

APPENDIX A
Air Emissions

APPENDIX A
2017 AIR EMISSIONS ASSESSMENT

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ASSESSMENT OF US ECOLOGY WASHINGTON AIR EMISSIONS

Summary

This appendix evaluates air emissions from the US Ecology Washington (USEW) Facility to verify compliance with Clean Air Act emissions standards. Air sampling results and the waste's isotopic distributions are used to develop an upper bound source term. This source term is input to the US Environmental Protection Agency (EPA) "Comply" Code and National Council on Radiation Protection and Measurements (NCRP) Commentary 3, "Screening Techniques for Determining Compliance with Environmental Standards" or the EPA "CAP88" code to demonstrate compliance.

Description of Facility

All of the waste received at USEW is already packaged in closed containers with exterior surfaces below Department of Transportation (DOT) contamination levels. A majority of these packages are placed in trenches and covered with soil without opening the containers; therefore, there is very little potential for air emissions. However, a fraction of these packages must be opened for inspection, and a few burial containers are transported in shipping casks that may have contamination inside the cask. USEW also monitors these evolutions for airborne radionuclide emissions.

Most package inspections (PI) are conducted in a concrete block room in the south end of the USEW laboratory building. The room is approximately 16' by 23' with a 12' ceiling. Packages are placed inside an enclosed see-through tent located in the center of the room. The tent is 11' wide by 12' long and approximately 12' tall. The tent has flexible sides of heavy gauge plastic sheets. Two 1000-cfm axial fans (one normally operating) ventilate the inspection tent.

The ventilation system draws air from under the inspection tent skirt, around the package and up to an exhaust duct located in the top-center. The air then passes through roughing, charcoal and HEPA filters before entering the exhaust fans. Downstream of the fans, the air exits the building through a 16 square inch duct attached to louvers on the east side of the building. The vent is approximately 4 meters from the ground. The lab building is 7 meters high, 8 meters wide and 16 meters long. The ventilation system has filters installed, but they are not abatement technology. No filters are considered in the dose assessment.

Normal operations involve placing a package inside the tent for waste form verification. Waste form verification may include opening and/or punching a hole in the package, and inspection of package contents. The package is closed and patched as necessary before disposal.

Portable air samplers are used to monitor airborne activity during inspections. One air sampler is located inside the tent (the compliance sampler), one is in the inspection room outside the tent (background sampler), and one is at the air exhaust on the side of the building. Samplers are started before the package is opened and are changed and counted after the evolution is complete. Inspections for iodine containing material have an additional iodine cartridge, which is counted separately. The MDA for iodine is about $7\text{e-}12$ $\mu\text{Ci/cc}$. The iodine sampling occurs only when the total inspection package iodine concentration exceeds 1 mCi. The MDA for gross alpha is approximately $2\text{E-}13$ $\mu\text{Ci/ml}$ and $3\text{E-}13$ $\mu\text{Ci/ml}$ for gross beta.

Occasionally, a large package which cannot fit inside the inspection tent is inspected at its restricted area storage location. Non-inspection events that may have airborne potential are also

monitored (such as decontamination, or internally contaminated shipping cask offloads). These events are monitored using a portable air sampler placed downwind from the evolution. These samplers start before the evolution starts and are changed and counted after the evolution is complete. An additional upwind sample may be collected to account for background radioactivity.

In 2017, 23 inspections were conducted; all were conducted inside the PI Facility tent and none outside near the disposal trench. Table A-1 lists the airborne radioactivity concentrations for each of the inspections conducted.

The average emission flow rate is 1000 cfm, and the total air volume is:

$$1000 \text{ cfm} * 23 \text{ inspection} * 1 \text{ hr per inspection} * 60 \text{ min per hr} = 1.38\text{E}6 \text{ cubic feet.}$$

Table A-1- Potential Air Emissions Airborne Radioactivity Concentrations
(Units are E-14 $\mu\text{Ci/cc}$)

Date of Inspection	BATES #	Alpha Corrected	Beta Corrected
1/16/2017	24737	2.20	1.10
2/14/2017	24738	0.90	5.70
4/18/2017	24740	-0.33	1.00
5/3/2017	24741	0.51	45.60
5/11/2017	24743	-0.11	3.90
5/30/2017	24744	5.31	4.70
5/31/2017	24744	-2.55	7.60
5/31/2017	24744	-19.69	-47.20
6/1/2017	24744	0.52	21.00
6/15/2017	24745	1.13	-3.80
6/21/2017	24748	-1.60	-7.60
8/2/2017	24750	1.09	4.40
8/3/2017	24750	1.74	12.40
9/21/2017	24751	4.39	2.10
10/10/2017	24751	1.00	3.40
10/17/2017	24753	7.40	15.50
11/7/2017	24756	11.18	23.80
11/13/2017	24760	8.50	-1.30
11/27/2017	24763	13.73	23.30
11/27/2017	24764	-0.50	2.50
12/4/2017	24766	-3.44	-13.90
12/11/2017	24770	2.10	15.20
12/19/2017	24774	2.60	2.30

Bates# is the USEW tracking number.

Source Term Evaluation

Airborne monitoring results and the manifested isotopic content of the inspected packages are used to determine the source term input into the CAP88 computer code. Isotopic concentrations for alpha and beta emitters are calculated from the average concentration adjusted to the isotopes percentage in the inspected waste. These isotopes and their fraction of manifested waste are provided in Table A-2.

In 2017, No PIs were manifested with iodine equal or greater than one mCi. No iodine air concentrations were above our detection limits. No iodine release occurred.

In 2017, 1 PI package contained noble gases. Noble gasses are assumed to be released at a fraction of 1E-3, based on the waste form of the material that contains them (solid).

In 2017, PI packages contained a total of 0.01 Ci of Class A unstable tritium. Unstable tritium is assumed to be released at a release fraction of 1E-3. No Class B Stable tritium packages were inspected. The class B tritium is placed in a metal container which is welded closed, then the metal container is solidified in concrete. The package inspection is limited to verifying that the concrete has solidified properly using non-destructive testing (impact hammer). The inner packages are not opened, and no tritium is thought to be released during these inspections.

Release Concentrations

Releases were calculated as a one-hour release at the average concentrations of the isotopes listed in Table A-2.

Table A-2 Particulate Annual Release

<i>Isotope</i>	<i>Ci/Yr</i>
Ag-110m	2.531E-13
Ba-133	2.182E-12
C-14	7.326E-12
Cd-109	9.353E-13
Cm-244	3.492E-12
Co-57	3.118E-13
Co-58	7.731E-13
Co-60	1.703E-11
Cs-134	1.228E-13
Cs-137	7.461E-09
Fe-55	2.091E-11
Mn-54	6.422E-13
Ni-63	8.393E-10
Pb-210	5.818E-11
Pb-212	3.139E-12
Pm-147	1.060E-11
Pu-241	3.081E-12
Ra-224	1.795E-10
Ra-226	3.215E-11
Ra-228	1.541E-12
Sr-90	2.485E-10
Tc-99	8.389E-13

<i>Isotope</i>	<i>Ci/Yr</i>
Th-228	8.268E-10
Th-232	3.492E-12
U-234	3.141E-10
U-235	1.828E-11
U-238	6.294E-10
Unstable H-3	1.032E-02
Kr-85	7.147E-01

Table A-3 Wind Rose/Joint Frequency

<i>Pasqual Stability Class</i>	<i>2017 data from HMS Station 21</i>							
Direction	A	B	C	D	E	F	G	Wind Freq.
N	1.69	1.27	1.76	1.21	1.54	1.53	1.51	0.038
NNW	1.71	1.63	1.44	1.39	1.57	1.76	1.35	0.04
NW	1.73	1.48	1.83	1.26	1.26	1.44	1.26	0.038
WNW	1.65	1.97	1.74	1.23	1.14	1.17	1.04	0.033
W	1.68	1.54	1.36	1.2	1.24	1.15	1.08	0.03
WSW	1.74	1.32	1.59	1.19	1.17	1.22	1.25	0.032
SW	1.92	1.65	1.43	1.24	1.39	1.2	1.01	0.034
SSW	1.93	1.63	1.55	1.54	1.43	1.1	0.93	0.036
S	2	2.26	1.79	1.37	1.35	1.2	1.03	0.048
SSE	2.05	2.22	1.63	1.59	1.71	1.41	1.39	0.07
SE	3.12	2.44	2.53	2.36	2.88	2.13	2.03	0.145
ESE	2.41	1.84	2.4	2.36	3.22	2.38	2.21	0.148
E	2.16	1.78	1.88	1.94	2.5	2.2	2.19	0.106
ENE	2.75	2.86	3.38	3.15	2.59	2.13	2.11	0.088
NE	2.82	3.16	4.45	2.64	2.49	1.84	1.81	0.07
NNE	1.84	1.86	1.66	1.97	1.73	1.42	1.81	0.044

Additional input into CAP88:

Temperature: 11.75 °C

Precipitation: 21.8 cm/y

Humidity: 8 g/m³

Mixing Height: 1 km

MEI location: 122 meters, SE

Stack Height: 4 m

Stack diameter: 1 m

Plume rise: None

Agriculture data: Default rural food source, Washington State defaults for beef and milk use.

Wind file: 2017 Hanford Meteorological Station (HMS)

Decay chain length: 1

Results:

US Ecology evaluated the data using CAP88 (Capp88PC Version 4.0.1.17)

Effective dose equivalent = **1.1E-4 mrem/yr.** (all isotopes)

ATTACHMENT

A-1 RAES Data sheet

A-2 COMPLY Report

ATTACHMENT A-1

Washington State Department of Health
Office of Radiation Protection

RADIOACTIVE AIR EMISSIONS (RAE) DATA SHEET

NOTE: This Data Sheet is used by Washington State Department of Health (DOH), Radioactive Air Emissions Section (RAE) licensees to provide air emissions-specific technical data. The licensee may use this form to support reporting radioactive air emissions compliance information using the Environmental Report Format.

REFERENCES: Washington State Department of Health Air Emissions License RAES-009, Washington State Department of Health Radioactive Material License WN-I019-2. WAC 246-247-080, WAC 173-480-040.

DATA SECTION:

1. Name of DOH approved modeling program used to generate RAE compliance data:
CAP88
2. Wind rose/joint frequency table (may also be included as an attachment). **See A-3.**
3. Annual average ambient temperature: **11.75 °C**
4. Annual average emission unit gas temperature (if available): **N/A**
5. Annual total rainfall: **21.8 cm/yr**
6. Annual average emission unit flow rate and total volume of air released during the calendar year:
22 inspections x 60 minutes per inspection x 1000 cfm, = **1.38 E 6 cubic feet.**

STATEMENT OF RAE COMPLIANCE:

This facility is licensed to emit 1 mrem/year (RAEL 009, License Condition 1).

For Calendar Year 2017, this facility emitted **1.1E-4** mrem/year. This is in compliance with the above-referenced license condition and is supported by the above data and attached documentation. Licensees who are required by RAEL license to submit additional information should attach that information to this report.

SIGNED:

DATE: **February 23, 2017**



Radiation Protection Manager/RSO

ATTACHMENT A-2
CAP88 REPORT

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Fri Feb 23 13:45:33 2018

Facility: US Ecology Washington
Address: 1777 Terminal Drive
City: Richland
State: WA Zip: 99354

Source Category: stack
Source Type: Stack
Emission Year: 2017
DOSE Age Group: Adult

Comments: none

Committed Effective Dose Equivalent
(mrem)

1.13E-04

At This Location: 122 Meters Southeast
Dataset Name: 2017USEW.
Dataset Date: Feb 23, 2018 01:45 PM
Wind File: S:\Radiation Protection\Environmental\Environmental Rep

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 122 Meters Southeast
Lifetime Fatal Cancer Risk: 6.46E-11

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem)
Adrenal	7.58E-05
UB_Wall	7.59E-05
Bone_Sur	1.07E-04
Brain	8.17E-05
Breasts	8.46E-05
St_Wall	9.30E-05
SI_Wall	7.48E-05
ULI_Wall	7.77E-05
LLI_Wall	8.21E-05
Kidneys	7.77E-05
Liver	7.77E-05
Muscle	7.97E-05
Ovaries	7.35E-05
Pancreas	7.44E-05
R_Marrow	7.94E-05
Skin	3.02E-03
Spleen	7.78E-05
Testes	8.09E-05
Thymus	7.84E-05
Thyroid	8.11E-05
GB_Wall	7.52E-05
Ht_Wall	7.69E-05
Uterus	7.40E-05
ET_Reg	7.81E-05
Lung_66	9.30E-05
Effectiv	1.13E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2017

Nuclide	Type	Size	Source	
			#1 Ci/y	TOTAL Ci/y
Ag-110m	M	1.000	2.5E-13	2.5E-13
Ag-110	B	0.000	2.5E-13	2.5E-13
Ba-133	M	1.000	2.2E-12	2.2E-12

C-14	M	1.000	7.3E-12	7.3E-12
Cd-109	M	1.000	9.4E-13	9.4E-13
Cm-244	M	1.000	3.5E-12	3.5E-12
Co-57	M	1.000	3.1E-13	3.1E-13
Co-58	M	1.000	7.7E-13	7.7E-13
Co-60	M	1.000	1.7E-11	1.7E-11
Cs-134	F	1.000	1.2E-13	1.2E-13
Cs-137	F	1.000	7.5E-09	7.5E-09
Ba-137m	B	0.000	7.5E-09	7.5E-09
Fe-55	M	1.000	2.1E-11	2.1E-11
Kr-85	B	0.000	7.1E-01	7.1E-01
Mn-54	M	1.000	6.4E-13	6.4E-13
Ni-63	M	1.000	8.4E-10	8.4E-10
Pb-210	M	1.000	5.8E-11	5.8E-11
Pb-212	M	1.000	3.1E-12	3.1E-12
Pm-147	M	1.000	1.1E-11	1.1E-11
Sm-147	M	1.000	1.1E-11	1.1E-11
Pu-241	M	1.000	3.1E-12	3.1E-12
Ra-224	M	1.000	1.8E-10	1.8E-10
Ra-226	M	1.000	3.2E-11	3.2E-11
Sr-90	M	1.000	2.5E-10	2.5E-10
Y-90	M	1.000	2.5E-10	2.5E-10
Tc-99	M	1.000	8.4E-13	8.4E-13
Th-228	S	1.000	8.3E-10	8.3E-10
Th-232	S	1.000	3.5E-12	3.5E-12
U-234	M	1.000	3.1E-10	3.1E-10
U-235	M	1.000	1.8E-11	1.8E-11
U-238	M	1.000	4.3E-10	4.3E-10
H-3	V	0.000	1.0E-02	1.0E-02

SITE INFORMATION

Temperature:	11.750 degrees C
Precipitation:	21.800 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 4.00
Diameter (m): 1.00

Plume Rise							
Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m):	None	None	None	None	None	None	None

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.7000	0.4000	0.4400
Fraction From Assessment Area:	0.3000	0.6000	0.5600
Fraction Imported:	0.0000	0.0000	0.0000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

122	2400	4000	5600	7200	12050	24150
40250	56350	72450				