



Westinghouse Electric Company LLC
Nuclear Fuel
Columbia Fuel Site
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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-18-21

Subject: SNM-1107/70-1151
NRC Semi-Annual Discharge Report
July - December 2017

March 1, 2018

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 July 1, 2017, through December 31, 2017, the following quantities of radionuclides were released to the unrestricted area by the Westinghouse Electric Company's Columbia, South Carolina Nuclear Fuel Plant:

Discharge	uCi	Parameter
Gaseous	231.17	Uranium (analyzed as gross alpha)
Liquid Effluent	1463.5	U-234
	86.6	U-235
	295.5	U-238
	5050.0	Tc-99

Gaseous effluent results were obtained from point source gross alpha analysis of stack gas effluent, and the individual radionuclide activity composition (85.04% U-234, 3.38% U-235, and 11.43% U-238) is inferred from the calculated average enrichment. A 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 numerical 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-18-17 entitled "Annual Assessment of Public Dose due to Liquid and Gaseous Effluents" has been provided as Attachment "C."

Sincerely,

John Howell, Manager, Environment, Health and Safety

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

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SEMI ANNUAL AVERAGE STACK EFFLUENT REPORT - ATTACHMENT A

Westinghouse Electric Company Nuclear Fuel, Columbia 07/01/2017 to 12/31/2017

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			Jan-Jun	Jul-Dec
							U234	U235	U238	U234	U235	U238		
1201	FURNACE EX LINE 1	9.36E-14	4.11	+/-	8.00E-14	2.78	7.96E-14	2.81E-15	1.12E-14	3.49	0.12	0.49	3.46	4.1
1202	FURNACE EX LINE 2	8.78E-14	3.86	+/-	8.00E-14	2.78	7.47E-14	2.63E-15	1.05E-14	3.28	0.12	0.46	3.46	3.86
1203	FURNACE EX LINE 3	8.18E-14	3.59	+/-	8.00E-14	2.78	6.96E-14	2.46E-15	9.82E-15	3.06	0.11	0.43	3.46	3.6
1204	FURNACE EX LINE 4	9.64E-14	4.23	+/-	8.00E-14	2.78	8.19E-14	2.89E-15	1.16E-14	3.6	0.13	0.51	3.45	4.24
1205	FURNACE EX LINE 5	8.38E-14	3.68	+/-	8.00E-14	2.78	7.12E-14	2.51E-15	1.01E-14	3.13	0.11	0.44	3.45	3.68
1206	NEW DECON ROOM	9.53E-14	2.47	+/-	8.00E-14	1.64	8.10E-14	2.86E-15	1.14E-14	2.1	0.07	0.3	2.19	2.47
1207	MET LAB EXHAUST	3.53E-13	3.1	+/-	8.00E-14	0.56	3.00E-13	1.06E-14	4.24E-14	2.64	0.09	0.37	2.02	3.1
1208	INCINERATOR EX	2.70E-13	8.06	+/-	8.00E-14	1.89	2.29E-13	8.09E-15	3.24E-14	6.85	0.24	0.97	5.35	8.06
1209	SUPPL INCIN EX	3.62E-13	5.4	+/-	8.00E-14	0.94	3.07E-13	1.09E-14	4.34E-14	4.59	0.16	0.65	1.49	5.4
1210	CONV 1-A EX	1.87E-13	12.29	+/-	8.00E-14	4.17	1.59E-13	5.60E-15	2.24E-14	10.45	0.37	1.47	5.83	12.29
1211	CONV 1-B EX	2.19E-13	0	+/-	8.00E-14	4.17	1.86E-13	6.57E-15	2.63E-14	0	0	0	0	0
1212	S1030 A	1.57E-13	17.89	+/-	8.00E-14	7.56	1.34E-13	4.72E-15	1.89E-14	15.21	0.54	2.15	11.1	17.9
1213	S1030 B	4.77E-13	2.71	+/-	8.00E-14	7.56	4.06E-13	1.43E-14	5.73E-14	2.3	0.08	0.33	1.34	2.71
1217	CONV ENCL EX 4-C	3.91E-13	24.02	+/-	8.00E-14	3.89	3.32E-13	1.17E-14	4.69E-14	20.41	0.72	2.88	9.23	24.01
1218	CONV ENCL EX 4-D	2.33E-13	0	+/-	8.00E-14	3.89	1.98E-13	7.00E-15	2.80E-14	0	0	0	0	0
1219	CONV EMERG EX 4E	3.75E-13	1.1	+/-	8.00E-14	3.89	3.19E-13	1.13E-14	4.51E-14	0.93	0.03	0.13	0.6	1.09
1220	CHEM LAB FILT EX	1.17E-13	10.3	+/-	8.00E-14	5.56	9.96E-14	3.52E-15	1.41E-14	8.75	0.31	1.24	7.48	10.3
1221	DECON ROOM EX	5.35E-13	11.98	+/-	8.00E-14	1.42	4.55E-13	1.60E-14	6.42E-14	10.18	0.36	1.44	5.32	11.98
1222	CALC COMB GAS LN 1	2.52E-13	0.65	+/-	8.00E-14	0.16	2.14E-13	7.55E-15	3.02E-14	0.55	0.02	0.08	0.58	0.65
1223	CALC COMB GAS LN 2	2.27E-13	0.59	+/-	8.00E-14	0.16	1.93E-13	6.82E-15	2.73E-14	0.5	0.02	0.07	1.11	0.59
1224	CALC COMB GAS LN 3	2.46E-13	0.64	+/-	8.00E-14	0.16	2.09E-13	7.39E-15	2.96E-14	0.54	0.02	0.08	0.36	0.64
1225	CALC COMB GAS LN 4	2.15E-13	0.56	+/-	8.00E-14	0.16	1.83E-13	6.45E-15	2.58E-14	0.47	0.02	0.07	0.33	0.56
1226	CALC COMB GAS LN 5	1.65E-13	0.43	+/-	8.00E-14	0.16	1.40E-13	4.95E-15	1.98E-14	0.36	0.01	0.05	0.56	0.42
1227	CHEM LAB EX #2	4.50E-13	4.15	+/-	8.00E-14	0.58	3.82E-13	1.35E-14	5.40E-14	3.53	0.12	0.5	2.51	4.15
1228	CHEM LAB EX #3	9.02E-14	0.46	+/-	8.00E-14	0.64	7.67E-14	2.71E-15	1.08E-14	0.39	0.01	0.05	0.46	0.45
1229	HP LAB EX	1.04E-13	0.96	+/-	8.00E-14	0.58	8.85E-14	3.12E-15	1.25E-14	0.82	0.03	0.12	0.77	0.97
1230	DEV LAB EX #1	4.31E-13	6.43	+/-	8.00E-14	0.94	3.66E-13	1.29E-14	5.17E-14	5.47	0.19	0.77	3.03	6.43
1231	DEV LAB EX #2	4.14E-13	6.18	+/-	8.00E-14	0.94	3.52E-13	1.24E-14	4.96E-14	5.25	0.19	0.74	3.24	6.18
1232	PELLET COMBINED EX	8.87E-14	6.62	+/-	8.00E-14	4.72	7.54E-14	2.66E-15	1.06E-14	5.63	0.2	0.79	6.74	6.62
1233	SOLVENT EXT N EX	1.10E-13	4.98	+/-	8.00E-14	3.33	9.37E-14	3.31E-15	1.32E-14	4.23	0.15	0.6	3.9	4.98
1234	SOLVENT EXT S EX	3.57E-13	2.69	+/-	8.00E-14	3.33	3.03E-13	1.07E-14	4.28E-14	2.29	0.08	0.32	1.8	2.69
1236	MAP COMBINED	2.24E-13	0	+/-	8.00E-14	2.78	1.90E-13	6.72E-15	2.69E-14	0	0	0	0	0
1237	ABF HOOD TORIT EX	9.54E-14	2.14	+/-	8.00E-14	1.42	8.11E-14	2.86E-15	1.15E-14	1.82	0.06	0.26	1.89	2.14
1238	IFBA EXHAUST	8.28E-14	6.18	+/-	8.00E-14	4.72	7.04E-14	2.48E-15	9.94E-15	5.26	0.19	0.74	6.32	6.19
1239	MAINT WELD EX	3.76E-13	5.62	+/-	8.00E-14	0.94	3.20E-13	1.13E-14	4.52E-14	4.78	0.17	0.67	3.2	5.62
1240	AC-3	8.10E-14	4.84	+/-	8.00E-14	3.78	6.89E-14	2.43E-15	9.72E-15	4.11	0.15	0.58	4.77	4.84
1241	PELLET LINE 6	8.53E-14	3.75	+/-	8.00E-14	2.78	7.25E-14	2.56E-15	1.02E-14	3.18	0.11	0.45	3.62	3.74
1242	AC-5	8.77E-14	5.24	+/-	8.00E-14	3.78	7.45E-14	2.63E-15	1.05E-14	4.45	0.16	0.63	5.07	5.24
1243	AC-8	1.03E-13	6.14	+/-	8.00E-14	3.78	8.74E-14	3.09E-15	1.23E-14	5.22	0.18	0.74	4.99	6.14
1244	AMMON FUME SCR 1008A	1.06E-13	3.18	+/-	8.00E-14	1.89	9.04E-14	3.19E-15	1.28E-14	2.7	0.1	0.38	2.9	3.18
1245	AMMON FUME SCR 1008B	2.43E-13	0	+/-	8.00E-14	1.89	2.07E-13	7.30E-15	2.92E-14	0	0	0	0	0
1246	AC-4	1.08E-13	6.62	+/-	8.00E-14	3.89	9.15E-14	3.23E-15	1.29E-14	5.62	0.2	0.79	5.35	6.61
1247	HOT OIL RM EX	1.74E-13	10.72	+/-	8.00E-14	3.89	1.48E-13	5.23E-15	2.09E-14	9.11	0.32	1.29	9.39	10.72
1248	ERBIA FURNACE EX	8.21E-14	10.61	+/-	8.00E-14	8.17	6.98E-14	2.46E-15	9.86E-15	9.02	0.32	1.27	14.01	10.61
1249	ERBIA SCRUBBER EX	8.54E-14	5.85	+/-	8.00E-14	4.33	7.26E-14	2.56E-15	1.02E-14	4.97	0.18	0.7	5.56	5.85
1250	ERBIA CHANGE ROOM	8.70E-14	2.61	+/-	8.00E-14	1.9	7.40E-14	2.61E-15	1.04E-14	2.22	0.08	0.31	2.61	2.61
1251	WATERGLASS SCR S1190	9.52E-14	3.55	+/-	8.00E-14	2.36	8.09E-14	2.86E-15	1.14E-14	3.02	0.11	0.43	3.49	3.56
Total							8.06E-12	2.84E-13	1.14E-12	Total uCi	6.95	27.74	sum 1st	sum 2nd
										196.48			167.79	231.17

Total derived isotopic release

Jan-Jun 17	sum iso U uCi/mL	7.10E-12	semiannual total
Jul-Dec 17	sum iso U uCi/mL	9.48E-12	semiannual total
2017	sum iso U uCi/mL	1.66E-11	annual total
2017	avg iso U uCi/mL	4.54E-14	annual average per day

ATTACHMENT "B"
LIQUID EFFLUENT DISCHARGES
SECOND HALF 2017

- A. Report Period: July 1, 2017, through December 31, 2017
 B. Sample Location: Composite Sampler at Waste Treatment, prior to discharge to Congaree River
 C. Total Liquid Flow: 6.40E+07 liters
 D. Sample Collection: Effluent Composite Sampler

SECOND HALF LIQUID DISCHARGES

Radionuclide	LLD (uCi/ml)	Quantity Released (uCi)	Error		Average Concentration Released (uCi/ml)
U234	6.00E-10	1463.5	+/-	168	2.29E-08
U235	6.00E-10	86.6	+/-	48	1.35E-09
U238	6.00E-10	295.5	+/-	78	4.62E-09
<i>Total U</i>		<i>1845.6</i>			<i>2.88E-08</i>
Tc-99	6.00E-10	5050.0	+/-	7760	7.89E-08
Total (July-Dec)		6895.6			1.37E-07

Note:

- Liquid effluent composites were analyzed by alpha spectroscopy, and significant quantities of U-236 were not detected using this method.
- Tc-99 is not reported for gaseous effluents, as significant quantities of Tc-99 were not detected during benchmark testing of gaseous emissions.



To: Cynthia Logsdon, Diana Joyner

Date: February 22, 2018

cc: John Howell, Nancy Parr, Anna Pearson, Sherrie Culler

From: David Wagoner
Ext: 1919
Fax: 803.695.4158

Your ref:
Our ref: LTR-EHS-18-17

Subject: **Annual Assessment of Public Dose due to 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 and EPA to estimate the dose to the public.

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

- Dose due to Gaseous Effluents by Direct Inhalation
 - The whole body dose was estimated using the EPA's COMPLY Code at level 2 complexity. The organ dose was estimated using the calculated X/Q factor for stack number 1217 (Conv. Encl. Ex. 4-C), 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 effluent and external dose from sediment deposition is determined at the point where the liquid effluent leaves the diffuser in the Congaree River.

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 composite liquid effluent samples taken monthly (Attachment 3). Based on these results, the following quantities were released in calendar year 2017:

- 398.98 μCi of Uranium in gaseous effluent
- 4.08 mCi of Uranium in liquid effluent
- 7.19 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 2017 resulted in a potential whole body dose of 0.16 mrem to an individual present at the nearest site boundary. This dose is significantly less than the 25 mrem annual whole body dose limit for a member of the public.

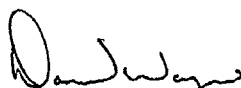
Table 1. 2017 Annual Dose to the Public from Liquid and Gaseous Effluents

	Whole Body Dose (mrem/yr)	Organ Dose - Bone (mrem/yr)	Organ Dose - Lung (mrem/yr)
Gaseous Effluents			
Direct inhalation*	0.16	5.5E-03	1.5
Liquid Effluents			
Potable Water	9.9E-05	1.4E-03	-
Aquatic Food (Fish)	6.0E-06	8.3E-05	-
Shoreline Deposition	3.4E-09	-	-
<i>Total (mrem)</i>	<i>0.16</i>	<i>7.0E-03</i>	<i>1.5</i>

* Assumes 80 % residence time

One release point (Maint. Encl. Ex. 4-B) was decommissioned and removed from the effluent monitoring program in 2017. No release points were added to the effluent monitoring program in 2017. The attachments below illustrate the method used to calculate each result listed in Table 1.

- Attachment 1: 2017 Gaseous Effluent Discharges
- Attachment 2: Lung/Bone Organ Dose due to Gaseous Effluent
- Attachment 3: 2017 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: 2017 Isotopic Fractions
- Attachment 10: Comply Results



David Wagoner
Radiation Safety Engineer
EH&S Operations



Anna Pearson
Manager, RSO
EH&S Operations

Attachment 1
2017 Gaseous Effluent Discharges

Sampling Location	Stack Height	Gross Alpha Concentration*	1st Half (Jan-Jun)	2nd Half (July-Dec)	Total uCi	Release Rate (Ci/s)		
Station Description	(m)	(uCi/mL)	uCi Uranium Released	Released	Released	U234	U235	U238
1207 MET LAB EXHAUST	10	3.53E-13	2.02	3.10	5.12	1.38E-13	5.50E-15	1.86E-14
1238 IFBA EXHAUST	10	8.28E-14	6.32	6.19	12.51	3.38E-13	1.34E-14	4.55E-14
1239 MAINT WELD EX	11	3.76E-13	3.20	5.62	8.82	2.38E-13	9.48E-15	3.21E-14
1243 AC-8	11	1.03E-13	4.99	6.14	11.13	3.01E-13	1.20E-14	4.05E-14
1222 CALC COMB GAS LN 1	12	2.52E-13	0.58	0.65	1.23	3.33E-14	1.32E-15	4.47E-15
1223 CALC COMB GAS LN 2	12	2.27E-13	1.11	0.59	1.70	4.60E-14	1.83E-15	6.18E-15
1224 CALC COMB GAS LN 3	12	2.46E-13	0.37	0.64	1.01	2.73E-14	1.09E-15	3.67E-15
1225 CALC COMB GAS LN 4	12	2.15E-13	0.32	0.56	0.88	2.38E-14	9.46E-16	3.20E-15
1226 CALC COMB GAS LN 5	12	1.65E-13	0.55	0.42	0.97	2.62E-14	1.04E-15	3.53E-15
1228 CHEM LAB EX #3	12	9.02E-14	0.46	0.45	0.91	2.46E-14	9.78E-16	3.31E-15
1231 DEV LAB EX #2	12	4.14E-13	3.24	6.18	9.42	2.55E-13	1.01E-14	3.42E-14
1237 ABF HOOD TORIT EX	12	9.54E-14	1.89	2.14	4.03	1.09E-13	4.33E-15	1.46E-14
1241 PELLET LINE 6	12	8.53E-14	3.62	3.74	7.36	1.99E-13	7.91E-15	2.67E-14
1247 HOT OIL RM EX	12	1.74E-13	9.39	10.72	20.11	5.44E-13	2.16E-14	7.31E-14
1201 FURNACE EX LINE 1	13	9.36E-14	3.46	4.10	7.56	2.04E-13	8.13E-15	2.75E-14
1202 FURNACE EX LINE 2	13	8.78E-14	3.46	3.86	7.32	1.98E-13	7.87E-15	2.66E-14
1203 FURNACE EX LINE 3	13	8.18E-14	3.46	3.60	7.06	1.91E-13	7.59E-15	2.57E-14
1204 FURNACE EX LINE 4	13	9.64E-14	3.46	4.24	7.70	2.08E-13	8.28E-15	2.80E-14
1205 FURNACE EX LINE 5	13	8.38E-14	3.46	3.68	7.14	1.93E-13	7.67E-15	2.59E-14
1206 NEW DECON ROOM	13	9.53E-14	2.19	2.47	4.66	1.26E-13	5.01E-15	1.69E-14
1208 INCINERATOR EX	13	2.70E-13	5.36	8.06	13.42	3.63E-13	1.44E-14	4.88E-14
1209 SUPPL INCIN EX	13	3.62E-13	1.50	5.40	6.90	1.87E-13	7.42E-15	2.51E-14
1217 CONV ENCL EX 4-C	13	3.91E-13	9.23	24.01	33.24	8.99E-13	3.57E-14	1.21E-13
1218 CONV ENCL EX 4-D	13	2.33E-13	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00
1219 CONV EMERG EX 4E	13	3.75E-13	0.60	1.09	1.69	4.57E-14	1.82E-15	6.14E-15
1221 DECON ROOM EX	13	5.35E-13	5.32	11.98	17.30	4.68E-13	1.86E-14	6.29E-14
1230 DEV LAB EX #1	13	4.31E-13	3.04	6.43	9.47	2.56E-13	1.02E-14	3.44E-14
1232 PELLET COMBINED EX	13	8.87E-14	6.74	6.62	13.36	3.61E-13	1.44E-14	4.86E-14
1233 SOLVENT EXT N EX	13	1.10E-13	3.89	4.98	8.87	2.40E-13	9.53E-15	3.22E-14
1234 SOLVENT EXT S EX	13	3.57E-13	1.80	2.69	4.49	1.21E-13	4.83E-15	1.63E-14
1229 HP LAB EX	15	1.04E-13	0.77	0.97	1.74	4.70E-14	1.87E-15	6.32E-15
1236 MAP COMBINED	15	2.24E-13	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00
1240 AC-3	15	8.10E-14	4.77	4.84	9.61	2.60E-13	1.03E-14	3.49E-14
1246 AC-4	15	1.08E-13	5.35	6.61	11.96	3.23E-13	1.29E-14	4.35E-14
1251 WATERGLASS SCR S1190	15	9.52E-14	3.49	3.56	7.05	1.91E-13	7.58E-15	2.56E-14
1210 CONV 1-A EX	16	1.87E-13	5.83	12.29	18.12	4.90E-13	1.95E-14	6.59E-14
1211 CONV 1-B EX	16	2.19E-13	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00
1212 S1030 A	16	1.57E-13	11.11	17.90	29.01	7.84E-13	3.12E-14	1.05E-13
1213 S1030 B	16	4.77E-13	1.34	2.71	4.05	1.10E-13	4.35E-15	1.47E-14
1227 CHEM LAB EX #2	16	4.50E-13	2.51	4.15	6.66	1.80E-13	7.16E-15	2.42E-14
1220 CHEM LAB FILT EX	17	1.17E-13	7.48	10.30	17.78	4.81E-13	1.91E-14	6.46E-14
1242 AC-5	17	8.77E-14	5.07	5.24	10.31	2.79E-13	1.11E-14	3.75E-14
1244 AMMON FUME SCR 1008/	17	1.06E-13	2.89	3.18	6.07	1.64E-13	6.52E-15	2.21E-14
1245 AMMON FUME SCR 1008E	17	2.43E-13	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00
1248 ERBIA FURNACE EX	18	8.21E-14	14.01	10.61	24.62	6.66E-13	2.65E-14	8.95E-14
1249 ERBIA SCRUBBER EX	18	8.54E-14	5.55	5.85	11.40	3.08E-13	1.23E-14	4.14E-14
1250 ERBIA CHANGE ROOM	18	8.70E-14	2.61	2.61	5.22	1.41E-13	5.61E-15	1.90E-14
Total			167.81	231.17	398.98	1.08E-11	4.29E-13	1.45E-12

*Concentration LLD is 8E-14 uCi/mL

Total offsite dose calculated by Comply (mrem/y) = 0.2
Assume 80% residence time = 0.16

Attachment 2

O:\Regulatory\EH&S Operations\Environment\Environment 2017\Annual\2017 Gaseous effluents Jan-Dec.xlsx

Attachment 3 - 2017 LIQUID EFFLUENT DISCHARGES

Month	Liquid Effluent Discharges			Isotopic Uranium Measured Concentrations				Tc-99 Measured Concentrations	Sum U & Tc-99	Total uCi/month Released (based on monthly GEL discharge samples)				Measurement Uncertainty / Error				Uncertainty / Error			
	Average kgal/day	Actual kgal/month	Actual gal/month	U234 pCi/L	U235 pCi/L	U238 pCi/L	Total U pCi/L	Tc-99 pCi/L	Total U & Tc-99 pCi/L	U234	U-235	U-238	Tc-99	U234 pCi/L	U235 pCi/L	U238 pCi/L	Tc-99 pCi/L	U234 (uCi)	U-235 (uCi)	U-238 (uCi)	Tc-99 (uCi)
JAN	120.873	3747.076	3,747,076	18.9	0.785	3.15	22.835	34.4	57.235	268.053	11.133	44.675	487.884	2.24	0.555	0.932	141	31.769	7.871	13.218	1999.758
FEB	84.715	2372.024	2,372,024	15.9	1.08	2.25	19.230	60.3	79.530	142.752	9.696	20.201	541.380	2.38	0.742	0.918	142	21.368	6.662	8.242	1274.892
MAR	87.840	2723.042	2,723,042	36.1	1.93	6.95	44.980	82.6	127.580	372.072	19.892	71.632	851.335	2.88	0.765	1.27	143	29.683	7.885	13.090	1473.860
APR	112.071	3250.064	3,250,064	31.4	1.12	5.98	38.500	0.0	38.500	386.267	13.778	73.563	0.000	3.27	0.748	1.44	152	40.226	9.202	17.714	1869.827
MAY	131.362	3940.857	3,940,857	20.9	0.842	4.22	25.962	0.0	25.962	311.747	12.559	62.946	0.000	1.93	0.504	0.904	121	28.788	7.518	13.484	1804.853
JUNE	107.721	2693.033	2,693,033	33.4	2.34	4.98	40.720	26.1	66.820	340.450	23.852	50.762	266.041	3.32	0.999	1.29	154	33.841	10.183	13.149	1569.742
July	113.837	3301.271	3,301,271	23.7	2.04	5.29	31.0	56.6	87.6	296.139	25.490	66.100	707.235	2.42	0.807	1.16	152	30.239	10.084	14.495	1899.287
August	103.264	3201.190	3,201,190	20.9	0.825	4.09	25.8	230.0	255.8	253.235	9.996	49.557	2786.796	2.64	0.629	1.18	179	31.988	7.621	14.297	2168.854
September	119.386	3581.584	3,581,584	18.7	0.971	3.89	23.6	12.4	36.0	253.503	13.163	52.734	168.098	2.60	0.826	1.24	145	35.246	11.198	16.810	1965.663
October	85.717	2314.352	2,314,352	17.8	0.545	4.24	22.6	83.0	105.6	155.925	4.774	37.142	727.065	2.47	0.526	1.23	151	21.637	4.608	10.775	1322.733
November	78.944	2210.426	2,210,426	23.8	1.64	4.65	30.1	60.3	90.4	199.122	13.721	38.904	504.498	3.10	0.933	1.38	22.5	25.936	7.806	11.546	188.245
December	84.957	2293.843	2,293,843	35.2	2.24	5.88	43.3	18.0	61.3	305.613	19.448	51.051	156.280	2.68	0.799	1.13	24.8	23.268	6.937	9.811	215.318

Total (Jan-June)	35628.762	35,628,762
Liters (L)		1.35E+08
Milliliters (ml)		1.35E+11

3284.878	177.504	619.266	7196.611	354	98	157	17753
4081.6							
uCi Uranium (all types)							
11278.3							
uCi Uranium & Tc-99							

LIQUID DISCHARGES

Radionuclide	LLD (uCi/ml)	Quantity Released (uCi)	Error		Average Concentration Released (uCi/ml)
U234	6.00E-10	3284.9	+/-	354	2.44E-08
U235	6.00E-10	177.5	+/-	98	1.32E-09
U238	6.00E-10	619.3	+/-	157	4.59E-09
Total U		4081.6			3.03E-08
Tc-99	6.00E-10	7196.6	+/-	17753	5.34E-08
Total (Jan-June)		11278.3			1.14E-07

Attachment 4
Whole Body Dose from Liquid Effluent Pathways - Potable Water

Whole Body-Ingestion														
730 liters	Usage by adult/yr	U	10CFR20	7.3 x 10 ⁵ (ml) which is the annual water intake of "Reference Man."										
31293 mixing - dilution	Dilution at difuser	M												
0.3 cubic ft/sec	Average discharge	F	Congaree Flow	9388 cubic feet/sec	see Nureg-1118 Environmental Assessment for renewam ...SNM-1107 May 1985									
			Effluent Flow	3.00E-01 cubic feet/sec										
2.83E-04 U-234	mRem/pCi	D	EPA Limiting Values of Radioanuclide Intake.....		effective	bone	effective	bone						
2.66E-04 U-235	mRem/pCi	D	FRG no 11 1988		Sv/Bq	Sv/Bq	mRem/pCi	mRem/pCi						
2.69E-04 U-236	mRem/pCi	D	Exposure-to-dose conversion factors for ingestion		U-234	7.66E-08	1.13E-06	2.83E-04	4.18E-03					
2.55E-04 U-238	mRem/pCi	D			U-235	7.19E-08	1.05E-06	2.66E-04	3.88E-03					
1.46E-06 Tc-99	mRem/pCi	D			U-236	7.26E-08	1.07E-06	2.69E-04	3.96E-03					
					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							
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							
0.9999999961 U-234	exp(-λt-p)													
1.0000000000 U-235	exp(-λt-p)													
1.0000000000 U-236	exp(-λt-p)													
1.0000000000 U-238	exp(-λt-p)													
0.9999999955 Tc-99	exp(-λt-p)													
Activity Released					Part 20 table 2 soluble forms									
4.082E-03 total uranium(Ci)	Q		summation of liquid effluent alpha activity		Dose Conversion									
			% of activity based on current nominal uranium isotopic (see U activity tab)		ICRP 69 Comparison									
3.471E-03 U-234 release fraction	Ci		URANIUM234		85.04%									
1.380E-04 U-235 release fraction	Ci		URANIUM235		3.38%									
6.122E-06 U-236 release fraction	Ci		URANIUM236		0.15%									
4.665E-04 U-238 release fraction	Ci		URANIUM238		11.43%									
7.197E-03 Tc-99 release fraction	Ci		TC-99											
check U sum	0.00408													
9.84E-07 U-234	release fraction *dose factor*exp(-λt-p)													
3.67E-08 U-235	release fraction *dose factor*exp(-λt-p)													
1.64E-09 U-236	release fraction *dose factor*exp(-λt-p)													
1.19E-07 U-238	release fraction *dose factor*exp(-λt-p)													
1.05E-08 Tc-99	release fraction *dose factor*exp(-λt-p)													
1.15E-06 all nuclides	sum of nuclides													
85.53473 usage	1100*(usage*dilution)/flow													
9.85E-05 mRem	see regulatory guide 1.109 page 1.109-2 and 1.109-3 for formula and definition of terms.													

Attachment 5
Dose to the Bone Surface from Liquid Effluent Pathways - Potable Water

Bone Surface-Ingestion														
730	liters	Usage by adult/yr	U	10CFR20	7.3 x 10 ⁵ (ml) which is the annual water intake of "Reference Man."									
31293	mixing - dilution	Dilution at difuser	M											
0.3	cubic ft/sec	Average discharge	F	Congaree Flow	9388	cubic feet/sec	see Nureg-1118 Environmental Assessment for renewam ... SNM-1107 May 1985							
				Effluent Flow	3.00E-01	cubic feet/sec								
4.18E-03	U-234	mRem/pCi	D-bone	EPA Limiting Values of Radioanuclide Intake.....				effective	bone	effective	bone			
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	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						
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						
0.9999999961	U-234	exp(-λt-p)								U-234	3.00E-07	7.30E+05	2.19E+05	50
1.0000000000	U-235	exp(-λt-p)								U-235	3.00E-07	7.30E+05	2.19E+05	50
1.0000000000	U-236	exp(-λt-p)								U-236	3.00E-07	7.30E+05	2.19E+05	50
1.0000000000	U-238	exp(-λt-p)								U-238	3.00E-07	7.30E+05	2.19E+05	50
0.9999999955	Tc-99	exp(-λt-p)								Tc-99	6.00E-05	7.30E+05	4.38E+01	50
										ICRP 69	Comparison			
Activity Released														
4.082E-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)										
3.4710E-03	U-234 release fraction	Ci		URANIUM234	85.04%					adult	5.00E-08	0.005	1.85E-04	
1.3796E-04	U-235 release fraction	Ci		URANIUM235	3.38%					infant	3.70E-07	0.037	1.37E-03	
6.1224E-06	U-236 release fraction	Ci		URANIUM236	0.15%					bone-adult	7.90E-07	0.079	2.92E-03	
4.6653E-04	U-238 release fraction	Ci		URANIUM238	11.43%									
7.197E-03	Tc-99 release fraction	Ci		TC-99										
check U sum	0.00408													
1.45E-05	U-234	release fraction *dose factor*exp(-λ*tp)												
5.36E-07	U-235	release fraction *dose factor*exp(-λ*tp)												
2.42E-08	U-236	release fraction *dose factor*exp(-λ*tp)												
1.74E-06	U-238	release fraction *dose factor*exp(-λ*tp)												
1.61E-09	Tc-99	release fraction *dose factor*exp(-λ*tp)												
1.68E-05	all nuclides	sum of nuclides												
85.53473	usage	1100*(usage*dilution)/flow												
1.44E-03	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

[illegible]

Attachment 7
Dose to the Bone Surface from Liquid Effluent Pathways - Aquatic Foods

Bone Surface														
21 Kg	Usage by adult/yr	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								
4.18E-03	U-234	mRem/pCi	D	EPA Limiting Values of Radioanuclide Intake.....			effective	bone	effective	bone				
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 comaprisn 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	milliliters	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								Comparison						
4.082E-03	total uranium(Ci)	summation of liquid effluent alpha activity						Sv/Bq	Rem/Bq	mRem/pCi				
		% of activity based on current nominal uranium isotopic (see U activity tab)												
3.4710E-03	U-234 release frqCi	URANIUM234 85.04%						adult	5.00E-08	0.005	1.85E-04			
1.3796E-04	U-235 release frqCi	URANIUM235 3.38%						infant	3.70E-07	0.037	1.37E-03			
6.1224E-06	U-236 release frqCi	URANIUM236 0.15%						bone-adult	7.90E-07	0.079	2.92E-03			
4.6653E-04	U-238 release frqCi	URANIUM238 11.43%												
7.197E-03	Tc-99 release fra Ci	TC-99												
check U sum	0.00408							bioaccumulation factor	BNWL-2075					
2.90E-05	U-234	release fraction *bioaccumulation factor*dose factor*exp(-λt*p)					2	UC-11						
1.07E-06	U-235	release fraction *bioaccumulation factor*dose factor*exp(-λt*p)					2	Methodology for Calculation of Radiation Doses						
4.85E-08	U-236	release fraction *bioaccumulation factor*dose factor*exp(-λt*p)					2	in the Environs from Nuclear Fuel						
3.49E-06	U-238	release fraction *bioaccumulation factor*dose factor*exp(-λt*p)					2	Cycle Facilities						
2.41E-08	Tc-99	release fraction *bioaccumulation factor*dose factor*exp(-λt*p)					15							
3.37E-05	all nuclides	sum of nuclides												
2.46059	usage	1100*(usage*dilution)/flow												
8.28E-05	mRem	see regulatory guide 1.109 page 1.109-2 and 1.109-3 for formula and definition of terms.												

Attachment 9

2017 Isotopic Fractions

Based on the plant nominal enrichment for 2017

Nuclide	Average wt%	Specific Activity Ci/g	Weighted Activity	% Activity
U-234	0.04	6.220E-03	2.388E-06	85.04
U-235	4.40	2.160E-06	9.504E-08	3.38
U-236	0.01	6.470E-05	4.076E-09	0.15
U-238	95.57	3.360E-07	3.211E-07	11.43
Total	100.0		2.809E-06	100.00

Attachment 10 - Comply Results

COMPLY: V1.6.

2/21/2018 3:48

40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

REPORT ON COMPLIANCE WITH
THE CLEAN AIR ACT LIMITS FOR RADIONUCLIDE EMISSIONS
FROM THE COMPLY CODE - V1.6.

Prepared by:

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Columbia Fuel Fabrication Facility
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David Wagoner
803.647.1919

Prepared for:

U.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Washington, DC 20460

2017 Annual Dose to the Public due to Gaseous Effluent

SCREENING LEVEL 2

DATA ENTERED:

RELEASE RATES FOR STACK 1.

Nuclide		Release Rate (curies/SECOND)
-----		-----
U-234	Y	4.770E-13
U-235	Y	1.890E-14
U-238	Y	6.410E-14

RELEASE RATES FOR STACK 2.

Nuclide		Release Rate (curies/SECOND)
-----		-----
U-234	Y	5.390E-13
U-235	Y	2.140E-14
U-238	Y	7.250E-14

RELEASE RATES FOR STACK 3.

Nuclide		Release Rate (curies/SECOND)
-----		-----
U-234	Y	1.290E-12
U-235	Y	5.120E-14
U-238	Y	1.730E-13

RELEASE RATES FOR STACK 4.

Nuclide		Release Rate (curies/SECOND)
-----		-----
U-234	Y	4.060E-12
U-235	Y	1.610E-13
U-238	Y	5.460E-13

RELEASE RATES FOR STACK 5.

Nuclide		Release Rate (curies/SECOND)
-----		-----
U-234	Y	8.210E-13
U-235	Y	3.260E-14
U-238	Y	1.100E-13

RELEASE RATES FOR STACK 6.

Nuclide		Release Rate (curies/SECOND)
-----		-----

U-234	Y	1.560E-12
U-235	Y	6.220E-14
U-238	Y	2.100E-13

RELEASE RATES FOR STACK 7.

Nuclide		Release Rate (curies/SECOND)
U-234	Y	9.240E-13
U-235	Y	3.670E-14
U-238	Y	1.240E-13

RELEASE RATES FOR STACK 8.

Nuclide		Release Rate (curies/SECOND)
U-234	Y	1.120E-12
U-235	Y	4.430E-14
U-238	Y	1.500E-13

SITE DATA FOR STACK 1.

Release height 10 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

SITE DATA FOR STACK 2.

Release height 11 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

SITE DATA FOR STACK 3.

Release height 12 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

SITE DATA FOR STACK 4.

Release height 13 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

SITE DATA FOR STACK 5.

Release height 15 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

SITE DATA FOR STACK 6.

Release height 16 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

SITE DATA FOR STACK 7.

Release height 17 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

SITE DATA FOR STACK 8.

Release height 18 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

Building (width) is unusually WIDE.

Receptor is unusually FAR.

RESULTS:

Effective dose equivalent: 0.2 mrem/yr.

*** Comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

***** END OF COMPLIANCE REPORT *****

COMPLY: V1.6.

2/21/2018 4:05

40 CFR Part 61
National Emission Standards
for Hazardous Air Pollutants

REPORT ON COMPLIANCE WITH
THE CLEAN AIR ACT LIMITS FOR RADIONUCLIDE EMISSIONS
FROM THE COMPLY CODE - V1.6.

Prepared by:

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Prepared for:

U.S. Environmental Protection Agency
Office of Radiation and Indoor Air
Washington, DC 20460

Conv Encl Ex 4-C

SCREENING LEVEL 2

DATA ENTERED:

Nuclide		Release Rate (curies/SECOND)
U-234	Y	8.990E-13
U-235	Y	3.570E-14
U-238	Y	1.210E-13

Release height 13 meters.

Building height 9 meters.

The source and receptor are not on the same building.

Distance from the source to the receptor is 595 meters.

Building width 137 meters.

Default mean wind speed used (2.0 m/sec).

NOTES:

Input parameters outside the "normal" range:

Building (width) is unusually WIDE.
Receptor is unusually FAR.

RESULTS:

Effective dose equivalent: 1.8E-02 mrem/yr.

*** comply at level 2.

This facility is in COMPLIANCE.

It may or may not be EXEMPT from reporting to the EPA.

You may contact your regional EPA office for more information.

***** END OF COMPLIANCE REPORT *****