

**WASTE ENCAPSULATION AND STORAGE FACILITY  
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

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**WASTE ENCAPSULATION AND STORAGE FACILITY  
ADDENDUM B  
WASTE ANALYSIS PLAN**

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**GLOSSARY**

Characterization	Information provided for a waste stream that includes the use of “Knowledge” and/or the methods of laboratory analysis approved in Washington Administrative Code (WAC) 173-303-110, Dangerous Waste Regulations, <i>Sampling, testing methods, and analyses</i> .
Dangerous Waste Management Unit	A contiguous area of land on which dangerous waste is placed, or the largest area in which there is a significant likelihood of mixing dangerous waste constituents in the same area. Examples of dangerous waste management units include a surface impoundment, a waste pile, a land treatment area, a landfill cell, an incinerator, a tank and its associated piping and underlying containment system and a container storage area. A container alone does not constitute a unit; the unit includes containers and the land or pad upon which they are placed.
Designation	The process of determining whether a waste is regulated under the dangerous waste lists (WAC 173-303-080 through 173-303-082) or characteristics (WAC 173-303-090); or criteria (WAC 173-303-100). The procedures for designating wastes are in WAC 173-303-070. A waste that has been designated as a dangerous waste may be either dangerous waste or extremely hazardous waste.
Ignitable Waste	Means a dangerous waste that exhibits the characteristic of ignitability described in WAC 173-303-090(5).
Knowledge	Sufficient information about a waste to make a reliable substitution for direct testing of the waste. To be sufficient and reliable, “Knowledge” used must provide information necessary to manage the waste in accordance with the requirements of WAC 173-303-300, <i>General waste analysis</i> . Note: “Knowledge” may be used by itself, or in combination with testing to designate a waste, pursuant to WAC 173-303-070(3)(c), <i>Designation of dangerous waste</i> , or to obtain a detailed chemical, physical, and/or biological analysis of a waste as required in WAC 173-303-300(2).
Reactive Waste	A dangerous waste that exhibits the characteristic of reactivity described in WAC 173-303-090(7).
Satellite Accumulation Area	A location at or near any point of generation where dangerous waste is initially accumulated in containers (during routine operations) prior to consolidation at a designated central accumulation area or storage area.
Treatment	Physical, chemical, or biological processing of dangerous waste to make such wastes nondangerous or less dangerous, safer for transport, amenable for energy or material resource recovery, amenable for storage, or reduced in volume, with the exception of compacting, repackaging, and sorting as allowed under WAC 173-303-400(2), <i>Interim status facility standards</i> , and WAC 173-303-600(3), <i>Final facility standards</i> .
Waste Stream	Waste or a group of wastes from a process or a facility with similar physical, chemical, or radiological properties.

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

2 This addendum details the Waste Analysis Plan (WAP) required by WAC 173-303-300, Dangerous  
3 Waste Regulations, *General waste analysis*, in effect at the Waste Encapsulation and Storage Facility  
4 (WESF) Operating Unit Group.

5 The purpose of this WESF WAP is to provide a clear outline of the waste analysis processes that occur  
6 for storage of mixed waste at WESF. This WAP demonstrates compliance with the applicable  
7 requirements of WAC 173-303-300(1) through (5). Information on WESF storage and transfer operations  
8 is detailed in WESF Addendum C, "Process Information."

9 WESF is comprised of the following three operating Dangerous Waste Management Units (DWMUs):  
10 Pool Cells DWMU, Hot Cell G DWMU, and Truckport DWMU. WESF also has one closing DWMU,  
11 Hot Cells A through F.

12 **B.2 Waste Management Activities**

13 Waste management within WESF includes storage and transfer of the 1,936 capsules containing cesium  
14 and strontium radioactive mixed waste currently being stored within the Pool Cells DWMU. Waste may  
15 also be generated from operations and maintenance activities, including debris, discarded personal  
16 protective equipment, and maintenance waste. WESF does not produce products for use, have any  
17 production processes, nor receive waste from offsite facilities or other Hanford locations.

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

19 Three studies, described in the following subsections, were conducted to determine impurities in the  
20 WESF capsules. Based on process knowledge and available analytical methods, the capsules do not  
21 exhibit ignitable, corrosive, or reactive characteristics, as defined in WAC 173-303-090, *Dangerous waste*  
22 *characteristics*. Of the 27 total impurities found, only 4 are designated as hazardous waste per  
23 WAC 173-303-070, *Designation of dangerous waste*. The analyses of the cesium and strontium salts  
24 have identified possible dangerous waste designations of barium (D005), cadmium (D006), chromium  
25 (D007), and lead (D008). The silver (D011) concentration was not estimated but was added from process  
26 knowledge described in *Process Test Report for Silver Decontamination of Strontium in the Waste*  
27 *Encapsulation and Storage Facility (WESF) (SD-WM-PTR-003)*; therefore, it is not listed on the tables in  
28 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 have been maintained in  
33 sealed capsules since encapsulation and no changes are expected due to the properties of the waste. The  
34 waste encapsulated in Type W overpacks was verified to be consistent with the original standard capsules,  
35 as described in HNF-2928, *Certification that CsCl Powder and Pellet Materials Meet WESF Acceptance*  
36 *Criteria*. WESF will not accept additional waste; thus, reanalysis is not necessary in accordance with  
37 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 <sup>a</sup> (wt%)	Salt Analysis <sup>a</sup> (wt%)	Mass Spectrometry Salt Analysis <sup>b</sup> (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	-- <sup>c</sup>	D005 <sup>d</sup>
Calcium (Ca)	1.0	--	0.05	N/A
Cadmium (Cd)	--	0.02	--	D006 <sup>d</sup>
Cobalt (Co)	--	0.10	0.02	N/A
Chromium (Cr)	0.27	1.4	0.1	D007 <sup>d</sup>
Iron (Fe)	0.38	-- <sup>e</sup>	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 <sup>d</sup>
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	--	NA
Zinc (Zn)	--	0.03	0.08	NA

<sup>a</sup>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.

<sup>b</sup>Analyzed by spark source mass spectrometry.

<sup>c</sup>Barium was not analyzed because Barium-137 was not distinguished from Cesium-137, therefore, it was included with the cesium.

<sup>d</sup>Waste has been designated per WAC 173-303-070, Dangerous Waste Regulations, *Designation of dangerous waste*.

<sup>e</sup>Iron percentage was very high and non-reproducible, indicating probable contamination of cesium chloride solution.

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, *Certification that CsCl Powder and Pellet Materials Meet WESF Acceptance Criteria*.
- 4 Concentrations are listed in Table B-2 by weight percent.
- 5 Encapsulated cesium chloride salt contains dangerous waste chemical impurities from the fractionation
- 6 process consisting of lead, barium, chromium, cadmium, and silver. Barium is generated continuously as
- 7 a result of the cesium-137 decay chain.
- 8

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

Element	wt% <sup>a</sup>	Dangerous Waste Designation
Aluminum (Al)	0.68	N/A
Boron (B)	5.2	N/A
Barium (Ba)	3.0	D005 <sup>b</sup>
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

<sup>a</sup>Numbers have been rounded to two significant figures.

<sup>b</sup>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 <sup>90</sup>SrF<sub>2</sub> 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.

8

**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

**Table B-3 Impurities in Strontium Salt**

<b>Element</b>	<b>Probable Concentration (wt%)</b>	<b>Dangerous Waste Designation</b>
Hydrogen (H)	<0.01	N/A
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 WESF does not accept dangerous waste from onsite or offsite facilities nor have any production  
4 processes; thus, no additional sampling and analysis are necessary and the requirements of  
5 WAC 173-303-300(3), (4), (5)(c) through (e), and (6) do not apply.

6 **B.2.3 Other Waste Encapsulation Storage Facility-Generated Waste**

7 Dangerous waste generated at WESF from capsule movement operations, performing repair and  
8 maintenance activities, spill cleanup materials, or other sources within WESF will be managed under a  
9 satellite or central accumulation area in accordance with WAC 173-303-174, *Satellite accumulation area*  
10 *regulations for medium quantity generators and large quantity generators* and WAC 173-303-200,  
11 *Conditions for exemption for a large quantity generator that accumulates dangerous waste* and will not  
12 be managed under this permit.

13 **B.3 Recordkeeping**

14 Permittees will place documentation into the Hanford Facility Operating Record (WESF portion), as  
15 required by WA7890008967, Hanford Facility Resource Conservation and Recovery Act Permit  
16 Condition II.I (WAC 173-303-380, *Facility recordkeeping*) WAC 173-303-300(5), and  
17 WAC 173-303-806(4)(a)(iii), *Final facility permits*. Documentation will be maintained in electronic  
18 format or hard copy, and include waste transfer records (*Hanford Facility Resource Conservation and*  
19 *Recovery Act of 1976* (RCRA) Permit Condition II.I.1.j), and results of waste analysis (Hanford Facility  
20 RCRA Permit Condition II.I.1.b). Records will be maintained in accordance with Hanford Facility  
21 RCRA Permit Condition II.I.1.

1 **B.4 References**

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- 8 PNL-5170, 1984, *A Review of Safety Issues that Pertain to the Use of WESF Cesium Chloride Capsules*  
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- 11 SD-WM-PTR-003, 1984, *Process Test Report for Silver Decontamination of Strontium in the Waste*  
12 *Encapsulation and Storage Facility (WESF)*, Rockwell Hanford Operations, Richland,  
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14 [02422](https://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=AR-02422).
- 15 WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous*  
16 *Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c,  
17 as amended, Washington State Department of Ecology. Available at:  
18 <https://fortress.wa.gov/ecy/nwp/permitting/hdwp/rev/8c/index.html>.
- 19 WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code, Olympia, Washington.  
20 Available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303>.
- 21 173-303-070, *Designation of dangerous waste*.  
22 173-303-080, *Dangerous waste lists*.  
23 173-303-082, *Dangerous waste sources*.  
24 173-303-090, *Dangerous waste characteristics*.  
25 173-303-100, *Dangerous waste criteria*.  
26 173-303-110, *Sampling, testing methods, and analyses*.  
27 173-303-174, *Satellite accumulation area regulations for medium quantity generators and*  
28 *large quantity generators*.  
29 173-303-200, *Conditions for exemption for a large quantity generator that accumulates*  
30 *dangerous waste*.  
31 173-303-300, *General waste analysis*.  
32 173-303-380, *Facility recordkeeping*.  
33 173-303-400, *Interim status facility standards*.  
34 173-303-600, *Final facility standards*.  
35 173-303-806, *Final facility permits*.

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