CALC COMB GAS LN 3	12	1.38E-13	0.35	+/-	8.00E-14	0.16	1.18E-13	4.15E-15	1.66E-14	0.3	0.01	0.04	0.35
1225	CALC COMB GAS LN 4	12	1.42E-13	0.36	+/-	8.00E-14	0.16	1.20E-13	4.25E-15	1.70E-14	0.31	0.01	0.04	0.36
1226	CALC COMB GAS LN 5	12	1.62E-13	0.41	+/-	8.00E-14	0.16	1.38E-13	4.86E-15	1.94E-14	0.35	0.01	0.05	0.41
1228	CHEM LAB EX #3	12	3.89E-13	1.93	+/-	8.00E-14	0.64	3.31E-13	1.17E-14	4.67E-14	1.64	0.06	0.23	1.93
1231	DEV LAB EX #2	12	2.57E-13	3.77	+/-	8.00E-14	0.94	2.18E-13	7.71E-15	3.08E-14	3.21	0.11	0.45	3.77
1237	ABF HOOD TORIT EX	12	8.45E-14	1.86	+/-	8.00E-14	1.42	7.18E-14	2.53E-15	1.01E-14	1.58	0.06	0.22	1.86
1241	PELLET LINE 6	12	8.11E-14	3.5	+/-	8.00E-14	2.78	6.89E-14	2.43E-15	9.73E-15	2.98	0.11	0.42	3.51
1247	HOT OIL RM EX	12	4.71E-13	28.49	+/-	8.00E-14	3.89	4.00E-13	1.41E-14	5.65E-14	24.21	0.85	3.42	28.48
1201	FURNACE EX LINE 1	13	8.07E-14	3.49	+/-	8.00E-14	2.78	6.86E-14	2.42E-15	9.69E-15	2.96	0.1	0.42	3.48
1202	FURNACE EX LINE 2	13	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1203	FURNACE EX LINE 3	13	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1204	FURNACE EX LINE 4	13	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1205	FURNACE EX LINE 5	13	8.00E-14	3.46	+/-	8.00E-14	2.78	6.80E-14	2.40E-15	9.60E-15	2.94	0.1	0.41	3.45
1206	NEW DECON ROOM	13	5.70E-13	14.53	+/-	8.00E-14	1.64	4.85E-13	1.71E-14	6.84E-14	12.35	0.44	1.74	14.53
1208	INCINERATOR EX	13	1.78E-13	5.23	+/-	8.00E-14	1.89	1.51E-13	5.34E-15	2.14E-14	4.45	0.16	0.63	5.24
1209	SUPPL INCIN EX	13	8.12E-14	1.19	+/-	8.00E-14	0.94	6.90E-14	2.44E-15	9.74E-15	1.01	0.04	0.14	1.19
1216	MAINT ENCL EX 4-B	13	8.46E-13	0	+/-	8.00E-14	3.89	7.19E-13	2.54E-14	1.02E-13	0	0	0	0
1217	CONV ENCL EX 4-C	13	1.01E-13	6.12	+/-	8.00E-14	3.89	8.60E-14	3.03E-15	1.21E-14	5.2	0.18	0.73	6.11
1218	CONV ENCL EX 4-D	13	2.45E-13	0	+/-	8.00E-14	3.89	2.08E-13	7.34E-15	2.94E-14	0	0	0	0
1219	CONV EMERG EX 4E	13	2.65E-13	0.76	+/-	8.00E-14	3.89	2.26E-13	7.96E-15	3.18E-14	0.65	0.02	0.09	0.76
1221	DECON ROOM EX	13	2.43E-13	5.36	+/-	8.00E-14	1.42	2.07E-13	7.29E-15	2.92E-14	4.55	0.16	0.64	5.35
1230	DEV LAB EX #1	13	1.75E-13	2.57	+/-	8.00E-14	0.94	1.49E-13	5.25E-15	2.10E-14	2.18	0.08	0.31	2.57
1232	PELLET COMBINED EX	13	8.79E-14	6.45	+/-	8.00E-14	4.72	7.47E-14	2.64E-15	1.05E-14	5.49	0.19	0.77	6.45
1233	SOLVENT EXT N EX	13	8.88E-14	3.95	+/-	8.00E-14	3.33	7.55E-14	2.67E-15	1.07E-14	3.36	0.12	0.47	3.95
1234	SOLVENT EXT S EX	13	2.46E-13	1.82	+/-	8.00E-14	3.33	2.09E-13	7.38E-15	2.95E-14	1.55	0.05	0.22	1.82
1229	HP LAB EX	15	9.28E-14	0.84	+/-	8.00E-14	0.58	7.89E-14	2.78E-15	1.11E-14	0.72	0.03	0.1	0.85
1236	MAP COMBINED	15	1.65E-13	0	+/-	8.00E-14	2.78	1.40E-13	4.94E-15	1.98E-14	0	0	0	0
1240	AC-3	15	8.48E-14	4.98	+/-	8.00E-14	3.78	7.21E-14	2.54E-15	1.02E-14	4.23	0.15	0.6	4.98
1246	AC-4	15	9.06E-14	5.48	+/-	8.00E-14	3.89	7.70E-14	2.72E-15	1.09E-14	4.66	0.16	0.66	5.48
1210	CONV 1-A EX	16	1.02E-13	6.58	+/-	8.00E-14	4.17	8.64E-14	3.05E-15	1.22E-14	5.6	0.2	0.79	6.59
1211	CONV 1-B EX	16	3.06E-13	0	+/-	8.00E-14	4.17	2.60E-13	9.17E-15	3.67E-14	0	0	0	0
1212	S1030 A	16	1.17E-13	13.11	+/-	8.00E-14	7.56	9.96E-14	3.51E-15	1.41E-14	11.14	0.39	1.57	13.1
1213	S1030 B	16	2.84E-13	1.58	+/-	8.00E-14	7.56	2.41E-13	8.51E-15	3.40E-14	1.35	0.05	0.19	1.59
1227	CHEM LAB EX #2	16	2.46E-13	2.23	+/-	8.00E-14	0.58	2.09E-13	7.38E-15	2.95E-14	1.9	0.07	0.27	2.24
1220	CHEM LAB FILT EX	17	8.81E-14	7.62	+/-	8.00E-14	5.56	7.49E-14	2.64E-15	1.06E-14	6.47	0.23	0.91	7.61
1242	AC-5	17	8.08E-14	4.75	+/-	8.00E-14	3.78	6.87E-14	2.42E-15	9.70E-15	4.04	0.14	0.57	4.75
1244	AMMON FUME SCR 1008A	17	9.80E-14	2.88	+/-	8.00E-14	1.89	8.33E-14	2.94E-15	1.18E-14	2.45	0.09	0.35	2.89
1245	AMMON FUME SCR 1008B	17	2.00E-13	0	+/-	8.00E-14	1.89	1.70E-13	6.01E-15	2.41E-14	0	0	0	0
1248	ERBIA FURNACE EX	18	8.02E-14	10.19	+/-	8.00E-14	8.17	6.82E-14	2.41E-15	9.63E-15	8.66	0.31	1.22	10.19
1249	ERBIA SCRUBBER EX	18	8.24E-14	5.55	+/-	8.00E-14	4.33	7.00E-14	2.47E-15	9.89E-15	4.72	0.17	0.67	5.56
1250	ERBIA CHANGE ROOM	18	9.38E-14	2.77	+/-	8.00E-14	1.9	7.97E-14	2.81E-15	1.13E-14	2.35	0.08	0.33	2.76
														Total
	Total derived isotopic release										163.5	5.77	23	192.3
								7.39E-12	2.61E-13	1.04E-12				

Jan-Jun 14	sum iso U uCi/mL	8.70E-12
Jan-Jun 14	avg iso U uCi/mL	4.80E-14 per day

Lung/Bone Organ Dose due to Gaseous Effluents

STACK IDENTIFICATION	1st half (Jan-Jun) uCi Uranium	2nd half (Jul-Dec) uCi Uranium	Total uCi released	EPA Comply Run Results			
Hot Oil Room Ex.	28.49	N/A	28.49	Dose (mrem/yr)	2.70E-02		
use highest release to calculate X/Q used by COMPLY				Stack height (m)	12		
				Release Rate (Ci/s)	U-234	U-235	U-238
Dose from comply	0.01350	mrem/6 mo			1.54E-12	5.96E-14	1.77E-19
release quantity	28.49	uCi					
Inhalation from RG1.109	2.85E-05	Ci					
App E table E-5 Effective Dose conversion	4000.00	m3/6 mo					
EPA FGR 11 p150-151							
U-234	3.58E-05	Sv/Bq	85.10%				
U-235	3.32E-05	Sv/Bq	3.29%				
U-238	3.20E-05	Sv/Bq	11.46%				
weighted dose conversion	3.52E-05	Sv/Bq					
conversion factor	3700.00	mrem/pCi= factor* Sv/Bq					
weighted dose conversion	0.1303	mrem/pCi					
Dose (mrem) = R(a)*3.17e4*Q*(X/Q)*effective Dose conversion			equations see RG1.109-25				
Dose (mrem)/(R(a)*3.17e4*Q*effective Dose conversion)=(X/Q)							
	2.87E-05	X/Q					

Estimate Lung Dose using X/Q and semi-annual releases for 2014				Estimate Bone Dose using X/Q and semi-annual releases for 2014	
App E table E-5 Lung Organ Dose conversion EPA FGR 11 p150-151					
U-234	2.98E-04	Sv/Bq	85.10%	1.13E-06	Sv/Bq
U-235	2.76E-04	Sv/Bq	3.29%	1.05E-06	Sv/Bq
U-238	2.66E-04	Sv/Bq	11.46%	1.01E-06	Sv/Bq
weighted dose conversion	2.93E-04	Sv/Bq		1.11E-06	Sv/Bq
conversion factor	3700.00	mrem/pCi= factor* Sv/Bq		3700.00	mrem/pCi= factor* Sv/Bq
weighted dose conversion	1.0847	mrem/pCi		4.11E-03	mrem/pCi
release quantity	192.30	uCi/6 mo		192.30	uCi/6 mo
	1.92E-04	Ci/6 mo		1.92E-04	Ci/6 mo
Lung *	0.61	mrem/6 mo	Bone *	2.30E-03	mrem/6 mo
	assume 80% residence				

2014

Attachment 3 - First HALF LIQUID EFFLUENT RADIOACTIVITY DISCHARGES

Month	Liquid Effluent Discharges: Average kgal/day	Actual kgal/month	Actual gal/month	Isotopic Uranium Measured Concentrations: U234 piC/L	U234 uCi/ml E-06	U235 piC/L	U235 uCi/ml E-06	U238 piC/L	U238 uCi/ml E-06	SUM ISO U uCi/ml E-06	Tc-99 Measured Concentrations: Tc-99 piC/L	Tc-99 uCi/ml E-06	Sum U & Tc-99 uCi/ml E-06
JAN	103.928	2806.060	2,806,060	23.9	0.024	0.890	0.001	3.29	0.003	0.028	69.2	0.069	0.097
FEB	113.506	2951.150	2,951,150	29.0	0.029	1.73	0.002	4.37	0.004	0.0351	145	0.145	0.180
MAR	119.329	3699.200	3,699,200	21.1	0.021	0.865	0.001	2.44	0.002	0.024405	39.0	0.039	0.063
APR	84.031	2352.880	2,352,880	27.9	0.028	1.25	0.001	4.40	0.004	0.03355	34.0	0.034	0.068
MAY	97.970	2253.310	2,253,310	27.6	0.028	0.539	0.001	3.34	0.003	0.031479	51.6	0.052	0.083
JUNE	100.426	3012.780	3,012,780	13.0	0.013	0.899	0.001	2.38	0.002	0.016279	109	0.109	0.125
Total (Jan-June)		17075.380	17,075,380										
Liters (L)			6.46E+07										
Milliliters (ml)			6.46E+10										

Month	Total uCi/month Released (based on monthly GEL discharge samples): U234	U-235	U-238	Tc-99
JAN	291.446	10.853	40.120	843.852
FEB	348.852	20.811	52.568	1744.258
MAR	295.431	12.111	34.164	546.057
APR	266.214	11.927	41.984	324.418
MAY	317.271	6.196	38.394	593.158
JUNE	148.244	10.252	27.140	1242.968
	1667.457	72.150	234.369	5294.711
	1974.0			5294.711
	uCi Uranium for 6-month period (all types)			
	7268.7			
	uCi Uranium & Tc-99 for 6-month period			

Total uCi/month Released (based on calculated Total U discharged and normalized with Isotopic Fractions): U234	U235	U238	Tc-99
65.11%	3.29%	11.46%	--
1680.051	64.944	226.218	
1971.2			5294.711
uCi Uranium for 6-month period (all types)			
7265.9			
uCi Uranium & Tc-99 for 6-month period			

Month	Liquid Effluent Discharges: Average kgal/day	Actual kgal/month	Actual gal/month	Uncertainty / Error Measured Concentrations: U234 piC/L	U234 uCi/ml E-06	U235 piC/L	U235 uCi/ml E-06	U238 piC/L	U238 uCi/ml E-06		Tc-99 piC/L	Tc-99 uCi/ml E-06
JAN	103.928	2806.060	2,806,060	2.38	0.00238	0.537	0.000537	0.891	0.000891		123	0.123
FEB	113.506	2951.150	2,951,150	2.73	0.00273	0.759	0.000759	1.07	0.00107		99.2	0.0992
MAR	119.329	3699.200	3,699,200	4.08	0.00408	1.10	0.0011	1.47	0.00147		159	0.159
APR	84.031	2352.880	2,352,880	2.710	0.00271	0.654	0.000654	1.08	0.00108		92.6	0.0926
MAY	97.970	2253.310	2,253,310	3.050	0.00305	0.520	0.00052	1.08	0.00108		115	0.115
JUNE	100.426	3012.780	3,012,780	1.41	0.00141	0.431	0.000431	0.609	0.000609		147	0.147
Total (Jan-June)												

Month	Total uCi/month (based on monthly GEL discharge samples): U234	U-235	U-238	Tc-99
JAN	29.023	6.548	10.865	1499.910
FEB	32.840	9.130	12.871	1193.313
MAR	57.126	15.402	20.582	2226.233
APR	25.858	6.240	10.305	883.563
MAY	35.061	5.978	12.415	1321.961
JUNE	16.079	4.915	6.945	1676.296
	195.986	48.213	73.983	8801.276
	9119.5			

Nominal U-235 Concentration:	4.273%

FIRST HALF LIQUID DISCHARGES

Radionuclide	uCi/ml		Error	LLD,uCi/ml	Quantity Released uCi
U234	2.60E-08	+/-	3.03E-09	6.00E-10	1680.1
U235	1.00E-09	+/-	7.46E-10	6.00E-10	64.9
U238	3.50E-09	+/-	1.14E-09	6.00E-10	226.2
Tc-99	8.19E-08	+/-	1.36E-07	6.00E-10	5294.7
					7265.9 sum

Whole Body Dose from Liquid Effluent Pathways - Potable Water																					
		Whole Body-Ingestion																			
365	liters	Usage by adult/6 mo	U	10CFR20	7.3 x 10^5 (ml) which is the annual water intake of "Reference Man."																
31293	mixing - dilution	Dilution at diffuser	M																		
				Congaree Flow		9388	cubic feet/sec		see Nureg-1118 Environmental Assessment for renewam ...SNM-1107 May 1985												
0.3	cubic ft/sec	Average discharge	F	Effluent Flow		3.00E-01	cubic feet/sec														
									effective	bone	effective	bone									
2.83E-04	U-234	mRem/pCi	D	EPA Limiting Values of Radioanuclide Intake.....					Sv/Bq	Sv/Bq	mRem/pCi	mRem/pCi									
2.66E-04	U-235	mRem/pCi	D	FRG no 11	1988			U-234	7.66E-08	1.13E-06	2.83E-04	4.18E-03									
2.69E-04	U-236	mRem/pCi	D	Exposure-to-dose conversion factors for ingestion				U-235	7.19E-08	1.05E-06	2.66E-04	3.88E-03									
2.55E-04	U-238	mRem/pCi	D					U-236	7.26E-08	1.07E-06	2.69E-04	3.96E-03									
1.46E-06	Tc-99	mRem/pCi	D					U-238	6.88E-08	1.01E-06	2.55E-04	3.74E-03									
								Tc-99	3.95E-10	6.04E-11	1.46E-06	2.23E-07									
12	hrs	transit time	t-p	reg guide 1.109	table E-15																
3.23557E-10	U-234	decay const	λ	Nuclide		T(1/2) yr	T(1/2) hr	λ													
1.12404E-13	U-235	decay const	λ	URANIUM234		2.45E+05	2.14E+09	3.24E-10													
3.38075E-12	U-236	decay const	λ	URANIUM235		7.04E+08	6.17E+12	1.12E-13													
1.77058E-14	U-238	decay const	λ	URANIUM236		2.34E+07	2.05E+11	3.38E-12			for comaprison only										
3.71407E-10	Tc-99	decay const	λ	URANIUM238		4.47E+09	3.91E+13	1.77E-14													
				TC-99		2.13E+05	1.87E+09	3.71E-10			Part 20 table 2		soluble forms								
0.9999999961	U-234	exp(-λt-p)									Dose Conversion										
1.0000000000	U-235	exp(-λt-p)										uCi/ml	milliters	uCi	pCi	mRem	mRem/pCi				
1.0000000000	U-236	exp(-λt-p)									U-234	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
1.0000000000	U-238	exp(-λt-p)									U-235	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
0.9999999955	Tc-99	exp(-λt-p)									U-236	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
											U-238	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
Activity Released											Tc-99	6.00E-05	7.30E+05	4.38E+01	4.38E+07	50	1.14E-06				
1.9712E-03	**total uranium(Ci)**	Q		summation of liquid effluent alpha activity																	
				% of activity based on current nominal uranium isotopic **(see U activity tab)**							ICRP 69	Comparison									
1.6777E-03	U-234 release fraction	Ci		URANIUM234	85.11%	0.8511						Sv/Bq	Rem/Bq	mRem/pCi							
6.4852E-05	U-235 release fraction	Ci		URANIUM235	3.29%	0.0329															
2.9568E-06	U-236 release fraction	Ci		URANIUM236	0.15%	0.0015					adult	5.00E-08	0.005	1.85E-04							
2.2590E-04	U-238 release fraction	Ci		URANIUM238	11.46%	0.1146					infant	3.70E-07	0.037	1.37E-03							
5.2940E-03	Tc-99 release fraction	Ci		TC-99							bone-adult	7.90E-07	0.079	2.92E-03							
check U sum	0.00197																				
4.75E-07	U-234	release fraction *dose factor*exp(-λ*tp)																			
1.73E-08	U-235	release fraction *dose factor*exp(-λ*tp)																			
7.94E-10	U-236	release fraction *dose factor*exp(-λ*tp)																			
5.75E-08	U-238	release fraction *dose factor*exp(-λ*tp)																			
7.74E-09	Tc-99	release fraction *dose factor*exp(-λ*tp)																			
5.59E-07	all nuclides	sum of nuclides																			
42.76736	usage	1100*(usage*dilution)/flow																			
2.39E-05	**mRem**	see regulatory guide 1.109 page 1.109-2 and 1.109-3 for formula and definition of terms.																			

Dose to the Bone Surface from Liquid Effluent Pathways - Potable Water

Bone Surface-Ingestion

365	liters	Usage by adult/6 m	U	10CFR20	7.3 x 10^5 (ml) which is the annual water intake of "Reference Man."													
31293	mixing - dilution	Dilution at difuser	M															
				Congaree Flow		9388	cubic feet/sec		see Nureg-1118 Environmental Assessment for renewam ...SNM-1107 May 1985									
0.3	cubic ft/sec	Average discharge	F	Effluent Flow		3.00E-01	cubic feet/sec											
									effective	bone	effective	bone						
4.18E-03	U-234	mRem/pCi	D-bone	EPA Limiting Values of Radioanuclide Intake.....					Sv/Bq	Sv/Bq	mRem/pCi	mRem/pCi						
3.88E-03	U-235	mRem/pCi	D-bone	FRG no 11	1988			U-234	7.66E-08	1.13E-06	2.83E-04	4.18E-03						
3.96E-03	U-236	mRem/pCi	D-bone	Exposure-to-dose conversion factors for ingestion				U-235	7.19E-08	1.05E-06	2.66E-04	3.88E-03						
3.74E-03	U-238	mRem/pCi	D-bone					U-236	7.26E-08	1.07E-06	2.69E-04	3.96E-03						
2.23E-07	Tc-99	mRem/pCi	D-bone					U-238	6.88E-08	1.01E-06	2.55E-04	3.74E-03						
								Tc-99	3.95E-10	6.04E-11	1.46E-06	2.23E-07						
12	hrs	transit time	t-p	reg guide 1	table E-15													
3.23557E-10	U-234	decay const	λ	Nuclide		T(1/2) yr	T(1/2) hr	λ										
1.12404E-13	U-235	decay const	λ	URANIUM234		2.45E+05	2.14E+09	3.24E-10										
3.38075E-12	U-236	decay const	λ	URANIUM235		7.04E+08	6.17E+12	1.12E-13			Part 20 table 2		soluble forms					
1.77058E-14	U-238	decay const	λ	URANIUM236		2.34E+07	2.05E+11	3.38E-12			Dose Conversion							
3.71407E-10	Tc-99	decay const	λ	URANIUM238		4.47E+09	3.91E+13	1.77E-14				uCi/ml	milliters	uCi	pCi	mRem	mRem/pCi	
				TC-99		2.13E+05	1.87E+09	3.71E-10			U-234	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04	
0.9999999961	U-234	exp(-λt-p)									U-235	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04	
1.0000000000	U-235	exp(-λt-p)									U-236	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04	
1.0000000000	U-236	exp(-λt-p)									U-238	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04	
1.0000000000	U-238	exp(-λt-p)									Tc-99	6.00E-05	7.30E+05	4.38E+01	4.38E+07	50	1.14E-06	
0.9999999955	Tc-99	exp(-λt-p)																
											ICRP 69	Comparison						
Activity Released												Sv/Bq	Rem/Bq	mRem/pCi				
1.9712E-03	**total uranium(Ci)**	**Q**	summation of liquid effluent alpha activity															
			% of activity based on current nominal uranium isotopic **(see U activity tab)**															
1.6777E-03	U-234 release fraction	Ci	URANIUM234	85.11%	0.8511						adult	5.00E-08	0.005	1.85E-04				
6.4852E-05	U-235 release fraction	Ci	URANIUM235	3.29%	0.0329						infant	3.70E-07	0.037	1.37E-03				
2.9568E-06	U-236 release fraction	Ci	URANIUM236	0.15%	0.0015						bone-adult	7.90E-07	0.079	2.92E-03				
2.2590E-04	U-238 release fraction	Ci	URANIUM238	11.46%	0.1146													
5.2940E-03	Tc-99 release fraction	Ci	TC-99															
check U sum	0.00197																	
7.01E-06	U-234	release fraction *dose factor*exp(-λ*tp)																
2.52E-07	U-235	release fraction *dose factor*exp(-λ*tp)																
1.17E-08	U-236	release fraction *dose factor*exp(-λ*tp)																
8.44E-07	U-238	release fraction *dose factor*exp(-λ*tp)																
1.18E-09	Tc-99	release fraction *dose factor*exp(-λ*tp)																
8.12E-06	all nuclides	sum of nuclides																
42.76736	usage	1100*(usage*dilution)/flow																
3.47E-04	**mRem**	see regulatory guide 1.109 page 1.109-2 and 1.109-3 for formula and definition of terms.																

Attachment 6

Whole Body Dose from Liquid Effluent Pathways - Aquatic Foods																		
		Whole Body																
10.5	Kg	Usage by adult/6 m	U	see regulatory guide 1.109 page 1.109-40 table E-5, Recommended Values for U(ap)														
31293	mixing - dilution	Dilution at difuser	M	Congaree Flow		9388	cubic feet/sec		see Nureg-1118 Environmental Assessment for renewam ...SNM-1107 May 1985									
0.3	cubic ft/sec	Average discharge	F	Effluent Flow		3.00E-01	cubic feet/sec											
									effective	bone	effective	bone						
2.83E-04	U-234	mRem/pCi	D	EPA Limiting Values of Radioanuclide Intake.....					Sv/Bq	Sv/Bq	mRem/pCi	mRem/pCi						
2.66E-04	U-235	mRem/pCi	D	FRG no 11	1988			U-234	7.66E-08	1.13E-06	2.83E-04	4.18E-03						
2.69E-04	U-236	mRem/pCi	D	Exposure-to-dose conversion factors for ingestion				U-235	7.19E-08	1.05E-06	2.66E-04	3.88E-03						
2.55E-04	U-238	mRem/pCi	D					U-236	7.26E-08	1.07E-06	2.69E-04	3.96E-03						
1.46E-06	Tc-99	mRem/pCi	D					U-238	6.88E-08	1.01E-06	2.55E-04	3.74E-03						
								Tc-99	3.95E-10	6.04E-11	1.46E-06	2.23E-07						
24	hrs	transit time	t-p	reg guide 1 table E-15														
3.23557E-10	U-234	decay const	λ	Nuclide		T(1/2) yr	T(1/2) hr	λ										
1.12404E-13	U-235	decay const	λ	URANIUM234		2.45E+05	2.14E+09	3.24E-10				for comaprison only						
3.38075E-12	U-236	decay const	λ	URANIUM235		7.04E+08	6.17E+12	1.12E-13										
1.77058E-14	U-238	decay const	λ	URANIUM236		2.34E+07	2.05E+11	3.38E-12				Part 20 table 2		soluble forms				
3.71407E-10	Tc-99	decay const	λ	URANIUM238		4.47E+09	3.91E+13	1.77E-14				Dose Conversion						
				TC-99		2.13E+05	1.87E+09	3.71E-10					uCi/ml	milliters	uCi	pCi	mRem	mRem/pCi
0.99999999223	U-234	exp(-λt-p)										U-234	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04
1.00000000000	U-235	exp(-λt-p)										U-235	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04
0.99999999992	U-236	exp(-λt-p)										U-236	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04
1.00000000000	U-238	exp(-λt-p)										U-238	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04
0.99999999109	Tc-99	exp(-λt-p)										Tc-99	6.00E-05	7.30E+05	4.38E+01	4.38E+07	50	1.14E-06
Activity Released												ICRP 69	Comparison					
1.9712E-03	total uranium(Ci)	Q	summation of liquid effluent alpha activity										Sv/Bq	Rem/Bq	mRem/pCi			
			% of activity based on current nominal uranium isotopic		(see U activity tab)													
1.8777E-03	U-234 release fraction	Ci	URANIUM234	85.11%	0.8511							adult	5.00E-08	0.005	1.85E-04			
6.4852E-05	U-235 release fraction	Ci	URANIUM235	3.29%	0.0329							infant	3.70E-07	0.037	1.37E-03			
2.9568E-06	U-236 release fraction	Ci	URANIUM236	0.15%	0.0015							bone-adult	7.90E-07	0.079	2.92E-03			
2.2590E-04	U-238 release fraction	Ci	URANIUM238	11.46%	0.1146													
5.2940E-03	Tc-99 release fraction	Ci	TC-99															
check U sum	0.00197																	
							bioaccumulation factor		BNWL-2075									
9.51E-07	U-234	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		UC-11									
3.45E-08	U-235	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		Methodology for Calculation of Radiation Doses									
1.59E-09	U-236	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		in the Environs from Nuclear Fuel									
1.15E-07	U-238	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		Cycle Facilities									
1.16E-07	Tc-99	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					15											
1.22E-06	all nuclides	sum of nuclides																
1.23029	usage	1100*(usage*dilution)/flow																
1.50E-06	mRem	see regulatory guide 1.109 page 1.109-2 and 1.109-3 for formula and definition of terms.																

Dose to the Bone Surface from Liquid Effluent Pathways - Aquatic Foods

Bone Surface

10.5	Kg	Usage by adult/6 m	U	see regulatory guide 1.109 page 1.109-40 table E-5, Recommended Values for U(ap)																		
31293	mixing - dilution	Dilution at difuser	M	Congaree Flow		9388	cubic feet/sec		see Nureg-1118 Environmental Assessment for renewam ...SNM-1107 May 1985													
0.3	cubic ft/sec	Average discharge	F	Effluent Flow		3.00E-01	cubic feet/sec															
									effective	bone	effective	bone										
4.18E-03	U-234	mRem/pCi	D	EPA Limiting Values of Radioanuclide Intake.....					Sv/Bq	Sv/Bq	mRem/pCi	mRem/pCi										
3.88E-03	U-235	mRem/pCi	D	FRG no 11	1988			U-234	7.66E-08	1.13E-06	2.83E-04	4.18E-03										
3.96E-03	U-236	mRem/pCi	D	Exposure-to-dose conversion factors for ingestion				U-235	7.19E-08	1.05E-06	2.66E-04	3.88E-03										
3.74E-03	U-238	mRem/pCi	D					U-236	7.26E-08	1.07E-06	2.69E-04	3.96E-03										
2.23E-07	Tc-99	mRem/pCi	D					U-238	6.88E-08	1.01E-06	2.55E-04	3.74E-03										
								Tc-99	3.95E-10	6.04E-11	1.46E-06	2.23E-07										
24	hrs	transit time	t-p	reg guide 1.109	table E-15																	
3.23557E-10	U-234	decay const	λ	Nuclide		T(1/2) yr	T(1/2) hr	λ				for comaprison only										
1.12404E-13	U-235	decay const	λ	URANIUM234		2.45E+05	2.14E+09	3.24E-10														
3.38075E-12	U-236	decay const	λ	URANIUM235		7.04E+08	6.17E+12	1.12E-13				Part 20 table 2		soluble forms								
1.77058E-14	U-238	decay const	λ	URANIUM236		2.34E+07	2.05E+11	3.38E-12				Dose Conversion										
3.71407E-10	Tc-99	decay const	λ	URANIUM238		4.47E+09	3.91E+13	1.77E-14					uCi/ml	milliters	uCi	pCi	mRem	mRem/pCi				
				TC-99		2.13E+05	1.87E+09	3.71E-10				U-234	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
0.99999999223	U-234	exp(-λt-p)										U-235	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
1.00000000000	U-235	exp(-λt-p)										U-236	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
0.99999999992	U-236	exp(-λt-p)										U-238	3.00E-07	7.30E+05	2.19E-01	2.19E+05	50	2.28E-04				
1.00000000000	U-238	exp(-λt-p)										Tc-99	6.00E-05	7.30E+05	4.38E+01	4.38E+07	50	1.14E-06				
0.99999999109	Tc-99	exp(-λt-p)																				
												ICRP 69	Comparison									
Activity Released																						
1.9712E-03	total uranium(Ci	Q		summation of liquid effluent alpha activity									Sv/Bq	Rem/Bq	mRem/pCi							
				% of activity based on current nominal uranium isotopic (see U activity tab)																		
1.8777E-03	U-234 release fra	Ci		URANIUM234	85.11%	0.8511						adult	5.00E-08	0.005	1.85E-04							
6.4852E-05	U-235 release fra	Ci		URANIUM235	3.29%	0.0329						infant	3.70E-07	0.037	1.37E-03							
2.9568E-06	U-236 release fra	Ci		URANIUM236	0.15%	0.0015						bone-adult	7.90E-07	0.079	2.92E-03							
2.2590E-04	U-238 release fra	Ci		URANIUM238	11.46%	0.1146																
5.2940E-03	Tc-99 release fra	Ci		TC-99																		
check U sum	0.00197																					
							bioaccumulation factor		BNWL-2075													
1.40E-05	U-234	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		UC-11													
5.04E-07	U-235	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		Methodology for Calculation of Radiation Doses													
2.34E-08	U-236	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		in the Environs from Nuclear Fuel													
1.69E-06	U-238	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					2		Cycle Facilities													
1.77E-08	Tc-99	release fraction *bioaccumulation factor*dose factor*exp(-λ*tp)					15															
1.63E-05	all nuclides	sum of nuclides																				
1.23029	usage	1100*(usage*dilution)/flow																				
2.00E-05	**mRem**	see regulatory guide 1.109 page 1.109-2 and 1.109-3 for formula and definition of terms.																				

Whole Body Dose from Liquid Effluent Pathways - Shoreline Deposits																
		Whole Body														
6	hr	Usage by adult/6 mo	U	see regulatory guide 1.109 page 1.109-40 table E-5, Recommended Values for U(ap)												
31293	mixing - dilution	Dilution at difuser	M													
				Congaree Flow		9388	cubic feet/sec	see Nureg-1118 Environmental Assessment for renewam ...SNM-1107 May 19								
0.3	cubic ft/sec	Average discharge	F	Effluent Flow		3.00E-01	cubic feet/sec									
					Sv/s:Bq/m^2	mrem/hr:pCi/m^2										
9.86E-12	U-234	mRem*m^2/pCi*hr	D	U-234	7.40E-19	9.86E-12	EPA FRG 12	Dose Coeff for exposure to contaminated ground surface								
1.97E-09	U-235	mRem*m^2/pCi*hr	D	U-235	1.48E-16	1.97E-09										
8.66E-12	U-236	mRem*m^2/pCi*hr	D	U-236	6.50E-19	8.66E-12										
7.34E-12	U-238	mRem*m^2/pCi*hr	D	U-238	5.51E-19	7.34E-12										
1.04E-12	Tc-99	mRem*m^2/pCi*hr	D	Tc-99	7.80E-20	1.04E-12										
12	hrs	transit time	t-p	see regulatory guide 1.109 page 1.109-69 table E-15, Recommended Values ...									t-i			
131040	hrs	xposure time of sedime	t-b	page 1.109-68			Nuclide	T(1/2) yr	T(1/2) hr	λ	T(1/2) day					
3.23557E-10	U-234	decay const	λ				URANIUM234	2.45E+05	2.14E+09	3.24E-10	8.90E+07					
1.12404E-13	U-235	decay const	λ				URANIUM235	7.04E+08	6.17E+12	1.12E-13	2.56E+11					
3.38075E-12	U-236	decay const	λ				URANIUM236	2.34E+07	2.05E+11	3.38E-12	8.52E+09					
1.77058E-14	U-238	decay const	λ				URANIUM238	4.47E+09	3.91E+13	1.77E-14	1.63E+12					
3.71407E-10	Tc-99	decay const	λ				TC-99	2.13E+05	1.87E+09	3.71E-10	7.75E+07					
0.0000423980	U-234	exp(-λt-p)*[1-exp(-λt-b)]														
0.0000000147	U-235	exp(-λt-p)*[1-exp(-λt-b)]														
0.0000004430	U-236	exp(-λt-p)*[1-exp(-λt-b)]														
0.0000000023	U-238	exp(-λt-p)*[1-exp(-λt-b)]														
0.0000486679	Tc-99	exp(-λt-p)*[1-exp(-λt-b)]														
Activity Released																
1.9712E-03	**total uranium(Ci)**	**Q**	summation of liquid effluent alpha activity													
			% of activity based on current nominal uranium isotopic **(see U activity tab)**													
1.6777E-03	U-234 release fraction	Ci	URANIUM234	85.11%	0.8511											
6.4852E-05	U-235 release fraction	Ci	URANIUM235	3.29%	0.0329											
2.9568E-06	U-236 release fraction	Ci	URANIUM236	0.15%	0.0015											
2.2590E-04	U-238 release fraction	Ci	URANIUM238	11.46%	0.1146											
5.2940E-03	Tc-99 release fraction	Ci	TC-99													
check U sum	0.00197															
6.24E-11	U-234	release fraction *dose factor*exp(-λt-p)*1-exp(-λt-b)*t-i														
4.82E-10	U-235	release fraction *dose factor*exp(-λt-p)*1-exp(-λt-b)*t-i														
9.66E-14	U-236	release fraction *dose factor*exp(-λt-p)*1-exp(-λt-b)*t-i														
6.26E-12	U-238	release fraction *dose factor*exp(-λt-p)*1-exp(-λt-b)*t-i														
2.08E-11	Tc-99	release fraction *dose factor*exp(-λt-p)*1-exp(-λt-b)*t-i														
5.72E-10	all nuclides	sum of nuclides														
1.406050	usage	11000*(usage*dilution*shore width factor)/flow	see regulatory guide 1.109 page 1.109-40 table A-2,Shore width...													
8.04E-10	**mRem**	see regulatory guide 1.109 page 1.109-2 and 1.109-3 for formula and definition of terms.														

Attachment 9

2014 Isotopic Fractions

Based on the plant nominal enrichment for 2014

Nuclide	Average wt%	Specific Activity Ci/g	Weighted Activity	% Activity
U-234	0.038	6.220E-03	2.388E-04	85.11
U-235	4.270	2.160E-06	9.223E-06	3.29
U-236	0.006	6.470E-05	4.076E-07	0.15
U-238	95.685	3.360E-07	3.215E-05	11.46
Total	100.000		2.806E-04	100.000