CP-14682
Revision 0

Data Quality Objectives Summary Report for the Designation of the 200-PW-2 and 200-PW-4 Investigation-Derived Wastes

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management
Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Release Approval _____ Date _____

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TABLES

TERMS

AA	alternative action
AEA	alpha energy analysis
BHI	Bechtel Hanford, Inc.
CAS	Chemical Abstract Service
CFR	*Code of Federal Regulations*
CH2M HILL	CH2M HILL Hanford Group, Inc.
COC	contaminant of concern
COPC	contaminant of potential concern
DQO	data quality objective
DS	decision statement
EPA	U.S. Environmental Protection Agency
FH	Fluor Hanford, Inc.
FS	feasibility study
GeLi	germanium-lithium
HPGe	high-purity germanium
ICP	inductively-coupled plasma
IDW	investigation-derived waste
OU	operable unit
PCB	polychlorinated biphenyl
PSQ	principal study question
PUREX	Plutonium-Uranium Extraction (Facility)
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation (Facility)
RI	remedial investigation
TCLP	toxicity characteristic leaching procedure
UHC	underlying hazardous constituent
WAC	*Washington Administrative Code*
WESF	Waste Encapsulation and Storage Facility

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	Meters	meters	3.281	feet
yards	0.914	Meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.0836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerel	0.027	picocuries

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this data quality objective (DQO) summary report is to identify additional data collection needs to support waste designation and disposal for the investigation-derived waste (IDW) generated during soil sampling activities for the 200-PW-2 and 200-PW-4 Operable Unit (OU) remedial investigation (RI). This DQO summary report augments the 200-PW-2 and 200-PW-4 RI DQO processes that were conducted to support the preparation of the RI/feasibility study (FS) work plan and the sampling and analysis plan for these OUs. The results of the RI DQOs are summarized in BHI-01411, *Remedial Investigation DQO Summary Report for the 200-PW-2 Uranium-Rich Waste Group Operable Unit*, and the draft CP-14176, *Remedial Investigation Data Quality Objectives Summary Report for the 200-PW-4 Operable Unit*. These are incorporated into DOE/RL-2000-60, *200-PW-2 Uranium-Rich Process Waste Group Operable Unit RI/FS Work Plan and Process Waste RCRA TSD Unit Sampling Plan*.

The two RI DQO summary reports serve as the starting point for this waste designation DQO summary report. Contaminants of potential concern (COPC), originally identified for the OU based on historical process information, were screened against exclusion criteria in the RI DQO report to arrive at a list of contaminants of concern (COC) that will be submitted for laboratory analysis as part of the RI. This list of COCs represents the contaminants that may present potential human health or environmental risks. The laboratory data will be evaluated against regulatory and health-based standards to determine the need to evaluate potential remedial actions.

This waste designation DQO summary report incorporates the initial COPC lists from the RI DQOs, but employs COPC exclusions that are aligned with waste designation requirements (rather than RI/FS requirements). The resulting list of waste designation COCs then was compared to the RI COCs to identify additional data needs for the waste designation DQO process (i.e., additional sample collection and analysis needs). The additional analyses identified as a result of this IDW DQO effort will be incorporated into the RI sampling and analysis plan.

Data generated from the RI are being collected mainly to support the preparation of an FS and the selection of a preferred alternative. The goal of the RI is to identify the types and vertical distribution of contaminants present in the representative waste sites and *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and disposal (TSD) units from historical disposal activities. The lateral extent of contaminants is not a goal of this particular investigation, but will be addressed in the future during confirmatory sampling.

In addition to the RI-specified sampling, waste designation sampling identified by this DQO effort will be used for waste designations and waste profiles. The waste profiles will be applicable not only to the IDW but also to all 200-PW-2 and 200-PW-4 waste sites. The waste profiles will be applied to future sampling and to remedial actions, as necessary.

Table 1-1 identifies the DQO scoping team members who also served as the decision makers for this DQO effort.

Table 1-1. Data Quality Objective Scoping Team Members and Decision Makers.

Name	Organization	Area of Expertise (Role)
Roy Bauer	FH Waste Site Remedial Actions	Data quality objective facilitator
Bruce Ford	FH Waste Site Remedial Actions	Project Manager
Sharon Steele	FH Waste Management	Waste designation
Larry Hulstrom	FH Waste Site Remedial Actions	200-PW-2 and 200-PW-4 Operable Unit lead
Michelle Mandis	CH2M HILL	Process history/chemistry
Steve Trent	FH Sample/Data Management	Radiochemical and analytical data management

BHI = Bechtel Hanford, Inc.
CH2M HILL = CH2M HILL Hanford Group, Inc.
FH = Fluor Hanford, Inc.

1.2 EXISTING REFERENCES

Table 1-2 presents a list of the references that were reviewed as part of the scoping process and a summary of the pertinent information contained within each reference.

Table 1-2. Existing References. (2 Pages)

Reference*	Summary
Remedial Investigation DQO Summary Report for the 200-PW-2 Uranium-Rich Waste Group Operable Unit (BHI-01411)	Presents the data quality object process and proposed sampling design for the 200-PW-2 Operable Unit. All pertinent references are contained within this document.
200-PW-2 Uranium-Rich Process Waste Group Operable Unit RI/FS Work Plan and Process Waste RCRA TSD Unit Sampling Plan (DOE/RL-2000-60)	Contains waste site information and sampling and analysis requirements.
U Plant Source Aggregate Area Management Study Report (DOE/RL-91-52)	Contains process information on U Plant facilities, chemicals and radionuclides used and discharged, known and suspected contaminants, and the contaminant of concern list.

Table 1-2. Existing References. (2 Pages)

Reference*	Summary
REDOX Plant Source Aggregate Area Management Study Report (DOE/RL-91-60)	Contains process information on REDOX facilities, chemicals and radionuclides used and discharged, known and suspected contaminants, and the contaminants of potential concern list.
B Plant Source Aggregate Area Management Study Report (DOE/RL-92-05)	Contains process information on B Plant facilities, chemicals and radionuclides used and discharged, known and suspected contaminants, and the contaminants of potential concern list.
PUREX Plant Source Aggregate Area Management Study Report (DOE/RL-92-04)	Contains process information on PUREX facilities, chemicals and radionuclides used and discharged, known and suspected contaminants, and the contaminants of potential concern list.
Semiworks Plant Source Aggregate Area Management Study Report (DOE/RL-92-18)	Contains process information on Hot Semiworks facilities, chemicals and radionuclides used and discharged, known and suspected contaminants, and the contaminants of potential concern list
Listed Waste History at Hanford Site TSD Units (WHC-MR-0517)	Addresses potential listed waste issues regarding vadose zone materials.

* See 5.0, References, for full citation.
PUREX = Plutonium Uranium Extraction (Plant).
REDOX = Reduction Oxidation (Plant).

1.3 CONTAMINANTS OF POTENTIAL CONCERN

Table 1-3 identifies the COPCs that potentially could be associated with IDW from the RI activities. Based on a review of process, operational, and waste discharge information from various sources, the chemical behavior of the constituents was evaluated. The process streams that contaminated these sites were the cooling water and steam condensate discharges from the U Plant, Reduction-Oxidation (REDOX), Plutonium-Uranium Extraction (PUREX), Waste Encapsulation and Storage Facility (WESF)/221-B Building, and the Hot Semiworks facilities (C Plant).

Tables 1-3a and 1-3b represent the complete unconstrained set of COPCs that were (or could have been) discharged to the 200-PW-2 and 200-PW-4 cooling water OU waste sites. The master COPC list was evaluated against a set of exclusion rationale to determine a final list of project COCs. The COPCs that were excluded and the rationale for their exclusion are listed in Table 1-4.

Based on a review of the potential waste constituent lists in the U Plant (DOE/RL-91-52), REDOX Plant (DOE/RL-91-60), B Plant (DOE/RL-92-05), PUREX (DOE/RL-92-04), and Hot

Semiworks (DOE/RL-92-18) source aggregate area management study reports and the process records and associated plant technical manuals, the chemical behavior of the constituents was evaluated. A brief summary of the process history associated with the uranium-rich process waste sites follows.

- U Plant: Waste generated in the 221-U (UO_3 Plant) and 224-U (U Plant Canyon) Buildings as part of the uranium recovery process. Waste streams included aqueous and organic solvent extraction wastes from uranium recovery operations of original bismuth phosphate/lanthanum fluoride separation process wastes, process drainage, process distillate drainage, and miscellaneous off-gas condensates from the 291-U-1 Stack, waste treatment condensers, nitric acid and solvent recoveries, 241- and 244-U and -UR vaults (waste treatment/storage), and 224-U storm drainage waste streams.

- REDOX Plant: Waste generated in the 202-S (REDOX Canyon) Building. Waste streams were mainly aqueous and organic solvent extraction wastes from several REDOX Plant operations, including process drainage, process distillate drainage, and miscellaneous off-gas condensates from the silver filter, air sparger, ruthenium tetraoxide scrubber, waste treatment condensers, solvent recovery, and 240- and 241-S vaults (waste treatment/storage) waste streams.

- PUREX Plant: Waste generated in 202-A (PUREX Canyon), 203-A (Acid Pump House), 206-A (Vacuum Acid Fractionator Building), 293-A (Off-Gas Treatment Facility), 294-A (Off-Gas Treatment and Monitoring Station), and 295-A (Ammonia Scrubber Distillate Sample Station) Buildings. Waste streams were mainly aqueous and organic solvent extraction wastes from several PUREX Plant operations, including process drainage, process distillate drainage, and miscellaneous off-gas condensates from the acid absorbers, ammonia scrubber, nitric acid fractionalization, waste treatment condensers, solvent recoveries, nitric acid storage, and waste treatment/storage waste streams.

- WESF/221-B Building: The waste fractionization process included a thermal evaporation concentrator in cell 23 of the 221-B (B Plant) Building to concentrate process wastewater before disposal. This system was used to concentrate low-level radioactive waste after the cesium and strontium waste fractionization process was shut down in 1984. Double-shell tank waste was received at the 221-B Building to be processed through the low-level waste concentrator until 1986. The 221-B Building did not receive double-shell tank wastes after April 1986, and processing of these wastes was completed by late 1986.

  Other sources of low-level waste included miscellaneous sumps and drains in the WESF, which diverted decontamination waste solutions generated in the WESF process cells. Another contributor was a liquid collection system located beneath the 40 cells in the 221-B Building that collected cell drainage from decontamination work and water washdowns in the processing section of the 221-B Building. The concentrator also processed wastes produced by the cleanout of various process vessels at the 221-B Building and the WESF through 1986. The process condensate was disposed of in the 216-B-12 Crib beginning in May 1967, when disposal to this crib began again. In November 1973, the process condensate was diverted to the 216-B-62 Crib.

- Hot Semiworks Facility: The 216-C-1 Crib received 23,400,000 L (6,180,000 gal) of liquid waste. Until September 1955, the crib received REDOX and PUREX Plant high-salt waste, process condensate from the 201-C Process Building, and material described as "cold-run" waste from the REDOX and PUREX processes. From September 1955 to June 1957, the crib also received high-salt, cold-run waste from the 201-C Process Building (WHC-SD-EN-TI-019, *Hydrogeologic Model for the 200-East Groundwater Aggregate Area*). The WIDS database estimated that there are approximately 153 m^3 (200 yd^3) of contaminated soil at this site.

- 242-A Evaporator Facility: The A Tank Farms routed waste to Tank 241-AW-102, which fed the 242-A Evaporator. Waste sent to the 242-A Evaporator included dilute noncomplexed radioactive waste, PUREX dilute miscellaneous waste, PUREX cladding removal waste, and complexed radioactive waste. The 242-A Evaporator also received quantities of 204-AR Waste Unloading Facility tank car wastes, 300 and 400 Area laboratory wastes, 100 N wastes, B Plant aging wastes, United Nuclear Corporation fuel fabrication wastes, and Plutonium Finishing Plant wastes. These wastes may have contained spent solvents. Hazardous chemicals used include sodium nitrate used to regenerate ion-exchange column, sodium hydroxide used for decontamination applications, and the antifoam agent used in the evaporator vessel. The evaporator removed water and most volatile organics from the waste streams. The 242-A Evaporator condensate subsequently was routed through filters before being discharged to the 207-A South Retention Basin and the 216-A-37-1 Crib.

Table 1-3a. Sources of Contamination, Contaminants of Potential Concern, and Affected Media for the 200-PW-2 Operable Unit. (2 Pages)

Known or Suspected Source of Contamination (Process)	Type of Contamination from Each Source (General Contamination)	Affected Media
Tank waste discharges from U Plant, PUREX, REDOX, WESF/221-B Building, and the Hot Semiworks Facility during uranium recovery, scavenging operations, REDOX and PUREX operations, and the experimental processes conducted at the Hot Semiworks Facility.	Various acidic, neutral, and basic waste streams containing, mixed fission products, activation products, inorganic chemicals, metals, and semivolatile and volatile organic chemicals.	Shallow soils, deep zone soils associated with the waste sites, and potentially the groundwater beneath the waste sites.

Radioactive COPCs			
Americium-241	Curium-244	Plutonium-238	Tellurium-129
Americium-242	Curium-245	Plutonium-239/240	Tellurium-129m
Americium-243	Europium-152	Plutonium-241/242	Thorium-232
Antimony-123	Europium-154	Praseodymium-143	Tin-113
Antimony-125	Europium-155	Praseodymium-144	Tin-123
Barium-137	Iodine-129	Promethium-147	Tin-123m
Barium-137m	Iodine-131	Radium-226	Tin-125
Barium-140	Lanthanium-140	Radium-228	Tin-126
Cadmium-113m	Neodymium-147	Rhodium-106	Tritium
Carbon-14	Neptunium-237	Ruthenium-103	Uranium-232
Cerium-141	Neptunium-239	Ruthenium-106	Uranium-233/234
Cerium-144	Nickel-59	Samarium-149	Uranium-235/236
Cesium-134	Nickel-63	Samarium-151	Uranium-238
Cesium-135	Niobium-93m	Selenium-79	Yttrium-90
Cesium-137	Niobium-95	Strontium-89	Yttrium-91
Cobalt-60	Niobium-96	Strontium-90	Zirconium-93
Curium-242	Niobium-98	Technetium-99	Zirconium-95
Curium-243	Palladium-107		

Table 1-3a. Sources of Contamination, Contaminants of Potential Concern, and Affected Media for the 200-PW-2 Operable Unit. (2 Pages)

Inorganic COPCs			
Aluminum	Anionic resins (sulfates)	Chromium	Iron sulfate
Aluminum fluoride	Antimony	Chromium nitrate	Lanthanum
Aluminum nitrate	Arsenic	Copper	Lanthanum fluoride
Aluminum nitrate nonahydrate (ANN)	Barium	Cyanide(s)	Lanthanum hydroxide
	Beryllium	Ferric ammonium sulfate	Lanthanum nitrate
Aluminum nitrate (mono basic)	Bismuth	Ferric hydroxide	Lead
Aluminum silicate	Bismuth subnitrate/oxynitrate	Ferric nitrate	Lead oxide
Aluminum sulfate	Bismuth orthophosphate	Ferrous ammonium sulfate	Magnesium
Ammonia	Borate(s)	Ferro/ferric cyanide	Magnesium nitrate
Ammonium cerium nitrate	Cadmium	Ferrous sulfamate	Manganese
Ammonium hydroxide	Calcium	Fluoride	Manganese oxide
Ammonium iron fluoride	Calcium carbonate (lime)	Hydrazine	Manganese nitrate
Ammonium iron sulfate	Calcium nitrate	Hydrochloric acid	Mercury
Ammonium lanthanum nitrate	Cerium	Hydrofluoric acid	Molybdenum
Ammonium oxalate	Cerium phosphate	Hydrogen	Nickel
Ammonium fluoride/ammonium nitrate (AFAN)	Cesium nitrate	Hydrogen peroxide	Nickel sulfate
	Cesium phosphate	Hydroxide	Nitrate
Ammonium fluosilicate	Chloride	Hydroxylamine nitrate (HN)	Nitrite
Ammonium sulfate	Chromic acid	Iron	Nitric acid
Inorganic COPCs (cont)			
Ozone	Potassium nitrate	Sodium metabismuthate	Sulfate
Peroxide	Potassium permanganate	Sodium nitrate	Sulfite
Phosphate	Ruthenium oxide	Sodium nitrite	Sulfuric acid
Phosphoric acid	Selenium	Sodium oxalate	Tin
Phosphotungstic acid (PTA)	Silicon	Sodium silicate	Tungsten
Plutonium	Silver	Sodium sulfate	Uranium
Plutonium fluoride	Sodium	Sodium hydrogen sulfate	Uranium dioxide
Plutonium dioxide	Sodium aluminate	Sodium phosphate	Uranium trioxide
Plutonium nitrate	Sodium bicarbonate	Disodium phosphate	Uranyl nitrate
Plutonium peroxide	Sodium carbonate	Sodium pyrophosphate	Vanadium
Potassium	Sodium chloride	Sodium uranyl carbonate	Zinc
Potassium carbonate	Sodium dichromate	Disodium uranyl oxide	Zinc nitrate
Potassium chloride	Sodium fluoride	Strontium (metal)	Zinc phosphate
Potassium dichromate	Sodium hexametaphosphate (Calgon)	Strontium carbonate	Zirconium
Potassium hydroxide		Strontium nitrate	Zirconium carbonate gel
Potassium fluoride	Sodium hydroxide	Sulfamic acid	Zirconyl nitrate
Organic Chemical COPCs			
Acetone	Dibutyl phosphate	Mono-2-ethylhexyl phosphoric acid	Tetrahydrofuran
AMSCO	Ethylene diamine tetra-acetate (EDTA)		Toluene
1-butanol		Normal paraffin hydocarbons	Tributyl phosphate
2-butanone (methyl ethyl ketone)	Hexone	Oxalic acid	Trisodium hydroxyethyl ethylene – diamine triacetate (HEDTA)
	Kerosene	Polychlorinated biphenyls	
Benzyl alcohol	Monobutyl phosphate	Super gel hyflo	Trisodium nitrilo triacetate (NTA)
Citric acid		Tartaric acid	Xylene
Di(2-ethylhexyl) phosphoric acid			

Table 1-3b. Sources of Contamination, Contaminants of Potential Concern, and Affected Media for the 200-PW-4 Operable Unit. (2 Pages)

Known or Suspected Source of Contamination (Process)	Type of Contamination from Each Source (General Contamination)	Affected Media
Tank waste discharges from U Plant, T Plant, PUREX, REDOX, 242-A Evaporator, and the experimental processes conducted at the Hot Semiworks Facility.	Various acidic, neutral, and basic waste streams containing, mixed fission products, activation products, inorganic chemicals, metals, and semivolatile and volatile organic chemicals.	Shallow soils, deep zone soils associated with the waste sites, and potentially the groundwater beneath the waste sites.

Radioactive COPCs			
Americium-241	Curium-244	Plutonium-238	Tellurium-129
Americium-242	Curium-245	Plutonium-239/240	Tellurium-129m
Americium-243	Europium-152	Plutonium-241/242	Thorium-232
Antimony-123	Europium-154	Praseodymium-143	Tin-113
Antimony-125	Europium-155	Praseodymium-144	Tin-123
Barium-137	Iodine-129	Promethium-147	Tin-123m
Barium-137m	Iodine-131	Radium-226	Tin-125
Barium-140	Lanthanium-140	Radium-228	Tin-126
Cadmium-113m	Neodymium-147	Rhodium-106	Tritium
Carbon-14	Neptunium-237	Ruthenium-103	Uranium-232
Cerium-141	Neptunium-239	Ruthenium-106	Uranium-233/234
Cerium-144	Nickel-59	Samarium-149	Uranium-235/236
Cesium-134	Nickel-63	Samarium-151	Uranium-238
Cesium-135	Niobium-93m	Selenium-79	Yttrium-90
Cesium-137	Niobium-95	Strontium-89	Yttrium-91
Cobalt-60	Niobium-96	Strontium-90	Zirconium-93
Curium-242	Niobium-98	Technetium-99	Zirconium-95
Curium-243	Palladium-107		

Inorganic COPCs			
Aluminum	Antimony	Copper	Iron sulfate
Aluminum fluoride	Arsenic	Cyanide(s)	Lanthanum
Aluminum nitrate	Barium	Ferric ammonium sulfate	Lanthanum fluoride
Aluminum nitrate nonahydrate (ANN)	Beryllium	Ferric hydroxide	Lanthanum hydroxide
	Bismuth	Ferric nitrate	Lanthanum nitrate
Aluminum nitrate (mono basic)	Bismuth subnitrate/oxynitrate	Ferrous ammonium sulfate	Lead
Aluminum silicate	Bismuth orthophosphate	Ferro/ferric cyanide	Lead oxide
Aluminum sulfate	Borate(s)	Ferrous sulfamate	Magnesium
Ammonia	Cadmium	Fluoride	Magnesium nitrate
Ammonium cerium nitrate	Calcium	Hydrazine	Manganese
Ammonium hydroxide	Calcium carbonate (lime)	Hydrochloric acid	Manganese oxide
Ammonium iron fluoride	Calcium nitrate	Hydrofluoric acid	Manganese nitrate
Ammonium iron sulfate	Cerium	Hydroiodic acid	Mercury
Ammonium lanthanum nitrate	Cerium phosphate	Hydrogen	Molybdenum
Ammonium oxalate	Cesium nitrate	Hydrogen peroxide	Nickel
Ammonium fluoride/ammonium nitrate (AFAN)	Cesium phosphate	Hydroxide	Nickel sulfate
	Chloride	Hydroxylamine	Nitrate
Ammonium fluosilicate	Chromic acid	Hydroxylamine hydrochloride	Nitrite
Ammonium sulfate	Chromium	Hydroxylamine nitrate (HN)	Nitric acid
Anionic resins (sulfates)	Chromium nitrate	Iron	

Table 1-3b. Sources of Contamination, Contaminants of Potential Concern, and Affected Media for the 200-PW-4 Operable Unit. (2 Pages)

Inorganic COPCs (cont)			
Ozone	Potassium nitrate	Sodium metabismuthate	Sulfate
Peroxide	Potassium permanganate	Sodium nitrate	Sulfite
Phosphate	Ruthenium oxide	Sodium nitrite	Sulfuric acid
Phosphoric acid	Selenium	Sodium oxalate	Tin
Phosphotungstic acid (PTA)	Silicon	Sodium silicate	Tungsten
Plutonium	Silver	Sodium sulfate	Uranium
Plutonium fluoride	Sodium	Sodium hydrogen sulfate	Uranium dioxide
Plutonium dioxide	Sodium aluminate	Sodium phosphate	Uranium trioxide
Plutonium nitrate	Sodium bicarbonate	Disodium phosphate	Uranyl nitrate
Plutonium peroxide	Sodium carbonate	Sodium pyrophosphate	Vanadium
Potassium	Sodium chloride	Sodium uranyl carbonate	Zinc
Potassium carbonate	Sodium dichromate	Disodium uranyl oxide	Zinc nitrate
Potassium chloride	Sodium fluoride	Strontium (metal)	Zinc phosphate
Potassium dichromate	Sodium hexametaphosphate (Calgon)	Strontium carbonate	Zirconium
Potassium hydroxide	Sodium hydroxide	Strontium nitrate	Zirconium carbonate gel
Potassium fluoride		Sulfamic acid	Zirconyl nitrate
Organic Chemical COPCs			
Acetic acid	Dibutyl phosphate (DBP)	Hydroxyacetic acid	Sodium gluconate
Acetone	p-Dichlorobenzene	Hydroxyquinoline	Sodium tetraphenyl boron
AMSCO	1,1-Dichloroethane (DCA)	Isopropyl alcohol (2-Propanol)	Sugar
Benzene	1,2-Dichloroethane (DCA)	Kerosene	Super gel hyflo
Benzaldehyde	1,1-Dichloroethylene	Methanol	Tartaric acid
Benzyl alcohol	Di(2-ethylhexyl) phosphoric acid	Methoxydiglycol	Tetradecane
Bromodichloro methane	Dimethylnitrosamine	Methoxytriglycol	Tetrahydrofuran
1-Butanol (Butyl alcohol)	3,5-Dimethylpyridine	Methylene chloride	Tetrachloroethylene (PCE)
2-Butanone (methyl ethyl ketone/MEK)	Dodecane	Methyl ethyl ketone (MEK)	Thenoyltrifluoroacetone
Butoxydiglycol	Ethanol (ethyl alcohol)	2-Methylnonane	Thymolphthalein
2-Butoxyethanol	Ethoxytriethylene glycol	Methyl n-propyl ketone (2 Pentanone)	Toluene
Butoxyglycol	Ethyl benzene	Monobutyl phosphate	Tributyl phosphate (TBP)
Butoxytriethylene glycol	Ethylene diamine tetraacetate (EDTA)	Mono-2-ethylhexyl phosphoric acid	1,1,1-Trichloroethane (TCA)
n-Butyl benzene	Ethylene glycol	N-Nitrodimethylamine	Trichloroethylene (TCE)
Butyraldehyde (butanal)	Ethyl ether	Normal paraffin hydocarbons	Tridecane
Carbon tetrachloride	Heptadecane	Oxalic acid	Triglyme
Chlorobenzene	Hexadecane	Pentadecane	Trisodium hydroxyethyl ethylene – diamine triacetate (HEDTA)
Chloroform (trichloromethane)	Hexanoic acid	Pentasodium diethylene triamine penta acetate (DTPA)	Tris (hydroxymethyl) amino methane
Chloro sulfonic acid	2-Hexanone (Methyl n-butyl ketone)	Phenol	Trisodium nitrilo triacetate (NTA)
Citric acid	Hexone (MIBK)	Polychlorinated biphenyls (PCBs)	Vinyl chloride
Cis/trans-1,2-dichloroethylene	Hydraulic fluids (greases, lard oil)	Pyridine	Xylene
Dibutyl butyl phosphonate (DBBP)			

1.4 CONTAMINANT OF POTENTIAL CONCERN EXCLUSIONS

Table 1-4 presents a list of the COPCs to be excluded from the investigation. Except where noted, this table applies to both the 200-PW-2 and the 200-PW-4 OUs. Table 1-4 also provides specific rationale for the exclusion of the identified COPCs. These exclusions are based on physical laws, process knowledge, task focus, and/or other mitigating factors.

Inorganic salts and acids represent a large group of constituents in the waste sites being evaluated. Because laboratory analyses generally are not acid- or compound-specific, the acids and inorganic salts were excluded from further consideration. Instead, the readily detected cations and anions (e.g., metals, fluorides, and nitrates) associated with the acids and inorganic

salts serve as the target constituents for those compounds. This logic recognizes the small volumes of wastes released into large-volume aqueous discharges.

The COPCs identified in Table 1-4 were excluded from further consideration for this IDW DQO summary report because they meet at least one of the following criteria for exclusion:

- Short-lived radionuclides with half-lives of less than 2 years, in accordance with Environmental Restoration Disposal Facility waste acceptance criteria (BHI-00139, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*)[1]
- Naturally occurring isotopes that were not created as a result of Hanford Site operations and that are expected to be at background levels
- Constituents for which there was no known usage by the plant processes and there was no suspected introduction to waste streams except in incidental quantities
- Chemicals that exist in a gaseous state under ambient conditions and cannot accumulate in soil media
- Chemicals that are not federally regulated (40 CFR 261, "Identification and Listing of Hazardous Waste," or 40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions") and are not a state ((WAC 173-303, "Dangerous Waste Regulations") constituent
- Chemicals that are not persistent in the environment, because of biological degradation or other natural mitigating features
- Chelating compounds that are not present at greater than 1 percent.

The following criteria may provide the basis for exclusion of certain constituents. However, certain constituents may be required to meet more than one of the following conditions to be excluded from consideration:

- Chemicals for which analytical detection methods are not available
- Products for which chemical composition is unknown and, therefore, analytical requirements cannot be specified
- Stable nuclides that are not radioactive
- Radionuclides that constitute less than 1 percent of the fission product inventory and for which historical sampling indicates nondetection.

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[1] If the IDW is not shipped to the Environmental Restoration Disposal Facility, waste designation will be performed in accordance with HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria*, and the 2-year half-life exclusion will not apply.

Table 1-4. 200-PW-2 and 200-PW-4 Operable Unit Investigation-Derived Waste Contaminants of Potential Concern Exclusions. (5 Pages)

IDW COPCs	Rationale for Exclusion of Further Analysis
Radionuclides	
Antimony-123	Less than 2-year half-life.
Barium-137	Stable isotope
Barium-137m	Less than 2-year half-life.
Barium-140	Less than 2-year half-life.
Cerium-141	Less than 2-year half-life.
Cerium-144	Less than 2-year half-life.
Curium-242	Less than 2-year half-life.
Iodine-131	Less than 2-year half-life.
Lanthanum-140	Less than 2-year half-life.
Neodymium-147	Less than 2-year half-life.
Neptunium-239	Less than 2-year half-life.
Niobium-95	Less than 2-year half-life.
Niobium-96	Less than 2-year half-life.
Niobium-98	Less than 2-year half-life.
Plutonium-242	Constituent with atomic mass number equal to 242 that represents << 1% of the actinide activity based on ORIGIN2 modeling (CCN 097716, "N Reactor ORIGEN2 Simulation Runs"). The production of this isotope is extremely minute. It is historically not detected in alpha-spec analysis and, therefore, is used as a tracer to determine recovery effectiveness for other plutonium isotopes in laboratory chemical separations.
Praseodymium-143	Less than 2-year half-life.
Praseodymium-144	Less than 2-year half-life.
Rhodium-106	Less than 2-year half-life.
Ruthenium-103	Less than 2-year half-life.
Ruthenium-106	Less than 2-year half-life.
Samarium-149	Stable isotope
Strontium-89	Less than 2-year half-life.
Tellurium-129	Less than 2-year half-life.
Tellurium-129m	Less than 2-year half-life.
Tin-113	Less than 2-year half-life.
Tin-123	Less than 2-year half-life.
Tin-123m	Less than 2-year half-life.
Tin-125	Less than 2-year half-life.
Uranium-232	<2.0 E-03 times the U-238 activity. Because the production of this isotope is extremely minute it is not detected in routine sample analyses. It, therefore, is used as a tracer to determine recovery effectiveness for other uranium isotopes in laboratory chemical separations.
Yttrium-91	Less than 2-year half-life.
Zirconium-95	Less than 2-year half-life.
Metals	
Aluminum	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Calcium	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Cerium	Not a Washington State toxic or persistent waste.
Cesium	Radiological analysis will supercede any chemical analysis for this constituent.
Copper	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Iron	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.

Table 1-4. 200-PW-2 and 200-PW-4 Operable Unit Investigation-Derived Waste Contaminants of Potential Concern Exclusions. (5 Pages)

IDW COPCs	Rationale for Exclusion of Further Analysis
Lanthanum	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Magnesium	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Manganese	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Molybdenum	A D001 code is applied only to metallic objects. Because these are not present, it is not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Permanganate	Dissociates from potassium in aqueous environment. It is an oxidizer that degrades to manganese dioxide.
Plutonium	Radiological analysis will supercede any chemical analysis for this constituent.
Potassium	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Ruthenium	A D001 code is applied only to metallic objects. Because these are not present, it is not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Silicon compounds	According to various 200 Area process technical manuals (HW-18700-DEL, *REDOX Technical Manual*, HW-31000-DEL, *PUREX Technical Manual*, and WHC-SP-0479, *PUREX Technical Manual*, HW-31442, *Recovery of Cesium-137 from Uranium Recovery Process Wastes*), silicon compounds had minimal use in 200 Areas processes. A silicon coating was applied to irradiated fuel rods. This coating was removed during the first step of plutonium/uranium separation operations. The waste generated was routed directly to the tank farms and never released with chemical sewer or cooling water discharges. If present, these compounds would be bound up in the soil matrix and could not pose an inhalation risk, which is the basis for the Washington State toxic status.
Sodium	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Strontium	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Tin	A D001 code is applied only to metallic objects. Because these are not present, it is not a Washington State toxic or persistent waste and is not a UHC as defined in 40 CFR 268.2.
Tungsten	A D001 code is applied only to metallic objects. Because this constituent, if present would not be present as a metallic object, it is not a Washington State toxic or persistent waste and is not a UHC as defined in 40 CFR 268.2.
Uranium	Radiological analysis will supersede any chemical analysis performed for this constituent.
Vanadium	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Zinc	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Zirconium	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Inorganics	
Carbonate	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Chloride	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Fluoride	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Hydrazine	Constituent used in very small quantities for analytical sampling in PUREX. Because it is highly reactive, it would not be present or detectable in the soil environment.
Hydrogen	Gas
Hydrogen peroxide	Has degraded to water and oxygen.
Hydroxide	Not detectable in soil. It is assessed via pH.
Hydroxylamine	Very reactive reducing agent that degrades to ammonia or nitrogen and water. No direct standard analytical technique available.
Hydroxylamine hydrochloride	Very reactive reducing agent that degrades to ammonia or nitrogen and water. No direct standard analytical technique available.
Hydroxylamine nitrate	This constituent potentially carries a D002 code. However, the code applicability is dependant on the pH of the waste material and is related to its explosive behavior when in concentrated form. It is excluded in this case, because it will not be concentrated after dilution in the aqueous waste stream and percolation into the soil column.
Iodine	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Nitrate/nitrite	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.

Table 1-4. 200-PW-2 and 200-PW-4 Operable Unit Investigation-Derived Waste Contaminants of Potential Concern Exclusions. (5 Pages)

IDW COPCs	Rationale for Exclusion of Further Analysis
Oxides	Only metallic oxides are listed in this study. They are very stable, (not reactive, toxic, characteristic, and/or ignitable). The analyses are performed for the metals, not the oxides.
Ozone	Gas
Peroxide	See rationale for hydrogen peroxide.
Phosphate	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Phosphotungstic acid (PTA)	This acid will not be detectable in soil, because of dissociation of the component parts in the aqueous waste stream. Neither phosphorous or tungsten is toxic.
Sulfamates	Have degraded to sulfates ($NH_2SO_3H + H_2O \rightarrow NH_4HSO_4 + H_2O$ [aquatic environment] $\rightarrow NH_4^+ + HSO_4^- + OH^- \rightarrow HOH + SO_4^{2-}$).
Sulfate	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Sulfite	Because of its reactivity, sulfite is present in the form of sulfate in the soil.
Organics	
Acetic acid	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
AMSCO	This is analyzed as a kerosene normal paraffin hydrocarbon, which is not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Benzyaldehyde	Readily degrades in soil and is not likely to be persistent or detectable.
1-butanol (Butyl alcohol)	Extremely water soluble, with higher evaporation rate than water, subject to biodegradation, and highly mobile in soil. Likely not detectable in soil.
Butoxydiglycol	Water-soluble compound that is mobile in soil. Not persistent and hence not likely detectable in soil.
Butoxyglycol	Water-soluble compound that is mobile in soil. Not persistent and hence not likely detectable in soil.
Butoxytriethylene glycol	Water-soluble compound that is mobile in soil. Not persistent and hence not likely detectable in soil.
n-Butyl benzene	This constituent could carry a D001 code for flammable liquid. However, after mixing in the aqueous discharge and percolation through the soil column, it will not exist as a flammable liquid.
Butyraldehyde	Readily degrades in soil and is not likely to be persistent or detectable.
Chlorosulfonic acid	This compound is reactive with water and is therefore no longer present or detectable after introduction into the large volume aqueous waste stream.
Citric acid	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. No direct standard analytical technique available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs.
Dibutyl butyl phosphonate	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. This compound is unlikely to be present in detectable concentrations.
Dibutyl phosphate	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. This compound is unlikely to be present in detectable concentrations.
Di(2-ethylhexyl) phosphoric acid	This compound degrades to alcohol and phosphate in the aqueous waste stream and would not be detectable in soil.
Dimethylnitrosamine	Water-soluble compound that is not likely detectable in soil after mixing in the aqueous waste stream and percolation into the soil column.
3,5-Dimethylpyridine	This constituent potentially carries a D001 Code. However, it is excluded because of the significant dilution in the aqueous waste stream and subsequent percolation into the soil column.
Dodecane	Kerosene-range organic that is not a Washington State toxic or persistent waste and is not a UHC as defined in 40 CFR 268.2.
Ethanol	Miscible with water, subject to biodegradation, and highly mobile in soil (Wade 1991, *Organic Chemistry*). For these reasons, and because of the water discharges that diluted and dispersed it through the soil column, it is extremely unlikely to be detectable in soil samples.
Ethoxytriethylene glycol	Water-soluble compound that is mobile in soil. Not persistent and hence is not likely detectable in soil.

Table 1-4. 200-PW-2 and 200-PW-4 Operable Unit Investigation-Derived Waste Contaminants of Potential Concern Exclusions. (5 Pages)

IDW COPCs	Rationale for Exclusion of Further Analysis
Ethylene-diamine tetraacetic acid (EDTA)	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. No direct standard analytical technique is available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs.
Ethylene glycol	Miscible with water, subject to biodegradation, and highly mobile in soil (Wade 1991). For these reasons, and because of the water discharges that diluted and dispersed it through the soil column, it is extremely unlikely to be detectable in soil samples.
Heptadecane	Diesel-range organic that is readily biodegradable. Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Hexadecane	Diesel-range organic that is readily biodegradable. Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Hexanoic acid	This compound degrades into its elemental components in the aqueous waste stream and would not be detectable in soil.
2-Hexanone	This constituent is a flammable liquid that is soluble in water. However, after mixing in the aqueous discharge and percolation through the soil column, it will not exist as a flammable liquid.
Hydraulic fluids (greases, lard oil)	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Hydroxyquinoline	This compound is a chelating agent for which there is no analytical methodology.
Hydroxyacetic acid	Used as a food additive for a component of adhesives. Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Isopropyl alcohol	Extremely water soluble, has a higher evaporation rate than water, subject to biodegradation, and highly mobile in soil (Wade 1991). For these reasons, and because of the water discharges that diluted and dispersed it through the soil column, it is extremely unlikely to be detectable in soil samples.
Kerosene	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Methoxydiglycol	Water-soluble compound that is mobile in soil. Not persistent and hence not likely detectable in soil.
Methoxytriglycol	Water-soluble compound that is mobile in soil. Not persistent and hence not likely detectable in soil.
2-Methylnonane	This constituent potentially carries a D001 code. However, it is excluded because of the significant dilution in the aqueous waste stream and subsequent percolation into the soil column.
Methyl n-propyl ketone	This constituent is a flammable liquid that is soluble in water. However, after mixing in the aqueous discharge and percolation through the soil column, it will not exist as a flammable liquid.
Monobutyl phosphate	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Mono-2-ethylhexyl phosphoric acid	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
N-Nitrodimethyl amine	No analytical method available.
Normal paraffin hydrocarbon	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Oxalic acid (oxalate)	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. Has dissolved into a complexing agent that could have affected the mobility of certain COCs. No direct standard analytical technique is available.
Polychlorinated biphenyls (200-PW-2 only)	During the sampling and analysis of the 200-UP-2 OU, it is documented in the limited field investigation (DOE/RL-95-13, *Limited Field Investigation for the 200-UP-2 Operable Unit*,) that the polychlorinated biphenyls Aroclors 1254 and 1260[a] were detected only at the 216-U-10 Pond and not at any of the waste sites within the 200-PW-2 OU (216-U-1, 216-U-2, 216-U-8, and 216-U-12 Cribs). All three of the near-surface samples were detected at levels less than 1 mg/kg. None of the samples exceeded WAC 173-340, "Model Toxics Control Act-Cleanup," Method B values (0.50 mg/kg). None of the samples exceeded WAC 173-340 Method C values, all three samples were near detection limits, and one sample was qualified as an estimated value (Table B-4B of DOE/RL-95-13).
Pentasodium diethylene triamine penta acetate (DTPA)	Chelating agent that is used for removing toxic metals from humans. Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.

Table 1-4. 200-PW-2 and 200-PW-4 Operable Unit Investigation-Derived Waste Contaminants of Potential Concern Exclusions. (5 Pages)

IDW COPCs	Rationale for Exclusion of Further Analysis
Pentadecane	Diesel-range organic. Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Pyridine	Flammable liquid that is miscible in water. After mixing with the aqueous waste stream and percolation into the soil column, it will not be present as a flammable liquid and is not likely to be detectable.
Sodium gluconate	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Sodium tetraphenyl boron	This compound is freely soluble in water. It is used as a laboratory reagent and tends to deteriorate within 5 days of make-up.
Sugar	Dietary sweetener, not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Super gel hyflow	A chromatography medium similar to diatomaceous earth. Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Tartaric acid	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. No direct standard analytical technique is available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs.
Tetradecane	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Tetrahydrofuran	No direct standard analytical technique is available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs. This compound is unlikely to be present in toxic or high concentrations.
Thenoyltrifluoro acetone	No analytical methodology available.
Thymolphthalein	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Tridecane	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Triglyme	Water-soluble compound that is mobile in soil. Not persistent and hence is not likely detectable in soil.
Trisodium hydroxyethyl ethylene-diamine triaceatate (HEDTA)	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. No direct standard analytical technique is available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs.
Tris(hydroxymethyl) amino methane	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. Used in pharmaceuticals and as emulsifying agent in cosmetics and mineral oil and paraffin wax emulsions.
Trisodium nitrilo triacetate (NTA)	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. No direct standard analytical technique is available. Has dissolved to a complexing agent that could have affected the mobility of certain COCs.

[a] Aroclor is an expired trademark.

40 CFR 268.2, "Land Disposal Restrictions," Subsection 2, "Underlying hazardous constituent means any constituent listed in Sec. 268.48, Table UTS--Universal Treatment Standards, except fluoride, selenium, sulfides, vanadium, and zinc, which can reasonably be expected to be present at the point of generation of the hazardous waste at a concentration above the constituent-specific UTS treatment standards."

CCN 097716, "N Reactor ORIGEN2 Simulation Runs."

DOE/RL-95-13, *Limited Field Investigation for the 200-UP-2 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

HW-18700-DEL, *REDOX Technical Manual*, General Electric Company, Richland, Washington.

HW-31442, *Recovery of Cesium-137 from Uranium Recovery Process Wastes*, General Electric Company, Richland, Washington.

HW-31000-DEL, *PUREX Technical Manual*, General Electric Company, Richland, Washington.

WAC 173-340, "Model Toxics Control Act-Cleanup," *Washington Administrative Code,* as amended, Washington State Department of Ecology, Olympia, Washington.

Wade, L. G., Jr., 1991, Organic Chemistry, 2nd edition, Englewood Cliffs, New Jersey.

WHC-SP-0479, *PUREX Technical Manual*, Westinghouse Hanford Company, Richland, Washington.

COPC = contaminant of potential concern.
IDW = investigation-derived waste.
PUREX = Plutonium-Uranium Extraction (Facility).
REDOX = Reduction-Oxidation (Facility).
UHC = underlying hazardous constituent.
WESF = Waste Encapsulation and Storage Facility.

1.5 CONTAMINANT OF CONCERN CONCENTRATIONS ESTIMATED BY CALCULATION

Table 1-5 identifies the lists of IDW COCs for the 200-PW-2 and 200-PW-4 OUs that will not require laboratory analysis for quantification but that will be estimated based on calculations from other COC concentrations by one of the following methods:

- The concentration of the progeny can be determined from the parent nuclide when it is in secular equilibrium with a parent nuclide (i.e., the progeny is decaying as fast as it is formed from the parent)
- Any radionuclide with concentrations less than 1 pCi/g based on laboratory analytical measurements or that can be calculated using reactor physics principles/relationships (ORIGEN2 code) (ORNL-5621, *ORIGEN2 – A Revised and Updated Version of the Oak Ridge Isotope Generation and Depletion Code*) from known concentrations of isotopes being analyzed during the characterization activities (CCN 097716).

Table 1-5. 200-PW-2 and 200-PW-4 Operable Unit Investigation-Derived Waste Contaminants of Concern to Be Determined by Calculation. (2 Pages)

IDW COCs	Rationale for Determination by Calculation
Radionuclides	
Americium-242	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) (ORNL-5621, *ORIGEN2 – A Revised and Updated Version of the Oak Ridge Isotope Generation and Depletion Cod*) from known concentrations of isotopes being analyzed. This isotope represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production) (CCN 097716, "N Reactor ORIGEN2 Simulation Runs").
Americium-243	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) (ORNL-5621) from known concentrations of isotopes being analyzed. This isotope represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production) (CCN 097716).
Cadmium-113m	Constituent generated at less than 1% of the Cs-137 activity. May be calculated from that isotope.
Cesium-135	Constituent generated at less than 5.0 E-05 times Cs-137 activity. May be calculated from that isotope.
Curium-243	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed. This isotope represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production) (CCN 097716).
Curium-244	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed. This isotope represents less than 1% of the actinide activity (CCN 097716). May be reported via americium isotopic analysis.
Curium-245	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed. This isotope represents << 1% of the actinide activity (based on ORIGEN2 modeling of Hanford reactor production) (CCN 097716).
Iodine-129	Isotopic concentration can be calculated based on ORIGEN2 modeling (CCN 097716).
Nickel-59	Activity will be < 5% of Ni-63 activity (CCN 097716) and may be calculated from that isotope.
Niobium-93m	Isotopic concentration can be calculated based on ORIGEN2 modeling (CCN 097716).

Table 1-5. 200-PW-2 and 200-PW-4 Operable Unit Investigation-Derived Waste Contaminants of Concern to Be Determined by Calculation. (2 Pages)

IDW COCs	Rationale for Determination by Calculation
Palladium-107	Constituent generated at less than 5.0 E-05 times Cs-137 activity. May be calculated from that isotope.
Plutonium-241	Not detected by normal plutonium analysis. Can infer from americium/plutonium results.
Promethium-147	The concentration can be calculated with the average decay from Cs-137.
Samarium-151	Isotopic concentration can be calculated based on ORIGEN2 modeling (CCN 097716).
Selenium-79	Isotopic concentration can be calculated based on ORIGEN2 modeling (CCN 097716).
Uranium-236	Measurement cannot resolve U-235 + U-236 isotopes, reported as U-235.
Yttrium-90	In secular equilibrium with parent nuclide Sr-90.
Zirconium-93	Constituent generated at less than 5.0 E-05 times Cs-137 activity. May be calculated from that isotope.

CCN 097716, "N Reactor ORIGEN2 Simulation Runs."
ORNL-5621, *ORIGEN2 – A Revised and Updated Version of the Oak Ridge Isotope Generation and Depletion Code.*

COC = contaminant of concern.
IDW = investigation-derived waste.

1.6 FINAL LIST OF CONTAMINANTS OF CONCERN

This section identifies the final list of IDW COCs for the 200-PW-2 and 200-PW-4 OUs and the rationale of inclusion. Tables 1-6a and 1-6b identify the final IDW analytical COC list for the 200-PW-2 OU and the 200-PW-4 OU, respectively. In addition, pH measurements will be made in the field to determine hydroxide concentrations.

Table 1-6a. 200-PW-2 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (4 Pages)

Final IDW COCs	Rationale for Inclusion
Radiological Constituents	
Americium-241	Known production from fission reaction and listed via tank farm integration (LA-UR-96-3860, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model*; WHC-SD-WM-ER-133, *An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks*).
Antimony-125	Known fission product. Analytical data needed for waste designation.
Carbon-14	Known fission product and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Cesium-134	Analytical data needed for waste designation.
Cesium-137	Known fission product (HW-10475, *Hanford Engineer Works Technical Manual (T/B Plants)* [Sections A, B, and C]; HW-18700-DEL, *REDOX Technical Manual*).
Cobalt-60	Known activation product (HW-10475 [Sections A, B, and C]; HW-18700-DEL; WHC-MR-0227, *Tank Waste Discharge Directly to Soil at the Hanford Site*).
Europium-152	Known fission product (HW-10475 [Sections A, B, and C]; HW-01744, *Radionuclide Inventory of Liquid Waste Disposal Sites on the Hanford Site*).

Table 1-6a. 200-PW-2 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (4 Pages)

Final IDW COCs	Rationale for Inclusion
Europium-154	Known fission product (HW-10475 [Sections A, B, and C]; HW-01744).
Europium-155	Known fission product (HW-10475 [Sections A, B, and C]; HW-18700-DEL).
Neptunium-237	Known production from fission reaction and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Nickel-63	Known fission product and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Plutonium-238	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Plutonium-239/240	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Radium-226	Analytical data needed for waste designation.
Radium-228	Analytical data needed for waste designation.
Strontium-90	Known fission product (HW-10475 [Sections A, B, and C]; HW-18700-DEL). Analyzed as total radioactive strontium.
Technetium-99	Known fission product (HW-10475 [Sections A, B, and C]; WHC-MR-0227).
Thorium-232	Known production from fission reaction (HW-10475 [Sections A, B, and C]; HW-01744).
Tin-126	Known fission product. Analytical data needed for waste designation.
Tritium	Known fission product and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Uranium-233/234	Known production from fission reaction/fission product (HW-10475 [Sections A, B, and C]).
Uranium-235	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Uranium-238	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Nonradiological Constituents – Metals	
Antimony	Metal byproduct from uranium fuel rod (HW-19140, *Uranium Recovery Technical Manual*).
Arsenic	*Resource Conservation and Recovery Act of 1976*, 42 U.S.C. 6901, et seq. (RCRA) metal for which analytical data is needed for waste designation.
Barium	Metal byproduct from uranium fuel rod (HW-19140). RCRA metal for which analytical data is needed for waste designation.
Beryllium	Metal used in braze to seal end of fuel rod (HW-19140). Potential underlying hazardous constituent.
Bismuth	Analytical data needed for waste designation.
Cadmium	Metal used in lead-dipped cladding and thus cladding waste stream (1952 to 1956) (HW-10475, Section A). RCRA metal for which analytical data is needed for waste designation.
Chromium[a]	Due to sodium/potassium dichromate added during first- and second-cycle decontamination and concentration operations of bismuth phosphate process (HW-10475, Section C; WHC-MR-0132, *History of the 200 Area Tank Farms*). RCRA metal for which analytical data is needed for waste designation.
Lead	Metal used in lead-dipped cladding and thus cladding waste stream (1952 to 1956) (HW-10475, Section A) lead oxide was added as an oxidizing agent to the first- and second-cycle decontamination operations of bismuth phosphate process (HW-10475, Section C). RCRA metal for which analytical data is needed for waste designation.
Mercury	Several uses in bismuth phosphate campaign including addition to cladding and metal waste streams to prevent gaseous generations and miscellaneous laboratory uses. Listed by the basis of knowledge gained by interviews and via tank farm integration (LA-UR-96-3860). RCRA metal for which analytical data is needed for waste designation.

Table 1-6a. 200-PW-2 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (4 Pages)

Final IDW COCs	Rationale for Inclusion
Nickel	Experimental additions of nickel sulfate added during the bismuth phosphate process to serve as a scavenging agent. Listed as a result of tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133) and extensive use (1954 to 1958) as nickel ferro/ferric cyanide during scavenging and recovery processes (WHC-SD-WM-ER-133). Analytical data is needed for waste designation.
Selenium	Several uses in bismuth phosphate campaign including filtering of gases generated in the 1950s and miscellaneous laboratory uses. Listed by the basis of knowledge gained by previous sampling efforts in the 200 Areas. RCRA metal for which analytical data is needed for waste designation.
Silver	Several uses in bismuth phosphate campaign, including filtering of gas generated in the 1950s and miscellaneous laboratory uses. Listed by the basis of knowledge gained by interviews. RCRA metal for which analytical data is needed for waste designation.
Nonradiological Constituents – General Inorganics	
Ammonia/ ammonium	Several compounds contained ammonium the most widely used included ammonium silica fluoride which was used as a cleaning and decontamination compound based on ability to dissolve metals and fission products (HW-10475, Section C; WHC-SD-WM-ER-133; OUT-1462, *History of Operations (1 January 1944 to March 1945)*).
Boron	Analytical data needed for waste designation.
Cyanide	Extensive use (1954 to 1958) as nickel ferro/ferric cyanide during scavenging and recovery processes listed as a result of tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Volatile Organics	
Acetone	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HEW-31000-DEL, *PUREX Technical Manual*, and WHC-SP-0479, *PUREX Technical Manual* [PUREX]; HW-31442, *Recovery of Cesium-137 from Uranium Recovery Process Wastes* [WESF]).
2-butanone (methyl ethyl ketone or MEK)	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HEW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]).
Hexone (MIBK)	Although highly mobile in soil, and subject to biodegradation and evaporation, it is retained as a COC because it was used in significant quantities as a solvent in the REDOX process.
Toluene	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations HW-18700-DEL [REDOX]; HEW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]).
Xylene	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HEW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]).

Table 1-6a. 200-PW-2 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (4 Pages)

Final IDW COCs	Rationale for Inclusion
Semivolatile Organics	
Benzyl alcohol	This constituent is retained as a COC because of Washington State WT01 and WT02 codes.
Tributyl phosphate	Solvent dilutant used for PUREX process (HW-18700-DEL [REDOX]; HEW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]).

[a] Waste designation is based on total chromium.

COC = contaminant of concern.
IDW = investigation-derived waste.
PUREX = Plutonium-Uranium Extraction (Facility).
RCRA = *Resource Conservation and Recovery Act of 1976*, 42 U.S.C. 6901, et seq.
REDOX = Reduction-Oxidation (Facility).
WESF = Waste Encapsulation and Storage Facility.

HW-01744, 1999, *Radionuclide Inventory of Liquid Waste Disposal Sites on the Hanford Site.*
HW-10475, 1944, *Hanford Engineer Works Technical Manual (T/B Plants).*
HW-18700-DEL, *REDOX Technical Manual.*
HW-19140, *Uranium Recovery Technical Manual.*
HW-31000-DEL, *PUREX Technical Manual.*
HW-31442, *Recovery of Cesium-137 from Uranium Recovery Process Wastes.*
LA-UR-96-3860, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model.*
OUT-1462, *History of Operations (1 January 1944 to March 1945).*
Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.
WHC-MR-0132, 1990, *History of the 200 Area Tank Farms.*
WHC-MR-0227, *Tank Waste Discharge Directly to Soil at the Hanford Site.*
WHC-SD-WM-ER-133, *An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks.*
WHC-SP-0479, *PUREX Technical Manual.*

Table 1-6b. 200-PW-4 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (5 Pages)

Final IDW COCs	Rationale for Inclusion
Radiological Constituents	
Americium-241	Known production from fission reaction and listed via tank farm integration (LA-UR-96-3860, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model*; WHC-SD-WM-ER-133, *An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks*).
Antimony-125	Known fission product. Analytical data needed for waste designation.
Carbon-14	Known fission product and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Cesium-134	Analytical data needed for waste designation.
Cesium-137	Known fission product (HW-10475, *Hanford Engineer Works Technical Manual (T/B Plants)* [Sections A, B, and C]; HW-18700-DEL, *REDOX Technical Manual*).
Cobalt-60	Known activation product (HW-10475 [Sections A, B, and C]; HW-18700-DEL; WHC-MR-0227, *Tank Waste Discharge Directly to Soil at the Hanford Site*).
Europium-152	Known fission product (HW-10475 [Sections A, B, and C]; HW-01744, *Radionuclide Inventory of Liquid Waste Disposal Sites on the Hanford Site*).
Europium-154	Known fission product (HW-10475 [Sections A, B, and C]; HW-01744).
Europium-155	Known fission product (HW-10475 [Sections A, B, and C]; HW-18700-DEL).
Neptunium-237	Known production from fission reaction and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Nickel-63	Known fission product and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).

Table 1-6b. 200-PW-4 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (5 Pages)

Final IDW COCs	Rationale for Inclusion
Plutonium-238	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Plutonium-239/240	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Radium-226	Analytical data needed for waste designation.
Radium-228	Analytical data needed for waste designation.
Strontium-90	Known fission product (HW-10475 [Sections A, B, and C]; HW-18700-DEL). Analyzed as total radioactive strontium.
Technetium-99	Known fission product (HW-10475 [Sections A, B, and C]; WHC-MR-0227).
Thorium-232	Known production from fission reaction (HW-10475 [Sections A, B, and C]; HW-01744).
Tin-126	Known fission product. Analytical data needed for waste designation.
Tritium	Known fission product and listed via tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Uranium-233/234	Known production from fission reaction/fission product (HW-10475 [Sections A, B, and C]).
Uranium-235	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Uranium-238	Known production from fission reaction (HW-10475 [Sections A, B, and C]).
Nonradiological Constituents – Metals	
Antimony	Metal byproduct from uranium fuel rod (HW-19140, *Uranium Recovery Technical Manual*).
Arsenic	*Resource Conservation and Recovery Act of 1976* (RCRA) metal for which waste designation analytical data is required.
Barium	Metal byproduct from uranium fuel rod (HW-19140). RCRA metal for which waste designation analytical data is required.
Beryllium	Metal used in braze to seal end of fuel rod (HW-19140). Potential underlying hazardous constituent.
Bismuth	Analytical data needed for waste designation.
Cadmium	Metal used in lead-dipped cladding and thus cladding waste stream (1952 to 1956) (HW-10475, Section A). RCRA metal for which waste designation analytical data is required.
Chromium	Caused by sodium/potassium dichromate added during first- and second-cycle decontamination and concentration operations of bismuth phosphate process (HW-10475, Section C; WHC-MR-0132, *History of the 200 Area Tank Farms*). RCRA metal for which waste designation analytical data is required.
Lead	Metal used in lead-dipped cladding and thus cladding waste stream (1952 to 1956) (HW-10475, Section A) lead oxide was added as an oxidizing agent to the first- and second-cycle decontamination operations of bismuth phosphate process (HW-10475, Section C). RCRA metal for which waste designation analytical data is required.
Mercury	Several uses in bismuth phosphate campaign including addition to cladding and metal waste streams to prevent gaseous generations and miscellaneous laboratory uses. Listed by the basis of knowledge gained by interviews and via tank farm integration (LA-UR-96-3860). RCRA metal for which waste designation analytical data is required.
Nickel	Experimental additions of nickel sulfate added during the bismuth phosphate process to serve as a scavenging agent. Listed as a result of tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133) and extensive use (1954 to 1958) as nickel ferro/ferric cyanide during scavenging and recovery processes (WHC-SD-WM-ER-133).
Selenium	Several uses in bismuth phosphate campaign including filtering of gases generated in the 1950s and miscellaneous laboratory uses. Listed by the basis of knowledge gained by previous sampling efforts in the 200 Areas. RCRA metal for which waste designation analytical data is required.
Silver	Several uses in bismuth phosphate campaign, including filtering of gas generated in the 1950s and miscellaneous laboratory uses. Listed by the basis of knowledge gained by interviews. RCRA metal for which waste designation analytical data is required.

Table 1-6b. 200-PW-4 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (5 Pages)

Final IDW COCs	Rationale for Inclusion
Nonradiological Constituents – General Inorganics	
Ammonia/ ammonium	Several compounds contained ammonium the most widely used included ammonium silica fluoride which was used as a cleaning and decontamination compound based on ability to dissolve metals and fission products (HW-10475, Section C; WHC-SD-WM-ER-133; OUT-1462, *History of Operations (1 January 1944 to March 1945)*).
Boron	Analytical data needed for waste designation.
Cyanide	Extensive use (1954 to 1958) as nickel ferro/ferric cyanide during scavenging and recovery processes listed as a result of tank farm integration (LA-UR-96-3860; WHC-SD-WM-ER-133).
Volatile Organics	
Acetone	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HW-31000-DEL, *PUREX Technical Manual* and WHC-SP-0479, *PUREX Technical Manual* [PUREX]; HW-31442, *Recovery of Cesium-137 from Uranium Recovery Process Wastes* [WESF]).
Benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248, *1994 Conceptual Model of the Carbon Tetrachloride Contamination in the 200 West Area at the Hanford Site*). No basis for exclusion.
Bromodichloro methane	Identified as a constituent in the 242-A Evaporator process condensate stream-specific report (WHC-EP-0342, *B Plant Process Condensate Stream-Specific Report*, Addendum 17).
2-Butanone (methyl ethyl ketone)	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]).
Carbon tetrachloride	Carbon tetrachloride was a solvent used in fuel reprocessing and was discharged in aqueous and spent solvent waste streams.
Chlorobenzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248). No basis for exclusion.
Chloroform (trichloromethane)	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]). Chloroform is a degradation product of carbon tetrachloride.
Cis/trans-1,2-dichlorotheylene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248). No basis for exclusion.
1,1-Dichloroethane	Analytical data needed for waste designation.
1,2-Dichloroethane	Analytical data needed for waste designation.
1,1-Dichloroethylene	D029 code listed contaminant.
Ethyl ether	Potential underlying hazardous constituent.
Hexone	Analytical data needed for waste designation.
Methanol	Listed waste.
Methylene chloride	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248). No basis for exclusion.
Tetrachloroethylene (PCE)	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248). No basis for exclusion.

Table 1-6b. 200-PW-4 Operable Unit Final Investigation-Derived Waste Analytical Contaminant of Concern List. (5 Pages)

Final IDW COCs	Rationale for Inclusion
Toluene	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]).
1,1,1-Trichloroethane (TCA)	Analytical data needed for waste designation.
Trichloroethylene	Analytical data needed for waste designation.
Vinyl chloride	D043 code listed contaminant.
Xylene	Solvents were often introduced to pretreat, wash, and/or purify the solvents, chemical materials, equipment, and/or dilutants in process operations to gain a better separation of the plutonium, uranium, and other products (including tritium, thorium, americium, neptunium, etc.) from various undesirable fission products and other chemical impurities that would negatively effect partition coefficients and overall efficiency of process operations (HW-18700-DEL [REDOX]; HW-31000-DEL and WHC-SP-0479 [PUREX]; HW-31442 [WESF]). Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248).
Semivolatile Organics	
Benzyl alcohol	This constituent is retained as a COC because of Washington State WT01 and WT02 codes.
2-Butoxyethanol	This constituent is retained as a COC because of Washington State WT01 and WT02 codes.
P-Dichlorobenzene	Toxicity characteristic list as D027. It is a halogenated organic compound that could have WP01 or WP02 codes. It also could have WT01 or WT02 applied and would contribute to the total equivalent calculation.
Ethyl benzene	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248). No basis for exclusion.
Polychlorinated biphenyls	Various types of normal paraffins were used as milling, cutting, and washing solutions during the production of plutonium buttons/rods. These solutions almost always contained polychlorinated biphenyls (CCN 092730, "Discussion Notes with PFP Personnel").
Phenol	Analytical results and measurements have illustrated that this contaminant is found throughout the vadose zone (WHC-SD-EN-TI-248). No basis for exclusion.
Tributyl phosphate	Analytical data needed for waste designation.

COC = contaminant of concern.
IDW = investigation-derived waste.
PUREX = Plutonium-Uranium Extraction (Facility).
RCRA = *Resource Conservation and Recovery Act of 1976*, 42 U.S.C. 6901, et seq.
REDOX = Reduction-Oxidation (Facility).
WESF = Waste Encapsulation and Storage Facility.

CCN 092730, "Discussion Notes with PFP Personnel."
HW-01744, 1999, *Radionuclide Inventory of Liquid Waste Disposal Sites on the Hanford Site.*
HW-10475, *Hanford Engineer Works Technical Manual (T/B Plants).*
HW-18700-DEL, *REDOX Technical Manual.*
HW-19140, *Uranium Recovery Technical Manual.*
HW-31000-DEL, *PUREX Technical Manual.*
HW-31442, *Recovery of Cesium-137 from Uranium Recovery Process Wastes.*
LA-UR-96-3860, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model.*
OUT-1462, *History of Operations (1 January 1944 to March 1945).*
Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.
WHC-EP-0342, *B Plant Process Condensate Stream-Specific Report*, Addendum 17.
WHC-MR-0132, 1990, *History of the 200 Area Tank Farms.*
WHC-MR-0227, *Tank Waste Discharge Directly to Soil at the Hanford Site.*
WHC-SD-EN-TI-248, *1994 Conceptual Model of the Carbon Tetrachloride Contamination in the 200 West Area at the Hanford Site.*
WHC-SD-WM-ER-133, *An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks.*
WHC-SP-0479, *PUREX Technical Manual.*

1.7 HERBICIDES AND PESTICIDES

With conventional borehole drilling techniques, the drill cuttings are collected in drums for disposition as waste, and analytical data are required for disposition. Because the 200-PW-2 and 200-PW-4 characterization boreholes will be drilled from the surface, contaminants uniquely associated with shallow zone soils (e.g., herbicides and pesticides) also will be considered as COCs. These are identified in Table 1-7.

Table 1-7. 200-PW-2 and 200-PW-4 Operable Unit Herbicide and Pesticide Contaminants of Concern.

Known or Suspected Source of Contamination (Process)	Type of Contamination from Each Source (General Contamination)	Affected Media
Herbicide and pesticide sprays over the ground surface.	Routine herbicide and pesticide analyte list.	Surface and shallow soils associated with the 200-PW-2 and 200-PW-4 representative waste sites and treatment, storage, and disposal units.
Herbicides		
2,4-D 2,4-DB 2,4,5-T	2,4,5 – TP (silvex) Dicamba	Dichloroprop DNBP
Pesticides		
4,4'-DDD 4,4'-DDE 4,4'-DDT Aldrin Alpha-BHC Alpha-chlordane Beta-BHC	Delta-BHC Dieldrin Endosulfan I Endosulfan II Endosulfan sulfate Endrin Endrin aldehyde	Endrin ketone Gamma-BHC (lindane) Heptachlor Heptachlor epoxide Methoxychlor Toxaphene

Table 1-8a identifies constituents that were not identified as final COCs in the 200-PW-2 DQO summary report (BHI-01411) but that have been identified for laboratory analysis in this DQO effort for the purpose of waste designation. Table 1-8b likewise lists the constituents that were not identified as COCs in the RI DQO for the 200-PW-4 OU. Sampling and analytical procedures for these additional analyses are presented in Chapter 4.0.

Table 1-8a. 200-PW-2 Operable Unit Final Investigation-Derived Waste Contaminants of Concern List.

Contaminants of Concern[a]
Radiological constituents: antimony-125, cesium-134, tin-126
Nonradiological constituents (inorganics): bismuth, boron
Nonradiological constituents (volatile organics): acetone, 2-butanone, toluene, xylene
Nonradiological constituents (semivolatile organics): benzyl alcohol, herbicides, pesticides

[a] These constituents were listed in the 200-PW-2 RI/FS DQO summary report (BHI-01411, *Remedial Investigation DQO Summary Report for the 200-PW-2 Uranium-Rich Waste Group Operable Unit*) as initial contaminants of potential concern; however, they were excluded from the final contaminants of concern list.

Table 1-8b. 200-PW-4 Operable Unit Final Investigation-Derived Waste Contaminants of Concern List.

Contaminants of Concern[a]
Radiological constituents: antimony-125, cesium-134, tin-126
Nonradiological constituents (inorganics): bismuth, boron
Nonradiological constituents (volatile organics): bromodichloromethane, 1,1-dichloroethylene, ethyl ether, methanol, vinyl chloride
Nonradiological constituents (semivolatile organics): benzyl alcohol, 2-butoxyethanol, p-dichlorobenzene, herbicides, pesticides

[a] These constituents were listed in the 200-PW-4 RI/FS DQO summary report (CP-14176, *Remedial Investigation DQO Summary Report for the 200-PW-4 General Process Waste Group Operable Unit*) as initial contaminants of potential concern; however, they were excluded from the final contaminants of concern list.

2.0 STATEMENT OF THE PROBLEM

Waste materials will be generated from the vadose zone during the RI in some cases by installation/removal of driven soil casings in the 200-PW-2 and 200-PW-4 waste sites and TSD units. In other cases, characterization boreholes may be used to reach the saturated zone. The drive casing will be installed through contaminated vadose zone materials to a maximum depth of approximately 27.5 m (90 ft) below ground surface. Boreholes will be installed through contaminated vadose zone materials to just above groundwater (i.e., saturated zone).

To correctly designate and appropriately dispose of the IDW from characterization activities in the 200-PW-2 and 200-PW-4 OUs, data are needed regarding radiological and chemical contamination to determine if the IDW is regulated. Although surface soils are not considered to be IDW (by definition), these soils will be collected and placed in drums for disposal during drilling operations, thereby requiring analytical data for disposition.

All IDW and remediation wastes generated in the A-37-1 Crib TSD unit will be designated with an "F001" listed waste code because of the organic solvent discharges associated with that site. The other waste sites did not receive those discharges and will not be assigned "F" listed waste codes.

As previously stated, data generated from the RI (including both the RI-specified sampling and the waste designation sampling) will be used to support waste designation and waste profiles. The waste profiles will be applicable to the IDW from other waste sites within the respective OUs. The waste profiles will be applied to future sampling and remedial actions, as necessary.

2.1 PROBLEM STATEMENT

To correctly designate and appropriately dispose of IDW from borehole sampling in the 200-PW-2 and 200-PW-4 OUs, data are needed regarding radiological and chemical contamination to determine if the IDW is regulated.

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3.0 IDENTIFY THE DECISION

To address the problem statement, a series of principal study questions (PSQ) must be answered. Table 3-1 presents these PSQs and the alternative actions (AA) that will be taken after each PSQ has been answered. Each AA has the possibility of being an incorrect choice. Table 3-1 discusses the consequences of incorrectly choosing each AA, and a qualitative assessment of the severity of the consequences of incorrectly choosing each AA is presented. Finally, the PSQs and AAs are combined into decision statements (DS). All of the DSs must be resolved to satisfy the DQOs for this effort.

Table 3-1. Summary of the Data Quality Objective Step 2 Information. (3 Pages)

PSQ-AA #	Alternative Action	Consequences of Implementing the Wrong AA	Severity of Consequences (Low/Medium/High)
PSQ #1 – Is IDW radiologically contaminated?			
1-1	Yes – Dispose of IDW as radioactive waste.	IDW is not radiologically contaminated. Unnecessary cost of disposal.	Low
1-2	No – Do not manage or dispose of IDW as radioactive waste.	IDW is radiologically contaminated. Wrong packaging, handling, and disposal may affect environment and workers.	Severe
DS #1 – Determine if IDW is radiological contaminated and requires disposal as radiological waste; otherwise do not manage or dispose of as radioactive waste.			
PSQ #2a – Is the material a listed dangerous waste?			
2a-1	Yes – Assign a listed dangerous waste code to the waste.	Unnecessary cost of treating clean material as a listed dangerous waste.	Low to moderate
2a-2	No – Do not assign a listed dangerous waste code to the waste.	Public may be exposed to listed dangerous waste. Waste disposal not in accordance with regulations.	Severe
DS #2a – Determine if the material is a listed dangerous waste and requires the assignment of a listed dangerous waste code; otherwise do not assign a listed dangerous waste code.			
PSQ #2b – Is the material a characteristic waste (e.g., ignitable, corrosive, reactive, toxic)?			
2b-1	Yes – Assign a characteristic waste code to the waste.	Unnecessary cost of treating clean material as a characteristic dangerous waste.	Low to moderate
2b-2	No – Do not assign a characteristic waste code to the waste.	Public may be exposed to characteristic dangerous waste. Waste disposal not in accordance with regulations.	Severe
DS # 2b – Determine if the material is a characteristic waste and requires the assignment of a characteristic waste code; otherwise do not assign a characteristic waste code.			

Table 3-1. Summary of the Data Quality Objective Step 2 Information. (3 Pages)

PSQ-AA #	Alternative Action	Consequences of Implementing the Wrong AA	Severity of Consequences (Low/Medium/High)
PSQ #2c – Is the material a toxic dangerous waste as defined by Washington State criteria?			
2c-1	Yes – Assign a toxic dangerous waste code to the waste.	Unnecessary cost of treating clean material as a toxic dangerous waste.	Low to moderate
2c-2	No – Do not assign a toxic dangerous waste code to the waste.	Public may be exposed to toxic dangerous waste. Waste disposal not in accordance with regulations.	Severe
DS #2c – Determine if the material is a toxic dangerous waste and requires the assignment of a toxic dangerous waste code; otherwise do not assign a toxic dangerous waste code.			
PSQ #2d – Is the material a persistent waste as defined by Washington State criteria?			
2d-1	Yes – Assign a persistent waste code to the waste.	Unnecessary cost of treating clean material as a persistent waste.	Low to moderate
2d-2	No – Do not assign a persistent waste code to the waste.	Public may be exposed to persistent waste. Waste disposal not in accordance with regulations.	Severe
DS #2d – Determine if the material is a persistent waste and requires the assignment of a persistent waste code; otherwise do not assign a persistent waste code.			
PSQ #2e – Is the material a PCB waste?			
2e-1	Yes – Regulate as a PCB waste.	Unnecessary cost of treating clean material as a PCB waste.	Low to moderate
2e-2	No – Do not regulate as a PCB waste.	Public may be exposed to PCB waste. Waste not managed or disposed of in accordance with TSCA regulations.	Severe
DS #2e – Determine if the material is a PCB waste and requires that it be regulated as such; otherwise do not regulate as a PCB waste.			
PSQ #2f – Is the material an asbestos waste?			
2f-1	Yes – Regulate as an asbestos waste.	Unnecessary cost of treating clean material as an asbestos waste.	Low to moderate
2f-2	No – Do not regulate as an asbestos waste.	Public may be exposed to asbestos waste. Waste disposal not in accordance with regulations.	Severe
DS #2f – Determine if the material is an asbestos waste and requires that it be regulated as such; otherwise do not regulate as an asbestos waste.			

Table 3-1. Summary of the Data Quality Objective Step 2 Information. (3 Pages)

PSQ-AA #	Alternative Action	Consequences of Implementing the Wrong AA	Severity of Consequences (Low/Medium/High)
PSQ #3 – Is the material land-disposal restricted?			
3-1	Yes – Handle material as if it were land-disposal restricted.	Unnecessary cost of handling clean material as if it were land-disposal restricted.	Low to moderate
3-2	No – Do not handle material as if it were land-disposal restricted.	Public may be exposed to land-disposal restricted waste. Waste disposal not in accordance with regulations.	Severe
DS #3 – Determine if the material is land-disposal restricted and requires that it be regulated as such; otherwise do not regulate as a land-disposal restricted waste.			

AA = alternative action.
DS = decision statement.
IDW = investigation-derived waste.
PCB = polychlorinated biphenyl.
PSQ = principal study question.
TSCA = *Toxic Substances Control Act of 1976*, 15 U.S.C. 2601, et seq..

3.1 IDENTIFY INPUTS TO THE DECISION

Table 3-2 identifies the DSs where data do not exist or are of insufficient quality to resolve the DSs.

Table 3-2. Information Required to Resolve the Decision Statements.

DS #	Information Needed	Available Data	Is Information Sufficient?
1	Information on radiological composition of waste from boring	*Remedial Investigation DQO Summary Report for the 200-PW-2 Uranium-Rich Waste Group Operable Unit* (BHI-01411) *200-PW-2 Uranium-Rich Process Waste Group Operable Unit RI/FS Work Plan and Process Waste RCRA TSD Unit Sampling Plan* (DOE/RL-2000-60)	No[a, b]
2a	Listed dangerous waste code status		Yes
2b	Characteristic waste code status		No[a]
2c	Toxic dangerous waste code status		No[a, b]
2d	Persistent waste code status		No[a]
2e	Polychlorinated biphenyl concentrations		No[a]
2f	Information regarding asbestos-containing materials		Yes
3	Information regarding land-disposal restricted materials		No[a]

DS = decision statement.

[a] Currently, information to resolve this question does not exist; however, sampling performed in accordance with the data quality objective summary reports for RI of the 200-PW-2 OU (BHI-01411, *Remedial Investigation DQO Summary Report for the 200-PW-2 Uranium-Rich Waste Group Operable Unit*) and the 200-PW-4 OU (CP-14176, *Remedial Investigation DQO Summary Report for the 200-PW-4 General Process Waste Group Operable Unit*) will provide the data to answer these questions.

[b] Currently, information to resolve this question does not exist; however, additional samples for constituents listed in Tables 1-8a and 1-8b will be analyzed in addition to those covered in footnote a (above).

4.0 ANALYTICAL PERFORMANCE REQUIREMENTS

Table 4-1 defines the additional analytical performance requirements for the data that need to be collected to resolve waste designation issues that were not previously identified in DOE/RL-2000-60).

Table 4-1. Analytical Performance Requirements. (5 Pages)

CAS #	Analyte	Survey or Analytical Method	Waste Designation Action Level (pCi/g or mg/kg or as noted)	Required Detection Limits[a] (pCi/g or mg/kg)	Precision Required	Accuracy Required
Radiological Constituents (pCi/g)						
14596-10-2	Americium-241	AmAEA[b]	1	1	±30%	70-130[c]
14234-35-6	Antimony-125	HPGe/GeLi	1	0.3	±30%	70-130[c]
14762-75-5	Carbon-14	Liquid scintillation	1	50	±30%	70-130[c]
13967-70-9	Cesium-134	HPGe/GeLi	1	0.1	±30%	70-130[c]
10045-97-3	Cesium-137	HPGe/GeLi	1	0.1	±30%	70-130[c]
10198-40-0	Cobalt-60	HPGe/GeLi	1	0.05	±30%	70-130[c]
14683-23-9	Europium-152	HPGe/GeLi	1	0.1	±30%	70-130[c]
15585-10-1	Europium-154	HPGe/GeLi	1	0.1	±30%	70-130[c]
14391-16-3	Europium-155	HPGe/GeLi	1	0.1	±30%	70-130[c]
13994-20-2	Neptunium-237	NpAEA[b]	1	1	±30%	70-130[c]
13981-37-8	Nickel-63	Liquid scintillation	1	30	±30%	70-130[c]
13981-16-3	Plutonium-238	PuAEA[b]	1	1	±30%	70-130[c]
Pu-239/240	Plutonium-239/240	PuAEA[b]	1	1	±30%	70-130[c]
13982-63-3	Radium-226	HPGe/GeLi	1	0.2	±30%	70-130[c]
15262-20-1	Radium-228	HPGe/GeLi	1	0.2	±30%	70-130[c]
Rad-Sr	Radiogenic strontium	RADSr	1	1	±30%	70-130[c]
14133-76-7	Technetium-99	Liquid scintillation	1	15	±30%	70-130[c]
TH-232	Thorium-232	ThAEA[b]	1	1	±30%	70-130[c]
15832-50-5	Tin-126	HPGe/GeLi	1	1	±30%	70-130[c]
10028-17-8	Tritium	Liquid separation	1	400	±30%	70-130[c]
13966-29-5	Uranium-233/234	UAEA[b]	1	1	±30%	70-130[c]
15117-96-1	Uranium-235/236		1	1	±30%	70-130[c]
U-238	Uranium-238		1	1	±30%	70-130[c]
Inorganic Chemical Constituents[d] (mg/kg or as noted)						
7440-36-0	Antimony	EPA Method 6010	1.9E+4 (1.15 mg/L TCLP)	6	[e]	[e]

Table 4-1. Analytical Performance Requirements. (5 Pages)

CAS #	Analyte	Survey or Analytical Method	Waste Designation Action Level (pCi/g or mg/kg or as noted)	Required Detection Limits[a] (pCi/g or mg/kg)	Precision Required	Accuracy Required
7440-38-2	Arsenic	EPA Method 6010	100 (5 mg/L TCLP)	10	e	e
7440-39-3	Barium	EPA Method 6010	2,000 (21 mg/L TCLP)	20	e	e
7440-41-7	Beryllium	EPA Method 6010	1.22 mg/L TCLP[f]	0.5	e	e
7440-69-6	Bismuth	EPA Method 6010[g]	h	10	e	e
		EPA Method 6010 ICP (trace)		1	e	e
7440-43-9	Cadmium	EPA Method 6010	20 (0.11 mg/L TCLP)	0.5	e	e
7440-47-3	Chromium (III)	EPA Method 6010	100 (Total Cr 0.60 mg/L TCLP)	1	e	e
7439-92-1	Lead	EPA Method 6010	100 (0.75 mg/L TCLP)	10	e	e
7439-97-6	Mercury	EPA Method 7471	4.0 (0.025 mg/L TCLP)	0.2	e	e
7440-02-0	Nickel	EPA Method 6010	(11 mg/L TCLP)	4	e	e
7782-49-2	Selenium	EPA Method 6010	20 (5.7 mg/L TCLP)	10	e	e
7440-22-4	Silver	EPA Method 6010	100 (0.14 mg/L TCLP)	2	e	e
7664-41-7/ 14798-03-9	Ammonia/ ammonium	Ammonia-350.N[i]	7	0.5	e	e
7440-42-8	Boron	EPA Method 6010	h	2	e	e
57-12-5	Cyanide	EPA Method 9010 total cyanide	Cyanides (total) 590	2	e	e
Organic Chemical Constituents[d] (mg/kg or as noted)						
67-64-1	Acetone	EPA Method 8260	160	0.02	e	e
71-43-2	Benzene	EPA Method 8260	10[d]	0.005	e	e
			0.5[j]			
100-51-6	Benzyl alcohol	EPA Method 8260/8270	h	0.33	e	e
75-27-4	Bromodichloro methane	EPA Method 8260	15	0.005	e	e
79-93-3	2-butanone (MEK)	EPA Method 8260	4,000 (36)[f]	0.02	e	e
111-76-2	2-Butoxyethanol	EPA Method 8015-M	h	5	e	e

Table 4-1. Analytical Performance Requirements. (5 Pages)

CAS #	Analyte	Survey or Analytical Method	Waste Designation Action Level (pCi/g or mg/kg or as noted)	Required Detection Limits[a] (pCi/g or mg/kg)	Precision Required	Accuracy Required
56-23-5	Carbon tetrachloride	EPA Method 8260	10 (6.0)[f] 0.5 (TCLP)	0.005	e	e
108-90-7	Chlorobenzene	EPA Method 8260	2,000 (16)[f]	0.005	e	e
67-66-3	Chloroform (trichloromethane)	EPA Method 8260	120 6 (TCLP)	0.005	e	e
156-60-5	Cis/Trans-1,2-Dichloroethylene	EPA Method 8260	36[h,j] (30)[f]	0.005	e	e
106-46-7	p-Dichlorobenzene	EPA Method 8270	7.5 mg/L (TCLP)	0.33	e	e
75-34-3	1,1-Dichloroethane	EPA Method 8260	6[h,j]	0.01	e	e
107-06-2	1,2-Dichloroethane	EPA Method 8260	10[d]	0.005	e	e
75-35-4	1,1-Dichloro ethylene	EPA Method 8260	(6.0)[f]	0.01	e	e
100-41-4	Ethyl benzene	EPA Method 8260	10[j]	0.005	e	e
60-29-7	Ethyl ether	EPA Method 8015	160	5	e	e
108-10-1	Hexone	EPA Method 8260	33 (0.14)[f]	0.01	e	e
67-56-1	Methanol	EPA Method 8015	0.75 mg/L TCLP	1	e	e
75-09-2	Methylene chloride	EPA Method 8260	36[h,j]	0.005	e	e
1336-36-3	Polychlorinated biphenyls	EPA Method 8082	2	0.02	e	e
108-95-2	Phenol	EPA Method 8270	6.2[h,j]	0.33	e	e
127-18-4	Tetrachloro ethylene (PCE)	EPA Method 8260	14[d] (6.0)[f] 0.7[k]	0.005	e	e
108-88-3	Toluene	EPA Method 8260	10	0.005	e	e
126-73-8	Tributyl phosphate	EPA Method 8270	[h]	4	e	e
71-55-6	1,1,1-Trichloro ethane (TCA)	EPA Method 8260	6.0	0.005	e	e
79-01-6	Trichloroethylene	EPA Method 8260	10[d] (6.0)[f] 0.5[k]	0.005	e	e
75-04-1	Vinyl chloride	EPA Method 8260	6.0	0.01	e	e
1330-20-7	Xylenes	EPA Method 8260	30[f,h]	0.005	e	e
Herbicides (mg/kg)						
94-75-7	2,4-D	EPA Method 8151	[h] 10 mg/L TCLP[l] 10 mg/kg[m]	400	e	e
94-82-6	2,4-DB	EPA Method 8151	[h]	100	e	e

Table 4-1. Analytical Performance Requirements. (5 Pages)

CAS #	Analyte	Survey or Analytical Method	Waste Designation Action Level (pCi/g or mg/kg or as noted)	Required Detection Limits[a] (pCi/g or mg/kg)	Precision Required	Accuracy Required
93-76-5	2,4,5-T	EPA Method 8151	[h] 7.9 mg/kg[m]	20	[e]	[e]
93-72-1	2,4,5-TP (silvex)	EPA Method 8151	[h] 1 mg/L TCLP[l] 7.9 mg/kg[m]	20	[e]	[e]
1918-00-9	Dicamba	EPA Method 8151	[h]	100	[e]	[e]
120-36-5	Dichloroprop	EPA Method 8151	[h]	100	[e]	[e]
88-85-7	DNBP	EPA Method 8151	[h] 2.5 mg/kg[m]	12	[e]	[e]
Pesticides (mg/kg)						
72-54-8	4,4'-DDD	EPA Method 8081	[h] 0.087 mg/kg[m]	3.3	[e]	[e]
72-55-9	4,4'-DDE	EPA Method 8081	[h] 0.087 mg/kg[m]	3.3	[e]	[e]
50-29-3	4,4'-DDT	EPA Method 8081	[h] 0.087 mg/kg[m]	3.3	[e]	[e]
309-00-2	Aldrin	EPA Method 8081	[h] 0.066 mg/kg[m]	1.65	[e]	[e]
319-84-6	Alpha-BHC	EPA Method 8081	[h] 0.066 mg/kg[m]	1.65	[e]	[e]
5103-71-9	Alpha-chlordane	EPA Method 8081	[h]	16.5	[e]	[e]
319-85-7	Beta-BHC	EPA Method 8081	0.066 mg/kg[m]	1.65	[e]	[e]
319-86-8	Delta-BHC	EPA Method 8081	[h] 0.066 mg/kg[m]	1.65	[e]	[e]
60-57-1	Dieldrin	EPA Method 8081	[h] 0.13 mg/kg[m]	3.3	[e]	[e]
959-98-8	Endosulfan I	EPA Method 8081	[h] 0.066 mg/kg[m]	1.65	[e]	[e]
33213-65-9	Endosulfan II	EPA Method 8081	[h] 0.13 mg/kg[m]	3.3	[e]	[e]
1031-07-8	Endosulfan sulfate	EPA Method 8081	[h] 0.13 mg/kg[m]	3.3	[e]	[e]
72-20-8	Endrin	EPA Method 8081	[h] 0.02 mg/L TCLP[l] 0.13 mg/kg[m]	3.3	[e]	[e]
7421-93-4	Endrin aldehyde	EPA Method 8081	0.13 mg/kg[m]	3.3	[e]	[e]
53494-70-5	Endrin ketone	EPA Method 8081	[h]	3.3	[e]	[e]
58-89-9	Gamma-BHC (lindane)	EPA Method 8081	[h] 0.4 mg/L TCLP[l] 0.066 mg/kg[m]	1.65	[e]	[e]

Table 4-1. Analytical Performance Requirements. (5 Pages)

CAS #	Analyte	Survey or Analytical Method	Waste Designation Action Level (pCi/g or mg/kg or as noted)	Required Detection Limits[a] (pCi/g or mg/kg)	Precision Required	Accuracy Required
76-44-8	Heptachlor	EPA Method 8081	[h] 0.008 mg/L TCLP[l] 0.066 mg/kg[m]	1.65	[e]	[e]
1024-57-3	Heptachlor epoxide	EPA Method 8081	[h] 0.066mg/kg[m]	1.65	[e]	[e]
72-43-5	Methoxychlor	EPA Method 8081	[h] 10 mg/L TCLP[l] 0.18 mg/kg[m]	16.5	[e]	[e]
8001-35-2	Toxaphene	EPA Method 8081	[h] 0.5 mg/L TCLP[l] 2.6 mg/kg[m]	165	[e]	[e]

[a] Detection limits are based on optimal conditions in a standard fixed laboratory. Interferences and matrix effects may degrade the values shown.

[b] AmAEA, NpAEA, PuAEA, ThAEA, UAEA = chemical separation, electro/microprecipitation deposition, alpha energy analysis via Si barrier detector.

[c] Accuracy criteria for associated batch laboratory control sample percent recoveries. Except for GEA analysis, additional analysis specific evaluations also preformed for matrix spikes, tracers, carriers as appropriate to the method. Precision criteria for batch laboratory replicate sample analyses.

[d] Waste disposition for this project will comply with the Phase IV *Resource Conservation and Recovery Act of 1976* implementation requirements in accordance with 40 CFR 261.24, "Identification and Listing of Hazardous Waste," "Toxicity Characteristic," and 40 CFR 268.40, "Land Disposal Restrictions," "Applicability of Treatment Standards." This applies to the toxicity characteristic metals and requires performance of TCLP analyses for sample results that exceed the land-disposal restriction threshold values. The totals analysis may be used as an alternative to TCLP. EPA allows the use of 20 times the TCLP values to determine the total action levels because of the "20 times" dilution used in the TCLP process. The dilution is discussed in SW-846, Method 1311. If TCLP analyses are performed, the analyte list will be expanded to include antimony and thallium as potential underlying hazardous constituents.

[e] Accuracy criteria for associated batch matrix spike percent recoveries. Evaluation based on statistical control of laboratory control samples also performed. Precision criteria for batch laboratory replicate matrix spike analyses or replicate sample analysis.

[f] Value reflects the universal treatment standard for the constituent as an underlying hazardous constituent.

[g] Bismuth is an additional requested constituent from EPA Method 6010. If bismuth is the only Washington State toxic waste, the equivalent concentration at 0.001% by weight would be equal to 10 mg/kg, and the super trace method would be required to achieve the lower reliable detection level.

[h] There is no action level for this constituent; it contributes to the Washington State equivalent concentration calculation.

[i] From EPA-600/4-79-020, *Methods of Analysis of Water and Waste.*

[j] Treatment standard as an underlying hazardous constituent in accordance with 40 CFR 268.48, "Land Disposal Restrictions," "Universal Treatment Standards."

[k] 40 CFR 261.24, Table 1.

[l] Federal toxic hazardous waste (TCLP).

[m] Treatment standard as an underlying hazardous constituent in accordance with 40 CFR 268.48 for non-waste waters (applicable value for soils).

AEA = alpha energy analysis.
CAS = Chemical Abstract Service.
EPA = U.S. Environmental Protection Agency.
EPA Methods = SW-846, 1986, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.
GeLi = germanium-lithium (drifted).
HPGe = high-purity germanium.
ICP = inductively coupled plasma.
RCRA = *Resource Conservation and Recovery Act of 1976.*
TCLP = toxicity characteristic leaching procedure.

4.1 SAMPLING DESIGN

A biased (or focused) sampling approach is used in this DQO effort that targets the most appropriate contamination zone for the constituents in the 200-PW-2 and 200-PW-4 waste sites and TSD units. Contaminant distributions are expected to follow relatively predictable patterns based on process knowledge and existing environmental data. The conceptual contaminant distribution models for the 200-PW-2 OU representative waste sites are discussed in Table 1-13 of the 200-PW-2 RI/FS DQO summary report (BHI-01411) and are graphically illustrated in Figures 1-8 through 1-14. The 200-PW-4 OU TSD unit conceptual contaminant distribution models are discussed in Table 1-12 of the 200-PW-4 RI/FS DQO summary report (CP-14176) and illustrated in Figures 10 and 11.

For liquids disposed to the ditches and cribs, the highest contaminant concentration layer is expected to be at the bottom of the waste site. At this layer, the particulates and high-distribution coefficient contaminants were sorbed and/or filtered out of the liquid flow in the native soils at the bottom of the crib/trench. Below this zone, the contaminants are expected to decrease in concentrations with depth, with residual concentrations of the mobile constituents present in the deeper portions of the vadose zone.

4.2 OPTIMAL SAMPLE SIZE THAT SATISFIES THE DATA QUALITY OBJECTIVES

Because judgmental sampling has been applied, a statistical design is not applicable. Soil sampling for waste profile/designation of the IDW will be focused in two soil zones. Sampling of soils for herbicides and pesticides will be performed near the soil surface, where these constituents are most likely to be present. Soil sampling for the other constituents will be performed in the most highly contaminated soil zones.

4.3 SELECTED SAMPLING DESIGN

This DQO effort concludes that the waste designation characterization requirements added the herbicide and pesticide categories as well as 10 specific chemical constituents to the 200-PW-2 OU final analytical list in the RI sampling and analysis plan (Appendix B of DOE/RL-2000-60). These constituents and the applicable depth zones for the additional analyses are identified in Table 4-2a.

In a similar manner, the waste designation characterization requirements added herbicides and pesticides and 13 specific chemical constituents to the 200-PW-4 OU RI final analytical list as shown in Table 4-2b.

Table 4-2a. Key Features of the 200-PW-2 Sampling Design.

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
Herbicides and pesticides		
Borehole characterization at the 200-PW-2 waste sites and/or TSD units	Collect one soil sample from the near-surface backfill soils.	Analysis for these constituents will be performed from the backfill soils near the ground surface to determine the herbicide and pesticide concentrations.
Antimony-125, cesium-134, and tin-126		
Borehole characterization at the 200-PW-2 waste sites and/or TSD units	Collect one soil sample from the highly contaminated zone within the waste site and/or TSD unit.	Analysis for these constituents will be performed from one sample in the most highly contaminated zone to represent IDW for waste designation.
Bismuth, boron		
Borehole characterization at the 200-PW-2 waste sites and/or TSD units	Collect one soil sample from the highly contaminated zone within the waste site and/or TSD unit.	Analysis for these constituents will be performed from one sample in the most highly contaminated zone to represent IDW for waste designation.
Acetone, 2-butanone, toluene, xylene, benzyl alcohol		
Borehole characterization at the 200-PW-2 waste sites and/or TSD units	Collect one soil sample from the highly contaminated zone within the waste site and/or TSD unit.	Analysis for these constituents will be performed from one sample in the most highly contaminated zone to represent IDW for waste designation.

IDW = investigation-derived waste. TSD = treatment, storage, and disposal.

Table 4-2b. Key Features Unique to the 200-PW-4 Sampling Design.

Sample Collection Methodology	Key Features of Design	Basis for Sampling Design
Herbicides and pesticides		
Concrete, soil sampling and borehole characterization at the 200-PW-4 TSD units	Collect one soil sample from the near-surface backfill soils.	Analysis for these constituents will be performed from the backfill soils near the ground surface to determine the herbicide and pesticide concentrations.
Antimony-125, cesium-134, and tin-126		
Concrete, soil sampling and borehole characterization at the 200-PW-4 TSD units	Collect one soil sample from the highly contaminated zone within the waste site and/or TSD unit.	Analysis for these constituents will be performed from one sample in the most highly contaminated zone to represent IDW for waste designation.
Bismuth, boron		
Concrete, soil sampling and borehole characterization at the 200-PW-4 TSD units	Collect one soil sample from the highly contaminated zone within the waste site and/or TSD unit.	Analysis for these constituents will be performed from one sample in the most highly contaminated zone to represent IDW for waste designation.
Bromodichloromethane, ethyl ether, methanol, 1,1-dichloroethylene, vinyl chloride,, benzyl alcohol, 2-butoxyethanol, p-dichlorobenzene		
Concrete, soil sampling and borehole characterization at the 200-PW-4 TSD units	Collect one soil sample from the highly contaminated zone within this TSD unit.	Analyze one soil sample for these constituents from the most highly contaminated zone.

5.0 REFERENCES

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