

**CAPSULE INTERIM STORAGE UNIT
ADDENDUM B
WASTE ANALYSIS PLAN
CHANGE CONTROL LOG**

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The “**Modification Number**” represents Ecology’s method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
02/20/2020	8C.2020.1F

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**ADDENDUM B
WASTE ANALYSIS PLAN**

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**ADDENDUM B
WASTE ANALYSIS PLAN**

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1 **B.1 Introduction and Unit Description**

2 This addendum details the Waste Analysis Plan (WAP) required by Washington Administrative Code
3 (WAC) 173-303-300, Dangerous Waste Regulations, *General waste analysis*, in effect at the Capsule
4 Interim Storage (CIS) Operating Unit Group (OUG).

5 The purpose of this CIS WAP is to provide a clear outline of the waste management activities that occur
6 for storage of waste at CIS. This WAP demonstrates compliance with the applicable requirements of
7 WAC 173-303-300(1) through (5). Information of CIS storage operations is detailed in CIS Addendum C,
8 “Process Information.”

9 The CIS OUG is comprised of the Capsule Storage Area (CSA) Dangerous Waste Management Unit
10 (DWMU). The CSA is an uncovered, unenclosed, concrete storage pad, as described in Addendum C.

11 **B.2 Waste Management Activities**

12 Waste management within CIS includes continued safe storage and maintenance of the Cask Storage
13 System storing 1,936 capsules containing cesium and strontium radioactive mixed waste. Waste managed
14 at CIS consists of waste previously accepted at the Waste Encapsulation and Storage Facility (WESF).
15 CIS does not produce products for use, have any production processes, nor receive waste from offsite
16 facilities. CIS does not treat or dispose of waste.

17 **B.2.1 Identification and Classification of Waste**

18 All waste stored in the CSA DWMU was designated prior to being placed in the storage casks
19 [WAC 173-303-300(1) and (2)]. Three studies, described in the following subsections, were conducted to
20 determine impurities in the WESF capsules, and are the basis used to support waste acceptance into the
21 CSA. Based on process knowledge and available analytical methods, the capsules do not exhibit ignitable
22 or reactive characteristics, as defined in WAC 173-303-090, *Dangerous waste characteristics*. Of the 23
23 total impurities found, only four are designated as dangerous waste per WAC 173-303-070, *Designation
24 of dangerous waste*. The analyses of the cesium and strontium salts have identified possible dangerous
25 waste designations of barium (D005), cadmium (D006), chromium (D007), and lead (D008). The silver
26 (D011) concentration was not estimated but was added from process knowledge described in *Process Test
27 Report for Silver Decontamination of Strontium in the Waste Encapsulation and Storage Facility (WESF)*
28 (SD-WM-PTR-003); therefore, it is not listed on the tables in this section.

29 Initial characterization of the contents of the cesium and strontium capsules predated promulgation of
30 WAC 173-303 and was conducted such that sampling and analysis was as accurate and representative as
31 possible, given the nature and properties of the materials.

32 Reanalysis based on WAC 173-303-300(5)(d) is not planned because the salts stored within the casks
33 have been maintained in sealed capsules since encapsulation and no changes are expected due to the
34 properties of the waste. The waste encapsulated in Type W overpacks was verified to be consistent with
35 the original capsules, as described in HNF-2928, *Certification that CsCl Powder and Pellet Materials
36 Meet WESF Acceptance Criteria*. The CIS will only accept the mixed waste capsules previously stored at
37 WESF; thus, reanalysis is not necessary in accordance with WAC 173-303-300(4).

38 **B.2.1.1 Cesium Impurities**

39 Impurities in the cesium salt are estimated as listed in PNL-5170, *A Review of Safety Issues that Pertain
40 to the Use of WESF Cesium Chloride Capsules in an Irradiator*. Table B-1 lists the impurities of the
41 cesium feed solution and salt analyzed for corrosion analysis. Concentrations are listed as weight percent
42 solids.

Table B-1 Impurities in Cesium Feed Solution and Salt

Element	Cesium Feed Solution ^a (Wt%)	Salt Analysis ^a (Wt%)	Mass Spectrometry Salt Analysis ^b (Wt%)	Dangerous Waste Designation
Aluminum (Al)	1.7	0.14	0.3	N/A
Boron (B)	--	0.14	0.4	N/A
Barium (Ba)	0.94	0.55	-- ^c	D005 ^c
Calcium (Ca)	1.0	--	0.05	N/A
Cadmium (Cd)	--	0.02	--	D006 ^c
Cobalt (Co)	--	0.10	0.02	N/A
Chromium (Cr)	0.27	1.4	0.1	D007 ^c
Iron (Fe)	0.38	-- ^d	0.5	N/A
Potassium (K)	0.79	0.68	0.1	N/A
Magnesium (Mg)	0.25	--	--	N/A
Sodium (Na)	0.70	2.8	0.2	N/A
Nickel (Ni)	0.33	0.1	0.1	N/A
Lead (Pb)	1.4	0.14	--	D008 ^c
Rubidium (Rb)	0.52	--	0.02	N/A
Silicon (Si)	7.0	0.21	5	N/A
Strontium (Sr)	0.18	0.02	0.001	N/A
Titanium (Ti)	--	0.07	--	N/A
Zinc (Zn)	--	0.03	0.08	N/A

a. Analyzed by dissolving in nitric acid, diluting, and analyzing by inductively coupled plasma atomic emissions spectroscopy. Numbers are averages of several analyses normalized to the chloride form.

b. Analyzed by spark source mass spectrometry.

c. Waste has been designated per WAC 173-303-070, Dangerous Waste Regulations, *Designation of dangerous waste*.

d. Iron percentage was very high and non-reproducible, indicating probable contamination of cesium chloride solution.

e. Ba was not analyzed since Ba-137 was not distinguished from Cs-137, therefore, it was included with the cesium.

N/A = not applicable

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- 2 Impurities in the cesium salts analyzed at the U.S. Department of Energy Oak Ridge Site are listed in
- 3 HNF-2928. Concentrations are listed in Table B-2 by weight percent.
- 4 Encapsulated cesium chloride salt contains dangerous waste chemical impurities from the fractionation
- 5 process consisting of lead, barium, chromium, cadmium, and silver. Barium is generated continuously as
- 6 a result of the cesium-137 decay chain.

Table B-2 Impurities in Cesium Salts Analyzed at the Oak Ridge Site

Element	Wt% ^a	Dangerous Waste Designation
Aluminum (Al)	0.68	N/A
Boron (B)	5.2	N/A
Barium (Ba)	3.0	D005 ^b
Calcium (Ca)	0.68	N/A
Copper (Cu)	0.016	N/A
Iron (Fe)	0.043	N/A
Potassium (K)	1.2	N/A
Magnesium (Mg)	0.044	N/A
Molybdenum (Mo)	0.0085	N/A
Sodium (Na)	7.8	N/A
Nickel (Ni)	0.085	N/A
Silicon (Si)	2.6	N/A
Strontium (Sr)	0.0097	N/A
Zinc (Zn)	0.032	N/A

a. Numbers have been rounded to two significant figures.

b. Waste has been designated per WAC 173-303-070, Dangerous Waste Regulations, *Designation of dangerous waste*.

N/A = not applicable

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2 **B.2.1.2 Strontium Impurities**

3 Impurities in strontium salt are estimated as listed in BNWL-1967, *The Containment of ⁹⁰SrF₂ at 800 to*
 4 *1100°C Preliminary Results*. Table B-3 data are estimates based on process flowsheet information;
 5 concentrations are listed in weight percent.

6 The encapsulated strontium fluoride salt contains dangerous waste chemical impurities from the
 7 fractionation process consisting of barium, lead, cadmium, chromium, and silver.

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Table B-3 Impurities in Strontium Salt

Element	Probable Concentration (Wt%)	Dangerous Waste Designation
Aluminum (Al)	<0.5	N/A
Barium (Ba)	0.1-2.0	D005*
Calcium (Ca)	0.1-2.0	N/A
Cadmium (Cd)	<0.1	D006*
Chromium (Cr)	<0.2	D007*
Copper (Cu)	<0.01	N/A
Iron (Fe)	<0.1	N/A
Hydrogen (H)	<0.01	N/A

Table B-3 Impurities in Strontium Salt

Element	Probable Concentration (Wt%)	Dangerous Waste Designation
Potassium (K)	<0.1	N/A
Magnesium (Mg)	0.05-0.5	N/A
Manganese (Mn)	<0.1	N/A
Nitrogen (N)	<0.01	N/A
Sodium (Na)	1-4	N/A
Nickel (Ni)	<0.1	N/A
Oxygen (O)	<0.05	N/A
Lead (Pb)	<0.2	D008*
R (Rare Earths)	<2.0	N/A
Silicon (Si)	<0.02	N/A
Zirconium (Zr)	Variable (decay product)	N/A

*Waste has been designated per WAC 173-303-070, Dangerous Waste Regulations, *Designation of dangerous waste*.

N/A = not applicable

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2 **B.2.2 Waste Acceptance and Analysis Parameters**

3 The mixed waste capsules managed at CIS were generated and accepted for storage at WESF;
4 consequently, the capsules will be accepted at CIS without any additional sampling and analysis.

5 Before acceptance into the CSA, an inspection of documentation will be conducted for each cask. In
6 addition to the inspection of documentation, 100 percent of containers will undergo physical inspection
7 for any damage to the container and the presence of accurate labeling.

8 Waste will be tracked by recording the waste into a waste inventory sheet. Following completion of
9 waste acceptance activities, the waste is considered accepted to the CIS.

10 **B.3 Recordkeeping**

11 Permittees will place documentation into the WA7890008967, Hanford Facility Resource Conservation
12 and Recovery Act Permit (CIS portion), as required by Hanford Facility RCRA Permit Condition II.I
13 (WAC 173-303-380, *Facility recordkeeping*), WAC 173-303-300(5), and WAC 173-303-806(4)(a)(iii),
14 *Final facility permits*. Documentation will be maintained in electronic format or hard copy, and include
15 waste transfer records (Hanford Facility RCRA Permit Condition II.I.1.j) and results of waste analysis
16 (Hanford Facility RCRA Permit Condition II.I.1.b). Records will be maintained in accordance with
17 Hanford Facility RCRA Permit Condition II.I.1.

18 **B.4 References**

19 BNWL-1967, 1975, *The Containment of ⁹⁰SrF₂ at 800 to 1100°C Preliminary Results*, Battelle Pacific
20 Northwest Laboratories, Richland, Washington. Available at:
21 https://inis.iaea.org/search/search.aspx?orig_q=RN:7255850.

22 HNF-2928, 1998, *Certification That CsCl Powder and Pellet Materials Meet WESF Acceptance Criteria*,
23 Rev. 0, B&W Hanford Company, Richland, Washington. Available at:
24 <https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0067067H>.

- 1 PNL-5170, 1984, *A Review of Safety Issues that Pertain to the Use of WESF Cesium Chloride Capsules*
2 *in an Irradiator*, Pacific Northwest Laboratory, Richland, Washington. Available at:
3 <http://www.osti.gov/scitech/servlets/purl/6656409>.
- 4 SD-WM-PTR-003, 1984, *Process Test Report for Silver Decontamination of Strontium in the Waste*
5 *Encapsulation and Storage Facility (WESF)*, Rev. 0, Rockwell Hanford Operations, Richland,
6 Washington. Available at: [https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=AR-](https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=AR-02422)
7 [02422](https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=AR-02422).
- 8 WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste*
9 *Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8C, as amended,
10 Washington State Department of Ecology. Available at:
11 <https://fortress.wa.gov/ecy/nwp/permitting/hdwp/rev/8c/index.html>.
- 12 WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code, Olympia, Washington.
13 Available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303>.
- 14 WAC 173-303-070, *Designation of dangerous waste*.
- 15 WAC 173-303-090, *Dangerous waste characteristics*.
- 16 WAC 173-303-300, *General waste analysis*.
- 17 WAC 173-303-380, *Facility recordkeeping*.
- 18 WAC 173-303-806, *Final facility permits*.

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