APPENDIX F
Correspondence

WASHINGTON STATE DEPARTMENT OF HEALTH

OFFICE OF RADIATION PROTECTION (ORP)

ENVIRONMENTAL REPORT FORMAT

Notes to Licensees:

This format is to be used as a guideline by licensees when preparing their annual environmental report.

This report will be used by the ORP regulatory section(s), Environmental Sciences Section and ORP management to ensure compliance with site specific license conditions.

This format is not intended to require licensees to change the current title of their annual environmental report, if a title is specified in their current ORP license(s).

Tables included in this report are shown as examples.

1. **Cover Page:** This page should include:
   - Site Name
   - Facility and Facility Address
   - Reporting Period
   - Radioactive Materials/Waste/Air Emissions License Number
   - Authors Name or Site Point of Contact

2. **Table of Contents:** This page should list the items below and the pertinent page or section numbers.
   - Sections
   - Figures
   - Maps
   - Tables
   - Radiological Air Emissions (RAE) Data Sheet
   - Appendices/Attachments
   - References

3. **Executive Summary** (Written in a non-technical manner. This section should be able to let the non-technical reader know well the site was operated and provide information regarding major issues the site experienced during the year.)
   - Statement of compliance with the appropriate sections of WAC 246 and other state or federal regulations.
   - Purpose of the environmental report.
   - Statement referring reviewer to the RAE Data Sheet (if required by license).
   - Site-specific diagram or map.
   - Map showing site in relation to the surrounding community.
   - Brief description of land and water use by the site.
   - Very brief list/summary of any radiological releases or major compliance issues.
   - List and description of radionuclides of concern.
   - Brief statement of **location and dose** to the Maximally Exposed Individual (MEI).
   - Map showing the location of the MEI in relation to the site.
   - What was the calendar year dose to the environment?

4. **Introduction** (Audience: Non-Technical)
   - Facility location (street address) and diagram showing general layout of the site
   - The purpose of the facility.
   - List facility officers (CEO, Manager, RSO, Health Physics/Technical Services Manager, Regulatory Compliance Officer).
   - Primary activities that occur at the facility.
   - Number of all full-time employees at the facility.
   - Photos and diagrams of the facility, with buildings/work areas labeled.
   - Radioactive material storage areas.

5. **License Condition Compliance Summary** (Audience: Technical)
   - Specify maximum quantity or annual possession quantity (specific terminology is dependent on language used in each specific license) or as listed in WAC 246-221/232/233/235.
   - Specify maximum radiological air emissions release limit under WAC 246-247 and basis for this license limit (air treatment system, inventory control, other applicable technologies).
   - At the discretion of the Office of Radiation Protection (ORP) licensing section manager, submit summaries of each Notice of Correction (NOC), Notice of Violation (NOV), and requests for compliance plans. This summary should list the basis for the finding (specify license condition(s) or reason(s) given by the department), status of corrective action (if any), status of compliance plan, or other actions taken by the facility to address the findings.
   - Summarize releases of radioactive material that require notification to an outside regulatory agency (this shall also include notification of non-radioactive material releases that have an impact on the radiological operations of the facility).

6. **Description of Environmental Monitoring Program** (Audience: Technical)
   - Brief description of the reason for the environmental monitoring program, which should be written from the standpoint of the licensee. The licensee should explain not only regulatory requirements, but also why environmental monitoring is a sound business practice.
   - Type of samples collected (soil, air, water, and vegetation) and frequency of collection (daily, weekly, quarterly, annually).
   - Sample-specific analysis information. (For example: type(s) of radiation counted, and/or isotopic analyses by sample type.)
   - Laboratory where sample analysis is conducted; list laboratory certifications and date of latest laboratory visit by facility staff.
   - Listing of the lower limits of detection for each isotope of concern for each laboratory used by the licensee.
   - Listing of investigation levels and criteria used to determine those criteria levels for each sample type and isotope.
   - List the results of facility-initiated self-assessments, environmental monitoring program audits, or other corporate environmental quality assurance efforts.

   - Maps, diagrams, or aerial photographs showing the locations where air, soil, vegetation, and water samples were taken, and of dosimeters.
   - Meteorological data (windrows and their sources (FAA, NOAA, other)).
   - Specify method of collection for all sample media. If corporate procedures are referenced, they must be included as an appendix.
   - Reporting units. The following units are those used to report radiological data by the Washington State Public Health Laboratory (WPHL), ***if a site specific license requires the use of different units; use the units required per the license:***
     - Air pCi/m3
     - Tritium pCi/m3
     - Sediment pCi/g
     - Food pCi/g
     - Vegetation pCi/g
     - Milk pCi/l
     - Soil pCi/g
     - Water pCi/l
     - Ambient Gamma (TLD) mrem/year

     NOTE 1: A reported value should be expressed using an appropriate amount of significant figures which is determined by the magnitude of the total uncertainty associated with the total value.

     NOTE 2: Reported values should be accompanied by uncertainty absolute error values of plus/minus 2 sigma.

7. **Environmental Radiation Protection Program and Dose Assessment** (Audience: Technical)
   - Description of the environmental radiation monitoring program.
   - "Outside the Fence" description of environmental radiation monitoring activities.
   - Description of the assumptions and models used in performing dose calculations. If there is a specific modeling program(s) mandated by a license condition, refer to the license condition(s) and the applicable Materials, Waste, or Air Emissions license number.
   - Definitive statement regarding the specific Air Emissions modeling program used (CAP-88, COMPLY or other Department of Health (DOH) approved model).
   - Tabular Reporting of Radiological Dose for the calendar year ***(EXAMPLE BELOW)***

Pathway	**Dose to Maximally Exposed Individual**	**Materials/Waste Licensed Limits (NRC)**	**Air Emissions Licensed Limits (EPA)**		
Air					
Water					
Other Pathways					
All Pathways					

8. **Ground Water Protection Program** (if required by license) (Audience: Technical)
   - If ground water protection measures and monitoring activities are being taken, the licensee will describe why these activities are necessary, the specific radionuclides of concern, and the non-radiological concerns.

9. **Environmental Quality Assurance (QA) Program** (Audience: Technical)
   - Corporate statement regarding use of internal Quality Assurance (QA) program.
   - Reference site QA procedures and latest revision(s) (table or appendix).
   - Describe basis for development of site QA procedures.
   - Synopsis of the results of any internal QA audits, their findings, and any process improvements implemented during the year due to the QA program.
   - Synopsis of any external QA activities (visits to laboratories, review of sub-contractor processes, and procedures).
   - Description of the statistical method(s) used to analyze and validate sample data.
   - What are the minimum detection limit (MDL) and minimum detection activity (MDA)?

10. **List of environmental sample locations where investigation or action levels were exceeded.** (Audience: Technical)
    - This should be tabular, showing the date, sample location, type of sample, analysis result with statistical error, any data from sample recounts or follow-up sampling to verify false or true positive, and a column to indicate how many times this specific site has exceeded investigation or action levels during the last 20 calendar quarters.
    - Map, diagram, or aerial photograph of the facility showing the specific locations where investigation or action levels were exceeded.
    - Include any communications with the pertinent ORP staff as supporting documentation. This includes emails or records of telephonic conversations regarding each specific site where analysis indicates that investigation or action levels have been exceeded.
    - Statement regarding any remediation activities planned or currently being undertaken to address sites where investigation or action levels have been exceeded.

Washington State Department of Health
Office of Radiation Protection

RADIOACTIVE AIR EMISSIONS (RAE) DATA SHEET

NOTE: This Data Sheet is used by RAE Section 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: Most current licensee copy of their specific Radioactive Air Emissions License (RAEL)

WAC 246-247-080

40 CFR 61, Subparts H and I

DATA SECTION:

1. Name of DOH approved modeling program used to generate RAE compliance data: _____

2. Wind rose/joint frequency table (may also be included as an attachment)

3. Annual average ambient temperature: _____

4. Annual average emission unit gas temperature (if available): _____

5. Annual total rainfall: _____

6. Annual average emission unit flow rate and total volume of air released during the calendar year: _____

STATEMENT OF RAE COMPLIANCE:

This facility is licensed to emit _____ mrem/year (RAEL # and License Condition #).

For Calendar Year XXXX, this facility emitted _____ mrem/year. This is in compliance with the above-referenced license condition and is supported by the above data and attached documentation (COMPLY or CAP-88 run). Licensees who are required by RAES license to submit additional information should attach that information to this report.

SIGNED: _____ DATE: _____

Licensee Signatory Title (Example: Chief Executive Officer, Radiation Safety Officer)

11. **Appendices or Attachments** (examples below)
    - Most current license(s) issued by the ORP.
    - Annual Air Emissions report and supporting documentation (COMPLY/CAP-88 run).
    - Procedures used to implement Environmental Monitoring Program.
    - Corporate policies or statements regarding environmental monitoring.
    - Results of internal audits.
    - Laboratory analysis protocols.

12. **Glossary**

13. **List of Acronyms**

Special Report: Cs-137 in Trench 16 Vegetation

2017

December 11

Prepared by: Sean Murphy, CHP
Radiation Protection Manger

Summary

On July 27, 2017, a vegetation sample was collected from the trench cap on closed Trench 16 at the US Ecology Low Level Radioactive Waste site near Richland Washington (USEW). The sample was collected in connection with the annual sampling, using Richland Operating Procedure (ROP) number 702. The samples were sent to Test America Laboratories in Richland Washington (TA) and analyzed for radionuclides required by the USEW Facility Standards Manual (September 2013) (FSM). On November 1, 2017, TA informed USEW that the sample for Trench 16 Cesium 137 concentration was probably above the action levels of the FSM (AL = 0.2 pCi/g). The results found were about 0.4 pCi/g. The sample results were confirmed on November 6. A partial preliminary report was sent to Washington state department of Health (WDOH) on November 6 2017. The lab had analyzed Trench 16 sample as a quality assurance duplicate sample, which confirmed the results of the first analysis. On November 1, 2017 it was determined that there was sufficient vegetation on the cap to resample and it was analyzed for gamma spec and gross beta analysis.

A review of historical data found no samples above the detection levels reported (since the year 2000) on Trench 16. There have been 12 instances where cap trench vegetation has been above 0.02 pCi/g (10% of the AL). Most have occurred since switching to TA, probably a result of TA reporting all values regardless of there relation to the method detection limit (MDL). The previous lab would not report values less than the detection level. The next highest result was in this set of samples, with Trench 13 reported as 0.0238 ±0.031 pCi/g and a critical level of 0.0466 pCi/g.

ROP 106 R0 (Corrective Action for Environmental Samples in Excess of Action Levels) was consulted. Section 4.2.2 of this procedure directs the following actions.

This 30 day report was delayed due to the holiday break and receiving the sample results.

Identification and isolation of suspected releases

Surveys from around the waste site for the months prior to this sample collection were reviewed. No abnormalities were observed. The remaining trench cap samples were less than the investigation/action levels, Trench 13 was the next highest concentration at 0.0238 pCi/g. Air sample results from operations and environmental samples were reviewed and no anomalies in gross beta or gross alpha concentration were found. There was no immediate source identified; isolation is not possible.

Evaluate need for initiation of contingency plan

The contingency plan was not initiated. This samples does not indicate a major release from our facility. There is no imminent threat to the public health and safety or to the environment.

Trench vegetation samples are used as an indication of radionuclides migrating out of the waste trenches. A positive result in the trench cap vegetation samples does not indicate a release from the trench, but may indicate that:

- deep rooted vegetation has contacted contaminated material, and has absorbed radionuclides,
- that windblown contamination has accumulated on the plants surfaces, or
- Laboratory or cross contamination issues.

We do not believe that the activity found in the 2017 vegetation sample originated in Trench 16 at the USEW site.

Review of results from DOE

In 2011 the Department of Energy completed a study of vegetation samples collected at Hanford to 2008 (PNNL-20577 *Radionuclide Concentrations in Terrestrial Vegetation and Soil Samples On and Around the Hanford Site, 1971 Through 2008*). This report shows that areas around the Hanford site has Cs-137 in vegetation results with a maximum of 0.0265 pCi/g offsite and 0.055 pCi/g onsite. (see Table 3.13 from that report below in the 2000 decade).

Table 3.13. Cesium-137 Concentrations (pCi/g dry weight) in Vegetation Samples Collected On and Around the Hanford Site by Decade

	Onsite				Offsite			
Statistics	1970	1980	1990	2000	1970	1980	1990	2000
Median	0.226	0.025	0.012	0.006	0.191	0.016	0.007	0.008
Mean	3.418	0.054	0.023	0.008	0.409	0.104	0.010	0.007
Standard Deviation	13.839	0.085	0.037	0.014	0.774	0.321	0.013	0.009
Minimum	–0.0463	–0.0275	–0.0262	–0.0123	–0.267	–0.0749	–0.0135	–0.0121
Maximum	120	0.566	0.164	0.055	5.8	1.9	0.0447	0.0265
25th Percentile[a]	0.112	0.011	0.005	–0.001	0.099	0.005	0.004	–0.0004
75th Percentile[a]	0.647	0.055	0.035	0.014	0.439	0.030	0.019	0.013
95th Percentile	16.3	0.254	0.107	0.019	1.19	0.975	0.032	0.024
N[b]	96	155	39	22	101	157	51	36
N above detection[c]	91	102	18	1	82	75	10	0

(a) Fifty percent of the data occurs between these two endpoints.
(b) Number of samples.
(c) Number of samples above the analytical detection limit.

This indicates that finding plants in the areas around the 200 areas with Cs-137 concentration of 0.4 pCi/g is unusual. Recent sample results can be found in the 2016 Hanford Environmental report. (DOE/RL-2017-24, Revision 0 *Hanford Site Environmental Report for CY 2016*). Table 10-6 summarizes the results from the department of Energy's sampling in 2016. It is interesting to note that the maximum value in 2016 was in the Hanford 600 area (0.13 pCi/g). The Hanford 600 area include our site, and encompasses all of the Hanford site that is not one of the other designated areas. Also interesting is that 0.4 pCi/g has not been seen in any area in the years this report covers (2011 -2016).

Table 10-6. Hanford Site Vegetation Concentrations of Select Radionuclides. (3 Pages)

Isotope	Hanford Area	2016 Number of Samples	2016 Number of Detects	2016 Average[a] (pCi/gm)	2016 Maximum[b] (pCi/gm)	2011–2015 Number of Samples	2011–2015 Number of Detects	2011–2015 Average[a] (pCi/gm)	2011–2015 Maximum[b] (pCi/gm)
Cobalt-60	100	3	0	3.1E-02 ± 6.9E-02	7.7E-02 ± 6.7E-02	12	0	-7.5E-05 ± 2.7E-02	1.9E-02 ± 4.4E-02
	200-East	9	0	5.3E-03 ± 2.7E-02	2.7E-02 ± 3.4E-02	38	0	1.7E-03 ± 4.1E-02	5.4E-02 ± 1.1E-01
	200-West	21	0	2.0E-03 ± 2.8E-02	3.5E-02 ± 3.4E-02	65	0	-3.8E-03 ± 4.3E-02	6.4E-02 ± 4.7E-02
	300	2	0	1.5E-02 ± 3.0E-04	1.5E-02 ± 2.8E-02	27	0	-8.3E-03 ± 5.8E-02	3.9E-02 ± 3.5E-02
	400	1	0	2.40E-02	2.4E-02 ± 2.4E-02	4	0	-5.7E-03 ± 3.4E-02	2.1E-02 ± 5.2E-02
	600	14	0	6.0E-03 ± 3.0E-02	3.0E-02 ± 2.2E-02	46	0	9.8E-03 ± 4.1E-02	6.7E-02 ± 6.5E-02
Cesium-137	100	3	0	5.3E-03 ± 4.0E-02	2.2E-02 ± 5.9E-02	12	1	1.4E-02 ± 4.7E-02	5.7E-02 ± 5.0E-02
	200-East	9	1	2.4E-02 ± 5.6E-02	9.1E-02 ± 3.3E-02	38	16	6.2E-02 ± 1.1E-01	2.4E-01 ± 2.6E-02
	200-West	21	1	1.9E-02 ± 4.4E-02	8.6E-02 ± 2.9E-02	65	17	4.8E-02 ± 1.2E-01	3.2E-01 ± 1.2E-01
	300	2	0	3.3E-02 ± 2.0E-02	4.3E-02 ± 4.8E-02	27	9	7.4E-02 ± 1.9E-01	3.6E-01 ± 9.7E-02
	400	1	0	-2.50E-03	-2.5E-03 ± 1.9E-02	4	0	2.5E-02 ± 6.5E-02	7.7E-02 ± 5.9E-02
	600	14	1	2.2E-02 ± 6.9E-02	1.3E-01 ± 3.5E-02	46	10	4.2E-02 ± 1.1E-01	2.0E-01 ± 8.6E-02
	100	3	0	1.8E-04 ± 7.1E-04	9.3E-05 ± 3.3E-04	11	0	4.9E-04 ± 4.3E-03	2.7E-03 ± 6.5E-03

10.17

Root up-take discussion

A root uptake factor for Cs of 0.24 (IAEA TRS 472 - For leguminous fodder in sand) which indicates that Cs-137 is readily taken up in plants. Root depth for Bursage (Ambroisa Acanthicarpa) and Rabbitbrush (Ericameria Nauseosa) is about 5 feet (1.6 meters) (PNL-5247, Rooting Depth and Distribution of Deep Rooted Plants in The 200 Area Control Zone On The Hanford Site, 1985). Waste in Trench 16 has at least 8 feet of soil over the waste. Trench 16 was closed in 2000, meaning the packages that contained the waste may still be present and intact. While Cs-137 uptake is biologically possible, physical interaction between plant and waste is improbable.

The resample collected on November 1, 2017 of the vegetation from this trench did not detect Cs-137. Samples from the trench caps are taken by harvesting deep-rooted vegetation within the confines of the trench's surface. As vegetation in this geographic area is sparse, collecting sufficient samples routinely means removing most of the vegetation. The lack of Cs-137 in the resample only indicates that we did not sample the same plant again, either the original plant was completely consumed on the first sample, or the samplers did not choose the plant on the second sample. In either event, the lack of finding detectable Cs-137 indicates the Cs-137 concentration is not pervasive or extreme. This lack of repeatability suggests this is a one-time occurrence such as sample cross contamination or windblown contamination.

Windblown discussion

Radioactive material that is blown from a source to the USEW site and then deposited on the leaves of plants is possible. There has not been gross beta contamination the air or soil indicating any airborne contamination was low, if it existed.

The possibility that the source of this radioactivity was atmospheric testing is not consistent with the concentration measured and the usual background concentration of Cs-137 in vegetation samples. The possibility that this contamination came from the DOE area is possible as two incidents occurred recently that had a high likelihood of dispersing radioactive material (air

sample results from the PFP demolition on May 8, 2017 and the railroad tunnel collapse May 9, 2017). This sporadic nature indicates a very localize deposition or sample contamination.

Sampling and Laboratory issues

There are no indications that the lab could have contributed to this problem. A review of the quality assurance results for these sample set's did not indicate any potential problems with the analysis.

Sampling does not appear to have caused cross contamination. The samples (both initial and backup) were taken in the center of the trench, in an area that included 30-40 yards of the trench, with dedicated equipment. USEW does not have areas that contain Cs-137 contamination that could have contaminated these samples.

A possibility is that the USEW or the lab introduced the Cs-137 through cross contamination despite normal precautions to prevent this occurrence. The sample collection procedure was reviewed and found no anomalies. The lab reported that all equipment used to count these samples was new. However, it does not take much of a cross contamination to create these levels in a sample. It is impossible to remove cross contamination from the possible sources.

The specific activity (SA) for Cs-137 is 87 Ci/g. The sample analyzed was 100g, which leads to a total activity in this sample divided by the SA to be 0.4 pCi/g x 100 g / 87pCi/pg .= 0.46 pg. The density of cesium metal is about 2 g/mL or 2 pg/fL. A 0.46 pg speck would have a volume of 0.23 fL or 2E9 atoms. The point is, this in a very small amount of material.

Probable source

USEW suspect that this activity was either wind-blown from DOE facilities or cross contamination.

Remediation discussion

Controlling the vegetation (removal or growth prevention) is not recommended.

The amount of Cs found in the vegetation is not a health risk to workers or the public. Removing the vegetation would increase the amount of meteoric moisture contacting the waste, increasing the potential for migration of the radionuclides out of the trench. Removing the vegetation would prevent future sampling evolutions that could detect a problem.

Increased sampling is not recommended.

Review of the sampling history of Trench 16 show that the plants can be harvested during the mid to late summer, and can usually produce enough vegetation for one or two complete analysis. There are several large rabbitbrush and bursage plants on Trench 16. Repeated sampling without allowing time for regrowth could decimate the available plants.

Recommendation

The recommended course of action is to continue to sample at the frequency required by our radioactive material license (annually). Continued elevated concentration would indicate a larger problem and provide more data to focus our investigation.

Immediate notification of RPM/ARPM

Completed on November 1, 2017.

Notification of WDOH within 24 hours of confirmation

Completed via email on November 6, 2017. The lab officially reported the results from the July sampling event to USEW on November 6, 2017.

Notification to WDOH written within 30 days

The 30 day report was sent to Kevin Siebert on December 11, 2017. This report was delayed due to the lab slowing down for the Thanksgiving holiday and not being able to supply results in the requested time. The Department of Health was aware of the late sample result and delayed reporting.

Reanalysis if possible

Resample was completed on November 1, 2017. A gamma spec and gross beta were completed on this sample, with no positive indication of other gamma emitters. The resampled concentration was similar to the concentrations found in the other samples from the cap trenches sampled in July.

Resample to confirm. Coordinate with WDOH

A sample was collected and sent to lab on November 1, 2017. The results from the resample and the original sample are attached to this report.

Dose assessment

Bursage and Rabbitbrush are not food sources, this area is not used for human habitation, and there are no pathways that could be used to determine dose. Dose assessment is not possible.

File results.

The sample report will be filed with the vegetation sample results.

Attachments
Field log for trench cap samples
Sample results
Picture of T-16 in sampled area

Attachment – Trench 16 in area sampled.

Special Report: Pu-239 in Station 6 Vegetation

2017

Prepared by: Sean Murphy, CHP
Radiation Protection Manger

Summary

On July 27, 2016, we collected a vegetation sample from the environmental monitoring station 6 at the US Ecology Washington (USEW). The sample was collected in connection with the annual sampling using Richland Operating Procedure (ROP) 702. The samples were sent to Test America Laboratories in Richland Washington (TA) and analyzed for radionuclides required by the USEW Facility Standards Manual (September 2013) (FSM). On October 26, 2017 TA informed USEW that the sample for Environmental Station 6 plutonium concentration was above the action levels of the FSM (0.02 pCi/l). The result was 0.04 pCi/g. The lab had analyzed Station 6 sample as a quality assurance duplicate sample, which confirmed the results of the first analysis. On October 26th it was determined that there was sufficient vegetation at station 6 to resample and a sample was collected. The lab reported on December 7, 2017 that the resample of station 6 was below 0.02 pCi/g (see attached report).

A review of historical data found one samples above the action level of 0.02 pCi/g from 1992 at 0.09 pCi/g. The average is 0.0057 pCi/g of Pu-239/240.

ROP 106 (Corrective Action for Environmental Samples in Excess of Action Levels) was consulted. Section 4.2.2 of this procedure directs the following actions:

Identification and isolation of suspected releases

Surveys from the months prior to this sample collection were reviewed. No abnormalities were observed. The remaining environmental samples were less than the investigation/action levels. Air sample results from operations and environmental samples were reviewed and no anomalies in gross alpha concentration were found. USEW has not accepted waste containing large amounts plutonium in the past year. There was no immediate source identified; isolation is not possible.

Evaluate need for initiation of contingency plan

The contingency plan was not initiated. This samples does not indicate a major release from our facility. There is no imminent threat to the public health and safety or to the environment.

Review of results from DOE

In 2011, the Department of Energy completed a study of vegetation samples collected at Hanford to 2008 (PNNL-20577 *Radionuclide Concentrations in Terrestrial Vegetation and Soil Samples On and Around the Hanford Site, 1971 Through 2008*). This report shows that areas around the 200 area has plutonium in vegetation sample results with a maximum of 0.102 pCi/g nearby and at the perimeter maximum concentration of 0.148 pCi/g. (see table 3.29 from that report below).

Table 3.29. Plutonium-239/240 Concentrations (pCi/g dry weight) in Vegetation Samples Collected on the Hanford Site (onsite) and at Various Distances from the Site Between 1973 and 2008

Statistics	Onsite	Perimeter	Nearby	Distant
Median	0.0007	0.0004	0.0004	0.0002
Mean	0.0024	0.0038	0.0028	0.0004
Standard Deviation	0.0064	0.0146	0.0133	0.0007
Minimum	–0.0006	–0.0004	–0.0001	0.0000
Maximum	0.0633	0.148	0.102	0.0033
25th Percentile[a]	0.0002	0.0002	0.0002	0.0001
75th Percentile[a]	0.0021	0.0016	0.0018	0.0003
95th Percentile	0.0082	0.0183	0.0048	0.0024
N[b]	278	184	58	53
N above detection[c]	186	107	31	23

(a) Fifty percent of the data occurs between these two endpoints. (b) Number of samples.
(c) Number of samples above the analytical detection limit.

This indicates that finding plants in the areas around the 200 areas with Pu-239 concentration of 0.04 is not unusual. However, because the average concentration for both nearby and perimeter samples is close to 0.003, indicates that this is not a normal occurrence.

Sampling of the leaves and stems by DOE around the Hanford reservation in 2016 did not find Pu-239 concentrations in the range found in the Station 6 sample, indicating again that this is an abnormal occurrence. (See table 10-6 from DOE/RL-2016-33, Revision 0 *Hanford Site Environmental Report for CY 2015*)

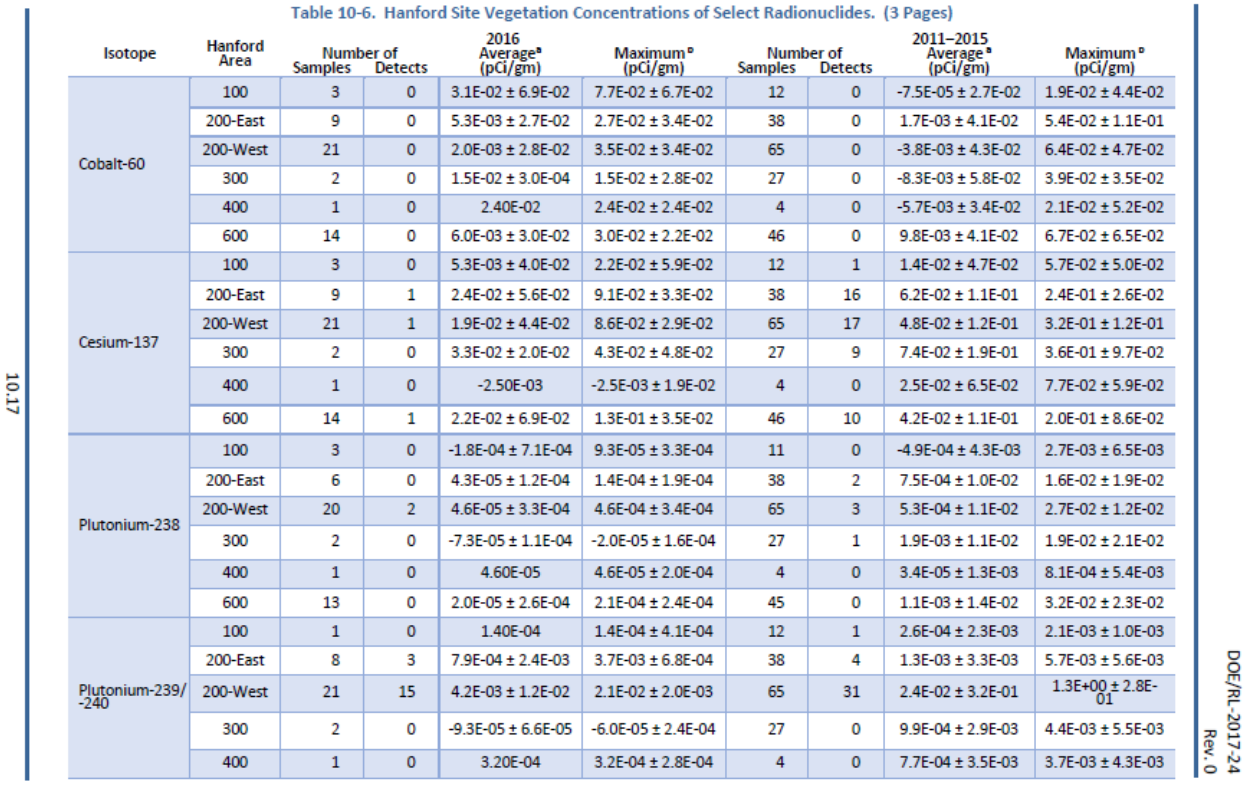

Table 10-6. Hanford Site Vegetation Concentrations of Select Radionuclides. (3 Pages)

Isotope	Hanford Area	Number of Samples	Number of Detects	2016 Average[a] (pCi/gm)	Maximum[b] (pCi/gm)	Number of Samples	Number of Detects	2011–2015 Average[a] (pCi/gm)	Maximum[b] (pCi/gm)
Cobalt-60	100	3	0	3.1E-02 ± 6.9E-02	7.7E-02 ± 6.7E-02	12	0	-7.5E-05 ± 2.7E-02	1.9E-02 ± 4.4E-02
	200-East	9	0	5.3E-03 ± 2.7E-02	2.7E-02 ± 3.4E-02	38	0	1.7E-03 ± 4.1E-02	5.4E-02 ± 1.1E-01
	200-West	21	0	2.0E-03 ± 2.8E-02	3.5E-02 ± 3.4E-02	65	0	-3.8E-03 ± 4.3E-02	6.4E-02 ± 4.7E-02
	300	2	0	1.5E-02 ± 3.0E-04	1.5E-02 ± 2.8E-02	27	0	-8.3E-03 ± 5.8E-02	3.9E-02 ± 3.5E-02
	400	1	0	2.40E-02	2.4E-02 ± 2.4E-02	4	0	-5.7E-03 ± 3.4E-02	2.1E-02 ± 5.2E-02
	600	14	0	6.0E-03 ± 3.0E-02	3.0E-02 ± 2.2E-02	46	0	9.8E-03 ± 4.1E-02	6.7E-02 ± 6.5E-02
Cesium-137	100	3	0	5.3E-03 ± 4.0E-02	2.2E-02 ± 5.9E-02	12	1	1.4E-02 ± 4.7E-02	5.7E-02 ± 5.0E-02
	200-East	9	1	2.4E-02 ± 5.6E-02	9.1E-02 ± 3.3E-02	38	16	6.2E-02 ± 1.1E-01	2.4E-01 ± 2.6E-02
	200-West	21	1	1.9E-02 ± 4.4E-02	8.6E-02 ± 2.9E-02	65	17	4.8E-02 ± 1.2E-01	3.2E-01 ± 1.2E-01
	300	2	0	3.3E-02 ± 2.0E-02	4.3E-02 ± 4.8E-02	27	9	7.4E-02 ± 1.9E-01	3.6E-01 ± 9.7E-02
	400	1	0	-2.50E-03	-2.5E-03 ± 1.9E-02	4	0	2.5E-02 ± 6.5E-02	7.7E-02 ± 5.9E-02
	600	14	1	2.2E-02 ± 6.9E-02	1.3E-01 ± 3.5E-02	46	10	4.2E-02 ± 1.1E-01	2.0E-01 ± 8.6E-02
Plutonium-238	100	3	0	-1.8E-04 ± 7.1E-04	9.3E-05 ± 3.3E-04	11	0	-4.9E-04 ± 4.3E-03	2.7E-03 ± 6.5E-03
	200-East	6	0	4.3E-05 ± 1.2E-04	1.4E-04 ± 1.9E-04	38	2	7.5E-04 ± 1.0E-02	1.6E-02 ± 1.9E-02
	200-West	20	2	4.6E-05 ± 3.3E-04	4.6E-04 ± 3.4E-04	65	3	5.3E-04 ± 1.1E-02	2.7E-02 ± 1.2E-02
	300	2	0	-7.3E-05 ± 1.1E-04	-2.0E-05 ± 1.6E-04	27	1	1.9E-03 ± 1.1E-02	1.9E-02 ± 2.1E-02
	400	1	0	4.60E-05	4.6E-05 ± 2.0E-04	4	0	3.4E-05 ± 1.3E-03	8.1E-04 ± 5.4E-03
	600	13	0	2.0E-05 ± 2.6E-04	2.1E-04 ± 2.4E-04	45	0	1.1E-03 ± 1.4E-02	3.2E-02 ± 2.3E-02
Plutonium-239/-240	100	1	0	1.40E-04	1.4E-04 ± 4.1E-04	12	1	2.6E-04 ± 2.3E-03	2.1E-03 ± 1.0E-03
	200-East	8	3	7.9E-04 ± 2.4E-03	3.7E-03 ± 6.8E-04	38	4	1.3E-03 ± 3.3E-03	5.7E-03 ± 5.6E-03
	200-West	21	15	4.2E-03 ± 1.2E-02	2.1E-02 ± 2.0E-03	65	31	2.4E-02 ± 3.2E-01	1.3E+00 ± 2.8E-01
	300	2	0	-9.3E-05 ± 6.6E-05	-6.0E-05 ± 2.4E-04	27	0	9.9E-04 ± 2.9E-03	4.4E-03 ± 5.5E-03
	400	1	0	3.20E-04	3.2E-04 ± 2.8E-04	4	0	7.7E-04 ± 3.5E-03	3.7E-03 ± 4.3E-03

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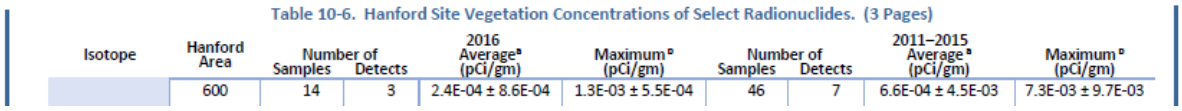

Table 10-6. Hanford Site Vegetation Concentrations of Select Radionuclides. (3 Pages)

Isotope	Hanford Area	Number of Samples	Number of Detects	2016 Average[a] (pCi/gm)	Maximum[b] (pCi/gm)	Number of Samples	Number of Detects	2011–2015 Average[a] (pCi/gm)	Maximum[b] (pCi/gm)
	600	14	3	2.4E-04 ± 8.6E-04	1.3E-03 ± 5.5E-04	46	7	6.6E-04 ± 4.5E-03	7.3E-03 ± 9.7E-03

Root up-take discussion

A root uptake factor for Pu is 4.8E-4 (IAEA TRS 472 - For leguminous fodder in sand) which indicates that the concentration in the soil around the roots would be about 0.03/4.8E-4 = 62.5 pCi/g for these plant to have this amount of Pu in them. Root depth for Bursage (Ambroisa Acanthicarpa) is about 5 feet (1.6 meters) (PNL-5247, Rooting Depth and Distribution of Deep Rooted Plants in The 200 Area Control Zone On The Hanford Site, 1985).

The absence of other Pu isotopes (mainly Pu-238) indicates that it did not come from our trenches but from a weapons facility affected source such as the Hanford reservation 200 area. Waste disposed at USEW contained twice as much Pu-238 then Pu-239. Plutonium in vegetation at the fenceline is highly improbably. There are no vectors to get from the trench to the fence and into plants undetected. An environmental release would be detected in air samples or soil samples.

Windblown discussion

Radioactive material that is blown from a source to the USEW site, then deposited on the leaves of plants, is possible. The other indications of this would be elevated gross alpha contamination on the environmental air and/or detectable Plutonium in the soil samples. There has not been Pu-239 or gross alpha contamination in the air or soil.

In 2017, USEW received a total of 1.7 mCi of Pu-239/240, which occurred in material that was also contaminated with other isotopes. It is very unlikely that site operations have caused the plutonium concentrations seen. The other radionuclides in the material received would be detectable because they were received in much higher concentrations.

Cross contamination

TA adjusted the preparation method for our vegetation in response to the Pu in trench 1 last year. They no longer reuse equipment. Because of this, the chance of cross contamination from the lab is lower. There is still a possibility as this lab routinely test Pu bearing material.

Contamination from our equipment is also unlikely, as we use dedicated equipment for the sampling. There could be some if other samples in the same set were contaminated, but this station was the only place Pu was detected. A review of the QA data from the lab indicated that the samples were analyzed correctly.

A review of the sampling procedure used did not find any anomalies.

Probable source

USEW suspect that this activity was either wind-blown from DOE facilities or lab contamination.

Remediation discussion

Controlling the vegetation (removal or growth prevention) is not recommended.

The amount of Pu found in the vegetation is not a health risk to workers or the public. Removing the vegetation would prevent future sampling evolutions that could detect a problem.

Increased sampling is not recommended.

Recommendation

The recommended course of action is to continue to sample at the frequency required by our radioactive material license (annually). Continued elevated concentration would indicate a larger problem.

Retrieving the samples from the lab that were above IL, and sending them to other laboratories for analysis should be completed. Split sampling with another lab is also recommended.

Immediate notification of RPM/ARPM

Completed on 12-11-2017.

Notification of WDOH within 24 hours of confirmation

Completed via email on 10/26/2017.

Notification to WDOH written within 30 days

The 30 day report was sent to Kevin Siebert on December 11, 2017. This report was delayed due to the holiday and late lab sample results.

Reanalysis

Resampling was completed on October 25, 2017. A gamma spec and Americium 241 was completed on this sample, with no positive indication of other gamma emitters or Am-241. Pu-238 was not found. The resampled concentration (0.00056 pCi/g) was similar to the concentrations found in the other samples from the environmental station sampled in July (average of about 0.003 pCi/g). All the samples were around the detection level.

Resample to confirm. Coordinate with WDOH

A sample was collected, and sent to lab on 10-6-2016. Results are attached to this report.

Dose assessment

Bursage is not a food source, this area is not used for human habitation, and there are no pathways that could be used to determine dose.

File results.

The sample report will be filed with the vegetation sample results.

Attachments
Field log for samples
Sample results