West Valley Demonstration Project

WVES LLC

POLICY AND PROCEDURES

TITLE: Waste Incidental to Reprocessing Determination

1.0 POLICY

It is the policy of the West Valley Environmental Services (WVES) to ensure that radioactive waste is managed in a manner that is protective of the worker, public health and safety, and the environment.

The purpose of this policy and procedure is to implement the process for determining if a waste is or contains a residue in a form that could be high-level radioactive waste (HLW) as defined in DOE M 435.1-1, but might be managed as other than HLW by using the Waste Incidental to Reprocessing (WIR) determination process.

All radioactive waste at the West Valley Demonstration Project (WVDP) SHALL be screened in accordance with this policy and procedure. This procedure is not intended to be retroactive: waste that has been packaged, characterized, classified for disposal as other than HLW or systems being utilized for other than HLW management on January 1, 2001 need not be re-evaluated.

This policy and procedure applies only to on-site storage and off-site disposal of radioactive wastes. This policy and procedure does not apply to on-site disposition (e.g., in-place closure) or the final HLW glass waste form.

NOTE *Minor changes and revision to this procedure do not require DOE-WVDP approval. Significant changes to this procedure (e.g., addition of a new waste category added to Attachment E) should be provided to the DOE-WVDP for approval. The DOE-WVDP should continue to be consulted on waste determined to be incidental to reprocessing through the "evaluation" process.*

2.0 REQUIREMENTS, REFERENCES, AND FORMS

2.1 Requirements

10 CFR 830.120, "Quality Assurance"

DOE O 414.1, "Quality Assurance"

DOE O 435.1, "Radioactive Waste Management"

DOE M 435.1-1, "Radioactive Waste Management Manual"

2.2 References

DOE Letter OH-0420-04, R. F. Warther to T. J. Jackson, "Waste Incidental to Reprocessing," dated July 27, 2004.

Letter, WVNSCO (L.E. Rowell) to DOE (T.J. Jackson), “Revision to Waste Incidental to Reprocessing Determination Procedure (WV-929) and Citations Submitted for Approval,” WD:2004:0138, dated March 16, 2004.

Section 3116 of the Ronald W. Reagan National Defense Authorization Act dated October 2004 provides criteria for incidental waste determinations applicable only to South Carolina and Idaho for wastes contaminated with high level waste residues not transported out of those states. The Section 3116 criteria are similar to but not word-for-word identical with those contained in DOE's 435.1, from which the WVDP's incidental waste determination requirements in WV-929 are derived. Thus, the Section 3116 requirements and criteria are not directly applicable to the West Valley Demonstration Project; the WVDP should be consistent the intent of Section 3116 in the preparation of incidental waste determinations by evaluation to support DOE Complex-wide conformity.

10 CFR 61.55, "Waste Classification"

10 CFR 61.58, "Alternative Requirements for Waste Classification and Characteristics"
Atomic Energy Commission, Notice of Proposed Rulemaking (34 FR 8712) for Proposed Appendix D, 10 CFR 50, Paragraphs 6 and 7, June 3, 1969.

Atomic Energy Commission, Rules and Regulations (35 FR 17530) 10 CFR 50, "Licensing of Production and Utilization Facilities, Siting of Fuel Reprocessing Plants and Related Waste Management Facilities," November 14, 1970.

"Bechtel Drawing Control Index," May 1978 (logbook).

DOE G 435.1-1, "Implementation Guide for DOE M 435.1-1."
EP-8-001, "Equipment, Instrument, and Valve Identification Numbers."

HLW-SUP-99-0060, "Citation Determination and Evaluation of Waste Incidental to Reprocessing," Savannah River Site, April 1, 2000.

Nuclear Regulatory Commission (NRC), "Issuance of Final Branch Technical Position on Concentration Averaging and Encapsulation, Revision in Part to Waste Classification Technical Position," January 17, 1995.

SOP 300-07, "Waste Generation, Packaging, and On-Site Transportation."

West Valley Nuclear Services Company, "WVDP DOE O 435.1 Implementation Plan."

"Cognizant Responsibility List for Systems and Facilities at WVDP."

WM-210, "Waste Stream Characterization."

WSRC-RP-2001-00341, "Comparison of LLW Disposal Performance Objectives 10 CFR 61 and DOE 435.1," prepared by E. Wilhite, Westinghouse Savannah River Company, Savannah River Technology Center, dated March 1, 2001.

WV-902, "Planning for Data Collection Activities."

WVDP-002, "Quality Management Manual."

WVDP-257, "WVNS Manual for the Preparation, Review, Approval, Distribution, and Revision of Controlled Documents."

WVDP-262, "WVNS Manual for Records Management and Storage."

WVDP-339, "Radioactive Waste Certification Program Plan."

WVDP-370, "WVDP Radioactive Waste Acceptance Program."

2.3 Forms

WV-4405, "WIR Determination Screen"

3.0 DEFINITIONS & ACRONYMS

3.1 Definitions

High-Level Waste (HLW) - High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. (See DOE M 435.1-1.)

Key Radionuclides - Key radionuclides are those controlled by concentration limits in 10 CFR 61.55 and those important to satisfying the performance objectives in 10 CFR Part 61 Subpart C. (See DOE G 435.1-1.)

Low-Level Waste (LLW) - Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in Section 11e.(2) of the Atomic Energy Act of 1954, as amended), or naturally occurring radioactive material. (See DOE M 435.1-1.)

Transuranic (TRU) Waste - TRU waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61. (See DOE M 435.1-1.)

Waste Incidental to Reprocessing (WIR) - Waste resulting from reprocessing spent nuclear fuel that is determined to be incidental to reprocessing is not HLW and SHALL be managed under DOE's regulatory authority in accordance with the requirements for TRU or LLW, as appropriate. (See DOE M 435.1-1.)

3.2 Acronyms

CFR	Code of Federal Regulations
DOE	(United States) Department of Energy
FEM	Field Element Manager (DOE)
HLW	High-level (radioactive) waste
LLW	Low-level (radioactive) waste
NRC	(United States) Nuclear Regulatory Commission
QA	Quality assurance
TRU	Transuranic
WAC	Waste acceptance criteria
WIR	Waste incidental to reprocessing
WPD	Waste Planning and Disposition organization department title
WVDP	West Valley Demonstration Project
WVES	West Valley Environmental Services, LLC
WVNS	West Valley Nuclear Services (a prior DOE contractor company name)
WVNSCO	West Valley Nuclear Services Company (a prior DOE contractor company name)

4.0 RESPONSIBILITIES

4.1 Waste Generator - The waste generator is responsible for providing available radiological characterization and process history information associated with the waste to be subjected to the WIR determination process to the Waste Planning & Disposition department.

4.2 Waste Planning & Disposition Manager - The Waste Planning & Disposition Manager has overall responsibility for ensuring that this policy and procedure is implemented. The Waste Planning & Disposition Manager is responsible for ensuring a process is established to determine and document that all appropriate wastes are subjected to the waste incidental to reprocessing determination. The Waste Planning & Disposition Manager SHALL be supported in the determination process by approved personnel who are deemed to be adequately trained to implement the requirements of this procedure. The Waste Planning & Disposition Manager and waste generator SHALL be supported in the WIR determination by the Project Integration, Strategy, and Communications Manager as appropriate. The Waste Planning & Disposition Manager is responsible for ensuring that WIR by evaluations are submitted to the DOE/OH.

4.3 Records Function - The Records Function within the Records and Property Department is responsible for maintaining records generated when implementing this procedure.

4.4 Waste Planning and Disposition (WPD) Engineering - WPD is responsible for characterizing waste, developing waste profiles, maintaining records pertaining to waste classification, characterization, and for WIR determinations. WPD may be asked to provide necessary assistance to persons assessing waste for WIR by evaluation. WPD is responsible for performing on-site certification activities for newly generated radioactive waste that will be stored in the Lag Storage Complex.

4.5 Department of Energy Field Element Manager (FEM) - The DOE FEM is responsible for ensuring that WIR determinations are made either by the citation or evaluation process. The DOE FEM is also responsible for consultation and coordination with the Office of Environmental Management (EM) if needed. The DOE FEM for the West Valley Demonstration Project is the DOE-WVDP Director.

4.6 Nuclear Regulatory Commission (NRC) - Consultation with the NRC for the review of the determination process is consistent with the requirement in the West Valley Demonstration Project Memorandum of Understanding between the U.S. Department of Energy and the U.S. Nuclear Regulatory Commission and DOE G435.1-1 states that the NRC may be consulted for review of the process for WIR evaluations.

4.7 WVES Quality Assurance (QA) - The QA Department is responsible for maintaining the site QA program under which activities for this procedure are conducted and for overseeing and assessing the process for WIR determinations.

4.8 WIR Evaluation Analyst - The WIR Evaluation Analyst is responsible for performing WIR determination evaluations and WIR determination screens and is knowledgeable of waste disposition processes through a combination of experience and technical training. In addition, the WIR analyst has successfully completed the training requirements (VO430Q) on the WIR procedure and process. WIR Evaluation Analysts are approved by the Waste Planning & Disposition Manager

5.0 GENERAL INFORMATION

5.1 DOE Definition of WIR

Waste incidental to reprocessing "refers to a process for identifying waste streams that would otherwise be considered HLW due to their sources of generation or concentration but can be managed in accordance with the DOE requirements for transuranic or low-level waste if the requirements for WIR can be met. . . . The goal of the WIR determination process is to safely manage and dispose of a limited number of reprocessing waste streams that do not warrant geologic repository disposal because of their lack of long-term threats to the environment and man." (See DOE G 435.1-1, p. II-18.) In accordance with DOE M 435.1-1, Chapter II, item B, wastes may be determined not to be HLW by one of two processes, (1) the citation process or (2) the evaluation process.

5.1.1 WIR by Citation

WIR by citation includes spent nuclear fuel reprocessing waste resulting from reprocessing plant operations such as (but not limited to) contaminated job wastes, including laboratory items such as clothing, tools, expended samples, sample media, and secondary waste. Secondary is defined as components and equipment that had been wetted by HLW but determined to not contain significant amounts of residual waste. Attachment G summarizes and justifies specific items included in this Citation Process waste category.

5.1.2 WIR by Evaluation

WIR by Evaluation includes spent nuclear fuel reprocessing plant wastes that meet the requirements in **either** Section 5.1.2.A **or** Section 5.1.2.B:

A. Wastes that will be managed as low-level waste and meet the following criteria:

1. **(LLW Criterion 1)** Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and

2. **(LLW Criterion 2)** Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and

3. **(LLW Criterion 3)** Are to be managed, pursuant to DOE's authority under the Atomic Energy Act of 1954, as amended, and in accordance with the provisions of Chapter IV of DOE M 435.1-1, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

B. Wastes that will be managed as transuranic waste and meet the following criteria:

1. **(TRU Criterion 1)** Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and

2. **(TRU Criterion 2)** Will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize; and

3. **(TRU Criterion 3)** Are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of DOE M 435.1-1, as appropriate.

5.2 WIR Determinations at the WVDP

5.2.1 The following waste streams are candidates for the WIR process: 1) wastes that would be considered as HLW (but have not been specifically excluded from this procedure), 2) wastes that are commingled with HLW, or 3) wastes that have been wetted by HLW.

NOTE *As understood in DOE G 435.1-1, Chapter II, p. II-6: DOE M 435.1-1 supports the implementation of part (2) of the 10 CFR Part 60 definition to mean that high-level wastes are wastes that are generated as a product of reprocessing of spent nuclear fuel downstream of, and including, the first step in a separations process, and the concentrated waste streams from subsequent extraction cycles or steps . . . Wastes that are produced upstream of these separations processes, from such processes as chemical or mechanical decladding, fuel dissolution, cladding separations, conditioning, or accountability measuring, are not high-level waste.*

5.2.2 Systems at the WVDP that have been used to process, transfer, or store HLW are listed in Attachment B. System components that may have been wetted with HLW are listed in Attachment C.

5.2.3 Wastes at the WVDP which are considered excluded by citation are listed in Attachment D. Justification for the Secondary Waste category of this list is summarized in Attachment F.

5.2.4 WIR determinations may be future oriented, i.e., they may be based upon not only the current waste form but the forecast form. Basis for the WIR determinations by the evaluation process will be documented. (See Section 6.4.8.)

5.2.5 As part of the WIR by evaluation process in this procedure, it is assumed that if a waste is expected to meet the criteria for off-site disposal it is compliant with the performance objectives set out in DOE M 435.1-1 and 10 CFR 61, Subpart C. (WSRC-RP-2001-00341 concludes the 435.1-1 performance measures are as protective as 10 CFR 61 performance objectives for non-in situ disposal. Thus, if a waste stream and/or container meets an off-site DOE waste disposal site's WAC (e.g., Nevada Test Site), it meets the WIR LLW Criterion 2.) However, if no disposal facility is available, the WIR Evaluation Analyst will review and ensure that there is compliance with on-site interim storage requirements in WVDP-370, which documents the requirements for on-site certification.

NOTE *DOE O 435.1-1 cites DOE M 435.1-1, which includes by reference performance objectives in 10 CFR 61, Subpart C. These performance objectives include 1) protection of the general population from releases of radioactivity, 2) protection of individuals from inadvertent intrusion, 3) protection of individuals during operations, and 4) stability of the disposal site after closure.*

5.2.6 If additional data are required, data may be collected in accordance with WV-902, "Planning for Data Collection Activities."

5.2.7 WIR determinations will be implemented in accordance with requirements of the WVDP Quality Assurance Program.

5.3 Training/Approval of Individuals Who Document WIR Determinations

5.3.1 Individuals who review and document WIR evaluations SHALL have been approved to perform this function by the Waste Shipping and Disposal Project Manager through completion of training requirements outlined by training activity number VO430Q.

6.0 PROCEDURE

The WIR process is summarized on the flow chart in Attachment A. Wastes may be excluded from the WIR process in accordance with Sections 6.1 and 6.2. If the waste does not meet criteria for exclusion as a result of these sections, trained personnel will be assigned to complete the WIR process, as summarized in Sections 6.3 through 6.5.

WIR determinations are performed on each waste characterization profile. If the waste profile is new, or is being revised, a new WIR Determination Screen (Form WV-4405) SHALL be completed and filed with the waste characterization profile. WIR determinations MAY be performed on a container by container basis.

6.1 Identify the Waste for the WIR Determination

If wastes are being evaluated on a waste profile basis, determine if a waste profile has been previously generated and the WIR process has been performed on the waste profile. If not, proceed to Step 6.1.1. If wastes are being evaluated on a container basis, proceed to Step 6.1.1.

6.1.1 Determine if a waste is radiologically contaminated. If not, the waste is excluded from any further WIR screening process. Document the screening results on Form WV-4405 (i.e., answer "No" at Gate 0 on Form WV-4405), check that the waste is not HLW and print/sign name underneath the first section of Form WV-4405. A peer review is required, with a signature and date. Forward completed form to WPD to be incorporated into the waste characterization profile file or with the individual file for the container. Otherwise, answer the gate "Yes" and continue with the screening process.

NOTE *The scope of a WIR determination may be narrowly or broadly defined, ranging from a single item or small group of items to an entire facility. For efficiency it is recommended that, whenever possible, wastes resulting from the same processes be combined into a single WIR determination (DOE G 435.1-1, p. II-18).*

6.2 Determine if the Waste is From a HLW System or Could Have Been "Wetted With" HLW

6.2.1 Determine if the waste originated from (or may have been contaminated with spills from) one of the systems that was "wetted" with HLW, as listed in Attachment B. If so, it is subject to this procedure. If not, it is excluded. Document the screening results on Form WV-4405 (i.e., answer "No" at Gate 1 on Form WV-4405), check that the waste is not HLW and print/sign name underneath this section of Form WV-4405. A peer review is required, with a signature and date. Forward completed form to WPD to be incorporated into the waste characterization profile file or with the individual file for the container. Otherwise, answer the gate "Yes" and continue with the screening process.

6.2.2 Determine if the waste is from a system component with the potential to have been "wetted" by HLW, as listed in Attachment C (for instance, tanks, pumps, and piping). If the waste is not from one of the system components that may have come into contact with HLW, it is excluded from this procedure. The component is also excluded if it is known never to have been "wetted" with HLW. Document the screening results on Form WV-4405 (i.e., answer "No" at Gate 2 on Form WV-4405), check that the waste is not HLW and print/sign name underneath this section of Form WV-4405. A peer review is required, with a signature and date. Forward completed form to WPD to be incorporated into the waste characterization profile file or with the individual file for the container. Otherwise, answer the gate "Yes" and continue with the screening process.

NOTE 1 *For example, a tank that was part of System 7 but was used only to hold evaporator condensate would be excluded from this process.*

NOTE 2 *Further evaluation requires completion by a WIR Evaluation Analyst.*

6.3 Determine if the Waste is not HLW by the Citation Process

NOTE *The individual performing the WIR determination may perform a WIR evaluation for any item listed in Attachment D if they feel it is necessary.*

If the waste does not consist of only items from the list in Attachment D, document the screening results on Form WV-4405 (i.e., answer "No" at Gate 3 on Form WV-4405 and skip to Section 6.4 of this procedure). Otherwise, the waste is determined to be not HLW by citation and can be managed as other than HLW. Waste will be classified, characterized, and managed in accordance with Waste Management Procedures.

6.3.1 Document the screening results on Form WV-4405 (i.e., answer "Yes" at Gate 3 on Form WV-4405 and complete the corresponding citation number from Attachment D), check that the waste is not HLW and print/sign name underneath this section of Form WV-4405. A peer review is required, with a signature and date.

6.3.2 Forward completed form to WPD to be incorporated into the waste characterization profile file or with the individual file for the container.

6.4 Determine if the Waste is Excluded by the Evaluation Process

NOTE *Consideration may be given to both the current and future waste forms when completing WIR evaluations.*

If process knowledge suggests that the waste could be managed as TRU waste, complete Section 6.4.1 to assess compliance with **TRU Criterion 1** and Section 6.4.6 in order to assess compliance with **TRU Criteria 2 and 3**.

If process knowledge suggests that the waste could be managed as LLW, complete Section 6.4.1 to assess compliance with **LLW Criterion 1** and Section 6.4.7 in order to assess compliance with **LLW Criteria 2 and 3**.

6.4.1 Evaluate the Waste for Removal of Key Radionuclides

In this section, the waste is evaluated for compliance with **TRU Criterion 1** and **LLW Criterion 1** as cited in Sections 5.1.2.A.1 and B.1 in order to determine if major radionuclides have been removed to the maximum extent technically and economically practical. A suggested tabular format for the evaluation is given in Section 6.4.2.

A. Assess Technical Practicality

1. Identify the technical decontamination methods that are applicable to the waste being evaluated. Technical treatment options may include the following:

    - chemical treatment processes (e.g., acid bath)
    - physical removal processes (e.g., spraying, scraping)
    - separation technologies (e.g., ion exchange)

    Include all treatment methods that were considered.

2. Identify the key radionuclides requiring removal.

3. Evaluate the radionuclide removal efficiencies for each technology listed. Document the evaluation.

4. Document the assessment of factors such as technical risk, physical or chemical factors incompatible with the waste, and potential effects on the public, the worker, and the environment.

5. For each treatment method, list the bases of the determination for those methods that were practical and those that were impractical. (Such bases may include the status of the technologies, such as the technical maturity or the results from applying the technology at other sites.)

6.4.2 Assess Economic Practicality

NOTE *If wastes could meet WAC of off-site disposal facilities or if wastes could meet 10 CFR 61.55 Class C LLW criteria without additional treatment, it may be determined that further removal of radionuclides is not economically practical.*

A. For each of the technical processes determined technically practical, include:

- total life cycle costs for an alternative or

- unit costs (e.g., cost per curie removed, cost per piece of equipment decontaminated, or cost per person-rem)

B. Determine, if possible, a relationship between costs and removal of the key radionuclides and identify the point in the relationship at which removal costs increase and become impractical.

C. An economic assessment may not be necessary if a treatment option is not considered to be technically practical.

Example Worksheet for Technical and Economical Practicality				
Technical Removal Process	**Estimated Removal Efficiency (%)**	**Cost Per Tank**	**Technology Status**	**Comments**
1) Spray Washing	99%	$1.2M	Demonstrated technology	Dependent upon properties of residual waste
2) Chemical Dissolution	99.9%	>$20M	Demonstrated technology	Possible equipment corrosion

6.4.3 On the basis of the technical and economic evaluation in this section as well as on the basis of the results from Sections 6.4.6 (TRU) and 6.4.7 (LLW), select the optimum treatment method and document the basis for the selection. An example text format for the evaluation is given in Attachment E.

6.4.4 If it is determined that radionuclides have been removed to the maximum extent technically and economically practical, then the waste is compliant with either **TRU Criterion 1** or **LLW Criterion 1**, whichever is being evaluated.

6.4.5 If it is determined that radionuclides have not been removed to the maximum extent technically and economically practical, then the waste may be processed further and re-evaluated. Otherwise, the waste must be managed as HLW. (See Section 7.5.)

6.4.6 Evaluate the Waste as Transuranic (TRU) Waste

In this section, waste is evaluated for compliance with **TRU Criteria 2 and 3** as cited in Sections 5.1.2.B.2 and B.3.

NOTE *The following procedural steps for WIR determinations do not require that formal waste profiles, container characterization files, and/or other documentation be generated in accordance with Waste Management procedures. The following steps are predictive and are intended to be used only for WIR determinations. Checklists and criteria in Waste Management documents or in WVDP controlled documents pertaining to waste storage are to be used for guidance only.*

A. Estimate the concentration (in nCi/g) of TRU in the waste being assessed and document the estimate.

1. Documentation should include calculations summarizing the technical basis for the concentration estimate including: the mass of the final waste form, analytical data used to estimate the activity of each TRU and any other supporting information. (See Section 6.4.8.)

2. Isotopes for TRU determinations include: neptunium-237, plutonium-238, plutonium-239, plutonium-240, plutonium-242, plutonium-244, americium-241, americium-242, americium-243, curium-243, curium-245, curium-246, curium-247, curium-248, curium-250, berkelium-247, californium-249, and californium-251. (Listing is from WVDP-370, item 4.2.1.)

B. Determine if the estimated concentration is more than 100 nCi/g (3700 Bq/g).

If the estimated concentration is less than or equal to 100 nCi/g, the waste cannot be classified as TRU and must be evaluated via the LLW option. (See Section 6.4.7.)

C. Using guidance from criteria in WM-210, "Waste Stream Characterization," determine if the waste has the potential to be disposed off-site.

1. If it is determined that the waste could meet the WAC of a disposal facility that can accept TRU waste (e.g., WIPP - in the event that this disposal facility may be used by the WVDP), the waste will be considered as compliant with **TRU Criteria 2 and 3**.

2. If the waste cannot meet WAC criteria for an off-site disposal facility, then the waste SHALL be managed as HLW in accordance with Section 6.5.

NOTE *Conditions for on-site storage include restrictions on free liquids, hazardous constituents, pressurization, pathogens, chelating agents, polychlorinated biphenyls, reactivity, fissile material, contamination, and contact exposure rate.*

D. If the waste has potential for on-site storage as TRU waste, it must be demonstrated to meet a TRU WAC for the anticipated final waste form.

E. If waste could not meet WAC criteria for an off-site disposal facility, then the waste SHALL be managed as HLW in accordance with Section 6.5.

6.4.7 Evaluate the Waste as Low-level Waste (LLW)

In this section, waste is evaluated for compliance with **LLW Criteria 2 and 3** as cited in Sections 5.1.2.A.2 and A.3.

NOTE *The following procedural steps for WIR determinations do not require that formal waste profiles, container characterization files, and/or other documentation be generated in accordance with Waste Management procedures. The following steps are predictive and are intended to be used only for WIR determinations. Checklists and criteria in Waste Management documents or in WVDP controlled documents pertaining to waste storage are to be used for guidance only.*

A. Estimate the concentration (in nCi/g or Bq/m^3, as appropriate) of key radionuclides in the waste being assessed and document the assessment.

1. Include all 10 CFR 61.55 Table 1 and Table 2 radionuclides applicable to the WVDP: hydrogen-3, carbon-14, cobalt-60, nickel-63, strontium-90, technetium-99, iodine-129, cesium-137, plutonium-241, curium-242, and alpha-emitting TRU nuclides (all of the TRU nuclides listed in Section 7.4.6.A.1, above, plus curium-244). Radionuclides in activated metals and those with half-lives less than five years were not included in the listing since these do not apply to WVDP waste.

2. Documentation should include calculations summarizing the technical basis for the concentration estimate, including: the mass of the material, analytical or measurement data used to estimate the activity of each key radionuclide, and any other supporting information, as appropriate. (See Section 6.4.8.)

B. Determine if the estimated concentrations are consistent with 10 CFR 61.55 criteria for Class C LLW.

1. If estimated concentrations are not within the Class C criteria, the waste may not have the potential to be classified as LLW but must either be processed further to remove additional radionuclides (Section 6.4.1) and re-evaluated <u>or</u> (if not already done) be assessed via the TRU option (Section 6.4.6) or pursue alternative classification.

2. If estimated concentrations are within Class C criteria, the waste has the potential to be classified as LLW.

3. The waste may also be considered LLW if it meets the alternative requirements for waste classification and characterization as DOE may authorize (DOE M 435.1-1, Section II, B(2)(a)3). Such alternative requirements for waste classification and characterization are not addressed in WV-929.

C. If the waste could meet the WAC of a disposal facility that can accept LLW (e.g., a DOE facility such as the Nevada Test Site (NTS) or Hanford or a commercial facility such as Envirocare), it is considered compliant with **LLW Criteria 2 and 3**. Document per Section 6.4.8.

D. If the waste could not meet WAC criteria for an off-site disposal facility or if no disposal facility is currently available, the waste must be evaluated for on-site storage.

NOTE *Conditions for on-site storage include restrictions on free liquids, hazardous constituents, pressurization, pathogens, chelating agents, polychlorinated biphenyls, reactivity, fissile material, contamination, and contact exposure rate.*

E. If the waste could meet criteria in WVDP-370 for on-site storage as LLW, the waste is considered compliant with **LLW Criteria 2 and 3**. Document per Section 6.4.8.

F. If the waste does not meet criteria of LLW it must either be processed further (Section 6.4.1) and re-evaluated or managed as HLW (Section 6.5).

6.4.8 <u>Document Results of the WIR Evaluation</u>

A. Document the screening results on Form WV-4405 (i.e., answer "Yes" or "No" at Gate 4 on Form WV-4405), check that the waste is or is not HLW and print/sign name underneath this section of Form WV-4405. A peer review is required, with a signature and date. Another WIR Evaluation Analyst or the Project Integration, Strategy, and Communications Manager can serve as a peer reviewer.

B. Transmit the completed form per WV-107 to DOE for review and consultation.

C. Once DOE has performed their review and consultation, forward completed form to WPD (as well as documentation from DOE) to be incorporated into the waste characterization profile file or with the individual file for the container.

D. A suggested format for documenting WIR evaluation determinations is provided in Attachment E. Supporting documentation for WIR evaluation determinations SHALL include the following at minimum:

- Calculations for radionuclide concentrations (e.g., analytical data, volume estimates, density estimates, dose estimates, dose-to-curie conversion factors);
- Comparison of nuclide concentrations with applicable limits (e.g., TRU limit in DOE M 435.1, Class C LLW limits in 10 CFR 61.55);
- Documentation of potential for compliance with off-site WAC criteria;
- Calculations for cost estimates;
- Bases for selection of preferred treatment methods; and
- Bases for ultimate WIR determination.

E. WIR evaluations SHALL be attached to the WIR Determination Screen (WV-4405) and maintained as part of characterization profile documentation or with the individual file for the container.

6.5 Disposition of Materials Determined to be HLW

Materials that have not been excluded and have not met the WIR criteria (e.g., are HLW are to be stored or managed as appropriate, for instance, in HLW interim storage, until such time as disposition is defined.

6.5.1 Document the results of the WIR evaluation in accordance with Section 6.4.8.

6.5.2 Wastes may be processed further to reduce radionuclide concentrations and may then be re-evaluated.

6.5.3 Alternate options for classification or disposal may be considered.

7.0 RECORDS

The following forms, data sheets, logs, reports, or any other form of documentation considered to be a record and generated in response to this procedure shall be prepared, maintained, and transferred to the MRC in accordance with WVDP-262. Refer to RIDS for further information.

7.1 Documentation supporting WIR determination by the evaluation process. (See Section 6.4.8.).

7.2 WIR Determination Screen (Form WV-4405).

8.0 ATTACHMENTS

Attachment A - Flow Chart for WIR Determinations

Attachment B - List of System Numbers and HLW Status of Each

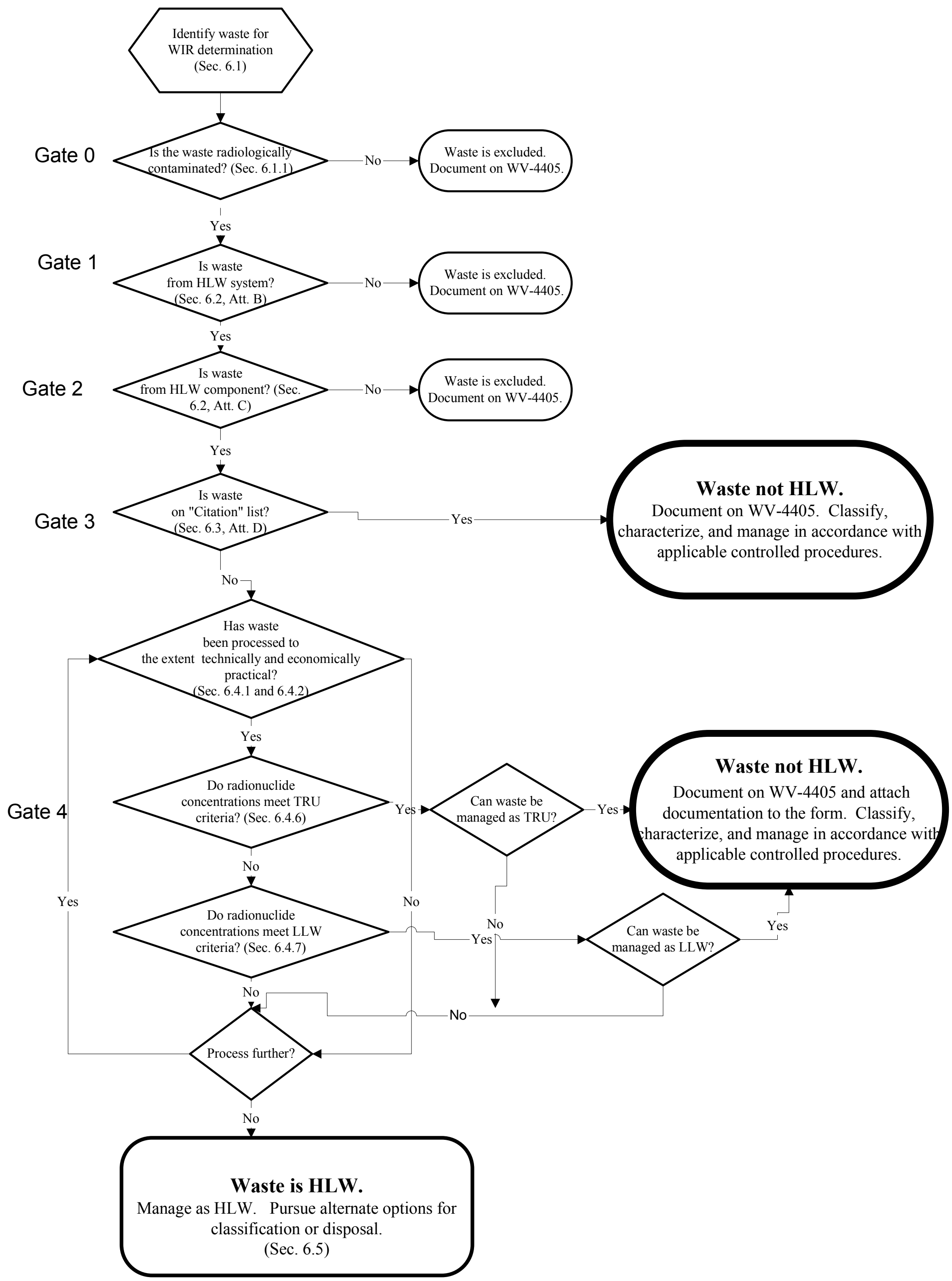
Attachment C - Equipment Type Designators at the WVDP

Attachment D - Listing of Items that are Excluded by Citation

Attachment E - Suggested Format for Documenting WIR by Evaluation

Attachment F - Justification for Adding an Incidental Waste Citation Process Category

Attachment A
Flow Chart for WIR Determinations



Attachment B - List of System Numbers and HLW Status of Each

The following is a list of system numbers and a description of systems that have been (or will be) used to process, transfer, or store HLW. Sources: EP-8-001 (and cited lists) and logbook "Bechtel Drawing Control Index," dated 5/78.

System #	Description
4	Solvent Extraction and Waste Separation
7	Process Waste Handling
8	High-Level Liquid Waste Storage (Waste Tank Farm)
50	Supernatant Treatment System
55	Sludge Mobilization and Transfer System
63	Vitrification Facility System
68	High-Level Waste Interim Storage
69	Vitrification Facility Sampling
90	Analytical Laboratory
313	Remote-Handled Waste Facility

Attachment C - Equipment Type Designators at the WVDP

Equipment used to process, transfer, or store HLW are in **bold**. Designators formerly used by NFS are listed. Sources: EP-8-001 (and cited lists) and logbook "Bechtel Drawing Control Index," dated May 1978.

Designator	Type	Designator	Type
A (NFS)	**General**	M	Shielding doors and windows
AAD	Air aspirating detector	MCC	Motor control center
ANN	Annunciator	MCP	Motor control panel
ANS	Annex distribution center	MPS	Manual pull station
AP	All-page, plant-page	MS	Motor starter
ARP	Agent release panel	MSM	Master/slave manipulator
ASD	Adjustable speed drive	MSS	Main switching station
B	Control panels (general)	N (NFS)	Insulation
B (NFS)	**Process**	OCB	Oil circuit breaker
BD	Beam detector	P	Generators (or "Electrical" as formerly used by NFS)
C	**Columns, pressure vessels, and scrubber**	PB	Pull box (wire pull box)
CAS	Clean agent system	PC	Pump controller
CB	Electrical circuit breaker	PDB	Power distribution box
CE	Communications panel	PLC	Programmable logic controller
CP	Control panel (electrical)	PP	Power panel
D	**Tanks**	Q (NFS)	Foundations
DC	Dry chemical	R (NFS)	Buildings
DGP	Data gathering panel	RDR	Radiation detection relay
DS	Disconnect switch	RE	Rad monitor skid
E	**Exchangers**	RP	Relay panel
EHT	Electrical heat trace box	RUD	Roll-up door
EJB	Electrical termination box	S (NFS)	Site improvements
F	Fired heaters	SA	Security alarm
FAP	Fire alarm panel	SD	Smoke detector
FD	Fire damper	SG	Switch gear
FU	Fuses	SPS	Spray process systems

Attachment C - Equipment type Designators at the WVDP (cont.)

Designator	Type	Designator	Type
G	**Pumps and drivers**	SRP	Sequence relay panel
GB	Glove box	SS	Selector switch
GE	Engine drive pump’s engine	STR	Storage rack
GM	Motor-driven pump’s motor	**T**	**Filters ("Special Equipment" as used by NFS)**
GT	Turbine-driven pump’s turbine	TC	Temperature controller
H	**Vacuum equipment**	TE	Resistance temperature detector (RID)
HD	Heat detector	TM	Electrical thermostat
HJB	Heater junction box	TPB	Telecommunications pull box
HTD	Heat trace power distribution panel	**TRS**	**Transfer system**
HTR	Electric heater	TS	Electrical transfer switch
HTT	Heat trace tee connection box	TTB	Telecommunications termination box
ID	Isolation damper	U (NFS)	Expendables
IM	Interface module	UPS	Uninterruptible power supply
J (NFS)	Instruments	US	Unit substation
JB	Junction box	**V**	**Package units**
K	**Fans, compressors, and mixers**	VC	Video camera
KM	Fan, compressor, mixer drive motor	VFD	Variable frequency drive
L	**Piping (NFS designator)**	W	Cranes, lifting equipment, and conveyors ("material processing" by NFS)
LC	Load center	WI	Weigh scale
LDR	Line driver	WT	Work table
LP	Lighting panel	X (NFS)	Painting
LS	Limit switch / level switch	XFR	Transformer
LT	Lighting transformer	**XX**	**Miscellaneous**
M (NFS)	**Structures**	Y	Ventilation, HVAC equipment

Attachment D - Listing of Items that are Excluded by Citation

The proposed addition of new waste categories to this listing should be forwarded to the DOE-WVDP for approval.

A. Contaminated Job Wastes

Citation Number	Waste
A1	hand tools (e.g., screwdrivers, wrenches, hammers)
A2	electrical tools (e.g., drills, grinders)
A3	job control wastes (e.g., paper, plastic, rubber, metal, wood, cloth items, tape, survey media, postings, signs, step-off pads, ropes, barricades, herculite)
A4	temporary containment materials (e.g., huts, windbreaks, glove bags, drip containment)
A5	ventilation system HEPA filters, ventilation systems, off-gas systems, and associated components
A6	personnel protective equipment (e.g., clothing, respiratory equipment)
A7	hoses and electrical cords
A8	radiological monitoring equipment (e.g., wipes, smears, filters, probes)
A9	portable tools (e.g., hydraulically-operated shears, cut-off saws, flame torches)
A10	emptied waste boxes, reusable insert containers (RIC)
A11	general debris (trash) removed during manual housekeeping
A12	material handling equipment (e.g., gantry crane)
A13	consumables (e.g., weld rod)
A14	portable fire extinguishers
A15	hoisting and rigging
A16	Replaced, worn and failed parts (e.g., wires, cables, motors, gears, brackets, plates, bearings, belts, gaskets, flanges, pipe, and valves)

B. Sample Media

Citation Number	Waste
B1	lab ware (e.g., funnels, beakers, cylinders, stir bars, flasks, sample bombs)
B2	thermometers
B3	sample vials, vessels, and bottles
B4	sample carriers
B5	tongs and forceps
B6	syringes and needles
B7	planchets, crucibles, and crucible lids
B8	expended samples

Attachment D - Listing of Items that are Excluded by Citation (cont.)

C. Measuring and Monitoring Equipment

Citation Number	Waste
C1	tapes (e.g., reel, steel)
C2	instruments and gauges
C3	indicators (e.g., level, pressure, density, specific gravity)
C4	temperature indicators and thermocouples in wells
C5	conductivity probes
C6	in-line monitors

D. Laboratory Clothing, Tools, and Equipment

Citation Number	Waste
D1	lab coats, gloves, tape, hoods, shoe covers, coveralls
D2	wipes, swabs, absorbent materials, towels
D3	weighing equipment (e.g., laboratory balances and scales)
D4	centrifuges
D5	sampling and analytical evaporators and condensers
D6	grinding equipment and lab ware for solid samples
D7	electronic measuring equipment and probes or detectors for chemical and radioactive constituents
D8	cables and cords
D9	heating equipment (e.g., hot plates, ovens, furnaces, microwave ovens)
D10	laboratory instrumentation with associated wiring, plumbing, and tubing
D11	laboratory quantities of contaminated resins, reagents, sample aliquots
D12	empty laboratory containers (e.g., leach buckets, mixing containers, digestion vessels)
D13	DELETED
D14	glove boxes, hoods, and associated equipment
D15	remote cameras and support equipment
D16	shield windows and other shielding (temporary or permanent)
D17	laboratory-associated operations equipment and media (e.g., HEPA and HEME filters)

E. Decontamination Media and Decontamination Solutions

Citation Number	Waste
E1	swabs, mops, masslin clothes, buckets, rollers, brushes
E2	kraft paper, surface coverings, wrappings
E3	strippable coatings and application equipment
E4	CO_2 decontamination equipment (tanks, hoses, nozzles)
E5	acids, bases, and cleaning solutions
E6	liquid, chemical, and steam spray nozzles, hoses, and piping
E7	scabbling equipment
E8	canister decontamination chambers and support equipment
E9	herculite and tape
E10	portable vacuum cleaners
E11	spray wands, spray manifolds
E12	piping, tanks and vessels used to collect cleaning solutions (e.g., contaminated water)

F. Secondary Waste

Citation Number	Waste
F1	Main Plant Process Building Vessels and Components including 4C-1, 4D-2, 7D-1, 7C-1, 7D-4, 7D-10 and 7C-2 and connective piping
F2	Equipment installed in underground waste tanks and used in managing and retrieving HLW, including Waste Tank Farm Mobilization and Transfer Pumps including 55-G-001, -002, -003, -004, -005, -006, -007, -008, -009, -010, -012, -013, -014, -014a, -014b, -018, 50-G-001, 50-G-004 and connective piping
F3	Waste transfer piping used to convey HLW from the Waste Tank Farm to the Vitrification Facility and related equipment.

Attachment E

Suggested Format for Documenting WIR by Evaluation

- Introduction and Summary
- Background
- Approach
    - Technical and Economic Practicality
    - Concentration and Physical Form
    - Performance Objectives
- Technical and Economic Practicality
    - Technical Practicality
        - Characteristics and Waste Properties
        - Methodology
        - Discussion
    - Economic Practicality
    - Conclusion
- Concentration Limits and Physical Form
- Performance Assessment
- References

1.0 INTRODUCTION

1.1 Purpose

The purpose of this attachment is to demonstrate that certain equipment and material contaminated by high-level waste (HLW) at West Valley are not HLW by the citation process of Section II.B(1) of Department of Energy (DOE) Manual 435.1-1, *Radioactive Waste Management*. This equipment and material is listed in Attachment D to this procedure, *Listing of Items that are Excluded by Citation*, and described below.

The information in this attachment provides the technical basis for DOE-West Valley to make a waste-incidental-to-reprocessing (WIR) determination by the citation process that this group of equipment and material is not HLW and can be managed as low-level waste (LLW) or transuranic (TRU) waste or their mixed waste counterparts.

1.2 Scope

This technical basis document applies to the following waste streams contaminated by HLW:

(1) The following seven vessels from the Main Plant Process Building that came in contact with HLW from spent nuclear fuel reprocessing operations:

- 4C-1, the Partition Cycle Extraction Column from Extraction Cell 1;
- 4D-2, the Partition Cycle Waste Catch Tank from Extraction Cell 1;
- 7D-1, the High-Level Waste Evaporator Feed Tank from Extraction Cell 1;
- 7C-1, the High-Level Waste Evaporator from the Chemical Process Cell;
- 7D-4, the High-Level Waste Accountability and Neutralizer Tank from the Chemical Process Cell;
- 7D-10, the Low-Level Waste Accountability and Neutralizer Tank from the Chemical Process Cell; and
- 7C-2, the Low-Level Waste Evaporator from the Chemical Process Cell.

The connective piping associated with these vessels is also part of the waste stream.

(2) Equipment installed in the underground waste tanks and used in managing and retrieving HLW, including 18 mobilization and transfer pumps and other similar and related items, including connective piping; and

(3) Waste transfer piping used to convey HLW from the waste tank farm to the Vitrification Facility.

This equipment and material is considered to be secondary waste.[1]

This technical basis document establishes that each of these waste streams is not HLW by the citation process by confirming that it does not contain a significant amount of waste due to (a) its design and usage and/or (b) decontamination consistent with as low as reasonably achievable (ALARA) requirements based on available information, as indicated in Section 3.1.

[1] As the term is used in this procedure, secondary waste consists of waste byproducts resulting from the management, retrieval, treatment, storage, handling, and analysis of HLW that have become radioactively contaminated by such waste.

However, consistent with guidance in DOE Guide 435.1-1, *Implementation Guide for use with DOE M 435.1-1*[2], it also considers the evaluation process criteria of Section II.B(2) of DOE Manual 435.1-1 and shows that the subject waste streams meet these criteria. This information is included to provide added assurance that these waste streams could not be HLW.

The citation process is used for reprocessing wastes that can be demonstrated not to be HLW using readily available or observable information. The evaluation process is used for reprocessing wastes whose classification cannot be readily discerned from readily available information and from which key (that is, highly radioactive) radionuclides must be removed to the maximum extent technically and economically practical in order to render the waste not highly radioactive. In addition, evaluation process wastes must be carefully analyzed to ascertain that, if they are disposed of at a LLW disposal site, performance objectives comparable to those set forth in 10 CFR Part 61, Subpart C*, Performance Objectives,* will be met. If the evaluation process wastes are to be disposed of as TRU waste, then analyses are required to ensure conformity with the disposal site's waste acceptance criteria and permit requirements. DOE Guide 435.1-1 states that:

> "The distinction between the two processes is important because it is clear from background events that citation process waste streams were so identified because of the ease of determining up front that they do not pose the long-term hazards associated with high-level waste. Evaluation process wastes, on the other hand, generally require a case-by-case evaluation and determination."

Section 1.3.3 describes the requirements for the citation and evaluation processes.

The WVDP consulted with the DOE Office of Environmental Management in development of this attachment and the related procedure revision consistent with guidance in DOE Guide 435.1-1.

1.3 Background

Nuclear Fuel Services, Inc. reprocessed spent nuclear fuel at the West Valley plant from 1966 through 1972. This commercial enterprise, which was licensed by the U.S. Atomic Energy Commission, generated approximately 600,000 gallons of HLW, which was stored in underground waste Tanks 8D-2 and 8D-4. Under the *West Valley Demonstration Project Act of 1980*, DOE built a Vitrification Facility and solidified the HLW, completing this activity in 2002. Pretreatment of the waste prior to solidification involved use of underground waste Tank 8D-1, which also contained HLW.

1.3.1 West Valley HLW

The HLW at the West Valley site can be grouped by its general location.

Main Plant Process Building

The areas in this facility that contained HLW from reprocessing are Extraction Cell 1 and the Chemical Process Cell. These areas contained:

- Unneutralized and neutralized PUREX[3] HLW,
- Unneutralized THOREX[4] HLW, and

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[2] DOE Guide 435.1-1 states: "While not required, it is recommended that the process described for the evaluation process be implemented for the citation process as well. These elements are considered important to making defensible and consistent citation determinations and would be valuable if such determinations are questioned or challenged."

[3] PUREX stands for plutonium uranium extraction, which was the primary separations process used in the West Valley plant.

- Unneutralized and neutralized concentrated waste from subsequent extraction cycles

Neutralized PUREX HLW, unneutralized THOREX HLW and neutralized concentrated waste from subsequent extraction cycles were transferred from the Main Plant Processing Building to Tanks 8D-2 and 8D-4 in the Waste Tank Farm from 1966 to 1972. Various decontamination flush solutions continued to be transferred from the Main Plant to the tank farm through 1976.

Waste Tank Farm

The waste tank farm contains four underground waste tanks designated 8D-1, 8D-2, 8D-3,and 8D-4. Tanks 8D-1 and 8D-2 have a capacity of 750,000 gallons and Tanks 8D-3 and 8D-4 have a nominal capacity of 15,000 gallons.

Tanks 8D-1, 8D-2, and 8D-4 contained unneutralized and neutralized THOREX and neutralized PUREX HLW in the form of supernatant and sludge, along with pre-treated supernatant and sludge. Supernatant and sludge were pre-treated between 1988 and 1995 and pre-treated supernatant and sludge composite was transferred from Tank 8D-2 to the Vitrification Facility for solidification from 1996 to 2002. Tank 8D-3 was a spare tank during Nuclear Fuel Services operations and was never used for HLW by ether Nuclear Fuel Services or DOE.

Vitrification Facility

The Vitrification Facility contained:

- High-activity pretreated supernatant and sludge composite from Tank 8D-2,
- Supernatant and sludge composite with glass formers and molten glass, and
- Canisters of vitrified HLW

During the 1996 to 2002 period, the HLW was vitrified into 275 stainless steel canisters, which remain stored in the Main Plant Process Building. The main equipment in the Vitrification Facility used in the solidification of HLW was the Concentrator Feed Makeup Tank, the Melter Feed Holdup Tank, and the Vitrification Melter. The Vitrification Melter is the subject of a separate WIR evaluation (DOE-WV 2011).

Equipment and Material Contaminated by HLW

Reprocessing wastes are subject to WIR determinations by the citation or evaluation processes to meet the requirements of DOE Manual 435.1-1, *Radioactive Waste Management*. However, these requirements do not necessarily apply to Tanks 8D-1, 8D-2, and 8D-4. If these tanks were to be closed in place, the residual material in these tanks would be subject to WIR criteria contained in the Nuclear Regulatory Commission's (NRC's) Final Policy Statement on the Decommissioning Criteria for the WVDP, dated January 2002 (NRC 2002). If the tanks were to be removed and the waste disposed of offsite, the requirements of DOE Manual 435.1-1 (or its successor, as applicable) would apply.

1.3.2 Deactivation, Decommissioning, and Radioactive Waste Management

In recent years, the WVDP has continued deactivation work in the Main Plant Process Building and other site facilities. This effort includes removing radioactive equipment and preparing it for shipment offsite for disposal.

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[4] THOREX stands for thorium uranium extraction, a separations process similar to the PUREX process that was used for one fuel batch. The THOREX HLW was collected in Tank 8D-4.

One important element in this process was removing as much residual radioactivity from process systems, waste transfer piping, and vitrification facility equipment as practicable before shutdown of the vitrification melter. The flushing performed to this end proved to be very effective as discussed below.

In 2009, the WVDP Phase 1 Decommissioning Plan (WSMS and SAIC 2009) was issued to provide requirements for the initial activities in decontamination and decommissioning of the facilities used by the WVDP in connection with solidification of HLW, including removal of the Main Plant Process Building and the Vitrification Facility. The Phase 1 Decommissioning Plan implements the Phase 1 portion of the preferred decommissioning alternative as expressed in the Record of Decision for the *Environmental Impact Statement on Decommissioning and/or Long-Term Stewardship of the West Valley Demonstration Project and the Western New York Nuclear Service Center* (DOE 2010).

The WVDP ships LLW offsite for disposal at either the Nevada National Security Site or the Energy*Solutions* LLW disposal facility in Utah. Some LLW may also be shipped to the Waste Control Specialists LLW disposal facility in Texas. Transuranic waste is temporarily stored onsite until an approved disposition path becomes available.

Because of the large amount of removed equipment and its complexity, much of the removed equipment remains in temporary storage pending offsite shipment for disposal, including the Main Plant Process Building and Vitrification Facility vessels that are among the subjects of this technical basis document.

1.3.3 Waste-Incidental-to-Reprocessing Requirements

As noted previously, the WIR process in DOE Manual 435.1-1 was established to determine whether equipment and material contaminated by HLW can be managed as LLW or TRU waste instead of HLW. Section II.B of DOE Manual 435.1-1 specifies the applicable requirements as follows:

> "Waste resulting from reprocessing spent nuclear fuel that is determined to be incidental to reprocessing is not high-level waste, and shall be managed under DOE's regulatory authority in accordance with the requirements for TRU waste or low-level waste, as appropriate. When determining whether spent nuclear fuel reprocessing plant wastes shall be managed as another waste type or as high-level waste, either the citation or evaluation process described below shall be used:
>
> (1) **Citation**. Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes that meet the description included in the Notice of Proposed Rulemaking (34 FR 8712) for proposed Appendix D, 10 CFR Part 50, Paragraphs 6 and 7. These radioactive wastes are the result of reprocessing plant operations, such as, but not limited to: contaminated job wastes including laboratory items such as clothing, tools, and equipment.
>
> (2) **Evaluation**. Determinations that any waste is incidental to reprocessing by the evaluation process shall be developed under good record-keeping practices, with an adequate quality assurance process, and shall be documented to support the determinations. Such wastes may include, but are not limited to, spent nuclear fuel reprocessing plant wastes that:
>
> (a) Will be managed as low-level waste and meet the following criteria:

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical[5]; and
2. Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and
3. Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual [DOE Manual 435.1-1][6], provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

(b) Will be managed as transuranic waste and meet the following criteria:

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and
2. Will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize; and
3. Are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of this Manual, as appropriate."

1.4 Information Provided in this Attachment

Section 2 provides additional information to establish the context for use of the citation process for the subject waste streams.

Section 3 explains how application of the citation process shows that the seven vessels from the Main Plant Process Building that contained HLW from spent nuclear fuel reprocessing operations, including connective piping, are not HLW.

Section 4 explains how application of the citation process shows that the equipment used in managing and retrieving HLW from underground waste tanks – including 18 mobilization and transfer pumps and other similar and related items, including connective piping – are not HLW.

Section 5 explains how application of the citation process shows that the waste transfer piping that conveyed HLW from the tank farm to the Vitrification Facility is not HLW.

Section 6 lists references cited in the text.

[5] Removal to the maximum extent "technically and economically practical" is not removal to the extent practicable or theoretically possible. The term "practical" is intended to convey its usual meaning, such as "fitting the needs of a particular situation in a helpful way, helping to solve a problem or difficulty, effective, or suitable" (Cambridge 2009). The conclusion as to whether a particular key radionuclide has been or will be removed to the "maximum extent that is technically and economically practical" may vary from situation to situation, based not only on reasonably available technologies but also on the overall costs and benefits of deploying a technology for decontamination of a particular waste stream. Comparing costs (monetary, societal, etc.) to benefits (primarily reduced radiation dose) is an inherent part of the (ALARA process, which is discussed in Section 2.3 below.

[6] Wherever the words "of this Manual" appear in information quoted from DOE Manual 435.1-1, the "Manual" is DOE Manual 435.1-1.

2.0 BACKGROUND INFORMATION RELATED TO USE OF THE CITATION PROCESS

2.1 Introduction

The following matters are briefly discussed to help establish the context for the discussions in Sections 3 through 6:

- Lessons learned in application of the WIR criteria,
- DOE's ALARA requirements and how they ensure that key radionuclides in equipment and material that comprise secondary waste are removed to the maximum extent technically and economically practical,
- Decontamination processes used at West Valley to implement ALARA requirements,
- Waste characterization protocols used at West Valley, and
- The link between waste acceptance criteria and disposal site performance.

2.2 Lessons Learned

As noted previously, events that led to development of the WIR criteria make it clear that citation process waste streams were so identified because of the ease of determining up front that they do not pose the long-term hazards associated with HLW. Experience has shown that it is indeed easy to determine that many reprocessing waste streams do not pose such long-term hazards.

Experience at the four sites that have followed DOE WIR requirements and guidance since they were issued in 1999 – the Hanford site, the Idaho National Laboratory, the Savannah River Site, and the West Valley Demonstration Project (WVDP) – shows that the citation process can be widely applied because it can be established with ease that many reprocessing waste streams are not HLW by their origin or characteristics. That is, it is readily evident that they (1) are not the actual liquid or solid waste from reprocessing of spent nuclear fuel, but became contaminated by this waste, (2) are not highly radioactive (i.e., will meet waste acceptance criteria for disposal as LLW or TRU waste), and (3) do not require long-term geologic isolation under 10 CFR Part 60 or 10 CFR Part 63[7].

This conclusion is based on consideration of points such as the following:

(1) Many reprocessing waste streams consist of equipment used in some aspect of management of HLW that was not produced in reprocessing of spent nuclear fuel;

(2) Most of this equipment has a low potential for retaining significant amounts of waste due to its configuration and use;

(3) Sites managing HLW are required by DOE regulations, policies, and technical standards to implement the ALARA principle to decontaminate equipment that becomes contaminated by HLW;

(4) Decontamination performed in the field effectively removes residual waste from most equipment by simple processes such as flushing and rinsing with water;

[7] 10 CFR Part 60, *Disposal of High-Level Wastes in Geologic Repositories*, and 10 CFR Part 63, *Disposal of High-Level Wastes in a Geologic Repository at Yucca Mountain, Nevada*, apply to HLW. Some waste determined not to be HLW by the citation process may be classified as transuranic waste. (When geologic isolation is mentioned in this attachment, it is intended to mean geologic isolation under 10 CFR 60 or 10 CFR 63.)

(5) Characterization data typically show that radionuclide concentrations in waste packages containing the decontaminated equipment meet waste acceptance criteria for disposal as LLW;

(6) Meeting the waste acceptance criteria for disposal in a shallow-land LLW disposal facility ensures that the equipment does not require geologic isolation; and

(7) Meeting these waste acceptance criteria ensures that disposal of the reprocessing waste stream will not impact performance of the disposal site.

Such factors make it clear without detailed analysis that many reprocessing waste streams are not HLW. It follows that the evaluation determination process should be reserved for the most complex reprocessing waste streams that have a potential for containing significant amounts of residual waste, such as vitrification melters used to solidify HLW for geologic disposal. The latest WIR procedures from Hanford (Hanford 2008) and the Savannah River Site (McNeil 2010), which incorporate these lessons learned, were considered in development of this attachment.

2.3 Application of the ALARA Principle

This section describes DOE's ALARA requirements and policy, briefly explains how they are implemented at West Valley, and shows how their implementation ensures that equipment and material that comprise the reprocessing waste streams of interest are decontaminated to remove key radionuclides to the maximum extent technically and economically practical.

2.3.1 DOE ALARA Requirements and Policy

The Department requires that radiation protection programs include formal plans and measures for applying the ALARA process to occupational radiation exposure (10 CFR 835, *Occupational Radiation Protection*, Section101). The Department defines ALARA in 10 CFR 835 as follows:

> "[ALARA is] is the approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. As used in this part, ALARA is not a dose limit but a process which has the objective of attaining doses as far below the applicable limits of this part as is reasonably achievable."

DOE Order 458.1, *Radiation Protection of the Public and the Environment*, requires that "The ALARA process must be applied to all routine radiological activities." DOE's policy on ALARA is stated in DOE Policy 441.1, *Department of Energy Radiological Health and Safety Policy*, as follows:

> "It is the policy of the Department of Energy to conduct its radiological operations in a manner that ensures the health and safety of all its employees, contractors, and the general public. In achieving this objective, the Department shall ensure that radiation exposures to its workers and the public and releases of radioactivity to the environment are maintained below regulatory limits and deliberate efforts are taken to further reduce exposures and releases as low as reasonably achievable. The Department is fully committed to implementing a radiological control program of the highest quality that consistently reflects this policy."

DOE field managers are responsible for ensuring that ALARA principles for radiation protection are incorporated when reviewing and approving radioactive waste management activities (DOE Manual 435.1-1, page I-9).

2.3.2 West Valley ALARA Program

Like other sites that manage HLW, West Valley maintains an ALARA program consistent with DOE requirements and guidance as described in the site Radiological Controls Manual (WVNSCO 2006). This program is an integral part of all site activities involving radioactive materials. Components of this program include:

(1) *Policy* for commitment and participation of all management and workforce levels,

(2) *Training* for management and workers,

(3) *Design* of equipment and facilities,

(4) *Procedures* providing direction for maintaining occupational exposure ALARA,

(5) *Radiological work/planning* that implements controls and uses optimum methods to ensure occupational doses are ALARA,

(6) *Audits* conducted periodically to help ensure that policy and requirements are effectively implemented, and

(7) *Records* that document compliance and demonstrate that the program is effectively carried out.

The site work planning process is consistent with the guiding principles and core functions of Integrated Safety Management System described in DOE Policy 450.4, *Safety Management System Policy*, in work planning and the performance of radiological work. The seven guiding principles are:

(1) Line management responsibility for safety,

(2) Clear roles and responsibilities,

(3) Competence commensurate with responsibilities,

(4) Balanced priorities,

(5) Identification of safety standards and requirements,

(6) Hazard controls tailored to work being performed, and

(7) Operations authorization.

The core functions of integrated safety management involve (1) defining the scope of work, (2) analyzing the hazards involved, (3) developing controls, (4) performing work within these controls, and (5) providing feedback that is used to improve the work process.

Equipment removal and decontamination are the subject of detailed written instructions generally provided in the form of work packages. These work packages provide administrative and engineering controls to ensure that the work is accomplished safely and efficiently and in a manner consistent with ALARA principles.

2.4 Decontamination

It is standard practice at West Valley, as with other DOE sites, to decontaminate equipment to be removed from underground waste tanks before and during removal. Installed equipment – such as the seven Process Building vessels, the mobilization and transfer pumps, and the waste transfer piping that are among the subjects of this attachment – is decontaminated before and/or during removal consistent with ALARA requirements, generally by flushing with water or other decontamination solutions.

More information on these field decontamination processes are provided in Sections 3, 4, 5, and 6 to show that extensive field decontamination has produced notable results useful in support of including the subject waste streams on the citation list.

Unlike large DOE HLW waste sites, West Valley has limited capability for decontamination of removed equipment. The Remote-Handled Waste Facility contains a work cell and two other areas are available for decontaminating removed equipment but no area has any special decontamination equipment such as soaking tanks or water or acid spray equipment. There is also no current system to manage decontamination solutions.

2.5 Waste Characterization

West Valley requirements for characterization of radioactive waste are described in WVDP-353, *Waste Management Procedures* (WVES 2011), and SOP 300-7, *Waste Generation, Packaging, and On-Site Transportation* (WVES 2010). These documents describe methods to be used to determine the characteristics of a waste stream, including its predominant radionuclide content and distribution. The characterization approach for each waste stream considers factors such as the following:

- Its source,
- Its use prior to being declared a waste,
- Its association with radioactive material management areas,
- Its predominant radionuclide content and distribution,
- Its physical properties and chemical constituents,
- The type of disposal container used, and
- The feasibility of quantifying the radionuclide or chemical content of a waste package directly or indirectly using emitted radiation.

Characterization is performed on waste packages, and not equipment or material before it is placed into the waste package.

2.6 Waste Acceptance Criteria and Disposal Site Performance

This section describes the radioactive waste disposal facilities used by the site, discusses the waste disposal criteria for these facilities, and describes the link between the waste acceptance criteria and disposal site performance. All West Valley radioactive waste is disposed of offsite because there are no active onsite radioactive waste disposal facilities.

2.6.1 DOE LLW Disposal Facilities

Waste acceptance criteria for DOE LLW disposal facilities are established to ensure that the facilities perform as required. The performance objectives for a DOE LLW facility include dose limits for a member of the public and for a hypothetical person who, unaware of the buried radioactive material, might inadvertently drill a well into the buried waste, referred to as the post-drilling scenario, or establish a farm on the site, known as the intruder-agriculture scenario.

The performance objectives for DOE LLW disposal facilities are identified in DOE Manual 435.1-1.[8] Because of the established relationship between the waste acceptance criteria and performance assessments of the waste disposal sites, satisfying the waste acceptance criteria ensures compliance with the disposal site performance assessment and, hence, with the performance objectives. The rationale for this conclusion may be summarized as follows:

- DOE performance objectives for its LLW disposal facilities are comparable with those of 10 CFR 61, Subpart C (Wilhite 2001)[9];
- Disposal site performance in compliance with the performance objectives is determined by a performance assessment of the facility;
- This performance assessment is based on a projected total radionuclide inventory for the full, closed disposal site;
- This projected total inventory is based on the waste acceptance criteria, thus linking these criteria directly to the calculated disposal site performance; and
- Meeting the waste acceptance criteria will therefore provide reasonable expectation that the performance objectives will be achieved, because waste meeting these criteria would not increase the assumed waste inventory used in the performance assessment analyses.

Implementation of the waste acceptance criteria therefore provides assurance that inventories in disposal units comply with performance assessment requirements. The waste acceptance criteria serve as the principal means of communicating to waste generators the performance assessment assumptions, radionuclide limits for performance assessment and documented safety analysis, waste form requirements, and waste packaging requirements.

Waste that meets the waste acceptance criteria for a DOE LLW disposal facility is not highly radioactive for reasons such as the following:

- The waste acceptance criteria are established to ensure that disposal site performance meets DOE performance objectives for LLW disposal, which are comparable to NRC performance objectives for LLW disposal in 10 CFR Part 61, Subpart C, as just discussed.
- Because the DOE performance objectives are comparable to these NRC performance objectives – which apply to shallow land disposal of radioactive waste and specifically not to a geologic repository – it follows that waste meeting the waste acceptance criteria does not require geologic disposal.

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[8] Low-level waste disposal facilities shall be sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following performance objectives will be met for waste disposed of after September 26, 1988:

(a) Dose to representative members of the public shall not exceed 25 mrem in a year total effective dose equivalent from all exposure pathways, excluding the dose from radon and its progeny in air.

(b) Dose to representative members of the public via the air pathway shall not exceed 10 mrem in a year total effective dose equivalent, excluding the dose from radon and its progeny.

(c) Release of radon shall be less than an average flux of 20 $pCi/m^2/s$ (0.74 $Bq/m^2/s$) at the surface of the disposal facility. Alternatively, a limit of 0.5 pCi/L (0.0185 Bq/L) of air may be applied at the boundary of the facility.

The facility performance assessment is also required to include an assessment of impacts to a hypothetical intruder with performance measures of 100 mrem in a year for chronic exposure and 500 mrem in a year for acute exposure, excluding radon dose (DOE manual 435.1-1, IV). In addition, for purposes of establishing limits on radionuclides that may be disposed of near-surface, the performance assessment is required to include an assessment of impacts to water resources.

[9] A detailed demonstration of the comparability of the DOE performance objectives to the NRC performance objectives at 10 CFR 61, Subpart C can also be found in the Draft Waste Incidental to Reprocessing Evaluation for the Vitrification Melter (DOE-WV 2011).

2.6.2 LLW Disposal at the Nevada National Security Site

This DOE facility maintains two separate LLW disposal facilities known as the Area 3 and the Area 5 Radioactive Waste Management Sites. Only Area 5 is currently available for LLW disposal.

The Nevada National Security Site provides specific radionuclide waste acceptance criteria for LLW (DOE-NV 2011) that are expressed primarily in terms of waste package activity limitations based on Pu-239 equivalent grams (PE-g). This quantity relates the amount of a particular radionuclide to Pu-239.

The waste acceptance criteria are based on a performance assessment that provides reasonable expectation that DOE's performance objectives will be achieved and that the predicted potential doses to representative members of the public will be much less than the performance objective dose limits. The Nevada National Security Site waste acceptance requirements incorporate various controls to ensure that waste packages could not affect disposal site performance, including a Waste Acceptance Review Panel, a group of waste management specialists who review new and revised waste streams planned for disposal at the site.

2.6.3 Energy*Solutions* Disposal Facility at Clive, Utah

This commercial radioactive waste disposal facility is licensed by the State of Utah to dispose of Class A LLW and mixed waste, including radioactively contaminated soil and large components.

Energy*Solutions* specifies waste acceptance criteria for its Bulk Waste Disposal and Treatment Facilities (Energy*Solutions* 2011) and separately for its Containerized Waste Facility (Energy*Solutions* 2010). Acceptable radioactive wastes are:

- Class A LLW;
- Naturally occurring or accelerator produced radioactive material (NORM/NARM);
- Mixed LLW;
- Uranium and thorium mill tailings byproduct material;
- Special nuclear material in limited concentrations; and
- Polychlorinated biphenyl (PCB) radioactive waste, and PCB mixed waste

The waste acceptance process involves developing a radioactive waste profile record that is approved by the facility prior to waste shipment. The acceptability of disposal of a particular waste stream at the Energy*Solutions* Clive, Utah Facility is based on compliance with the waste acceptance criteria. If the waste meets the waste acceptance criteria, it is not necessary for West Valley to consider the potential impact of the waste stream on disposal site performance because disposal of radioactive waste that meets the waste acceptance requirements will not adversely impact performance of the disposal facility.[10]

2.6.4 Transuranic Waste

Unlike other DOE sites, West Valley is not currently authorized to ship TRU waste to the DOE's Waste Isolation Pilot Plant for disposal. However, TRU waste is packaged and characterized to ensure that it meets the waste acceptance criteria for the Waste Isolation Pilot Plant and stored onsite until a disposition path becomes available.

[10] This conclusion would also apply to the Waste Control Specialists LLW disposal facility in Texas if West Valley were to ship LLW to that facility for disposal.

2.6.5 Mixed Waste

Mixed waste is shipped to the Nevada National Security Site, to the Energy*Solutions* Clive, Utah facility, or to another suitable facility for any necessary treatment and offsite disposal. The waste profile documentation will show that the waste packages meet the facility waste acceptance criteria, thus ensuring that there will be no adverse impact on disposal facility performance.

3.0 MAIN PLANT PROCESS BUILDING VESSELS

This section shows that these vessels are not HLW by the citation process using the following approach:

Section 3.1 describes how the citation determination process is typically implemented.

Section 3.2 describes the vessels and explains how they were contaminated by HLW.

Section 3.3 describes the process used to decontaminate the vessels and shows that they do not contain a significant amount of waste.

Section 3.4 briefly discusses disposal of the vessels.

Section 3.5 describes the conclusion from use of the citation process for this waste stream and summarizes the basis for this conclusion.

Section 3.6 shows that the waste stream meets the first evaluation criterion.

Section 3.7 shows that the waste stream meets the second evaluation criterion.

Section 3.8 shows that the waste stream meets the third evaluation criterion.

Section 3.9 summarizes the conclusions about this waste stream meeting the evaluation criteria.

3.1 The Citation Determination Process

The citation process is typically used to assess a particular waste stream resulting from reprocessing by accomplishing steps in a two-part process such as the following:

A. Establishing that the waste stream is not HLW by:

(1) Understanding how the waste stream became contaminated by HLW;

(2) Confirming it is not one of the following items excluded from the citation process: ion exchange beds, sludges, or process filter media; and

(3) Confirming that it does not contain a significant amount of waste due to (a) its design and usage and/or (b) decontamination consistent with ALARA based on available information.

B. Establishing that the waste stream is prepared for disposal by:

(4) Confirming that it has been characterized and that this characterization is suitably documented;

(5) Confirming that it is in a solid form or determining how it will be treated to achieve a solid form;

(6) Confirming it has been packaged for disposal and identifying the type of disposal container or determining how it will be packaged; and

(7) Deciding on the disposal facility and confirming that the waste stream meets the waste acceptance criteria.

Part A addresses the WIR aspects of the process and Part B establishes how the waste will be disposed of. This process is formally documented and approved.

3.2 The Vessels and Their Uses

Extraction Cell 1 housed the equipment that performed the first partition of the raw dissolved spent fuel solution. The Chemical Process Cell housed the vessels used to concentrate and neutralize HLW. All seven vessels of interest have been removed from the Main Plant Process Building and are in temporary storage pending disposal. Table 1 identifies the sizes and uses of the vessels, which are made of stainless steel.

Table 1. Process Building Vessels of Interest(1)

No.	Name	Length (ft)	Dia. (ft)	Use
4C-1	Partition Cycle Extraction Column	43	0.92	First separations column
4D-2	Partition Cycle Waste Hold Tank	13	6	Received bottom stream from 4C-1
7D-1	HLW Evaporator Hold Tank	10	6	Received 4D-2 waste stream
7C-1	HLW Evaporator	8.5	5	Reduced volume of aqueous waste from 4D-2
7C-2	LLW Evaporator	8.5	8	Reduced volume of aqueous waste from several sources
7D-4	HLW Accountability and Neutralizer Tank	8	5	Received evaporator bottoms from 7D-1 with <8 molar nitric acid concentrations
7D-10	LLW Accountability and Neutralizer Tank	9	6	Received evaporator bottoms from 7C-2

NOTES: (1) Information from Choroser 2004 or Meigs 1987.

These vessels are eligible for the citation process because (1) they are not among the waste streams for which a citation determination has already been made, (2) they are not among the items excluded from the citation process, and (3) information to demonstrate that they do not contain a significant amount of waste is readily available.

3.3 Decontamination and Residual Waste

Records show that the vessel interior surfaces were effectively decontaminated by a series of system flushes performed by Nuclear Fuel Services following plant shutdown that removed approximately 110,000 curies from the partition system (Riethmiller 1981). The vessel exterior surfaces were also decontaminated either by Nuclear Fuel Services or by the WVDP. Conservative estimates of residual radioactivity following decontamination are shown in Table 2.

Table 2. Estimated Residual Radioactivity in Process Building Vessels of Interest (Curies)(1)

No.	Name	Activity	Basis
4C-1	Partition Cycle Extraction Column	0.13	Choroser 2004
4D-2	Partition Cycle Waste Hold Tank	77	Choroser 2011d
7D-1	HLW Evaporator Hold Tank	300	Choroser 2004
7C-1	HLW Evaporator	15	Choroser 2011c
7C-2	LLW Evaporator	2.0	Scientech 1997
7D-4	HLW Accountability and Neutralizer Tank	10	Scientech 1997

Table 2. Estimated Residual Radioactivity in Process Building Vessels of Interest (Curies)[(1)]

No.	Name	Activity	Basis
7D-10	LLW Accountability and Neutralizer Tank[(2)]	0.8	Scientech 1997

NOTES: (1) Estimates for vessels 4D-2 and 7C1 are the waste package estimates. The other estimates were based on in-situ dose rate data and are more conservative.

Consideration of the original amount of residual activity in the partition system and the estimated amounts in the vessels after decontamination leads to the conclusions that the vessels do not contain significant amounts of waste and that they have been decontaminated consistent with ALARA principles. More information on the decontamination processes and their effectiveness is provided in Section 3.6 below.

3.4 Disposal of the Vessels

As indicated in Table 2, the vessels have been characterized for residual radioactivity, although additional characterization will be performed for the individual waste packages prior to shipment offsite. The vessels are in solid form. In most cases, they will be disposed of in the individual steel containers in which they are presently stored. The WVDP expects to dispose of most of the vessel waste packages at the Nevada National Security Site and expects that final characterization will show that most of the stabilized waste will meet the waste acceptance criteria (DOE-NV 2011) for LLW.

3.5 Conclusion from Application of the Citation Process

Consideration of the information just discussed leads to the conclusion that the seven vessels and their connective piping are not HLW and can be managed and disposed of as LLW or TRU waste because they do not contain a significant amount of waste due to decontamination consistent with ALARA principles. The next three subsections consider the evaluation determination criteria of Section II.B(2) of DOE Manual 435.1-1 to provide added assurance that the vessels are not HLW.

3.6 Consideration of the First Evaluation Criterion

The first evaluation criterion for both LLW and TRU waste reads as follows:

> “ [The waste] has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical.”

To evaluate compliance with this criterion, it is first necessary to determine the key radionuclides in the waste stream. Then, the processes actually used to decontaminate the vessels and remove the key radionuclides, which were obviously technically and economically practical, are described. Finally, other methods that might be used to further remove key radionuclides and the technical and economic practicality of these methods are discussed.

3.6.1 Key Radionuclides

For the purposes of this technical basis document, it is assumed that the key radionuclides will be (1) the radionuclides generally considered to be important in disposal of LLW as identified in Table 1 and 2 of Code of Federal Regulations 10 CFR 61.55, *Waste Classification*, and (2) those radionuclides important to the performance of the Area 5 Radioactive Waste Management Site at the Nevada National Security Site (NST 2011).

This approach is consistent with current guidance in DOE Guide 435.1-1. These key radionuclides are as follows:

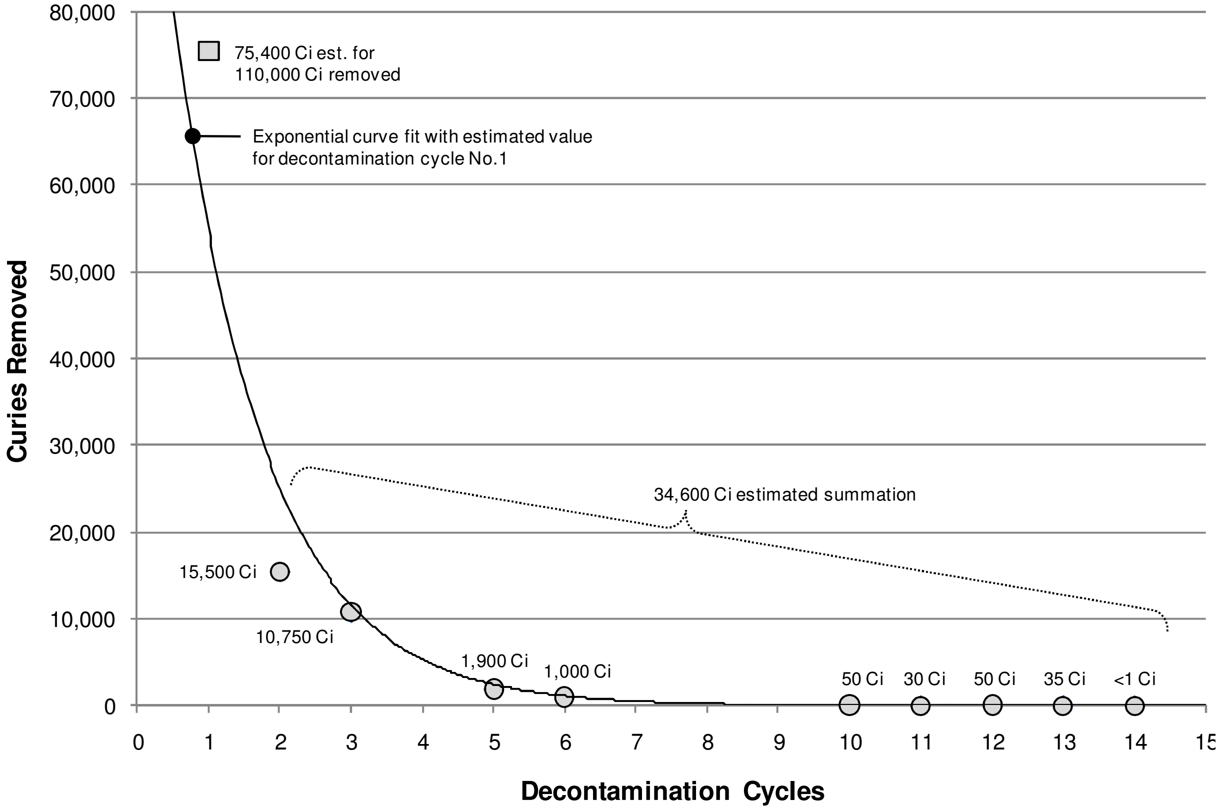
H-3	Ni-63	I-129	U-234	Pu-239	Am-241	Cm-244
C-14	Sr-90	Cs-137	U-238	Pu-240	Am-243	
Co-60	Nb-94	Th-229	Np-237	Pu-241	Cm-242	
Ni-59	Tc-99	U-233	Pu-238	Pu-242	Cm-243	

3.6.2 In-Place Decontamination

The final reprocessing campaign in 1972 served to flush HLW from the partition cycle equipment and piping. In this campaign, fuel material from the Southwest Experimental Fast Oxide Reactor consisting of a unirradiated liquid plutonium oxide fuel mixed with depleted uranium oxide was reprocessed. This material contained no fission products and was not HLW

From 1972 to 1974, Nuclear Fuel Services conducted an extensive plant decontamination campaign to reduce radiation and contamination levels. Ninety-three flushes of the partition cycle equipment were performed in 14 cycles over a 13-month period with a wide variety of chemicals and decontamination solutions, including solutions containing sodium hydroxide, potassium permanganate, and oxalic acid. Recovered nitric acid was also used. Techniques such as agitation, heating, column pulsing, and recirculating were used to aid in the decontamination. (Riethmiller 1981)

Figure 1 illustrates the effectiveness of the flushes. The diminishing returns in the later flushes indicate that flushing continued until the point where it was no longer effective. As noted previously, it was estimated that a total of 110,000 curies was removed from the partition system by the flushes, which was approximately 60 percent of the estimated total activity removed from the plant during the decontamination campaigns (Riethmiller 1981). This radioactivity was flushed to underground waste Tank 8D-2.



Summation: 110,000 Ci removed total, ~14 decon cycles, 93 flushes, 13 months – **Underline** = Potential HLW path
XC1: 4D-1, **4D-2**, **7D-1**, **4C-1**, 4C-2, 4Y-14, 4C-13a, 4C-13b, 4Y-5, 4Y-6
XC2: 4C-3, 4C-4, 4D-6, 4C-7, 4D-9
LWC: 4D-8, 4D-10; Flushing discharge path primarily included LWC: 7D-8 and CPC: **7D-10**, **7C-1**, **7D-4**
Also included were LWC: 7D-2 and CPC: **7C-2**, 7C-2 also part of Acid Recovery System flushes
7C-2 was replaced by NFS between 11-1971 and 4-1972 with a previously used unit prior to flushes

Figure 1. Partition System Flushing Results (based on Reithmiller 1981 data)

3.6.3 Additional Decontamination Performed

Nuclear Fuel Services washed the exterior surfaces of the vessels in Extraction Cell 1 with water using in-cell spray heads (Riethmiller 1981). The exterior surfaces were decontaminated again in the 2010 – 2011 period using high-pressure water spray (approximately 2000 pounds per square inch). Visual inspections at that time showed:

- Vessel 4D-2, a small amount of liquid which was drained before removal, after which the vessel appeared to be dry; and
- Vessel 7D-1, a small liquid heel was present and the vessel was spray washed on the inside and the heel (which consisted of decontamination solution) pumped out to the extent practicable.

WVDP decontaminated the exterior surfaces of the Chemical Process Cell vessels before they were removed from the cell in the 1980s by steam cleaning (Meigs 1987).

3.6.4 Key Radionuclide Removal

The decontamination methods used – flushing with various decontamination solutions and washing external surfaces with water – are gross decontamination techniques that remove waste and radioactive contamination in bulk quantities. As such, they remove the different key radionuclides in essentially the same proportions.

3.6.5 Other Methods of Key Radionuclide Removal

It is evident from Figure 1 that additional system flushing at the time of plant decontamination would not have been economically feasible because the final flushes removed only very small amounts of radioactivity. However, other decontamination methods – that is, methods for removing additional key radionuclides – that might be used for the removed vessels can be considered.

Decontamination Using Waste Spray

One method would be use of a water spray decontamination system in the Remote-Handled Waste Facility. The use of such a system would clearly be technically practical. However, it would not be economically practical for the following reasons:

- Water spray in the work cell would be unlikely to be effective, given the extensive chemical flushing that was performed by Nuclear Fuel Services that reached a point of diminishing returns and the previous efforts to decontaminate the vessel external surfaces.
- While limited decontamination could be performed in that facility if a decontamination system was installed or a portable system brought in, the radionuclides that may be removed would still remain in the facility to be processed by the WVDP through other means. That is, an additional radioactive waste stream would be produced that would include the building waste collection tanks and drain system since this equipment is not presently radioactively contaminated. The costs and worker radiation exposure to manage and eventually dispose of this additional radioactive waste[11] would obviously outweigh any minor benefits that could be realized from additional decontamination of the vessels in the facility.
- Since this facility is not equipped to perform decontamination, establishing such decontamination capabilities would be expensive.

Use of the Nitrocision® System

The WVDP has been using the Nitrocision® decontamination system for decontaminating surfaces in highly contaminated cells in the Main Plant Process Building. This equipment uses liquid nitrogen under extremely high pressure to clean facility surfaces and equipment and consequently does not produce a secondary waste stream other than the removed contamination itself. However, it requires frequent maintenance. Also, the removed contamination has to be collected, managed as radioactive waste, packaged for disposal, characterized, and disposed of as the appropriate waste type. These activities involve additional costs and worker radiation exposure like those required for other decontamination methods. Therefore, removing additional key radionuclides using the Nitrocision® decontamination system would not be consistent with ALARA requirements or economically practical.

[11] The Remote-Handled Waste Facility is to be removed during Phase 1 of the WVDP decommissioning (WSMS and SAIC 2009).

Other Methods

Other methods for further decontamination could be considered as well. However, if the use of the two decontamination systems discussed to remove additional key radionuclides from the vessels would not be economically practical, then other decontamination methods that would have to be fabricated or purchased and setup for this purpose would not be economically practical either. Additional decontamination would produce no net benefit to human health or the environment.

3.6.6 Conclusion

Key radionuclides have been removed from the vessels to the maximum extent that is technically and economically practical, satisfying the first evaluation criterion of Section II.B(2) of DOE Manual 435.1-1.

3.7 Consideration of the Second Evaluation Criterion

The second evaluation criterion for LLW reads as follows:

> "[The waste] will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*."

The second evaluation criterion for TRU waste reads as follows:

> "[The waste] will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize."

The alternative requirements for TRU waste are contained in DOE Manual 435.1-1 and the waste acceptance criteria for the Waste Isolation Pilot Plant (DOE-Carlsbad 2010).

3.7.1 Meeting the Second LLW Criterion

As noted in Section 2.6, DOE safety requirements for its LLW disposal facilities are comparable to the performance objectives at 10 CFR 61, Subpart C. The LLW waste packages associated with this waste stream are expected to meet the waste acceptance criteria for the Nevada National Security Site (DOE-NV 2011) and this will be confirmed during waste package characterization. Section 2.6 explains that satisfying the waste acceptance criteria ensures compliance with the disposal site performance objectives. Consequently, the vessel LLW waste packages will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, thus satisfying the second LLW evaluation criterion[12].

3.7.2 Meeting the Second Transuranic Waste Criterion

The vessels are already in a solid physical form. The characterization process will identify the portions of the vessel waste that meet TRU waste criteria. This waste will be packaged to meet the Waste Isolation Pilot Plant waste acceptance criteria (DOE-Carlsbad 2010). The WVDP will review the characterization data, review the waste packaging, assemble the data package, prepare the waste stream profile form, and certify that all applicable requirements are met.

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[12] Information on the predicted performance of the Area 5 Radioactive Waste Management Site compared to the DOE performance objectives can be found in the Annual Summary Report for the Area 3 and Area 5 Radioactive Waste Management Sites at the Nevada Nuclear Security Site (NST 2010).

Meeting the waste acceptance criteria will result in the TRU waste being managed to meet the alternative requirements for waste classification and characteristics, therefore satisfying the second transuranic waste evaluation criterion.

3.8 Consideration of the Third Evaluation Criterion

The third evaluation criterion for LLW reads as follows:

> "[The wastes] are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize."

The third evaluation criterion for TRU waste reads as follows:

> "[The wastes] are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of this Manual, as appropriate."

3.8.1 Meeting the Third LLW Criterion

Because this waste stream contains a mixture of radionuclides, the total concentration is determined by the sum of the fractions rule, as specified in 10 CFR 61.55(a)(7). Additionally, because the radionuclide mixture contains both long-lived radionuclides and short-lived radionuclide, waste classification is determined as specified in 10 CFR 61.55(a)(5). Radionuclide concentrations in waste packages of LLW are expected to be well below Class C limits.

The actual waste classification of the packaged vessels or vessel segments will be determined during processing and packaging for disposal, as noted previously[13]. Those waste packages determined to be LLW will be managed in accordance with DOE requirements for LLW and are expected to be disposed of at the Nevada National Security Site.

3.8.2 Meeting the Third Transuranic Waste Criterion

Those waste packages determined to be TRU waste will be managed in accordance with DOE requirements for TRU waste described Chapter III of in DOE Manual 435.1-1. The WVDP TRU waste will be stored onsite until an approved disposition path becomes available, as noted previously.

3.8.3 Conclusion

Based on the matters just discussed, the waste packages for the subject vessels will meet the third evaluation criterion for LLW or the third evaluation criterion for TRU waste, as applicable.

3.9 Summary and Conclusions

The vessel waste packages are not HLW by the citation process and may be managed as LLW or TRU waste, as applicable. This conclusion is supported by consideration of the evaluation criteria of Section II.B(2) of DOE Manual 435.1-1 based on the following factors:

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[13] Preliminary calculations show that Pu-238, Pu-239, Pu-240, and Am-241 will drive the waste classifications. Given this situation, waste packages with Class C sum of fractions >1.0 will have concentrations of alpha-emitting transuranic radionuclides with half-lives exceeding 20 years well over 100 nCi/g, making them transuranic waste.

- They have had key radionuclides removed to the extent technically and economically practical;
- The vessel waste packages will be managed to meet safety requirements for LLW or TRU waste, as applicable;
- The LLW associated with the vessels will not exceed Class C limits and will be managed in accordance with DOE requirements for LLW and disposed of at the Nevada National Security Site; and
- Those waste packages determined to be TRU waste will be managed in accordance with DOE requirements for this waste type, and will be stored onsite until an approved disposition path becomes available.

4.0 EQUIPMENT USED IN UNDERGROUND WASTE TANKS

This section shows that equipment installed in the underground waste tanks and used in connection with managing and retrieving HLW, including 18 mobilization and transfer pumps and other similar and related items such as connective piping, are not HLW by the citation process using the following approach:

Section 4.1 describes typical equipment and explains how it became contaminated by HLW.

Section 4.2 describes the process used to decontaminate the equipment and shows that it does not contain a significant amount of waste.

Section 4.3 briefly discusses disposal of the equipment

Section 4.4 describes the conclusion from use of the citation process for this waste stream and summarizes the basis for this conclusion.

Section 4.5 shows that the waste stream meets the first evaluation criterion.

Section 4.6 shows that the waste stream meets the second evaluation criterion.

Section 4.7 shows that the waste stream meets the third evaluation criterion.

Section 4.8 summarizes the conclusions about this waste stream meeting the evaluation criteria.

In 2001, in connection with preparation of the original version of this procedure, West Valley Nuclear Services Company prepared a WIR evaluation for the mobilization and transfer pumps (WVNSCO 2001). This evaluation incorporated comments provided by the DOE technical review team that reviewed the original version of the procedure, but DOE did not make a waste determination for the pumps based on the evaluation. Information from this evaluation is used in the discussions that follow.

4.1 The Equipment and How It was Used

Most of the items of equipment in this category are mobilization and transfer pumps. Table 5 summarizes the status of these pumps. It provides information on how each pump was used and how it became contaminated with HLW, along with information on its decontamination, which is discussed in Section 5.2 and Section 5.5.

As shown in the table, there are 12 mobilization pumps and six transfer pumps that were used in connection with transferring HLW to the Vitrification Facility. Of the 12 mobilization pumps, five are in Tank 8D-1, four are in Tank 8D-2 and three have been removed and are in onsite storage. Of the six transfer pumps, two are in Tank 8D-1, two are in Tank 8D-2, and two have been removed and are in onsite storage.

The mobilization pumps are centrifugal pumps that discharged liquid from two rotating nozzles to agitate the tank contents. The lower portion of the pump is about eight feet long and is attached to a 50-foot-long stainless steel pipe column that houses the drive shaft. A 150-horsepower motor located at the upper end was used to drive the pump.

Figure 2 shows a typical mobilization pump. Figure 2 also shows at typical transfer pump. These pumps are centrifugal multistage turbine type pumps.

Table 3. Waste Tank Farm Mobilization and Transfer Pump Summary Status[1]

Description	HLW Contact Contamination	Decontamination Actions	Location	Config
Mobilization Pumps				
Tank 8D-1				
55 G 006	Progressively more dilute contaminated Zeolite & Water	Submerged in sodium bearing waste water (mixed LLW)	In 8D-1	
55 G 008	Progressively more dilute contaminated Zeolite & Water	Submerged in sodium bearing waste water (mixed LLW)	In 8D-1	
55 G 009	Progressively more dilute contaminated Zeolite & Water	Submerged in sodium bearing waste water (mixed LLW)	In 8D-1	
55 G 010	Progressively more dilute contaminated Zeolite & Water	Submerged in sodium bearing waste water (mixed LLW)	In 8D-1	
55 G 018	Progressively more dilute contaminated Zeolite & Water	Submerged in sodium bearing waste water (mixed LLW)	In 8D-1	
Tank 8D-2				
55 G 001	Progressively more dilute supernatant & sludge	Submerged in sodium bearing waste water (mixed LLW) Incidental exterior decon from tank sluicing	In 8D-2	
55 G 002	Contaminated Zeolite & Water (from 8D-1) Progressively more dilute supernatant & sludge	Incidental exterior decon from tank sluicing Deconned during removal from 8D-1 Deconned during removal from 8D-2	In Storage	1 piece
55 G 003 a	Supernatant & Sludge	Incidental exterior decon from tank sluicing Deconned during removal from 8D-2 to 8D-1 Deconned during removal from 8D-1	In Storage	2 pieces
55 G 003 b	Progressively more dilute supernatant & sludge	Submerged in sodium bearing waste water (mixed LLW) Incidental exterior decon from tank sluicing	In 8D-2	
55 G 004	Progressively more dilute supernatant & sludge	Submerged in sodium bearing waste water (mixed LLW) Incidental exterior decon from tank sluicing	In 8D-2	
55 G 005	Progressively more dilute supernatant & sludge	Submerged in sodium bearing waste water (mixed LLW) Incidental exterior decon from tank sluicing	In 8D-2	
55 G 007	Progressively more dilute supernatant & sludge	Submerged in sodium bearing waste water (mixed LLW) Incidental exterior decon from tank sluicing Deconned during removal from 8D-2	In Storage	1 piece
Tank 8D-4				
N/A	No Mobilization needed for this tank		N/A	
Transfer Pumps				
Tank 8D-1				
55 G 012	Progressively more dilute contaminated Zeolite & Water	Backflushed after each transfer Suction inlet cleaned with pressurized sluicing Submerged in sodium bearing waste water (mixed LLW)	In 8D-1	
50 G 004	Assumed transfer role of 50 G 001 after failure Progressively more dilute sludge wash solutions	Submerged in sodium bearing waste water (mixed LLW)	In 8D-1	
Tank 8D-2				
55 G 014 a	Supernatant & sludge	Backflushed after each transfer Deconned during removal from 8D-2	In Storage	1 piece
55 G 014 b	Progressively more dilute supernatant & sludge	Backflushed after each transfer Incidental exterior decon from tank sluicing Submerged in sodium bearing waste water (mixed LLW)	In 8D-2	
50 G 001	Progressively more dilute supernatant & sludge wash solutions	Discharge from pump 50 G 001a transferring sodium bearing waste LLW Incidental exterior decon from tank sluicing Submerged in sodium bearing waste water (mixed LLW)	In 8D-2	
Tank 8D-4				
55 G 013	THOREX Liquid HLW	Nitric acid washed twice and water rinsed Flushed with decon solutions from VF Deconned during removal from 8D-4	In Storage	7 pieces

NOTE: (1) The sodium-bearing wastewater mentioned in the decommissioning actions column was not was not mixed waste after being solidified for disposal as LLW.

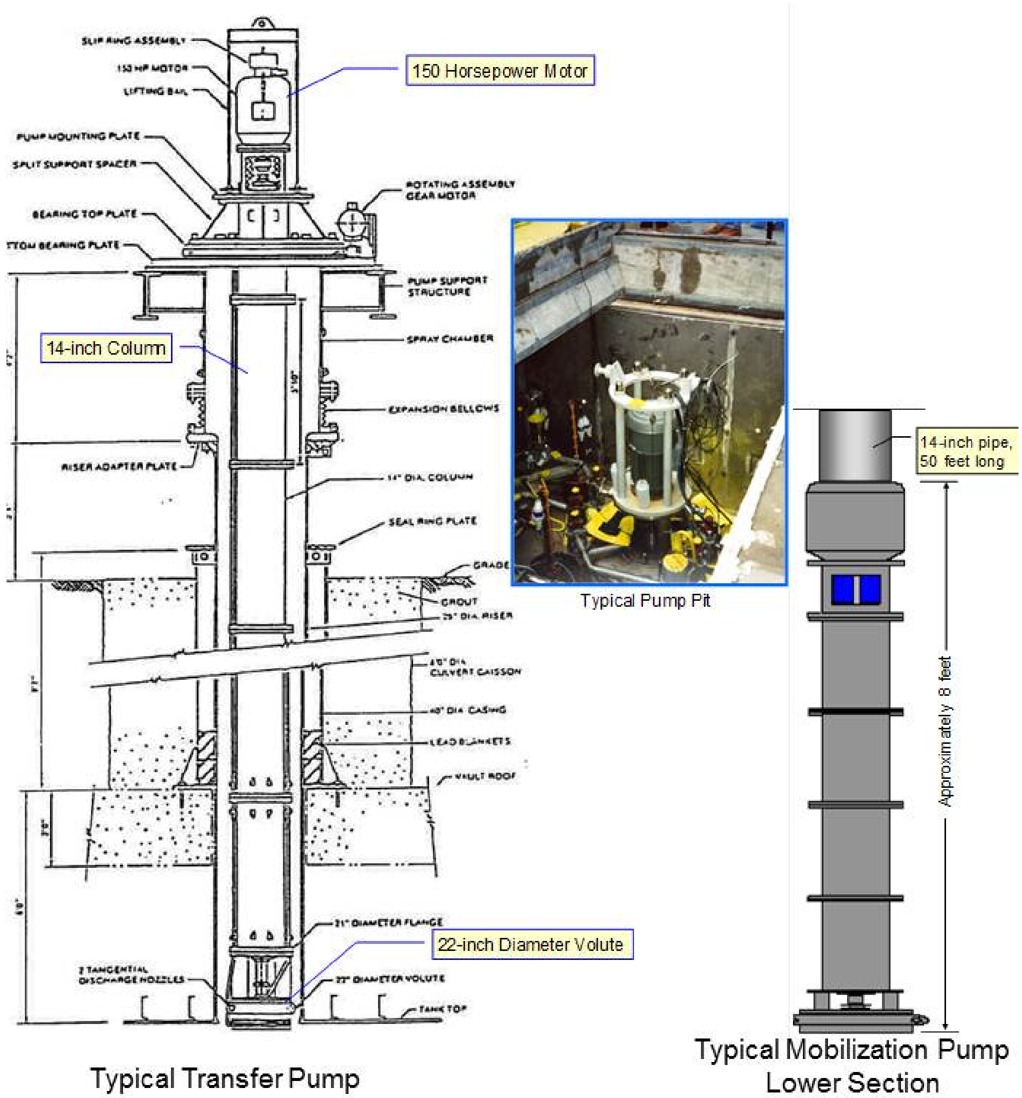

Figure 2. Mobilization and Transfer Pumps

4.2 Decontamination and Residual Waste

Table 3 shows how the mobilization and transfer pumps were decontaminated. As can be seen in the table:

- Most were operated with progressively more dilute solution;
- Most were submerged in low-activity sodium bearing wastewater[14];
- The exterior surfaces of the pumps in Tank 8D-2, except for pump 55 G 014a, were also decontaminated by incidental contact with water from tank sluicing activities; and
- Pumps that have been removed from the tanks were further decontaminated during removal.

Decontamination during removal entailed flushing the pump interiors and spraying the pump exteriors with uncontaminated water.

[14] Sodium bearing wastewater was eventually removed from the underground waste tanks, solidified in cement, and disposed of at the Nevada National Security Site as LLW.

This process, which is consistent with ALARA requirements, is similar to decontamination processes used during removal of waste tank equipment at both the Hanford site (Hanford 2008) and the Savannah River Site (McNeil 2010) and will be used during removal of the installed pumps[15].

The effectiveness of the method used for decontamination during removal is reflected in Table 4, which shows an order-of-magnitude estimate of residual radioactivity in one pump prior to the decontamination accomplished during removal compared with an estimate made with the removed pump section in a waste box.

Table 4. Mobilization Pump Final Decontamination Effectiveness(1)

Radionuclide	Before Final Decon (Ci)(2)	After Final Decon (Ci)(3)	Decontamination Factor
Cs-137	200	8.2	24

NOTES: (1) For the lower section of mobilization pump 55-G-003a.
(2) From WVNSCO 2001, Table 1, based on exposure rate data collected during removal of the pump prior to decontamination performed during removal of the pump.
(3) From the package characterization report (Choroser 2010).

Table 5 shows the estimated residual radioactivity in several removed pumps and pump sections based on the package characterization reports. These reports indicate that each waste container is classified as TRU waste, although the pumps may have to be size reduced and repackaged to meet waste acceptance criteria for the Waste Isolation Pilot Plant (DOE-Carlsbad 2010).[16]

Table 5. Removed Waste Tank Pump Residual Radioactivity Estimates (in Curies)

Pump	Sr-90	Cs-137	Pu-238	Am-241	Total
Mob. pump 55-G-003 lower section(1)	7.8	8.2	0.016	0.15	16.3
Mobilization pump 55-G-002(2)	26	27	0.05	0.46	54.3
Mobilization pump 55-G-007(3)	35	37	0.067	0.61	73.2
Transfer pump 55-G-014(1)	9.9	11	0.02	0.19	20.8

NOTES: (1) Data from package characterization report (Choroser 2010).
(2) Data from package characterization report (Choroser 2011b).
(3) Data from package characterization report (Choroser 2011a).
(4) Data from package characterization report (Choroser 2010e).

There is also a large body of data on residual radioactivity in pumps removed from underground waste tanks at Hanford (Hanford 2008) and the Savannah River Site (McNeil 2010) that show that this equipment does not contain significant amounts of waste after it has been decontaminated during removal using the same process used by the WVDP.

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[15] Conditions in the underground waste tanks have changed since the pumps were removed as indicated in Table 4 due to installation of a tank drying system. Data collected in the period from January 4 through March 9, 2011 show average evaporation rates of approximately 39 gallons per day for Tank 8D-1, 27 gallons per day for Tank 8D-2, and 2 gallons per day for Tank 8D-4 (Kurasch 2011). This drying system therefore provides a method for removing water introduced into the tanks during decontamination of removed equipment.

[16] According to the waste acceptance criteria, acceptable payload containers are 55-gallon drums, 85-gallon drums, 100-gallon drums, and standard waste boxes. The approximate inside dimensions of a standard waste box are 37 inches (height), 69 inches (length), and 52 inches (width). However, it may be practicable to dispose of most the pump sections as LLW after stabilization of the waste packages.

4.3 Disposal of the Pumps

After the installed pumps are removed, the pump waste packages will be characterized following site procedures as were the ones shown in Table 6. Pump sections that are classified as TRU waste will be packaged and characterized consistent with requirements of the Waste Isolation Pilot Plant waste acceptance criteria (DOE-Carlsbad 2010) and temporarily stored until a disposition path becomes available. Pump sections that are classified as LLW are expected to be shipped to the Nevada National Security Site for disposal.

4.4 Conclusion from Application of the Citation Process

Consideration of the information just discussed leads to the conclusion that pumps are not HLW and can be managed and disposed of as LLW or TRU waste as applicable because they do not contain a significant amount of waste due to decontamination consistent with ALARA requirements. This conclusion also applies to other equipment removed from the underground waste tanks which will also be decontaminated during removal as necessary to comply with ALARA requirements.

The next three subsections consider the evaluation determination criteria of Section II.B(2) of DOE Manual 435.1-1 to provide added assurance that the pumps are not HLW. As before, the information in the 2001 WIR evaluation for the mobilization and transfer pumps (WVNSCO 2001) is used in these discussions.

4.5 Consideration of the First Evaluation Criterion

As noted previously, the first evaluation criterion for LLW reads as follows:

> “ [The waste] has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical.”

As with the other waste streams, the key radionuclides are assumed to be those identified in Tables 1 and 2 of 10 CFR 61.55 and those important to the performance of the Area 5 Radioactive Waste Management Site at the Nevada National Security Site (NST 2010).

4.5.1 In-Place Decontamination

As discussed in Section 5.2, most of the mobilization and transfer pumps were operated with progressively more dilute solutions and submerged in low-activity sodium-bearing wastewater.

Tanks 8D-1, 8D-2 and 8D-4 were flushed in connection with the controlled shut-down of the Vitrification Facility. The objective of this system flushing was to mobilize as much residual radioactive material as practical so it could be vitrified. The flushing media for Tanks 8D-1 and 8D-2 was water (residual tank process liquid); 8D-4 was soaked with dilute nitric acid and subsequently flushed with water.

Flush solutions from this decontamination evolution were collected in 8D-2 and pumped from there to the Vitrification Facility. The total volume of liquid sprayed and recycled in Tank 8D-2 was approximately 910,000 gallons

Tank 8D-2 was flushed using all of the mobilization pumps, along with spray from two in-tank sluicers. Water leakage through the mobilization pumps contributed additional clean flush liquid. The sluicers delivered pressurized tank liquid to the support columns, tank walls and bottom structural grid-work of the tank with incidental contact of the pumps suspended into the tank’s interior from above.

Following completion of HLW retrieval, system flushing, and vitrification of the wastes, Tanks 8D-1 and 8D-2 contained a combined total of approximately 140,000 gallons of very dilute sodium-bearing wastewater. The radionuclide concentrations in this water were low, with Cesium-137 at 20 μCi/mL, Strontium-90 at 0.3 μCi/mL, and alpha-emitting plutonium at 0.00080 μCi/mL. These concentrations were small fractions of the radionuclide concentrations in HLW.

The processes just described served to decontaminate the pumps in place.

4.5.2 Decontamination During Removal

The pumps that have been removed from the tanks have been decontaminated by flushing them internally with water and by slowly pulling the pump through a water spray ring to decontaminate the exterior surfaces. Data in Table 4 showed the effectiveness of this process on pump 55-G-003a.

When this pump was removed, a dose rate exceeding 50 R/hr (WVNSCO 1998) was measured on its bottom end before it was decontaminated by flushing and spray washing. After flushing and spray washing, the bottom 4 feet of the pump measured generally between 1 R/hr and 5 R/hr with a hot spot area of about 8 R/hr (WVNSCO 1998). These data confirm the effectiveness of this field decontamination method.

As noted previously, those pumps that remain suspended in the underground waste tanks will be decontaminated in a similar manner as part of their removal from the tanks, as necessary consistent with ALARA requirements.

4.5.3 Other Methods Evaluated

The in-place decontamination proved to be technically and economically practical. So too did the decontamination method used during removal, which is similar to methods that have proven to be successful at Hanford and the Savannah River Site. Other methods of removing key radionuclides that have been considered (WVNSCO 2001) include:

(1) Spray washing the installed pumps with inorganic acid,

(2) Spray washing the installed pumps with organic acid,

(3) Mechanical decontamination in the Remote-Handled Waste Facility, and

(4) Acid bath in the Remote-Handled Waste Facility.

Spray Washing Installed Pumps With Acid

Spray washing the exteriors of the installed pumps with inorganic acid or organic acid was estimated to have a key radionuclide removal efficiency of more than 90 percent. However, these decontamination methods were determined not to be technically practical at West Valley for the following reasons (WVNSCO 2001, Table 2):

- Inorganic acid would not be technically practical due to major concerns over tank corrosion and hydrogen generation, and
- Organic acid would not be technically practical due to major concerns over tank corrosion, hydrogen generation, Vitrification Melter redox control, and vitrification product qualification.

Mechanical Decontamination in the Remote-Handled Waste Facility

The 2001 evaluation concluded that this process would have a key radionuclide removal efficiency of approximately 50 to 55 percent and would be technically practical. Because the Remote-Handled Waste Facility was not in operation in 2001, this process was determined not to be economically practical at that time (WVNSCO 2001).

In Section 3.6.5 use of a water spray decontamination system to remove additional key radionuclides from seven Main Plant Process Building vessels was determined not be economically practical for a variety of reasons. These reasons would also apply to use of the decontamination system to remove additional key radionuclides from the pumps.

Acid Bath Decontamination in the Remote-Handled Waste Facility

Decontamination of the pumps using an acid bath in the Remote-Handled Waste Facility was determined not to be economically practical in 2001 because this capability was not planned for the facility. The Remote-Handled Waste Facility does not presently have this capability. Establishing it would be costly and using it would result in unnecessary worker radiation exposure. Such decontamination would produce an additional waste stream that would have to be processed and disposed of at significant cost and worker radiation exposure. For these reasons, this decontamination method is not economically practical.

4.5.3 Conclusion

Based on the foregoing discussions, key radionuclides have been or will be removed from the pumps to the maximum extent that is technically and economically practical, satisfying the first evaluation criteria of Section II.B(2) of DOE Manual 435.1-1.

4.6 Consideration of the Second Evaluation Criteria

The second evaluation criterion for LLW reads as follows:

> "[The waste] will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*."

The second evaluation criterion for TRU waste reads as follows:

> "[The waste] will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize."

The alternative requirements for TRU waste are contained in DOE Manual 435.1-1 and the waste acceptance criteria for the Waste Isolation Pilot Plant (DOE-Carlsbad 2010).

4.6.1 Meeting the Second LLW Criterion

As noted in Section 2.6, DOE safety requirements for its LLW disposal facilities are comparable to the performance objectives at 10 CFR 61, Subpart C. The LLW waste packages associated with this waste stream are expected to meet the waste acceptance criteria for the Nevada National Security Site (DOE-NV 2011) and this will be confirmed during waste package characterization. Section 2.6 explains that satisfying the waste acceptance criteria ensures compliance with the disposal site performance objectives. Consequently, the pump LLW waste packages will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, thus satisfying the second LLW evaluation criterion.

4.6.2 Meeting the Second Transuranic Waste Criterion

The pumps are already in a solid physical form. The characterization process will identify the portions of the pump waste that meet TRU waste criteria. This waste will be packaged to meet the Waste Isolation Pilot Plant waste acceptance criteria (DOE-Carlsbad 2010). Meeting the waste acceptance criteria will result in the TRU waste being managed to meet the meet alternative requirements for waste classification and characteristics, therefore satisfying the second TRU waste evaluation criterion.

4.7 Consideration of the Third Evaluation Criterion

The third evaluation criterion for LLW reads as follows:

> "[The wastes] are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize."

The third evaluation criterion for TRU waste reads as follows:

> "[The wastes] are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of this Manual, as appropriate."

4.7.1 Meeting the Third LLW Criterion

Radionuclide concentrations in waste packages of LLW will be below Class C limits. Because Pu-238, Pu-239, Pu-240, and Am-241 will drive the waste classifications, waste packages with Class C sum of fractions >1.0 will have concentrations of alpha-emitting transuranic radionuclides with half-lives exceeding 20 years well above 100 nCi/g, making them TRU waste.

The actual classification of the packaged waste will be determined during processing and packaging for disposal. Those waste packages determined to be LLW will be managed in accordance with DOE requirements for LLW and disposed of as LLW.

4.7.2 Meeting the Third Transuranic Waste Criterion

Those waste packages determined to be TRU waste will be managed in accordance with DOE requirements for TRU waste described Chapter III of in DOE Manual 435.1-1 and stored onsite until a disposition path becomes available.

4.7.3 Conclusion

Based on the matters just discussed, the waste packages for the pumps will meet the third evaluation criterion for LLW or the third evaluation criterion for TRU waste, as applicable.

4.8 Summary and Conclusions

The pump waste packages are not HLW by the citation process and may be managed as LLW or TRU waste, as applicable. This conclusion is supported by consideration of the evaluation criteria of Section II.B(2) of DOE Manual 435.1-1 based on the following factors:

- They have had or will have key radionuclides removed to the extent technically and economically practical;

- The waste packages will be managed to meet safety requirements for LLW or TRU waste, as applicable;
- The LLW associated with the pumps will not exceed Class C limits and will be managed in accordance with DOE requirements for LLW and is expected to be disposed of at the Nevada National Security Site; and
- Those waste packages determined to be TRU waste will be managed in accordance with DOE requirements for this waste type and stored onsite until a disposition path becomes available.

5.0 PIPING USED TO CONVEY HIGH-LEVEL WASTE TO THE VITRIFICATION FACILITY

This section shows that piping used to convey HLW from the waste tank farm to the Vitrification Facility is not HLW by the citation process using the following approach:

Section 5.1 describes the piping and explains how it became contaminated by HLW.

Section 5.2 describes the process used to decontaminate the piping and shows that it does not contain a significant amount of waste.

Section 5.3 briefly discusses removal and disposal of the piping.

Section 5.4 describes the conclusion from use of the citation process for this waste stream and summarizes the basis for this conclusion.

Section 5.5 shows that the waste stream meets the first evaluation criterion.

Section 5.6 shows that the waste stream meets the second evaluation criterion.

Section 5.7 shows that the waste stream meets the third evaluation criterion.

Section 5.8 summarizes the overall conclusions and their basis.

The source of the information related to the piping that is discussed in Sections 6.1 and 6.2 is the *Balance of the Waste Tank Farm Radioisotope Inventory Report* (Fazio 2004).

5.1 The Piping and How It Became Contaminated With High-Level Waste

This piping is located within the HLW transfer trench, a long, covered concrete vault extending approximately 500 feet from the Tank 8D-3/Tank 8D-4 vault to the north side of the Vitrification Facility. The transfer trench is connected to stainless steel-lined concrete pump pits that house the upper sections of HLW transfer pumps that are located on top of each of the tank vaults.

There are six piping runs in the trench, two of which are unused spares, comprising approximately 3000 linear feet of double-walled stainless steel pipe. The four piping runs were used to convey liquid HLW from the tank farm to the Vitrification Facility. The trench also contains associated valves and jumpers. The pump pits each contain the upper part of the HLW transfer pump and flow monitoring equipment.

5.2 Decontamination and Residual Waste

The piping was routinely flushed with at least one line volume of water after each waste transfer. At the conclusion of vitrification operations, the lines were flushed again with one molar nitric acid followed by an additional flush with water. This process was used because the residual radioactivity was entirely inside the piping. There was no evidence of piping leaks during waste transfers that could have contaminated the outside surfaces of the piping based on monitoring of water in the transfer trench sump.

Dose rate data on piping within the transfer trench during operation are not available since the concrete trench covers remained in place. Dose rates measured in 1998 during vitrification operations in pump pit 8Q-2 over Tank 8D-2 ranged from 80 mR/hr to 5 R/hr. Dose rates measured in 2004 inside the transfer trench after completion of waste transfer and the flushing that followed ranged from 0.8 to 9.6 mR/hr. A conservative estimate of the residual radioactivity in the waste transfer piping totaled approximately 234 curies, with over 98 percent associated with Sr-90 and Cs-137.

5.3 Piping Removal and Disposal

The Phase 1 Decommissioning Plan (WSMS and SAIC 2009) provides for removal of the piping and the related equipment and disposing of it at an appropriate offsite disposal facility. Waste packages determined to be LLW are expected to be disposed of at the Nevada National Security Site. Any waste packages that are determined to be TRU waste would be temporarily stored pending an approved disposition path.

5.4 Conclusion from Application of the Citation Process

Consideration of the information just discussed leads to the conclusion that the waste transfer piping and the associated equipment are not HLW and can be managed and disposed of as LLW or TRU waste as applicable because they do not contain a significant amount of waste due to decontamination consistent with ALARA requirements.

The next three subsections consider the evaluation determination criteria of Section II.B(2) of DOE Manual 435.1-1 to provide added assurance that the pumps are not HLW.

5.5 Consideration of the First Evaluation Criterion

As noted previously, the first evaluation criterion for LLW and TRU waste reads as follows:

> “ [The waste] has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical.”

As with the other waste streams, the key radionuclides are assumed to be those identified in Tables 1 and 2 of 10 CFR 61.55 and those important to the performance of the Area 5 Radioactive Waste Management Site at the Nevada National Security Site (NST 2011).

5.5.1 Decontamination Methods Used

As noted in Section 6.2, the pipelines were flushed with water after every waste transfer, flushed with one molar nitric acid after completion of all the waste transfers, and then flushed again with water. The flush solutions and the associated removed key radionuclides were sent to the vitrification system like other decontamination solutions used in decontamination of the Concentrator Feed Makeup Tank and the Melter Feed Hold Tank. The flushing process effectively removed residual waste and key radionuclides as evidenced by the low dose rates measured in 2004.

5.5.2 Other Decontamination Methods

The decontamination methods used – flushing with nitric acid and water – have proven effective in decontaminating inside surfaces of stainless steel piping. It is unlikely that another decontamination process would be more effective.

It is evident that the flushes performed following the last waste transfer effectively removed waste and key radionuclides considering the low dose rates in the transfer trench in 2004. It would be technically practical to perform additional flushes with nitric acid and water to try to further reduce the key radionuclides in the piping. However, such additional flushing would not be economically practical for the following reasons:

- It is expected that the piping can be disposed of a LLW without further decontamination;
- Additional flushing would result in additional worker radiation exposure without commensurate benefit;

- Setting up the equipment to perform the flushes would be expensive;
- Additional flushing would produce an additional waste stream that would have to be managed as radioactive waste, which would require solidification to meet disposal site free liquid criterion, contribute to additional worker radiation exposure, and result in substantial expense for transport and disposal; and
- Even if additional flushing were to reduce the residual radioactivity in the piping, it would still have to be disposed of as LLW.

Consideration of such factors makes it clear without detailed analysis that additional flushing would be inconsistent with DOE ALARA requirements. Similar disadvantages would apply to other methods of removing additional key radionuclides.

5.5.3 Conclusion

Based on the foregoing discussions, key radionuclides have been removed from the piping to the maximum extent that is technically and economically practical, satisfying the first evaluation criteria of Section II.B(2) of DOE Manual 435.1-1.

5.6 Consideration of the Second Evaluation Criteria

The second evaluation criterion for LLW reads as follows:

> “[The waste] will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*.”

The second evaluation criterion for TRU waste reads as follows:

> “[The waste] will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize.”

The alternative requirements for TRU waste are contained in DOE Manual 435.1-1 and the waste acceptance criteria for the Waste Isolation Pilot Plant (DOE-Carlsbad 2010).

5.6.1 Meeting the Second Low-Level Waste Criterion

As noted in Section 2.6, DOE safety requirements for its LLW disposal facilities are comparable to the performance objectives at 10 CFR 61, Subpart C. The LLW waste packages associated with this waste stream are expected to meet the waste acceptance criteria for the Nevada National Security Site (DOE-NV 2011) and this will be confirmed during waste package characterization. Section 2.6 explains that satisfying the waste acceptance criteria ensures compliance with the disposal site performance objectives. Consequently, the pump LLW waste packages will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, thus satisfying the second LLW evaluation criterion.

5.6.2 Meeting the Second Transuranic Waste Criterion

The piping is already in a solid physical form. The characterization process will identify any portions of the piping waste that meet TRU waste criteria. This waste will be packaged to meet the Waste Isolation Pilot Plant waste acceptance criteria (DOE-Carlsbad 2010). Meeting the waste acceptance criteria will result in the TRU waste being managed to meet the meet alternative requirements for waste classification and characteristics, therefore satisfying the second TRU waste evaluation criterion.

5.6.3 Conclusion

The piping will meet the second TRU waste evaluation criterion.

5.7 Consideration of the Third Evaluation Criterion

The third evaluation criterion for LLW reads as follows:

> "[The wastes] are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize."

The third evaluation criterion for TRU waste reads as follows:

> "[The wastes] are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of this Manual, as appropriate."

5.7.1 Meeting the Third LLW Criterion

Radionuclide concentrations in waste packages of LLW will be below Class C limits. Because Pu-238, Pu-239, Pu-240, and Am-241 will drive the waste classifications, any waste packages with Class C sum of fractions >1.0 will have concentrations of alpha-emitting transuranic radionuclides with half-lives exceeding 20 years well over 100 nCi/g, making them TRU waste.

The actual classification of the packaged waste will be determined during processing and packaging for disposal. Those waste packages determined to be LLW will be managed in accordance with DOE requirements for LLW and are expected to be disposed of at the Nevada National Security Site.

5.7.2 Meeting the Third Transuranic Waste Criterion

The piping is in solid form. If any piping waste packages are determined to be TRU waste, they will be managed in accordance with DOE requirements for TRU waste described Chapter III of in DOE Manual 435.1-1 and stored onsite until a disposition path becomes available.

5.7.3 Conclusion

Based on the matters just discussed, the waste packages for the piping will meet the third evaluation criterion for LLW or the third evaluation criterion for TRU waste, as applicable.

5.8 Summary and Conclusions

The waste packages for the waste transfer piping and the related equipment will not be HLW by the citation process and may be managed as LLW or TRU waste, as applicable. This conclusion is supported by consideration of the evaluation criteria of Section II.B(2) of DOE Manual 435.1-1 based on the following factors:

- The piping has had key radionuclides removed to the extent technically and economically practical;
- The waste packages will be managed to meet safety requirements for LLW or TRU waste, as applicable;

- The LLW waste packages associated with the piping will not exceed Class C limits and will be managed in accordance with DOE requirements for LLW and are expected to be disposed of at the Nevada National Security Site; and
- Those waste packages determined to be TRU waste will be managed in accordance with DOE requirements for this waste type and stored onsite until a disposition path becomes available.

6.0 REFERENCES

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10 CFR Part 50, *Domestic Licensing of Production and Utilization Facilities.*

10 CFR Part 60, *Disposal of High-Level Wastes in Geologic Repositories.*

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WVDP RECORD OF REVISION

Rev. No.	Description of Changes	Revision On Page(s)	Dated
2	Changed the following in response to DOE Assessment Letter JJM:085 - 79315 - 435.5.1, T. J. Jackson to J. L. Little, "Technical Review Team Comments on WV-929, 'Waste Incidental to Reprocessing Determination'," dated September 13, 2001: Section 1.0: Replaced the paragraph with "The purpose of this policy and procedure is to implement the process for determining if a waste is or contains a residue in a form that could be high-level radioactive waste (HLW) as defined in DOE M 435.1-1, but might be managed as other that HLW by using the Waste Incidental to Reprocessing (WIR) determination process." Section 2.0 More clearly defined what waste is applicable to this procedure by changing, ". . . waste being stored on-site and managed in a controlled manner. . ." to ". . . waste that has been packaged, characterized, classified for disposal. . .". Section 2.0 Rewrote to say, "This policy and procedure applies only to on-site storage and off-site disposal of radioactive wastes. This policy and procedure does not apply to on-site disposition (e.g., in-place closure) or the final HLW glass waste form." Section 3.1 The first four requirements were moved to the reference section since they are not requirements. Section 3.2 Deleted "Technical Basis for Waste Incidental to Reprocessing Determination for Tanks 8D-1 and 8D-2: Revision 1, September 29, 2000 WD:2000:0733 Section 5.0 Deleted Responsibility 5.4 based upon recommended changes to Responsibility 5.9. Section 5.9 Changed "(FM)" to "(FEM)" to be consistent with DOE M 435.1-1.	All	11/01/01
	Added expended samples and sample media to Section 5.1.1.	4	
	Attachment E - Added Citation Number B8, Expended Samples.	20	

WVDP RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
	Deleted D13 from Citation List (Attachment E).	21	
	Attachment G - Physically removed Form WV-4405 from document and made minor formatting changes to it.	24	
	Changed references in text from Attachment G to Form WV-4405.	7, 8, 12, 13	
	Changed references throughout document from Waste Management Services (WMS) to Waste Shipping and Services (WSS) due to department title change.	3, 4, 7, 8, 12	
	Departments affected by this revision are Facility Characterization Project and Waste Shipping & Services.		
6	Revision is a minor change. Doe approval is not required.		08/02/04
	Added note that incorporates the direction given in DOE letter OH-0420-04, R. F. Warther to T. J. Jackson, "Waste Incidental to Reprocessing," dated July 27, 2004.	1	
	Made provisions for WIR determinations to be made on a container-by-container basis.	6, 7, 8, 10-13	
	Deleted the requirement to submit to DOE WIR screens that are excluded by citation per letter OH-0420-04.	8	
	Added how WIR evaluations are to be transmitted to DOE for consultation per DOE letter OH-0240-04.	12	
	Added note to Attachment E per DOE letter OH-0420-04.	20	
	Added “herculite” to the Citation List, duplicating it in both Citation number A-3 and E-9.	20	
	Changed references to Waste Shipping & Services (WSS) to Waste Shipping & Disposal to reflect current organization.	All	
	Departments affected by this revision are Facility Characterization Project and Waste Shipping & Disposal, Records & Configuration/Document Control		

WVDP RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
7	Third paragraph removed from Att. D as incorrect and. inconsistent with other provisions of WV-929 based on the following: Tank 7D-14 in the Liquid Waste Cell receives waste by gravity flow from the Analytical and Process Chemical Laboratory drain. Potential high level waste material in the Analytical and Process Chemistry Laboratories is considered to have always been a sample. (No high level liquid waste material from reprocessing came into the Analytical and Process Chemistry laboratories directly.) At the singular moment it was decided to put any sample material into the drain that led to Tank 7D-14, the sample is considered to be expended. At this moment, this material was non-HLW by citation (see Att. E, Citation Item B8, “expended samples.”) Thus, tanks 7D-14, 3D-2, and 7D-2 in the Liquid Waste Cell were contaminated with non-HLW materials by definition. Thus, these vessels are not subject to any subsequent WIR determination.	18, 19	03/27/07
	Changed approval authority from DOE-OH to DOE-WVDP.	1,4,20	
	Waste Shipping and Disposal Project Manager assigned overall responsibility with support from Strategic Planning Development Manager.	3,4,6,12	
	Added reference to WD:2004:0138 and Section 3116 of NDAA	1,2	
	A5 added “…ventilation systems, off-gas systems and associated Components…”	20	
	E12 added “…and vessels…”	20	
	A3 added “…wood…”	20	
	A10 added “…reusable insert containers (RIC)…”	20	
	A16 revised to be “…replaced, worn and failed parts (e.g., Wires, cables, motors, gears, brackets, plates, bearings, belts, Gaskets, flanges, pipe, valves)…”	20	
	Waste Shipping & Disposal is affected by this change.		
8	Minor Revision prompted by Periodic Review Updated changes to company and department names only.		06/08/10
	No Departments affected by these changes.		
9	Added definitions of FEM, WPD, WVES, WVNS and WVNSCO	3	05/19/11
	In Section 5.1.1 and 5.2.3, added definition of secondary waste and reference to Attachment F.	5, 6	
	Added alphabet designators to Citation List categories	19-21	
	Minor Changes in formatting the titles of Attachments A thru F	15-22	
	Added Attachment F	23-61	
	Waste Shipping & Disposal is affected by these changes.		