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Revision 0

Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste

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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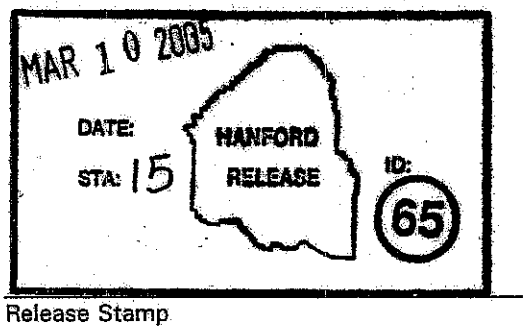

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Abstract:

This document establishes data quality objectives for treating, if necessary, and disposing of retrievably stored waste from burial grounds (e.g., 218-W-4C, 218-W-4B, 218-E-12B, and 218-W-3A) at the Environmental Restoration Disposal Facility.

Approval authorization for disposal at the ERDF of the LLW and MLLW fractions of the RSW and the secondary waste is documented in *Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Time Critical Removal Action Memorandum for Disposal at the Environmental Restoration Facility (ERDF) of Non-Transuranic (TRU) Waste Generated During the M-91 Retrieval Operations at Burial Ground 218-W-4C* (EPA 2004). This report provides a summary of the data quality objectives (DQO) that defines the required decisions and data to disposition this waste. A description of the RSW, secondary waste, and process for retrieval of the waste is provided. Then, the results of each step of the DQO process are described.

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AK	Acceptable Knowledge
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
COPC	contaminant of potential concern
CWC	Central Waste Complex
DQO	data quality objective
ERDF	Environmental Restoration Disposal Facility
GEA	gamma energy analysis
HPGE	high purity germanium detector
IPAN	imaging passive active neutron
LLD	lower limit of detection
LLW	low-level waste
MDA	minimum detectable activity
MDC	minimum detectable concentration
MLLW	mixed low-level waste
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant
PRF	Plutonium Reclamation Facility
PSQ	principal study question
RLS	radioactive lead solids
RMA	Remote Mechanical Line A
RMC	Remote Mechanical Line C
RSW	retrievably stored waste
TBP	tributyl phosphate
TMU	total measurement uncertainty
TCLP	toxicity characteristic leaching procedure
TRU	transuranic
TRU Program	Hanford Site Transuranic Waste Certification Program
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing

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DATA QUALITY OBJECTIVES SUMMARY REPORT FOR DISPOSITION OF THE LOW-LEVEL WASTE FRACTION OF RETRIEVABLY STORED WASTE

1.0 INTRODUCTION

Since 1970, approximately 37,400 suspect-transuranic (TRU) waste containers were placed in retrievable storage at the Hanford Site. The majority of these waste containers (approximately 26,200 drums) are stacked vertically on asphalt pads in earth-covered trenches in the low-level burial grounds. Retrieval of this waste is currently underway. The specific burial grounds and trenches where retrieval operations are expected include Burial Ground 218-W-4C (trenches 1, 4, 7, 20, and 29); Burial Ground 218-W-4B (trenches 7, V-7, and 11); Burial Ground 218-E-12B (parts of trenches 17 and 27); and Burial Ground 218-W-3A (parts of trenches 1, 4, 5, 6, 8, 10, 15, 17, 23, 30, 32, 34, S6, and S9). Retrievably stored waste (RSW) containers that are determined to be low-level waste (LLW) or mixed low-level waste (MLLW) will be treated, if necessary, and disposed of at the Environmental Restoration Disposal Facility (ERDF). Secondary waste generated from retrieval operations will be treated, if necessary, and disposed of at the ERDF.

Approval authorization for disposal at the ERDF of the LLW and MLLW fractions of the RSW and the secondary waste is documented in *Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Time Critical Removal Action Memorandum for Disposal at the Environmental Restoration Facility (ERDF) of Non-Transuranic (TRU) Waste Generated During the M-91 Retrieval Operations at Burial Ground 218-W-4C* (EPA 2004). This report provides a summary of the data quality objectives (DQO) that defines the required decisions and data to disposition this waste. A description of the RSW, secondary waste, and process for retrieval of the waste is provided. Then, the results of each step of the DQO process are described.

1.1 DATA QUALITY OBJECTIVES METHODOLOGY

The DQO process is a seven-step planning process described in EPA QA/G-4, *Guidance for the Data Quality Objectives Process* that is used to plan and coordinate data acquisition for environmental decision making. These are the seven steps in the DQO process:

1. State the problem.
2. Identify the decision.
3. Identify the inputs to the decision.
4. Define the study boundaries.
5. Develop a decision rule.
6. Specify acceptable limits on decision errors.
7. Optimize the design.

A brief description of each of these steps and their results is provided in Sections 2.0 through 8.0 of this report.

1.2 PROJECT SCOPE AND ASSUMPTIONS

Waste from Burial Ground 218-W-4C that is covered under the time-critical removal action (EPA 2004) includes the following:

- LLW debris fraction of the RSW contained in drums,
- MLLW debris and radioactive lead solids (RLS) fraction of the RSW contained in drums, and
- Secondary wastes generated by waste retrieval operations; e.g., personal protective equipment, wood, plastic, paper, metal, and soil.

These DQOs do not currently address all of the waste covered under the time-critical removal action (EPA 2004). This revision of the DQOs is currently limited to RSW debris/RLS waste from the Plutonium Finishing Plant (PFP) original waste-generating source and suspect-contaminated secondary waste from retrieval operations. LLW debris, MLLW debris and RLS packaged in a container other than a drum, and RSW in other burial grounds (i.e., 218-W-3A, 218-E-12B, and 218-W-4B) are not covered under these DQOs. The disposition of this waste will be addressed by subsequent *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) actions. These DQOs will be revised, as required, to include RSW from other original waste-generating sources and contaminated secondary waste.

As stated above, the LLW and MLLW fractions of the drummed, debris RSW are from several original waste-generating sources. For purposes of discussion in these DQOs, when the term debris is used, RLS is included. A list of the original waste-generating sources for RSW in Burial Ground 218-W-4C is provided in Table 1-1 based on the tracking code from the solid waste information and tracking system.

Radiological and chemical characterization is developed for the RSW based on the original waste-generating source. The methodology used to develop a waste stream characterization is the Acceptable Knowledge (AK) documentation process established by the Hanford Site Transuranic Waste Certification Program (TRU Program). This process was developed to meet the acceptance requirements for the Waste Isolation Pilot Plant (WIPP) and is also being used for the RSW. AK is used to meet all or part of the waste characterization requirements as an alternative to sampling and analysis. AK is described in OSWER 9938.4-03, *Waste Analysis at Facilities That Generate, Treat, Store, and Dispose of Hazardous Wastes, a Guidance Manual.* AK provides a basis for defining the waste stream and includes a number of techniques used to characterize a waste stream, such as process knowledge, historical records of analyses, and other supplemental sampling and analysis data. Additional discussion on the AK process is described in Section 1.4.

During the development of the DQOs, the following conditions were established:

- Waste that complies with the ERDF waste acceptance criteria (WAC) or that can be treated to comply with the ERDF WAC will be disposed of at the ERDF.

- The LLW and MLLW debris fractions of RSW will be radiologically characterized using radioassay and process knowledge. The minimum data requirements for the radioassay are established in these DQOs.

Table 1-1. Burial Ground 218-W-4C RSW Original Waste-Generating Sources.

Tracking Code	Waste-Generating Source
308 Facility	Plutonium Fabrication Pilot Plant (Plutonium Laboratory and Fuels Development Laboratory)
318 Facility	High Temperature Lattice Test Reactor
324	Chemical Engineering Laboratory
325	Radiochemistry Building
340	Retention and Neutralization Complex
105KE	Battelle Northwest Laboratory
105N	Plutonium production reactor, Reactor operation experimentation Domestic power production
1706K	Plutonium production reactor, Reactor operation experimentation
200W	Unspecified locations in the 200 West Area
202A /202AL	Plutonium Uranium Extraction Plant
209E	Critical Mass Laboratory
216Z9	PFP Complex Building and Crib
222S	REDOX Control Laboratory
231Z	Isolation Building (Concentration Building) Plutonium metallurgical laboratory
233S	Plutonium Concentration Facility
2345Z	Plutonium Finishing Plant
2WTF	West Tank Farms
327/327C	Radiometallurgy Building
BABCX	Babcox and Wilcox
BATCO	Battelle Columbus Laboratory
BETTS	Bettis Atomic Power Laboratory
CUPRC	Center for Energy and Environmental Research
ESG	Rocketdyne Energy Systems Group
EXXON	Exxon Nuclear Systems
LBLAB	Lawrence Berkeley Laboratory
MCGEE	Kerr-McGee, Cimarron Plutonium Fuel Fabrication Facility
VAL	General Electric - Vallecitos Nuclear Center
WARD	Westinghouse Advanced Reactor Division

During the development of the DQOs, the following concerns were raised. These concerns were factored into the decisions and data requirements.

- MLLW is required to be treated to meet land disposal restriction requirements. Because of the age of the waste and the limited historical information that may be available on the waste containers, the accuracy of the waste contents as described on the original waste paperwork is in question. Items/waste may be present that could impact the designation or treatment requirements, or otherwise be restricted at the ERDF. A verification program will be implemented as required by the ERDF WAC using the acceptable tolerable decision errors defined in this document.

- Process knowledge alone will not be used to radiologically characterize a RSW container to be eligible for disposal at the ERDF. Secondary waste may be characterized without the use of radioassay. The data requirements in these DQOs will be reviewed and updated prior to disposing of RSW that has not been subjected to radioassay.

1.3 RETRIEVAL INFORMATION

In 1970, the U.S. Atomic Energy Commission defined TRU waste as a separate waste category and declared that TRU waste must be retrievable. From 1970 on, suspect-TRU waste (identified as waste known or suspected to contain TRU elements) was separated from LLW and retrievably stored in the 200 Area burial grounds. In 1973, the U.S. Atomic Energy Commission changed the definition of TRU waste to waste containing greater than 10 nCi/g of TRU radionuclides. The definition of TRU was changed again in 1984 to specify only waste containing greater than 100 nCi/g of TRU radionuclides. Therefore, some of the suspect-TRU waste placed in retrievable storage is now defined as LLW. The process for retrieval and characterization of this non-TRU fraction of the RSW is shown in Figure 1-1. This section provides information on the process for identifying and characterizing RSW and an overview of the secondary waste expected to be generated by the project.

1.3.1 Waste Stream Identification and Characterization

Information on the characterization of the RSW is gathered as part of the retrieval planning process. Based on a review of records for the waste containers in 218-W-4C, the original waste-generating sources were identified. These original waste-generating sources are identified in Table 1-1. This list is subject to change as additional characterization data is gathered. For each original waste-generating source and waste stream, an AK documentation package is developed. A waste stream is any waste material generated from a process or activity that is similar in material, physical form, hazardous constituents, and radiological constituents. Information on the AK documentation process is provided in Section 1.4. The AK documentation is used to develop the contaminants of potential concern (COPC), contaminants of concern (COC), and designation.

1.3.2 Container Identification and Waste Source Assignment

As part of retrieval activities, each RSW container is identified from historical disposal records. The waste record for each container is reviewed against the AK documentation and designation. The container contents and packaging information are reviewed. A determination is made if the original waste-generating source, waste stream categorization, and designation are applicable. If any differences are identified, the container is placed in a category for further evaluation to determine the appropriate disposition pathway.

1.3.3 TRU/LLW Determination

As part of retrieval activities, the determination of TRU radionuclide content for each RSW container is accomplished by one of two methods: radioassay in combination with process knowledge or process knowledge review alone. Radioassay provides an isotopic inventory for the TRU isotopes as defined in DOE M 435.1-1, *Radioactive Waste Management Manual* (e.g., ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Am), and for certain other isotopes (e.g., ^{241}Pu, ^{90}Sr). Process knowledge review uses original waste documentation and knowledge of the waste source to estimate isotopic inventory.

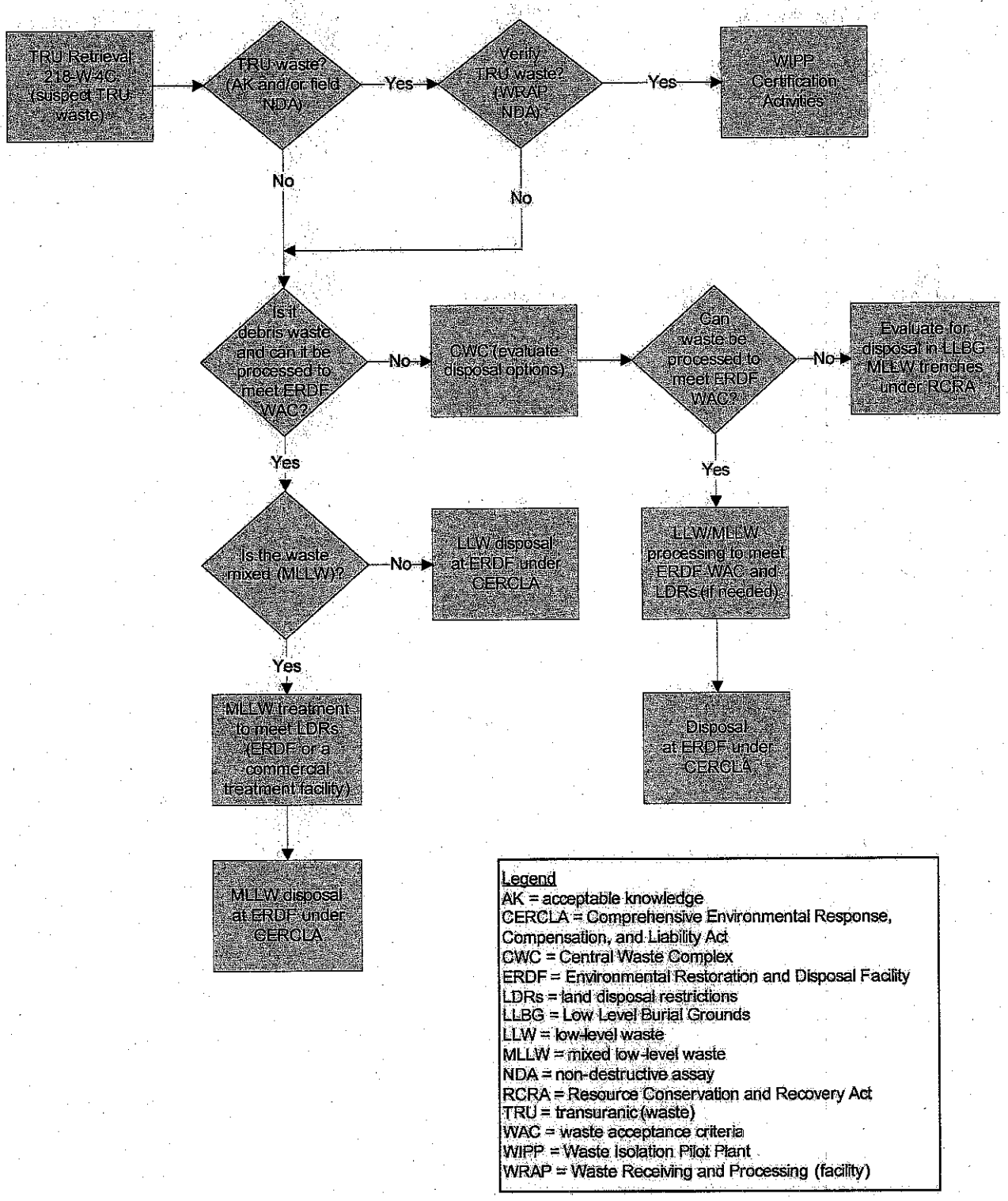
RSW containers may be determined to be TRU through process knowledge alone and be sent directly to venting and/or staging for shipment. All remaining suspect-TRU waste is sorted into TRU or non-TRU using a mobile radioassay unit. Waste determined to be TRU using this mobile radioassay unit will be processed through WIPP certification activities, including a radioassay at the Waste Receiving and Processing (WRAP) Facility.

At this time, the LLW determination for all RSW drums that are candidates for disposal at the ERDF will be made using radioassay results. The radioassay results will either be from the mobile radioassay unit or from the WRAP radioassay. RSW drums determined, through radioassay, to be non-TRU will be evaluated for treatment and subsequent disposal at the ERDF. Waste drums determined to be non-TRU through process knowledge alone are not currently eligible for disposal at the ERDF and will be further evaluated to determine the appropriate disposition pathway. This DQO may be revised to include the data requirements for determining radiological characterization based on process knowledge alone.

1.3.4 Secondary Waste Generation

Secondary waste is generated during retrieval activities and could consist of debris and/or soil. Non-debris waste (e.g., soil) will be segregated from debris. Material that is found, by using portable survey instruments, to contain detectable contamination or is visibly contaminated will be segregated and evaluated further to determine the appropriate disposition pathway. The secondary waste soil is separate from the RSW drums that contain contaminated soils. The process for dispositioning this waste is not shown in Figure 1-1.

Figure 1-1. Waste Retrieval Process Flow for RSW.



1.3.5 Radioassay Capabilities

RSW is radioassayed using either a mobile radioassay unit located at the Retrieval Site or radioassay units located at the WRAP Facility. A qualified contractor provides the mobile nondestructive assay equipment and services. At WRAP, measurements are obtained using gamma energy radioassay and/or imaging passive/active neutron systems.

Currently, the mobile radioassay services are provided by ANTECH. The primary purpose of the mobile radioassay system is to accurately and reliably identify and quantify radionuclides with sufficient confidence to distinguish TRU waste from non-TRU waste. The nondestructive assay system is required to report a minimum detectable concentration (MDC) of TRU isotopes sufficiently below 100 nCi/g to determine TRU from LLW (and nominally at 60 nCi/g or lower). The ANTECH Portable Drum Assay System consists of four gamma ray measurement stations situated in a mobile transport container. Each station has a separate drum rotator and consists of a far field measurement using a collimated and shielded high purity germanium detector (HPGe) in a support frame connected to a high resolution gamma ray spectroscopy system. The drum is measured on a rotating turntable to even out heterogeneities in the waste matrix. Control and analysis uses the ORTEC GAMMAVISION[1] and ISOTOPIC software for the identification and quantification of radionuclides.

The primary purpose of the WRAP facility nondestructive assay is to perform measurements for disposal of TRU waste at the WIPP. The WRAP facility has two types of assay systems: gamma energy analysis (GEA) and imaging passive active neutron (IPAN). WRAP is redundant in both system types and separates the units as A and B (GEA-A and GEA-B; IPAN-A and IPAN-B.) The GEA units contain four HPGe detectors which, when coupled with moving the drum through three vertical platform positions, breaks a drum into 10 assay segments. Four transmission sources are located directly opposite each HPGe detector. These sources are used to directly measure the attenuation of the matrix for that vertical segment. The analysis software used on the system is the Genie PC-based Gamma Waste Assay Software.

Numerous factors affect the MDC reported by the analysis system. Examples include the detector to sample calibration geometry, detector resolution, detector efficiency, sample density, sample elemental composition, spatial distribution of activity material, self attenuation of source materials, containers, energy of the photopeak of interest, and especially background contributions. The background contributions may be of two types, activity produced by sources external to the sample (ambient background) and background activity produced by sources internal to the sample.

The basis for determining the MDC is documented for each assay system. In general, the errors associated with the above factors are factored into the analysis software and the analysis of the data.

A quantitative comparison of the MDCs is <11 nCi/g for the ANTECH system and <100 nCi/g for the WRAP system. Note that these are typical numbers and are dependent on several factors,

[1]GAMMAVISION is a registered trademark of GAMMAFLUX L.P.. Sterling, Virginia.

such as the count time and matrix. They are also not directly comparable because of the differences in the units, software, and analysis techniques.

1.3.6 Treatment and Disposal Decisions

LLW and MLLW (including RSW and secondary waste) will be characterized and evaluated using the decision rules in these DQOs to determine if it is eligible for treatment (if required), processing (if required) and subsequent disposal at the ERDF. If a container meets all of the applicable treatment, transportation, and waste acceptance criteria, it will be prepared and transported for treatment (if required), processing (if required), and disposal. Unvented containers with the potential for generating gases above acceptance criteria limits are vented.

1.4 BACKGROUND INFORMATION

Characterization information for each RSW waste stream is compiled using AK documentation methods established by the TRU Program to meet WIPP requirements. AK documentation is developed using information sources such as process knowledge, records of analysis, and sampling and analysis data. Secondary waste characterization information is developed using similar methods but is not covered by the TRU Program scope.

AK documentation includes this information:

- Waste-generating source facility and/or process; e.g., weapons production, maintenance, fuel reprocessing, research and development facility stabilization, decontamination and decommissioning,
- Dates of waste generation,
- Physical waste form and waste material parameters; e.g., plastic, metal, glass, rubber,
- Hazardous/dangerous constituents regulated by the *Resource Conservation and Recovery Act of 1976* and the *Washington Administrative Code,* and
- Radiological constituents.

RSW may have been generated during deactivation, stabilization, and/or decontamination and decommissioning of facilities used prior to 1970. Facility missions and processes prior to 1970 are included in the AK documentation when they contribute to the RSW characterization.

This section contains a summary of the available information on the PFP debris and suspect-contaminated secondary waste streams.

1.4.1 PFP Debris Waste Stream

For the PFP debris waste stream, Table 1-2 lists the references reviewed as part of the scoping process and provides a brief narrative of the pertinent information contained in each reference.

The PFP began operating in 1949 to meet the increasing demands for plutonium to support Cold War efforts. The PFP processed plutonium nitrate to create buttons in the Remote Glove Line. The Remote Mechanical Line A (RMA) was a partially remote line that replaced the Remote Glove Line in 1952. Beginning in the late 1960s, the RMA was used exclusively to produce plutonium oxide. In 1960, the Remote Mechanical Line C (RMC) began and ran concurrently with the RMA to produce buttons and oxides.

Processes carried out in the Plutonium Reclamation Facility (PRF) and the laboratories supported the activities in the remote mechanical lines. The laboratories began operations in 1949, providing analytical and process development support. The PRF began operations in 1964, providing recovered plutonium as feed for the remote mechanical lines.

The following are areas from which the waste was generated, the time of generation, and a brief description of the activities:

- RMA: Waste generated from 1970 to the present from Room 235 of the 234-5Z Building. Waste was generated in support of plutonium button and oxide production and in support of reactive scrap stabilization of RMC oxalate, oxide, PRF sludge, and scrap from plutonium button and oxide campaigns using thermal treatment and solidification of sand, slag, and crucible waste using cementation.

- RMC: Waste generated from 1970 to the present from Room 228 and Room 230 of the 234-5Z Building. Waste was generated from activities associated with plutonium operations as well as stabilization of reactive plutonium materials, such as oxalate, oxide and PRF sludge.

- PRF: Waste generated from 1970 to the present from the 236-Z Building. Waste was generated in support of plutonium recovery using extraction during the plutonium button and oxide campaigns.

- Laboratories (Analytical and Plutonium Process Support): Waste generated from 1970 to the present. Waste was generated in support of the last plutonium button campaign and reactive scrap stabilization.

- 232-Z (Incinerator): Waste generated from 1970 to the present. Waste generated from clean-out activities.

- 2736-ZB: Waste generated from 1970 to the present. Waste generated from repackaging and assaying packages from areas within the PFP.

Table 1-2. Existing Documents and Data Sources for PFP Debris Waste.

Reference	Summary
WHC-EP-0223, 1989, *Stored, Contact-Handled Transuranic Waste Characterization at the Hanford Site*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.	Provides the plan for characterizing contact-handled transuranic waste using existing records, random sample nondestructive evaluation/nondestructive assay, and visual examination.
WHC-EP-0225, 1991, *Contact-Handled Transuranic Waste Characterization Based on Existing Records*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.	Provides baseline information on RSW content, volumes, characterization, and weights for waste received from onsite and offsite generating locations from 1970 through 1988.
WHC-EP-0659, 1993, *Characterization of Past and Present Solid Waste Streams from 231-Z*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.	Provides characterization data on radioactive solid waste generated at 231-Z based on process knowledge, existing records, and interviews.
WHC-EP-0621, 1992, *Characterization of Past and Present Solid Waste Streams from the Plutonium Finishing Plant (PFP)*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.	Provides characterization data on radioactive solid waste generated at the PFP based on process knowledge and existing records.
HNF-EP-5482, 2002, *Hanford Site Transuranic Waste Management Acceptable Knowledge Documentation for the Plutonium Finishing Plant*, Rev. 6, Fluor Hanford, Richland, Washington.	Contains a description of the PFP facility history and processing. Includes specific locations where waste was generated and chemicals used in the PFP complex.
HNF-EP-6489, 2003, *Hanford Site Transuranic Waste Management Acceptable Knowledge Documentation for the Plutonium Finishing Plant, Mixed Debris*, Rev. 15, Fluor Hanford, Richland, Washington.	Provides information regarding hazardous waste determination, packaging methodology, presence or absence of prohibited items, and radionuclide inventory.
Solid Waste Storage/Disposal Records	Provides inventory sheets, radionuclide information, and material weights on each PFP waste container.

PFP = Plutonium Finishing Plant.

1.4.1.1 Physical Waste Description. The waste consists of debris from the operational and decontamination and decommissioning activities; e.g., maintenance, clean-out, decontamination, decommissioning, stabilization. The debris wastes were comingled with chemicals within the gloveboxes. Waste materials include inorganic debris (lead [gloves]; iron-based metal; aluminum-based metal [hot plates, nuts, bolts, tubing, pipes, pumps]; glass; ceramics; asbestos [pot liners]) and organic debris (plastic [bags, liners]; rubber [gaskets, surgeon's gloves]; paper; cloth; wood). Waste packaging includes plastic, cloth (Conweb pads), and diatomaceous earth.

The PFP used administrative controls such as operating procedures and policies to regulate the physical, chemical, and radionuclide content of the waste. In the Analytical Laboratory, debris materials that were potentially contaminated with chemicals (e.g., pipettes) were required by procedure to be managed separately. Corrosive, ignitable, reactive, explosive, pyrophoric, and oxidizing wastes were prohibited in the debris waste by procedure. Free liquids, unreacted calcium, unvented gas cylinders, acid or caustic soaked rags, and absorbed materials were also prohibited.

The waste materials expected to be present that could potentially contain dangerous waste constituents include dry cell batteries, lead gloves, dried paint, and fluorescent light tubes.

Non-RSW containers from this same waste stream have been subjected to WIPP certification activities. Waste items have been identified that are not eligible for macroencapsulation or that do not meet the ERDF WAC. These types of restricted items include, for example, inner containers of liquid and mercury thermometers.

1.4.1.2 Radionuclides. Before and during the 1950s, the PFP remote mechanical lines used defense grade plutonium with a ^{240}Pu weight percentage less than 6%. Defense grade plutonium metals and oxides were in high demand up to the mid-1960s, but in 1965 the need for defense grade plutonium diminished. Then the mission of the complex turned toward fuels and reactor grade plutonium activities to support the commercial nuclear industry. The PFP Complex processed fuels and reactor grade material with varying concentrations of ^{240}Pu from 12% to 27% for experimental breeder reactor technology (e.g., Fast Flux Test Facility) and commercial reactors, but most of the fuels grade plutonium material was 12%. Fuels and reactor grade work ended in 1978 for both the RMA and the RMC. Defense work continued until shutdowns of the RMA and the RMC in 1983 and 1989, respectively.

Plutonium product specifications allowed for elemental impurity concentrations from between 50 and 500 ppm. These trace elements include americium, calcium, carbon, iron, nickel, neptunium, thorium, and uranium. Other radionuclides identified during radioassay or present from the decay of these radionuclides are provided in Section 1.5.

1.4.2 Secondary Waste Stream

Secondary waste streams generated during waste retrieval could consist of debris and/or soil. Non-debris waste (e.g. soil) will be segregated from debris. Material that contains detectable contamination using portable survey instruments or that is visibly contaminated will be segregated and evaluated further to determine the appropriate disposition pathway. The secondary waste soil is separate from the RSW drums that contain contaminated soils.

1.4.2.1 Physical Waste Description. Secondary wastes generated by waste retrieval operations could include soil or debris such as used personal protective equipment, wood, plastic, paper, and non-regulated metals (e.g., iron, aluminum, copper).

The debris waste consists of materials such as wood (generally pallets and plywood) used in supporting or protecting the waste packages, tarps, and personnel protective equipment generated during retrieval operation. Waste associated with the wood dunnage (plastic strapping, tape, staples, nails, etc.) could also be included. Trace amounts of soil may remain on the waste. The debris is considered suspect-contaminated; due to its porous nature, it cannot be surveyed for radiological release.

Waste soils will either be uncontaminated soil and managed as LLW (radioactive only) or contaminated and evaluated further to determine the appropriate disposition pathway.

1.4.2.2 Radionuclides. Radiological surveys are performed on the secondary waste to determine if any contamination is present. Surveys are conducted using programmatic guidance and procedures from the Hanford Site radiological control program. Typically, for removable contamination, the minimum detectable activities (MDA) are <1000 dpm/100 cm^2 beta-gamma and <20 dpm/100 cm^2 alpha. For total contamination (i.e., direct surveys), the MDAs are <5000 dpm/100 cm^2 beta-gamma and <100 dpm/100 cm^2 alpha.

Debris with no measurable quantities of contamination is suspected to be contaminated with radionuclides found in the 200 Area soils. As a bounding assumption, each cubic meter of debris is assumed to contain 280 grams of Hanford soil. Radionuclide inventories in soil are estimated from PNNL-13230, *Hanford Site Environmental Report for Calendar Year 1999*, Section 3.2, "Near-Facility Environmental Monitoring." Table 1-3 provides the isotopic inventory used for suspect-contaminated secondary waste based on data from this report.

Table 1-3. Isotopic Inventory for Suspect-Contaminated Secondary Waste.

Isotope	Reported Concentration in Soil (pCi/g)[1]	Concentration in Secondary Waste (Ci/m3)
^{90}Sr	5.9 ± 1.2	$\leq 1.99 \times 10^{-06}$
^{137}Cs	9.6 ± 1.3	$\leq 3.05 \times 10^{-06}$
^{234}U	0.49 ± 0.17	$\leq 1.85 \times 10^{-07}$
^{235}U	0.048 ± 0.034	$\leq 2.30 \times 10^{-08}$
^{238}U	0.50 ± 0.20	$\leq 1.96 \times 10^{-07}$
^{239}Pu / ^{240}Pu	0.6 ± 0.2	$\leq 2.24 \times 10^{-07}$

[1] ± counting error. Counting error included in determining isotopic concentration in waste.

1.5 CONTAMINANTS OF CONCERN

COCs are the radiological and chemical constituents in the waste that contribute to the waste characterization or are otherwise required to be reported under the ERDF WAC. To obtain the COC, a list of the COPCs is first compiled. COPCs are the potential sources of contamination from the original waste-generating source. The COPCs for the PFP debris waste are compiled using the AK documentation, the solid waste information tracking system, and information gathered on the waste through retrieval and WIPP certification efforts. The COPCs for the secondary waste stream are compiled from information on the characterization of Hanford Site soils. COPCs for which process knowledge and/or analytical data are sufficient to confirm that they are not present, or are not reasonably expected to be in the waste stream are excluded to obtain the COCs. Hazardous/dangerous constituents below regulatory thresholds are also excluded. Radionuclides are excluded when they are naturally occurring and have not been concentrated in the waste. The exclusions and rationale are provided in this section.

1.5.1 Contaminants of Potential Concern

Table 1-4 identifies the COPC for PFP debris waste stream and the suspect-contaminated secondary waste stream, including the known or suspected sources of contamination, the type of contamination, and affected environmental media.

Table 1-4. Contaminants of Potential Concern.

Waste source	Type of contamination (general)	Contaminants of potential concern (specific)
PFP debris	Chemicals from debris waste including laboratory operations	Hydrobromic acid, ferrous ammonium sulfate, silicon oxide, ferric nitrate, dibutyl phosphate, bis (2-ethylhexyl) phthalate, plutonium II oxide, nickel hydroxide, plutonium dioxide, 2,4-dinitrotoluene, ammonium chloride, chloride, tributyl phosphate, barium oxide, calcium hydroxide, calcium oxide, cadmium oxide, chromic oxide, cadmium hydroxide, ferric oxide, magnesium oxide, lead dioxide, potassium hydroxide, sodium hydroxide, lead hydroxide, manganese dioxide, nickel monoxide, zinc oxide, manganese oxide, lead monoxide, calcium carbonate, aluminum oxide, uranium dioxide, hydroxylamine nitrate, aluminum III nitrate (1:3), tellurium, ethanolamine, oxalic acid, plutonium nitrate (solution), chromium III, monobutyl phosphite, fluoride, lead chromate oxide, silver (1+) oxide, mercuric oxide, acetic acid, (1,2-cyclohexylenedinitrilo) tetra-, sodium carbonate, 2-bromo-2-nitro-1,3-propanediol, sulfamic acid, C.I. acid orange 52, carbon tetrachloride, zinc chloride, sodium acetate, diatomaceous earth, acetic acid, propane, aluminum, iron, lead, manganese, mercury. molybdenum, nickel, silver, tin, antimony, arsenic, barium, beryllium, cadmium, carbon, chromium, copper, yttrium, zinc, bismuth, calcium, silicon dioxide, sodium nitrate, zinc chloride, hydrochloric acid, sodium chloride, phosphoric acid, sulfuric acid, sodium bisulfate, sodium fluoride, nitric acid, hydrogen peroxide, cuprous chloride, lead chromate, dipotassium dichromate, graphite, selenium, silver chloride, potassium fluoride, calcium fluoride, soda lime, kerosene, dimethylaminepheylazobenzoic acid sodium salt, povidone
	Plutonium Reclamation Facility chemicals	Tributyl phosphate, carbon tetrachloride, aluminum nitrate nonahydrate, hydroxylamine nitrate, and nitric acid. Sodium hydroxide was used in the hydrolysis process in 234-5Z Building, Room 230-C, Glovebox 60 supported PRF miscellaneous treatment processes.
	Chemicals used in the RMA and RMC	Nitric acid, hydrogen peroxide, oxalic acid, potassium permanganate, hydrogen fluoride, calcium, iodine, magnesium, and potassium hydroxide
	Radionuclides	^{60}Co, ^{40}K, ^{22}Na, ^{90}Sr, ^{90}Y, ^{137}Cs, ^{137m}Ba, ^{152}Eu, ^{154}Eu, ^{233}Pa, ^{233}U, ^{234m}Pa, ^{234}U, ^{235}U, ^{235m}U, ^{237}Np, ^{238}U, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, ^{231}Th, ^{243}Cm
Suspect-Contaminated Secondary Waste	Radionuclides	^{90}Sr, ^{137}Cs, ^{234}U, ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu

PFP = Plutonium Finishing Plant.
RMA = Remote Mechanical Line A.
RMC = Remote Mechanical Line C.

1.5.2 COPCs Exclusions

Table 1-5 lists the excluded COPCs. The rationale for these exclusions is typically based on process knowledge or regulatory limits.

Table 1-5. Excluded Contaminants of Potential Concern. (4 sheets total)

Waste source	Contaminants of potential concern	Rationale for exclusion
PFP debris	Chemicals used in the Remote Mechanical Line A (RMA) and Remote Mechanical Line C (RMC)	Used nitric acid solution was sent to the Plutonium Reclamation Facility (PRF) to recover plutonium. The hydrogen peroxide solution was destroyed within the initial stage of the process by reacting with the plutonium and nitric acid mixture. The oxalic acid was destroyed within the process by reactions with potassium permanganate, nitric acid, and heat. Potassium permanganate solution was sent to the PRF for further oxalic acid decomposition. Excess hydrogen fluoride was exhausted as offgas and then treated with potassium hydroxide to neutralize the gas. The resultant mixture, potassium fluoride, was disposed of as high-salt waste at the Liquid Waste Treatment Facility (241-Z Building). Potassium hydroxide was not directly a part of the line process. Calcium, iodine, and magnesium fragments were swept up with crucible fragments and reprocessed at the PRF.

Table 1-5. Excluded Contaminants of Potential Concern. (4 sheets total)

Waste source	Contaminants of potential concern	Rationale for exclusion
	PRF chemicals	In general, spent liquid wastes were sent to the tank farm system and the 241-Z Waste Treatment Facility or through organic rework. The used tributyl phosphate (TBP) was processed through organic cleanup columns and then reused. Only small amounts would stay with the distillate product, but some of the TBP was stripped by the carbon tetrachloride within the disengager tank. Additionally, low-pressure steam at 135 °C or lower in the product concentrator stripped the TBP from the plutonium product. Most of the degraded TBP was sent to the 241-Z Waste Treatment Facility, and the balance was downloaded with carbon tetrachloride and send to the Central Waste Complex as solid waste. The majority of the carbon tetrachloride was removed with the TBP because of its low solubility. Low-soluble constituents tend not to break down in the presence of an aqueous solution, so the low-soluble constituent stays separate from the aqueous solution. Only traces of the carbon tetrachloride remained with the TBP. Because carbon tetrachloride has a boiling point of 76.76 °C, it was stripped away by low-pressure steam at 135 °C. Sodium hydroxide was used to neutralize the solvent extraction waste stream prior to disposal at the tank farms. Carbon tetrachloride did not reach the RMC and RMA. After the TBP/carbon tetrachloride stripped the plutonium from the feed stream, aluminum nitrate nonahydrate left the top of the 1st stage column as waste. The hydroxylamine nitrate was destroyed during the process by a reaction with nitrous acid, which was formed in a reaction between the hydroxylamine nitrate and the nitric acid. Nitric acid was recycled back into the process. The gelatinous plutonium oxide was transferred to the PRF, Room 41, Glovebox MT-5. Hydrolysis waste solutions were filtered and tested. If the organic content was below prescribed limits, the remaining supernate was disposed in the D-4 waste discharge system. Solutions containing high organic and high plutonium content were reprocessed. Since the solution was heated from 95 °C to 110 °C for up to 2 hours, the butyl alcohol stayed in the vapor phase and was vented through the glovebox ventilation system.
	Radionuclides	Potassium is found in soil, cement, limestone, and wood and should be expected to be naturally occurring within the waste stream. No processes are expected to have concentrated the potassium.

Table 1-5. Excluded Contaminants of Potential Concern. (4 sheets total)

Waste source	Contaminants of potential concern	Rationale for exclusion
	Chemicals: hydrobromic acid, ferrous ammonium sulfate, silicon oxide, ferric nitrate, dibutyl phosphate, bis (2-ethylhexyl) phthalate, plutonium II oxide, nickel hydroxide, plutonium dioxide, 2,4-dinitrotoluene, ammonium chloride, chloride, TBP, barium oxide, chromic oxide, ferric oxide, magnesium oxide, manganese dioxide, nickel monoxide, zinc oxide, manganese oxide, lead monoxide, calcium carbonate, aluminum oxide, uranium dioxide, hydroxylamine nitrate, aluminum III nitrate (1:3), tellurium, ethanolamine, oxalic acid, plutonium nitrate (solution), monobutyl phosphite, fluoride, acetic Acid, (1,2-cyclohexylenedinitrilo) tetra-sodium carbonate, bronopol, sulfamic acid, C.I. acid orange 52, zinc chloride, sodium acetate, diatomaceous earth, acetic acid, propane, aluminum, iron, manganese, molybdenum, tin, antimony, beryllium, carbon, copper, yttrium, zinc, bismuth, calcium, silicon dioxide, sodium nitrate, zinc chloride, hydrochloric acid, sodium chloride, phosphoric acid, sulfuric acid, sodium bisulfate, sodium fluoride, nitric acid, hydrogen peroxide, cuprous chloride, lead chromate, dipotassium dichromate, graphite, selenium, silver chloride, potassium fluoride, calcium fluoride, kerosene, dimethylaminephenylazobenzoic acid, sodium salt, providone	Not regulated under WAC 173-303 or below regulatory levels. Designation and concentration are documented in Waste Services Memo, 3/31/04.

Table 1-5. Excluded Contaminants of Potential Concern. (4 sheets total)

Waste source	Contaminants of potential concern	Rationale for exclusion
	Chemicals: 2-methoxyethanol, acetone, asbestos, barium sulfate, benzotriazole, bisphenol-A-epichlorohydrin copolymer, butanedioic acid, polyisobutenyl, citric acid, coal tar pitch, diatomaceous earth, dimethylaminoethanol, ethanol, 2-butoxy, ether alcohol, ethyl acetate, ethyltriacetoxysilane, iron oxide, isopropanol, isopropyl alcohol, magnesium silicate, methanol, methylene chloride, methyltriacetoxysilane, N-butyl alcohol, nitric acid, oxalic acid, phosphorodithoic acid 01, 0-D1 C1-14-alkylesters, zinc salts, polyamide resins, polyethylene, propane, propylene glycol monomethyl ether, silica, sodium hydroxide, titanium dioxide, toluene, VM & P naphtha, vermiculite, xylene, zinc, zinc dust, zinc oxide	Not regulated under WAC 173-303 or below regulatory levels. Designation and concentration are documented in Waste Services Memo, 4/04.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

1.5.3 Final List of COCs

Table 1-6 provides the COCs for the PFP debris waste stream and suspect-contaminated secondary waste streams.

Table 1-6. Final List of Contaminants of Concern.

Waste source	Contaminants of concern
PFP debris	Radionuclides[1]: ^{60}Co, ^{90}Sr, ^{90}Y, ^{137}Cs, ^{137m}Ba, ^{152}Eu, ^{154}Eu, ^{233}Pa, ^{233}U, ^{234m}Pa, ^{234}U, ^{235}U, ^{235m}U, ^{237}Np, ^{238}U, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, ^{231}Th, ^{243}Cm
	Chemicals: arsenic, barium, barium oxide, cadmium, cadmium hydroxide, cadmium oxide, calcium oxide, carbon tetrachloride, chromic oxide, chromium, chromium III, dipotassium dichromate, ethanolamine, hydroxylamine nitrate, lead, lead chromate, lead chromate oxide, lead dioxide, lead hydroxide, lead monoxide, mercury, mercuric oxide, potassium hydroxide, selenium, silver, silver chloride, silver (1+) oxide, soda lime, sodium carbonate, sodium hydroxide, 2,4-dinitrotoluene
Suspect-Contaminated Secondary Waste	Radionuclides: ^{90}Sr, ^{137}Cs, ^{234}U, ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu

PFP = Plutonium Finishing Plant.

[1]Other radionuclides may be identified during radioassay. These radionuclides will be evaluated to determine whether they are daughter products, fission products, or other reaction products from radionuclides in the PFP debris waste stream inventory. If the radionuclide can be associated with the PFP debris waste stream, it may be added to the waste profile for the ERDF.

2.0 STEP 1—STATEMENT OF THE PROBLEM

The objective of DQO Step 1 is to evaluate the available information and define the problem so that the data requirements and decisions can be developed. The problem is stated as:

The low-level and mixed low-level fractions of RSW, including secondary waste, will be treated (if required), processed (if required), and then disposed at the ERDF. The waste must be characterized and the RSW must meet the definition of debris or RLS eligible for macroencapsulation in order to properly manage the waste to the requirements of the ERDF WAC.

3.0 STEP 2—IDENTIFY THE DECISION

The objective of DQO Step 2 is to define the decision statements that must be addressed to resolve the problem. The decision statements are developed by identifying the key questions that the study attempts to address and alternative actions (AAs) that are taken based on the answer to

question. These questions are called Principle Study Questions (PSQ). The PSQs identify key unknown conditions that once answered, will address the problem of adequately characterizing the waste. Table 3-1 presents the PSQs and the alternative actions (AA) that will be taken when each PSQ is answered, along with a description and qualitative severity rating of the consequences of implementing the wrong alternative action.

Table 3-1. Decision Statements. (3 sheets total)

PSQ-AA#	*Principal Study Question #1 – Does the radiological activity of the RSW exceed the transuranic classification limits?*		
	Alternative action	*Consequences of erroneous actions*	*Severity of consequences*
1-1	The RSW activity is above the TRU classification and will be managed for disposal at WIPP.	The RSW is erroneously determined to be TRU and will be sent through the WIPP certification process.	Not severe. WIPP certification activities will perform additional characterization to make a final TRU determination.
1-2	The RSW activity is below the TRU classification limits and will be evaluated for treatment and subsequent disposal at the ERDF.	The RSW is erroneously determined to be LLW and is evaluated for disposal at the ERDF.	Potentially severe. TRU waste could be disposed of at the ERDF.
1-3	No action.	No action.	This alternative is not applicable to this project and is not considered further.
DS#	*Decision Statement #1—Determine whether or not the RSW exceeds classification as TRU waste.*		

PSQ-AA#	*Principal Study Question #2 – Does the RSW contain dangerous/hazardous wastes?*		
	Alternative action	*Consequences of erroneous actions*	*Severity of consequences*
2-1	The RSW contents do not include dangerous/hazardous waste.	The RSW is erroneously determined to be free of dangerous/hazardous wastes.	Potentially severe. The RSW would be disposed as LLW with no treatment.
2-2	The RSW contents include dangerous/hazardous waste. The RSW will be evaluated for treatment and subsequent disposal at the ERDF.	The RSW is erroneously determined to contain dangerous/hazardous wastes.	Not severe. Nondangerous waste would be treated and disposed in an approved disposal facility, which has minor cost impact, but no impact to human health or the environment.
2-3	No action.	No action.	This alternative is not applicable to this project and is not considered further.
DS #	*Decision Statement #2—Determine whether or the not the RSW contains dangerous/hazardous wastes.*		

Table 3-1. Decision Statements. (3 sheets total)

PSQ-AA#	*Principal Study Question #3 – Does the RSW contents classify as debris or RLS?*		
	Alternative action	*Consequences of erroneous actions*	*Severity of consequences*
3-1	The RSW is determined not to be debris or RLS.	The RSW is erroneously determined to not be debris or RLS.	Potentially severe. Nondebris or non-RLS waste would require a different treatment pathway. A different treatment method could significantly negatively impact cost.
3-2	The RSW is determined to meet the definition of debris or RLS.	The RSW is erroneously determined to be debris or RLS.	Potentially severe. Nondebris or non-RLS waste would not be treated to the appropriate requirements prior to disposal. The treatment process may not be protective of human health and the environment.
3-3	No action.	No action.	This alternative is not applicable to this project and is not considered further.
DS #	*Decision Statement #3—Determine whether or the not the RSW contents classify as debris or RLS.*		

PSQ-AA#	*Principal Study Question #4 – Does the RSW waste contain ERDF-restricted wastes that exceed the ERDF waste acceptance criteria (e.g, waste exceeding the NRC Class C limits, containerized waste holding free liquids, etc...)?*		
	Alternative action	*Consequences of erroneous actions*	*Severity of consequences*
4-1	The RSW is determined not to contain ERDF-restricted wastes.	The RSW is erroneously determined not to contain ERDF-restricted wastes.	Potentially severe. Restricted wastes could pose a threat to human health or the environment.
4-2	The RSW is determined to contain ERDF-restricted wastes.	The RSW is erroneously determined to contain ERDF-restricted wastes.	Not severe. Nonrestricted wastes would be treated and disposed in an approved disposal facility, which has minor cost impact, but no impact to human health or the environment.
4-3	No action.	No action.	This alternative is not applicable to this project and is not considered further.
DS#	*Decision Statement #4—Determine whether or the not the RSW contents contain ERDF-restricted wastes.*		

Table 3-1. Decision Statements. (3 sheets total)

PSQ-AA#	*Principal Study Question #5 – Does the secondary waste contain radiological and/or dangerous/hazardous constituents?*		
	Alternative action	*Consequences of erroneous actions*	*Severity of consequences*
5-1	The secondary waste does not include radiological and/or dangerous/hazardous constituents.	The secondary waste is erroneously determined to be free of radiological and dangerous/hazardous wastes.	Potentially severe. Dangerous/hazardous secondary waste would be disposed as LLW with no treatment. Radiological waste would be disposed as non-radioactive.
5-2	The secondary waste includes radiological and/or dangerous/hazardous waste. The secondary waste will be evaluated for treatment and subsequent disposal at the ERDF.	The secondary waste is erroneously determined to contain radiological and/or dangerous/hazardous wastes.	Not severe. Nonradiological or nondangerous waste would be treated and disposed in an approved disposal facility, which has minor cost impact, but no impact to human health or the environment.
5-3	No action.	No action.	This alternative is not applicable to this project and is not considered further.
DS #	*Decision Statement #5—Determine whether the secondary waste contains radiological and/or dangerous/hazardous constituents.*		

ERDF = Environmental Restoration Disposal Facility.
LLW = low-level waste.
NRC = U.S. Nuclear Regulatory Commission.
RLS = radioactive lead solids.
RSW = retrievably stored waste.
TRU = transuranic.
WAC = waste acceptance criteria.
WIPP = Waste Isolation Pilot Plant.

4.0 STEP 3—IDENTIFY INPUTS TO THE DECISION

The objective of DQO Step 3 is to identify the information that will be required to answer the PSQs identified in DQO Step 2 and to determine which information will require environmental measurements. The required information may already exist or may be derived from computational or surveying/sampling and analysis methods. The appropriateness of using existing data is evaluated.

Table 4-1 identifies the data requirements and the types of data that could be used to resolve each decision statement. Table 4-2 identifies if the data currently exists and if it is of sufficient quality to resolve the decision statement. A qualitative assessment is then provided on the usability of the data.

Table 4-1. Information Needs and Data Requirements.

PSQ #	Information need	Data requirement	Computational and survey/sampling methods that satisfy the information need
1	RSW isotopic distribution	ERDF WAC	Process flow calculations Waste Storage/Disposal Record Solid waste information tracking system Radioassay Scaling factors
	RSW TRU determination	ERDF WAC DOE M 435.1-1 Chg 1	TRU calculation Radioassay Scaling factors
2	RSW dangerous/ hazardous waste content	WAC 173-303	Process knowledge Laboratory sample data Waste Storage/Disposal Record Solid waste information tracking system Visual examination Real time radiography Verification
3	RSW debris/RLS content	40 CFR 268.42 40 CFR 268.45	Process knowledge Waste Storage/Disposal Record Solid waste information tracking system Visual examination Real time radiography Verification
4	RSW restricted wastes	ERDF WAC 10 CFR 61	Process knowledge Waste Storage/Disposal Record Solid waste information tracking system Visual examination Real time radiography Verification Radioassay Scaling factors
5	Secondary waste radiological content	ERDF WAC	Process knowledge Field instrumentation Scaling factors
	Secondary waste dangerous/hazardous waste content	ERDF WAC	Process knowledge

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," 268.42, "Treatment standards expressed as specific technologies," 268.45, "Treatment standards for hazardous debris," *Code of Federal Regulations*, as amended.

DOE M 435.1-1 Chg 1, 2001, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

ERDF = Environmental Restoration Disposal Facility.
RLS = radioactive lead solids.
TRU = transuranic.
WAC = waste acceptance criteria.

Table 4-2. Data Assessment. (2 sheets total)

PSQ #	Required data	Data collection methods	Does data exist? (Y/N)	Available source reference	Are the data of sufficient quality? (Y/N)	Additional information required? (Y/N)
1,4	Data to determine the isotopic quantities to determine if the RSW is low-level and otherwise meets the Environmental Restoration Disposal Facility waste acceptance criteria.	Process knowledge, radioassay	Y	HNF-EP-6489	N	Y[b]
2	Data to determine if the RSW is regulated as a listed dangerous waste in accordance with WAC 173-303-080, -081, and -082.	Process knowledge	Y	Waste Services Memo, 3/31/04; HNF-EP-6489	Y	N
2	Data to determine if the RSW meets the definition of a characteristic waste in accordance with 40 CFR 261.24, 40 CFR 268.40, WAC 173-303-140, and WAC 173-303-090[2]-[8]; if the RSW meets the definition of a toxic dangerous waste in accordance with WAC 173-303-100 and WAC 173-303-100[5]; and if the RSW meets the definition of a persistent waste, in accordance with WAC 173-303-100.	Process knowledge	Y	Waste Services Memo, 3/31/04; HNF-EP-6489	Y	Y[a]
2	Data to determine if the RSW is regulated for polychlorinated biphenyl concentrations in accordance with the *Toxic Substances Control Act of 1976* and/or WAC 173-303-9904.	Process knowledge	Y	Waste Services Memo, 3/31/04; HNF-EP-6489	Y	N
3	Data to determine if the RSW is land-disposal restricted and meets the definition of debris or radioactive lead solids, in accordance with 40 CFR 268.	Process knowledge	Y	Waste Services Memo, 3/31/04; HNF-EP-6489	Y	Y[a]

Table 4-2. Data Assessment. (2 sheets total)

PSQ #	Required data	Data collection methods	Does data exist? (Y/N)	Available source reference	Are the data of sufficient quality? (Y/N)	Additional information required? (Y/N)
4	Data to determine that restricted wastes are not present.	Process knowledge	Y	Waste Services Memo, 3/31/04; HNF-EP-6489	Y	Y[a,b]
5	Data to determine the isotopic quantities and the listed and/or characteristic constituents for secondary waste.	Process knowledge	Y	Radiological Survey Records Visual Inspection Procedures	Y	Y[c]

[a]Additional verification to determine the presence of prohibited articles and confirm the debris determination may be completed prior to treatment and disposal.
[b]Radioassay will be completed to quantify radionuclides and confirm isotopes listed on waste records. Scaling will be done to quantify isotopes not detected by radioassay.
[c]Visual verification will be performed and field radiological instruments will be used to determine the presence of dangerous and/or radiological constituents.

40 CFR 261, "Identification and Listing of Hazardous Waste," 261.24, "Toxicity characteristic," *Code of Federal Regulations*, as amended.
40 CFR 268, "Land Disposal Restrictions," 268.40, "Applicability of treatment standards," *Code of Federal Regulations*, as amended.
Waste Services Memo, 2004, *PFP Debris Waste Designation,* (Memo from Justin Bolles to Cindy Girres, Duratek Technical Services, March 31) Fluor Hanford, Inc., Richland, Washington.
HNF-EP-6489, 2003, *Hanford Site Transuranic Waste Management Acceptable Knowledge Documentation for the Plutonium Finishing Plant, Mixed Debris*, Rev. 15, Fluor Hanford, Richland, Washington.
WAC-173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.
Toxic Substances Control Act of 1976, 15 USC 2601, et seq.

PSQ = principal study question.

4.1 PFP DATA ASSESSMENT

Information on the PFP debris waste source consists of not only historical documentation but also information from TRU Program WIPP certification activities such as radioassay and nondestructive examination. As WIPP certification information was obtained on these waste containers, the solid waste information tracking system database was updated to include any new information.

4.1.1 Listed Dangerous Waste

This waste is not assigned any listed waste codes (P, U, K, and F codes) per WAC 173-303-080, -081, and -082 and 40 CFR 261, "Identification and Listing of Hazardous Waste," 261.31, "Hazardous wastes from non-specific sources"; 261.32, "Hazardous wastes from specific sources"; and 261.33, "Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof." Even though this waste is not listed, it is necessary to discuss a specific chemical usage at the PFP. The PRF used a solvent extraction process, which used carbon tetrachloride as a diluent for tributyl phosphate (TBP). The carbon tetrachloride was used as an extractant and not a degreaser; therefore, the carbon tetrachloride is not designated as an F-listed solvent. Degreasing operations may be classified as cold cleaning, vapor degreasing (open top and conveyorized), and fabric scouring, none of which resemble extraction as applied at the PRF during past operations.

4.1.2 Characteristic, Toxic, and Persistent Dangerous Waste

The waste materials expected to be present in this waste stream that could potentially contain dangerous waste constituents include dry cell batteries, alkaline batteries, lead gloves, dried paint, and fluorescent light tubes.

The designation for batteries was applied using historical information of alkaline batteries used at Hanford. Using a database of Material Safety Data Sheets of alkaline batteries known to be used at Hanford, worst-case chemical constituent concentrations were used as the basis for completing the designation. Waste codes for fluorescent light tubes are applied using dangerous constituents known to be present in light tubes at Hanford.

This mixed debris waste stream does not exhibit the characteristics of corrosivity or reactivity as defined by the *Resource Conservation and Recovery Act of 1976*, 40 CFR 261.22, "Characteristic of corrosivity," and 261.23, "Characteristic of reactivity," respectively. The Washington State code WSC2 (caustic) is applied. The waste materials present in this waste stream that exhibit this code are dry cell batteries and sodium hydroxide pellets.

4.1.3 Polychlorinated Biphenyls (PCB)

No evidence of items containing PCBs being added to the waste stream has been identified in AK documentation. The PFP Complex segregated items or materials that exhibited PCBs. Waste packaging procedures were used to segregate PCB-bearing wastes.

4.1.4 Debris Determination

Debris is defined as discarded materials that make up greater-than-or-equal-to 50 volumetric % of a container and exceed a 60 mm particle size. Even though debris must be a solid material, it may contain or be mixed with free liquids entrapped in the debris, provided the liquid is not in a containerized form. If liquids separate from hazardous debris prior to treatment of the debris, they must be managed as hazardous waste. Debris that is immobilized prior to land filling may not contain free liquids as provided by 40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;" 264.314, "Special requirements for bulk and containerized liquids;" and 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," 265.314, "Special requirements for bulk and containerized liquids." Free liquids cannot be present in debris that is macroencapsulated. A debris determination is made on each individual waste container based on the waste record.

4.1.5 Isotopic Content

Isotopic inventory is determined through radioassay and process knowledge. Process knowledge was developed to quantify the amount of ^{90}Sr and ^{234}U expected in the waste stream. Scale factors were determined or developed using historical records, chemical flow sheets used in reprocessing irradiated Hanford Site reactor fuels, and from calculated radioisotope generation and decay (M4T00-PJC-02-076, M4T00-PJC-02-077). The scaling factors used for the PFP debris waste stream are as follows:

- $^{234}U/^{235}U \simeq 30$
- $^{234}U/^{238}U \simeq 2$
- $^{137}Cs/^{90}Sr \simeq 1.1$

4.1.6 Restricted Waste

To date, over 1,200 low-level debris drums from the PFP debris waste stream have been processed through WIPP certification activities. The real-time radiography and visual examination results identified waste items that are not eligible for macroencapsulation or are otherwise prohibited at the ERDF. One to two percent of the containers have identified containerized mercury, such as in a thermometer. One to two percent of the containers have identified containerized liquids. Other restricted items, such as a cadmium battery or liquid acid, have been identified in a few cases.

4.2 SECONDARY WASTE DATA ASSESSMENT

No process knowledge was located that indicated that the secondary waste had come into direct contact with any dangerous/hazardous waste. Visual examination of the waste is performed as it is generated to ensure that no visible signs of chemical contamination are found on the waste. As such, the suspect-contaminated secondary waste is not assigned any listed waste codes (P, U, K, and F codes) per WAC 173-303-080, -081, and -082 and 40 CFR 261, "Identification and Listing of Hazardous Waste," 261.31, "Hazardous wastes from non-specific sources"; 261.32, "Hazardous wastes from specific sources"; and 261.33, "Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof." Suspect-contaminated secondary waste cannot be free-released. Radiological surveys are completed, documenting that radiological contamination above detection limits was not found.

5.0 STEP 4—DEFINE THE BOUNDARIES OF THE STUDY

The objective of DQO Step 4 is to define the spatial and temporal components of the RSW and suspect-contaminated secondary waste for each decision statement to ensure that the data collected are representative of the population. The scale of decision making for each decision statement is defined by combining the population of interest with the spatial and temporal boundaries. Practical constraints that could interfere with sampling are also identified.

The population of interest for these DQOs is the RSW drums and the suspect-contaminated secondary waste. The geographic boundary is Burial Ground 218-W-4C. This section establishes the limits for gathering data to address each decision statement. Table 5-1 provides a summary of these limits.

Table 5-1. Boundaries for Data Collection.

Decision Statement #	Population of Interest	Unit Measurement Size	Temporal Boundary	Scale of Decision Making
1	All RSW Drums	Each drum will be radioassayed; multiple measurements may be taken on a drum.	Radioassay results may be used from previous retrieval campaign assay units, a mobile radioassay unit, or from an assay unit located at WRAP.	The TRU/non-TRU determination will be made for each drum.
2	Non-TRU RSW Drums	The waste stream designation will be completed for the waste-generating source (e.g., PFP).	Visual verification or real-time radiography results will be used to confirm the designation. Data from the WIPP certification program will be used when possible.	The designation will be completed by waste stream for each original waste-generating source.
3	Non-TRU RSW Drums	The waste inventory for each drum will be reviewed to make the debris/RLS determination.	Visual verification or real-time radiography results will be used to confirm the waste contents. Data from the WIPP certification program will be used when possible.	Each drum will be evaluated to determine if it is debris/RLS and eligible for treatment.
4	Non-TRU RSW Drums	The waste stream will be evaluated for the presence of ERDF-restricted wastes. Calculations for NRC Class C limits will be completed for each drum.	Visual verification or real-time radiography results will be used to confirm the designation. Data from the WIPP certification program will be used when possible.	The prohibited item determination will be made for each original waste-generating source. NRC Class C determination will be made for each drum.
5	Secondary Waste	The waste will be evaluated as it is generated.	Visual examination and radiological surveys are conducted as the waste is generated.	Each waste article is examined and surveyed.

NRC = U.S. Nuclear Regulatory Commission.
PFP = Plutonium Finishing Plant.
RLS = radioactive lead solids.
RSW = retrievably stored waste.
TRU = transuranic.
WIPP = Waste Isolation Pilot Plant.
WRAP = Waste Receiving and Processing.

5.1 TRU/NON-TRU DETERMINATION

To determine whether a RSW drum is TRU or non-TRU, radioassay and a weight measurement will be performed on every waste drum for radiological characterization. The unit-measurement size is a waste drum. A statistically based sampling design for the waste stream will not be employed for radioassay because all drums of LLW and MLLW covered by these DQOs will be subjected to radioassay.

Radioassay techniques could include gamma energy assay or imaging passive/active neutron systems to determine the radioactive material composition and quantify radionuclide masses. Three sources of assay data could be used for radiological characterization:

- NDA from previous pilot retrieval campaigns,
- NDA from a mobile radioassay unit at 218-W-4C, or
- NDA at the WRAP facility.

Practical constraints on data collection, such as interference from background radiation levels and the inability to measure certain radioisotopes through radioassay will be taken into consideration when defining the tolerable decision error.

5.2 DANGEROUS/HAZARDOUS WASTE DETERMINATION

Historical data will be used to characterize the hazardous/dangerous constituents of the RSW. Verification of the accuracy of the historical waste contents will take place prior to treatment by performing real-time radiography or visual examination on a representative number of containers from each original waste-generating source.

Containers selected for verification are not limited to RSW LLW or MLLW containers. Any container from the same waste stream as defined in the applicable AK documentation may be used for verification. These containers include both TRU and non-TRU RSW containers as well as other containers in the same waste stream that are being certified for disposal at the WIPP. For a given generating source and waste stream, it must be demonstrated that the same generating processes have been used and that the current data is consistent with past data, with no shifts or trends in the error rate over time.

Verification will be ongoing throughout the project. The results of verification will be used to update the designation or identify a subset of the population that has a different characterization.

5.3 DEBRIS CLASSIFICATION

Existing RSW container inventories will be used to determine whether a waste drum classifies as debris or RLS and is eligible for macroencapsulation. The contents inventory for each drum will be evaluated and a determination will be made that the drum is debris waste.

If the results of verification indicate that a population of container inventories is not accurate for purposes of debris or RLS classification, the subject population will be re-evaluated and rejected if necessary.

5.4 ERDF-RESTRICTED WASTE DETERMINATION

Radionuclide inventories to determine if a RSW drum is greater than U.S. Nuclear Regulatory Commission Class C limits will be established in accordance with Decision Statement #1.

Historical data will be used to determine the potential for restricted items to be present in a waste stream. Verification of the accuracy of the historical waste contents will take place prior to treatment by performing real-time radiography or visual examination on a representative number of containers from each waste stream.

RSW containers selected for verification may be limited by which containers are available from retrieval and by which drums are being certified for disposal at the WIPP. Containers could consist of either TRU or non-TRU drums. Data to establish the accuracy of the historical information could be gathered from the RSW or from other TRU waste from the same waste stream as defined in the applicable AK documentation. For a given original waste-generating source and waste stream, it must be demonstrated that the same generating processes have been used and that the current data is consistent with past data with no shifts or trends in the error rate over time.

Verification will be ongoing throughout the project. The results of verification will be used to update the designation or identify a subset of the population that has a different characterization. Acceptable failure rates will be established when defining the tolerable decision error.

5.5 SECONDARY WASTE CHARACTERIZATION

Visual verification is performed to ensure no obvious indications of chemical contamination are present on the waste (e.g., stains). Radiological surveys are performed on the secondary waste to determine if any contamination is present. Surveys are conducted using programmatic guidance and procedures from the Hanford Site radiological control program. Typically, for removable contamination, the MDAs are <1000 dpm/100 cm^2 beta-gamma and <20 dpm/100 cm^2 alpha. For total contamination (i.e., direct surveys) the MDAs are <5000 dpm/100 cm^2 beta-gamma and <100 dpm/100 cm^2 alpha.

6.0 STEP 5—DECISION RULES

The objective of DQO Step 5 is to use the results from DQO Steps 1 through 4 to develop decision rules. Decision rules provide the parameter of interest, unit of decision making, action level, and alternative actions. Table 6-1 presents the decision rules that correspond to each of the decision statements identified in Table 3-1. Figure 6-1 provides the decision rule logic diagram for the RSW.

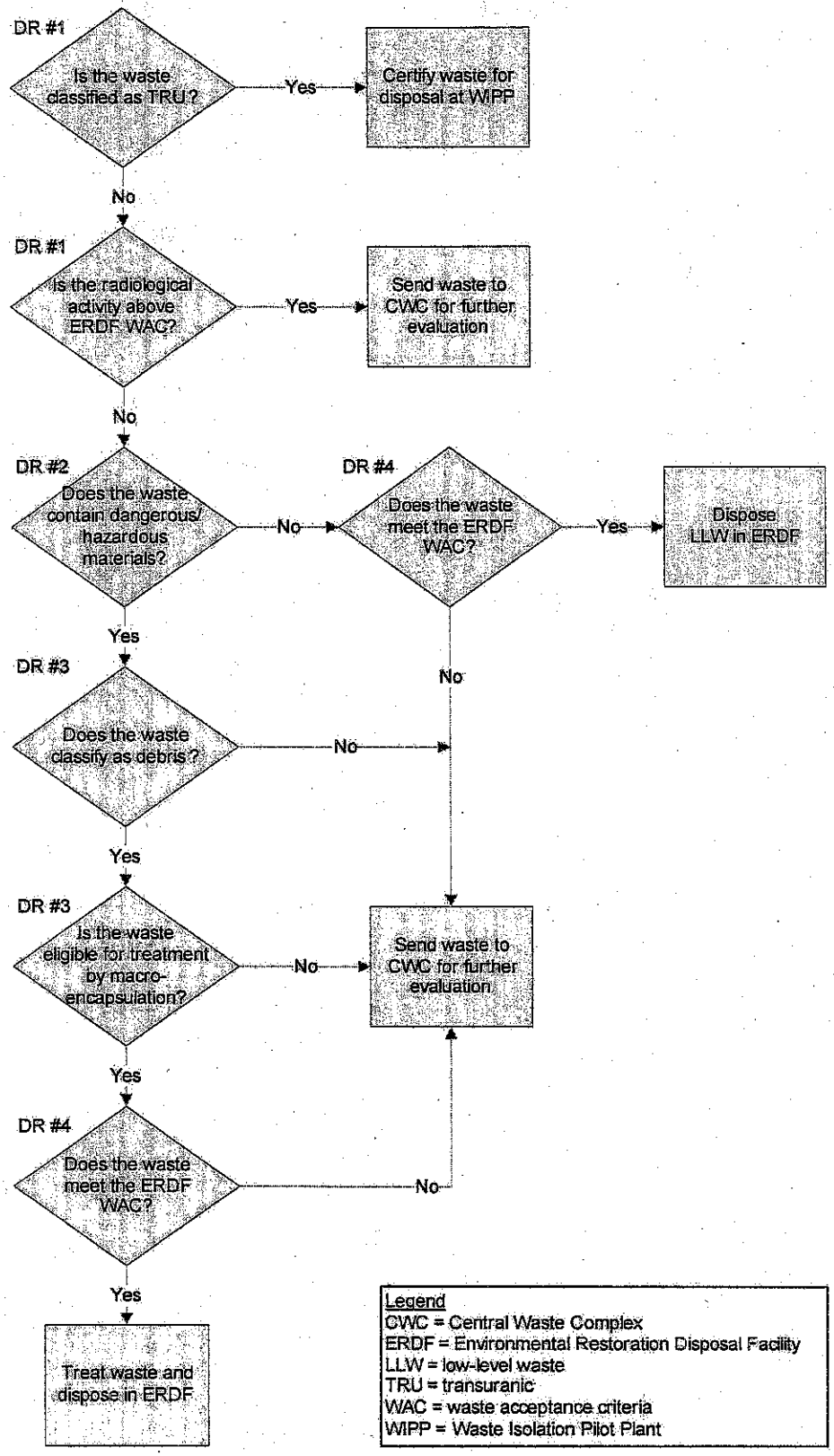
Table 6-1. Decision Rules for Characterization of Retrievably Stored Waste.

DR #	Decision Rule
1	If the radioassay results indicate that the waste is below TRU classification limits, then it will be evaluated for dangerous/hazardous waste content per Decision Rule #2. If the radioassay results indicate that the waste could exceed TRU classification limits, then it will be managed as TRU waste and managed under the TRU WIPP Program.
2	If the RSW records are evaluated for the presence of dangerous/hazardous constituents and/or the RSW is subjected to visual examination and the results indicate that the RSW contents do not designate as dangerous/hazardous waste, then the RSW will be evaluated for disposal at the ERDF per Decision Rule #4. If the RSW records are evaluated for dangerous/hazardous constituents and/or the RSW is subjected to visual examination and the results indicate that the RSW contains dangerous/ hazardous waste, then it will be evaluated for treatment and disposal per Decision Rule #3.
3	If the RSW records evaluated for dangerous/hazardous constituents and/or the RSW is subjected to visual examination and the results indicate that the RSW contents classify as debris or RLS and meet the criteria for the alternative treatment requirements under 40 CFR 268.45, then it will be evaluated for disposal at the ERDF per Decision Rule #4. If the RSW records evaluated for dangerous/hazardous constituents and/or the RSW is subjected to visual examination and the results indicate that the RSW contents do not classify as debris or RLS and are not eligible for alternative treatment requirements under 40 CFR 268.42 or 268.45, then the RSW will be sent to the CWC awaiting further evaluation for treatment and/or disposal.
4	If the RSW is evaluated and contains no ERDF-restricted wastes, is not NRC > Class C, and meets the ERDF WAC, then the waste will be treated and then disposed at the ERDF. If the RSW is evaluated and contains ERDF-restricted wastes, is NRC > Class C, and/or meets the ERDF WAC, then the waste will be sent to the CWC awaiting further evaluation for treatment and/or disposal.
5	If the secondary waste is evaluated for the presence of radiological and/or dangerous/hazardous constituents and no contamination is found, then the secondary waste will be disposed at the ERDF as suspect-contaminated LLW. If the secondary waste is evaluated for the presence of radiological and/or dangerous/hazardous constituents and contamination is identified, then a sampling and analysis plan will be developed to characterize this secondary waste.

40 CFR 268, "Land Disposal Restrictions," 268.42, "Treatment standards expressed as specific technologies," 268.45, "Treatment standards for hazardous debris," *Code of Federal Regulations*, as amended.

CWC = Central Waste Complex.
ERDF = Environmental Restoration Disposal Facility.
NRC = U.S. Nuclear Regulatory Commission.
RSW = retrievably stored waste.
TRU = transuranic.
WAC = waste acceptance criteria.
WIPP = Waste Isolation Pilot Plant.

Figure 6-1. Decision Rule Logic Diagram for RSW.



6.1 ACTION LEVELS

The action levels used to evaluate the decision rules are provided in Tables 6-2, 6-3 and 6-4. The action levels are generally based on regulatory thresholds for waste characterization and the ERDF WAC.

Table 6-2. Action Levels.

Parameter	Action Level
Transuranic Radionuclides	100 nCi/gram of TRU isotopes as defined in DOE M 435.1-1 Chg 1
Dangerous/Hazardous Constituents	Regulatory limits as defined in WAC 173-303 and 40 CFR 268.4.
Debris Classification (including RLS)	> 50% manufactured objects, plant or animal matter, natural geological material that exceeds 60 mm (2.36 in) particle size as defined in 40 CFR 268.2. Material with a specific treatment standard as provided in 40 CFR 268 is not authorized. Lead not meeting the RLS treatment subcategory per 40 CFR 268.42.
ERDF Restricted Wastes such as the following: • Explosives or reactives, • Toxic gases, fumes, or vapors • Gaseous waste at a pressure in excess of 1.5 atmospheres at 20 °C. • Free liquid • Pyrophoric material • Biological, pathogenic, or infectious material	Identified in the ERDF WAC as generally restricted.
NRC Class C Waste	Greater than U.S. NRC Class C limits as defined in 10 CFR 61.55.
ERDF Radionuclide Levels	See Table 6.3 based on the ERDF WAC
ERDF Chemical Levels	See Table 6.4 based on the ERDF WAC
Secondary Waste	Visible signs of chemical contamination or detectable radiological contamination.

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," 61.55, "Waste classification," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," 268.2, "Definitions applicable in this part," 268.4, "Treatment surface impoundment exemption," 268.42, "Treatment standards expressed as specific technologies," *Code of Federal Regulations*, as amended.

DOE M 435.1-1 Chg 1, 2001, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended, Olympia, Washington.

ERDF = Environmental Restoration Disposal Facility.
NRC = U.S. Nuclear Regulatory Commission.
RLS = radioactive lead solids.
TRU = transuranic.
WAC = waste acceptance criteria.

In addition to the transuranic radionuclide and NRC Class C levels, the ERDF has established limits for certain radionuclides that are provided in Table 6-3. When two or more radionuclides are present, the sum of the fractions is used to determine acceptability. Each radionuclide in the waste mixture must be divided by its associated limit, with the sum being less than or equal to 1.0. Waste sources above a limit must be evaluated further by the ERDF for acceptability.

In addition to the regulatory limits as defined in WAC 173-303 and 40 CFR 268.4, the ERDF has established concentration limits for certain chemicals that are provided in Table 6-4. Each chemical constituent must be below the established limit.

Table 6-3. ERDF Radionuclide Action Levels.

Radionuclide	Action Level
Major radionuclides[a]	> 1 pCi/g
Americium-241	0.050 Ci/m^3
Americium-243	0.057 Ci/m^3
Cesium-137	32 Ci/m^3
Cobalt-60	Unlimited
Europium-152	21,000,000 Ci/m^3
Europium-154	Unlimited
Neptunium-237	0.0015 Ci/m^3
Plutonium-238	1.5 Ci/m^3
Plutonium-239	0.029 Ci/m^3
Plutonium-240	0.029 Ci/m^3
Plutonium-241	6.2 Ci/m^3
Plutonium-242	0.11 Ci/m^3
Potassium-40	0.095 Ci/m^3
Strontium-90	7,000 Ci/m^3
Thorium-232	0.0060 Ci/m^3
Uranium-233/234	0.074 Ci/m^3
Uranium-235	0.0027 Ci/m^3
Uranium-238 + daughters	0.012 Ci/m^3

[a]A major radionuclide must also meet all of the following conditions:

- Half life greater than 2 years.
- Not in secular equilibrium with a parent nuclide.
- Is not naturally occurring at an activity level consistent with levels determined in Hanford Site Background: Part 2, Soil Background for Radionuclides (DOE/RL 1996)

DOE/RL-96-12, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, Rev 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Table 6-4. ERDF Chemical Action Levels.

Chemical constituent	ERDF concentration limit (mg/kg)
Antimony	19,000
Arsenic	3,000
Barium	940,000
Cadmium	39,000
Chromium	Total 59,000 VI – 59,000
Manganese	440,000
Selenium	400,000
Silver	350,000
Thallium	5,600
Vanadium	330,000
Zinc	300,000

ERDF = Environmental Restoration Disposal Facility.

7.0 STEP 6—TOLERABLE LIMITS ON DECISION ERRORS

The objective of DQO Step 6 is to define the tolerable limits on the probability of making a decision error. This section describes the tolerable limits that will be employed for the radioassay, verification, and secondary waste characterization.

7.1 RADIOASSAY TOLERABLE DECISION ERRORS

The radioassay equipment shall perform in a manner to accurately and reliably provide radioassay results with sufficient confidence to distinguish TRU waste from LLW. For each assay unit used, the radioassay techniques, instruments, and procedures used must conform in these ways:

- Be capable of reporting a minimum detectable concentration of TRU isotopes sufficiently below 100 nCi/g to determine TRU from LLW,
- Be capable of monitoring for fluctuations in background radiation levels, determining if background levels impact radioassay results, and correcting for excessive background radiation if applicable,
- Account for measurement errors from components such as internal consistency, transmission errors, self-absorption, and/or localized measurement problems,

- Be appropriate for the specific waste stream being assayed, and
- Result in defensible values for the activity and mass of the reported radionuclide inventory.

The radioassay system shall be capable of measuring and reporting radioassay results with the following minimum information:

- The measured value, in curies, +/- the uncertainty value calculated at the two-sided 95% confidence level of each isotope of concern detected,
- The TRU concentration reported in nCi/g +/- the uncertainty value calculated at the two-sided 95% confidence level,
- The method detection limit of gamma-emitting isotopes of concern that were not detected by gamma energy analysis,
- Identification and quantification of radionuclides (isotopes of concern) including ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{233}U, ^{235}U, ^{238}U, and ^{137}Cs in curies if detected in the waste drum,
- Total measurement uncertainty for the radioassay system, and
- Total TRU activity in every container in nCi/g.

Many factors affect the minimum detectable activity (MDA)/minimum detectable concentration and total measurement uncertainty (TMU) reported by an analysis system; for example, the detector to sample calibration geometry, detector resolution, detector efficiency, sample density, sample elemental composition, spatial distribution of activity material, self-attenuation of source materials, containers, energy of the photopeak of interest, and background contributions. The terms lower limit of detection (LLD) and MDA (in units of activity) are used interchangeably in these DQOs. In support of the above requirements, each nondestructive assay unit must evaluate, document, and technically justify the following determinations.

1. *Lower Limit of Detection.* The LLD for each nondestructive assay system must be determined. Instruments performing TRU waste/low-level waste discrimination measurements must have an LLD of 100 nCi/g or less. Environmental background and container-specific interferences must be factored into LLD determinations. LLD is that level of radioactivity which, if present, yields a measured value greater than the critical level with a 95% probability, where the critical level is defined as that value which measurements of the background will exceed with 5% probability. The method(s) for determining LLD shall be documented.

2. *Quantification of Non-detectable Radionuclides.* Radionuclide quantities that cannot be determined by radioassay because there is no method or the method detection limit is not low enough to support decision-making may be scaled to measured radionuclides. The radionuclides that are expected to be scaled are ^{90}Sr and ^{234}U. Daughter products that are below the method detection limit that are required to be reported will be scaled from the activity of the parent or

reported at the MDA (if they can be determined by radioassay). The means and methodology to quantify these isotopes from other measured isotopes shall be technically justified. In such cases, the facility shall derive the equivalent of an LLD (i.e., a reporting threshold for a radionuclide[s], when it is technically justified). This value may be based on decay kinetics, scaling factors, or other scientifically based relationships and must be documented.

3. *Total Measurement Uncertainty.* The method used to calculate the TMU shall be documented. Reports may be combined for like or similar systems if the TMU is justified to be identical or if any differences are clearly identified and do not affect the TMU. The likeness or similarity of the systems must be technically justified.

7.2 VERIFICATION TOLERABLE DECISION ERRORS

Verification is the evaluation performed to substantiate that the waste is the same as represented on the AK documentation and on the original waste records supplied by the generator. Verification elements include container inspection, initial confirmation of AK documentation, and periodic confirmation.

7.2.1 Container Inspection

One hundred percent of the containers being retrieved will be inspected for damage and to ensure the waste containers are those indicated on the documentation. During the initial inspection at the module face, the following information will be confirmed:

- Container number or other unique identifying characteristic (e.g., seal number),
- Module position,
- Vent clip installation,
- Contamination and surface dose, and
- Container condition [corrosion, deformities, degradation].

The initial inspection of a container primarily demonstrates that the drums are accurately identified on the waste records. The container must match up with a waste record and have a traceable association to a waste record and waste stream to be acceptable. The allowable decision error of a false negative (i.e., failing to correlate a container with a generating source) is 0%. If a positive identification cannot be established, the drum will not be eligible for subsequent treatment and disposal until further characterization takes place.

7.2.2 Initial Confirmation of AK Characterization

The designation for each waste stream will be confirmed as part of the initial waste stream characterization. Shipments of a new waste stream for treatment and disposal are not authorized until the initial confirmation of the waste stream is completed and documented. The inspection for RSW will primarily utilize data gathered from the WIPP certification program (i.e., nondestructive evaluation [NDE] using real time radiography or visual examination, headspace gas sampling and analysis, and homogeneous sampling and analysis, if appropriate). Alternately, a visual verification program may be established at a commercial treatment location or other facility that is authorized to manage the waste. A minimum of 10% of the projected RSW waste volume will be nondestructively examined to confirm the AK designation.

The allowable decision error of a false negative (i.e., failing to identify that a constituent or parameter exceeds a regulatory limit, action level, or is otherwise restricted at the ERDF) will be 10%.

7.2.3 Periodic Confirmation of AK Characterization

Once a waste stream has been released, it will be periodically assessed through nondestructive evaluation to determine whether the waste stream characteristics remain within established profile limits, if the established designation is accurate, and that the established allowable decision error remains at 10%. The cumulative total of all verification data for a waste stream will be used in performing this assessment. These results will be assessed a minimum of once a quarter for each waste stream that is actively being treated and disposed. Results are documented and tracked.

Nondestructive evaluation results will be reviewed and waste not described on the available paperwork will be evaluated further and the following questions answered.

- Is there a process or activity that was not previously identified?
- Does the physical form of the waste does not match the profile, and is management of debris allowed?
- Are hazardous constituents affecting treatment requirements identified?
- Are there radiological constituents affecting the TRU, NRC, or other action level?
- Is the waste stream as described in the AK accurate or does the waste stream need to be revised or a new waste stream created?

If a waste designation must be revised, the following steps are taken to reevaluate AK:

- Existing information is reviewed based on the container identification number, and differences in hazardous waste code assignments are documented.
- If differences exist in the hazardous waste codes previously assigned, the information is reassessed and all required AK information associated with the new designation is documented.
- All sampling and analytical data associated with the waste is reassessed and documented.
- The reassignment is documented and verified.
- The treatment and disposal facilities will be notified of the changes. Receipt documentation will be updated accordingly. Waste that has already been shipped will not be subjected to the new designation.

When a failure in excess of the established 10% rate occurs, a recovery plan shall be developed. The DQOs will be reevaluated and updated, if needed, to address the information and determine the path forward.

7.2.4 Verification of Secondary Waste

Secondary waste will be inspected and surveyed as it is generated and/or placed into the shipping container. An inventory of the contents is maintained. A periodic, independent review of the shipping container contents will be performed by a supervisor or designee to make sure the waste is as described on the inventory and that the inspection and surveys are being completed in accordance with approved procedures.

7.3 SECONDARY WASTE DECISION ERRORS

Secondary waste will be visually inspected for any indications of dangerous/hazardous contamination. Secondary waste will be screened using field instrumentation to determine if any radiological contamination is present. Typically, for removable contamination, the MDAs are <1000 dpm/100 cm^2 beta-gamma and <20 dpm/100 cm^2 alpha. For total contamination (i.e., direct surveys) the MDAs are <5000 dpm/100 cm^2 beta-gamma and <100 dpm/100 cm^2 alpha.

8.0 STEP 7—OPTIMIZE THE DESIGN

The objective of DQO Step 7 is to identify the most resource-effective data collection design for generating data that are expected to satisfy the DQO specified in the preceding six DQO steps.

A statistically based approach is not being used for radioassay; therefore, optimization of obtaining data is not applicable. For visual verification, existing verification results or WIPP certification data will be used when possible to minimize the number of waste containers subjected to verification.

9.0 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

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