



DOE/WIPP 89 - 025
Revision 0

Waste Characterization Program Plan for WIPP Experimental Waste

January 1991



Waste Isolation Pilot Plant



1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this program plan is to define the activities required to characterize Waste Isolation Pilot Plant (WIPP) experimental waste prior to conducting the Bin-Scale (1) and Alcove (2) tests in the WIPP.

1.2 BACKGROUND

The Department of Energy (DOE) must show compliance with applicable Environmental Protection Agency (EPA) regulations before waste can be disposed at the WIPP. 40 CFR Part 191 (3) defines the environmental radiation protection standards for management and disposal of transuranic (TRU) radioactive wastes. This requires that the disposal system provide a reasonable expectation, based upon performance assessments (PA), that the cumulative release of radionuclides to the accessible environment for 10,000 years after disposal meets the prescribed limits (3).

One current unknown for the WIPP is the rate of gas generation and its effect on the ability to demonstrate compliance with 40 CFR Part 191 (3). Sandia National Laboratories (SNL) has been assigned the responsibility for performing the PA and has designed multiple tests to evaluate gas generation rate and gas generation potential under simulated repository conditions using TRU waste. These tests are described in the Bin-Scale Test Plan (1) and Addendum (4), and the Alcove Test Plan (2).

SNL is currently preparing a drum-scale leaching/solubility test plan which is scheduled release in September of 1991. Waste characterization requirements for this test plan are expected to be very similar to those outlined in this program plan. If SNL identifies any additional requirements during the development of the leaching/solubility test plan, these requirements will be incorporated into a later version of this program plan.

The DOE submitted a No-Migration Variance Petition (NMVP) (5) to the EPA Office of Solid Waste (OSW) to request a No-Migration Determination for the WIPP under the Land Disposal Restrictions (6). Very conservative (high) estimates for the potential concentration of volatile organic compounds (VOCs) and/or toxic metals were made for the source term

for the long-term modeling of repository performance under undisturbed conditions (5). Also, estimates of VOCs in the headspace of waste drums were used to demonstrate near-term compliance with releases of VOCs during the experimental and operations periods.

The EPA/OSW determined that the DOE had demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate from the WIPP disposal unit during the testing period. Thus the WIPP has been granted a Conditional No-Migration Determination (NMD) for a period of ten years for testing and experimentation purposes (7). The DOE will comply with the requirements of that determination. 9107

It is anticipated that this current version of the program plan will support initial shipments of simpler waste forms from the Idaho National Engineering Laboratories (INEL) and the Rocky Flats Plant (RFP) in accordance with the SNL test plan addendum (4). Satisfying the requirements imposed by the NMD is also being addressed in the Waste Characterization/Waste Analysis portion of the WIPP Part B permit application being prepared and in the RCRA compliance section of the current revision of the Waste Acceptance Criteria (WAC) currently being revised (8). Any additional compliance methodologies resulting from requirements from the New Mexico Environmental Improvement Division (NM-EID), the NMD, or more complex waste forms will be included in subsequent program plan revisions as the DOE determines the planned method(s) of compliance, in conjunction with EPA/OSW and NM-EID.

Although characterization of TRU waste with hazardous constituents (TRU mixed waste) may not be necessary to demonstrate compliance with the long-term effects of TRU mixed waste disposal in the WIPP repository, because of the conservative assumptions for the source term, characterization of TRU mixed waste is necessary to:

- Verify that the assumptions made for the concentration of hazardous materials in the migration modeling are indeed very conservative.
- Provide data to show compliance with the RCRA requirements to characterize experimental waste prior to shipment to the WIPP for conducting Bin-Scale (1) and Alcove (2) tests.
- Analyze headspace gases from waste containers to confirm the assumptions from previous analyses made about the potential releases of VOCs during the experimental and operational demonstration periods.

- WIPPs*
- Collect standardized data as part of the Waste Characterization activities in support of meeting long term compliance with 40 CFR Part 191 (3) and 40 CFR Part 268.6 (6), to support the demonstration of compliance to the conditions of the No-Migration Determination.

Details of specific actions required at the generator/storage sites, described in this program plan (Section 2.0), are based on the needs specified in the experimental Bin-Scale and Alcove Test Plans and Bin-Scale Addendum (1,2,4). Data generated by this characterization will also be used by other programmatic efforts, including validation of waste previously certified to the WIPP WAC (8), evaluation of the information on hazardous constituents in support of the NMVP (5), verification of process knowledge databases, and documentation of TRUPACT-II payload compliance (9). ??

Overall management of the characterization program will be the responsibility of the DOE WIPP Project Office (WPO). The Waste Acceptance Criteria Certification Committee (WACCC) will review and approve site-specific Quality Assurance Project Plans (QAPjPs) (after appropriate site authorities have reviewed and issued them to the WACCC) and provide oversight activities (surveillances and audits). The actual characterization, sampling, quality control, and quality assurance will be the responsibility of the contractors at waste generator/storage sites. W

The EPA Office of Radiation Programs (ORP) is providing technical support on the safe and effective characterization of TRU mixed wastes under an interagency agreement (IAG) with DOE (Section 1.6). Chow...
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As previously mentioned, this program plan is a living document, and is expected to change as new requirements and methods of compliance are identified [e.g., the No-Migration Determination (7) and NM-EID (RCRA) compliance requirements]. The bin-scale wastes will be the first wastes to be received at WIPP according to current plans.

1.3 SCOPE

The scope of this waste characterization program plan includes the following activities:

- Determine the isotopic distribution and assay of test wastes within experimentally determined detection limits and uncertainties (Section 2.2.4).

- Identify requirements for analyzing TRU mixed wastes (for the analyses identified in Section 2.0) to be applied uniformly by all the DOE sites, and coordinate with the EPA and the NM-EID.
- Use real-time radiography (RTR) and videotapes as records for comparison of waste content codes among the different test wastes (Section 2.2.3).
- Visually inspect Contact-Handled (CH) TRU waste (Section 2.2.6).
- Sample and analyze headspace gas for VOCs and other gases present (Section 2.2.5).
- *WIPAC will do WIPAC*
- Ensure that all experimental waste meets the WIPP WAC and the TRUPACT-II Authorized Methods for Payload Control (TRAMPAC, Appendix 1.3.7 of the TRUPACT-II Safety Analysis Report) before shipment to WIPP (8,9).
- Ensure that the data requirements specified (1,2,4,) are satisfied (Section 1.4).
- Verify process knowledge (Section 1.4).
- Appoint the WACCC as the organization responsible to observe and oversee waste characterization activities with participation by State, Federal, and local agencies such as the EPA, the New Mexico EID, the Environmental Evaluation Group (EEG), and equivalent agencies of other affected states. (The NM-EID is the agency in New Mexico authorized by the EPA to regulate mixed wastes, and is a functional division of the New Mexico Health and Environment Department. The EEG is an organization created to provide independent technical review of all WIPP activities, and is funded by the DOE. The EEG reports through the auspices of The New Mexico Institute of Mining and Technology.)

The development of the analytical methods will be documented in a system-wide Quality Assurance Program Plan (QAPP) that will be the governing document for all activities performed in support of the waste characterization. This QAPP, currently under development, documents the quality control (QC) and quality assurance (QA) requirements based on the analytical requirements identified in this program plan, and will be approved by DOE Headquarters. Waste characterization activities at each site shall conform to this overall QAPP, and shall be in accordance with the QAPP as implemented by WACCC

approved site-specific QAPjPs. Figure 1 shows the relationship between this program plan, the overall system QAPP, the site-specific QAPjPs, and other related documentation.

Dosimetry records will be kept by each site for all personnel involved at the site receiving exposures during waste characterization activities. The purpose is to be able to define the doses received for each activity. The recorded doses will, in turn, be used to evaluate the relative risks and benefits of different waste treatment and handling options. These records, without any personnel identities, shall be made available to the WPO. The evaluations from the records will be provided to the EPA.

1.4 WASTE CHARACTERIZATION REQUIREMENTS TO DEMONSTRATE REPRESENTATIVENESS OF WASTE

The Bin-Scale and Alcove Test Plans and Bin-Scale Addendum (1,2,4), developed by SNL in support of the Performance Assessment Program, have waste characterization requirements specified in Sections 8.3.1, 10.4.1, and 4.2 respectively. These requirements will be revised and updated as necessary to reflect the status of waste characterization needs and/or developments in experimental design.

One goal of this program is to characterize waste used in experiments to demonstrate that the waste gas generation properties are comparable to all the CH TRU waste in DOE's system. To achieve that goal, all sites will have to generate waste characterization data for comparison with the results of the waste experiments. The basis for comparison of TRU waste in the DOE system is process knowledge, which consists of the following:

- Process flow diagrams presented in the NMVP (5)
- Information in the TRUPACT-II Content Codes (TRUCON) (10) document and chemical lists published in the NMVP
- Records and documentation from generator/storage sites.

Data on TRU waste generated as part of the present waste characterization program will be compared with the existing (process) knowledge, as outlined above, to verify that the DOE has been accurate in their assessments of the physical and chemical composition of the waste (e.g. the percentages of materials listed in Table 1) or conservative in its assumptions where no previous analytical data exist.

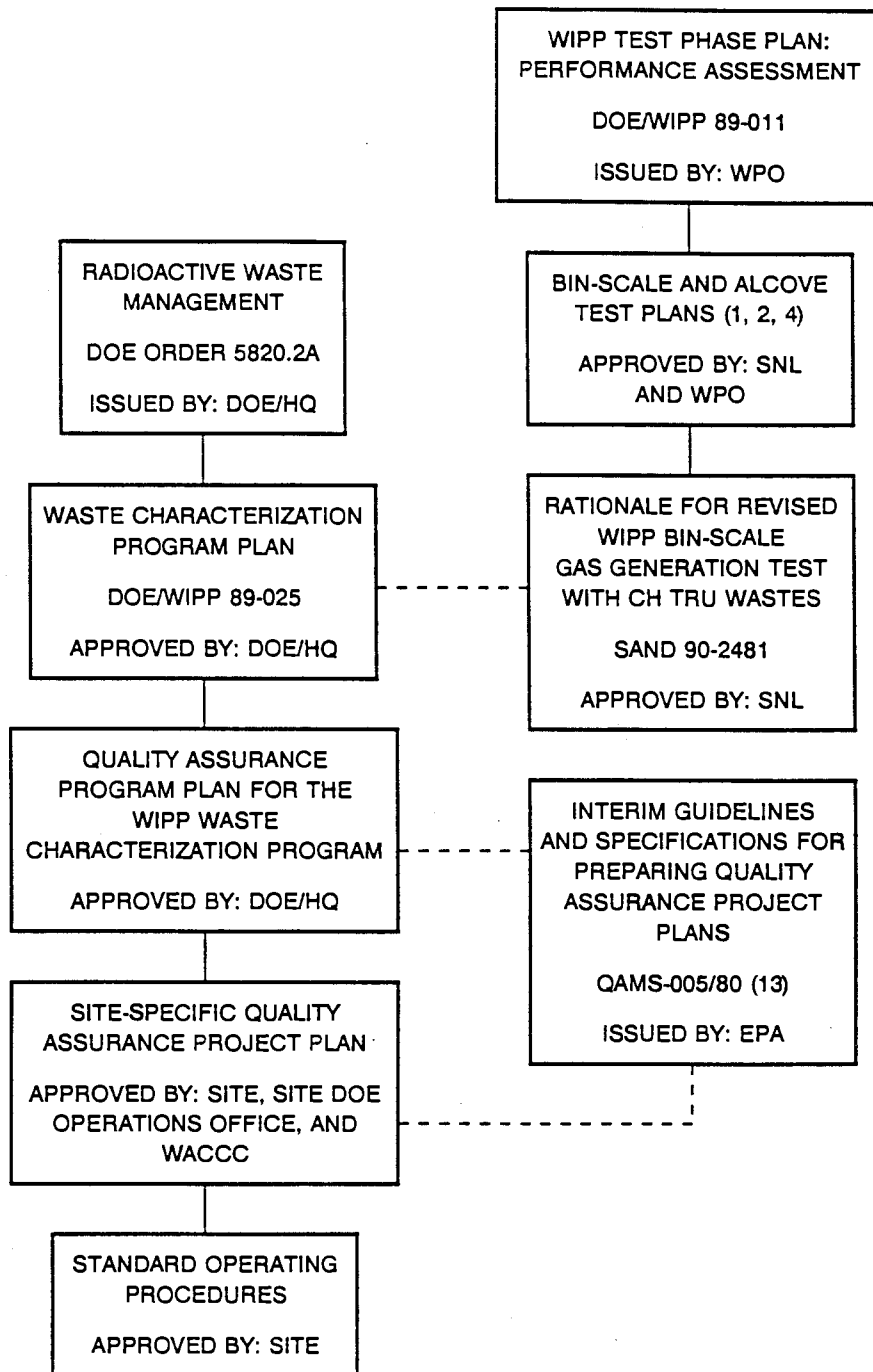


Figure 1. Documents Governing Waste Characterization

TABLE 1

CONTROLLING VARIABLES FOR WIPP WASTE CHARACTERIZATION

1. Cellulosics: paper, cloth, wood
2. Plastics: bags, liners, plexiglas
- pc → 3. Rubber: gloves, aprons
4. Corroding metal/steels: drums, wastes
5. Corroding metal/aluminum: wastes
6. "Non-corroding" metals: lead, tantalum, copper
7. Solid inorganics: glasses, ceramics
8. Inorganic sludges
9. Cements: including additives
10. Other organics: resins, organic sludges
11. Total alpha curies
12. Unknown*

* Sites will make every effort to identify "unkown" materials. Materials which fall into this category will be apportioned later between the 10 other visually identifiable categories (4).

If waste forms are identified in the system (by process knowledge) that do not appear to be comparable to the test waste, then the waste in question may have to be tested under the bin-scale test conditions (for its gas generation potential, etc.). Waste variables governing this characterization are described in detail below.

The logic, needs, and requirements for the characterization of the WIPP waste are as follows:

- A fraction of the total inventory is being tested in the bin-scale and alcove experiments to provide input into the performance assessment studies. This fraction is chosen via a statistical methodology described in the SNL document SAND 90-2481 (to be published). ✓
- The composition of the test waste has been chosen such that, based on process knowledge, it represents almost the entire waste inventory across the system. This waste defines the "envelope" for shipment to the WIPP site. The waste parameters and variables that determine this test waste envelope are listed in Table 1.
- Additional waste characterization (analytical data based on sampling) is needed for the waste at all the sites to verify the process knowledge information. This will be in the form of a sampling program across all sites that involves the examination of a fraction of the waste generated or stored at each site. } PM
- If waste is found in the system (based on the sampling) that is not represented by the test waste (that is, the gas generation properties cannot be described by the groups of waste components listed in Table 1), the following three options are available to qualify this "non-representative waste" for disposal at WIPP:
 - Process the non-representative waste so that its properties fall under that of the waste being tested in the experimental program. This option is equivalent to changing the non-conforming waste such that it falls under the envelope of waste defined by the test waste.
 - Test the non-representative waste under the conditions of the experimental waste, for the same test parameters, and include these results in the

performance assessment evaluations. This option is equivalent to expanding the current test waste envelope such that all of the waste in the system falls under it.

- Show, based on bounding analysis and knowledge of the waste (without actual gas generation testing), that the waste can be included in the performance assessment studies. This is equivalent to Option 2 of expanding the test envelope, but relies on conservative analysis instead of actual gas generation testing of the waste. This option requires that sufficient information be available regarding the properties of this waste to make the conservative analysis.

The first ten variables listed in Table 1 are groups of waste materials that affect the potential to produce gas from processes (i.e., bacterial, corrosive, and radiolytic) that might operate in the rooms of waste at WIPP.

The eleventh variable (alpha curies) is not a waste material that can decompose to produce gas, but is energy for a mechanism (radiolysis) by which gas is produced. Alpha radiation from all transuranic elements has approximately the same energy associated with an alpha decay. Therefore, equivalent alpha curies from different transuranic elements should produce the same potential amount of gas.

The twelfth variable, "unkown," is material not readily attributable to the other categories, and will be used to sum weights of undefined materials. When the data are all collected, this category of material will be apportioned to the other 10 variables based on the total weight of those 10. Thus, gas generation rates will be determined for known materials, based on the ratios of occurrence of each one.

Representativeness of the waste with respect to the variables in Table 1 refers only to overall properties (e.g., the gas generation potential) and not to the amount of constituents present in the waste. For example, if the maximum amount of cellulose (variable 1 in Table 1) present in a WIPP experimental drum is 50 kg, a drum of waste sampled at a site with 100 kg of cellulose can still be under the test waste envelope, provided it does not contain materials which cannot be classified by any of the ten waste constituents in Table 1.

The three options outlined above provide a basis for evaluating wastes which may fall outside the envelope of the variables listed in Table 1, including new unanticipated waste generation processes that may occur in the future.

1.5 STATISTICAL SAMPLING REQUIREMENTS

All of the drum equivalent waste to be used in the bin-scale tests (1) will be characterized according to the requirements described in Section 2.2. A statistical sample of the drum equivalent waste to be used in the alcove tests will be characterized in accordance with the requirements described in the SNL rationale document (to be published) and Section 2.3. Additionally, RTR as described in Section 2.2.3, and assay measurements as described in Section 2.2.4, will be used to characterize all experimental waste (both bin-scale and alcove).

The alcove test program involves two types of waste: "as received" waste and "specially prepared" waste (2). The "as received" waste doesn't require the opening of drums or boxes of wastes for test preparation. However, some specific characterization activities are required to be able to relate the "as received" waste in the alcove tests to both the waste used in the bin-scale tests and the "specially prepared" waste used in the other alcove tests.

Of the approximately 1050 drums (or drum equivalents) to be emplaced as "as received" waste into the alcoves, a statistical sample will be randomly selected for further characterization in exactly the same manner as for the bin-scale waste. The statistical evaluations to determine these sample sizes will be conducted by SNL and made available to the DOE sites early in 1991, prior to initiation of these tests. The number of drums (the sample size) included in the alcove test that will require detailed characterization (as described in Section 2.2) will depend on the results of the waste characterization done in the bin-scale program (1). With regard to the bin-scale tests, the sampling program will guarantee that the sample selected spans the central 90% of the distribution of each of the 11 controlling variables (given in Table 1) with 90% confidence. This limited sampling will provide a database to support the RTR methodology for making comparisons between similar waste content codes.

The remainder of the drum equivalents (approximately 2800) for the "specially prepared" wastes scheduled for the alcove tests will all be opened for insertion of additional materials

(2). A statistical sample of the 2800 drum population will also be characterized using the same procedures as described in Section 2.2 (for the bin-scale tests).

1.6 ENVIRONMENTAL PROTECTION AGENCY (EPA) INVOLVEMENT

Development of "standard" procedures for characterization of TRU and TRU-mixed wastes has been enhanced by the working interaction among the DOE, the EPA Office of Radiation Programs (EPA-ORP), and the waste generator and storage sites (Section 1.2). EPA-ORP will review and comment on proposed sampling methods, analytical methods, and the Quality Assurance Program Plan. EPA-ORP will also initiate coordination of an inter-laboratory performance evaluation program (including preparation and distribution of blind samples) to demonstrate the performance of the analytical methods and participant laboratories.

EPA-OSW will be involved in the waste characterization program throughout the development and implementation of sampling and analysis protocols. In addition to reviewing WIPP program plans, OSW will be asked to review and comment on the DOE's proposed sampling and analysis methods. In this way, OSW comments can be incorporated before waste characterization activities are initiated.

1.7 NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION

The EID was authorized by the EPA to regulate mixed waste in the State of New Mexico on July 25, 1990. The DOE has held several meetings with the EID, with discussions focusing on their basic philosophy regarding compliance with RCRA regulations.

2.0 WASTE CHARACTERIZATION - EXPERIMENTAL REQUIREMENTS

This section details waste characterization information and the analyses necessary for the different types of experimental waste. The WIPP bin-scale and alcove experiments (1,2,4), along with related laboratory experiments (11), are primarily intended to provide data in support of the WIPP Performance Assessment. The basis and presently approved details of the experiments to be placed in WIPP are described in the two test plans with the addendum (1,2,4) and the rationale document to be published by SNL. The experimental waste for the WIPP site can be grouped as follows:

1. Waste for the Bin-Scale Tests - The current plan involves about 800 drum volumes of waste to be repackaged into 146 bins (4).
2. Waste for the Alcove Tests - The approximately 3850 drum volumes of waste for the alcove tests can be subdivided into two groups:
 - "As-received" waste
 - "Specially prepared" waste.

The waste for these experiments is currently planned to be Rocky Flats waste located at the RFP and the INEL. As data are collected on these experiments and engineered alternatives are considered, tested, and evaluated, waste from other sites may be required. Waste characterization data requirements for the two types of tests have been initially identified and described in the two test plans (1,2), and will be revised as appropriate to reflect updates of these requirements (4). Details of the experimental waste characterization and site implementation requirements are presented in the following sections.

As stated in Section 1.3, each site supplying waste for the test phase is required to prepare a site-specific waste characterization document (a QAPjP) detailing how the needs and requirements outlined in this program plan and the system-wide QAPP are met by the site.

2.1 LOGIC AND METHODOLOGY FOR WASTE CHARACTERIZATION REQUIREMENTS

Waste characterization data requirements, identified in this document as applying to the governing regulations 40 CFR Part 191 (performance assessment) (3) and 40 CFR Part 268 (hazardous waste) (6), are presented in Table 2. The parameters in the table and their

relevance to the two regulations are described below. The table also addresses the issue of the verification of process knowledge. Performance assessment is addressed under 40 CFR Part 191 (3), and the No-Migration Determination (7) is addressed under 40 CFR Part 268.6 (6).

Waste characterization data on hazardous waste will be collected to verify assumptions of modeling in the NMVP and to support RCRA characterization of TRU wastes at the DOE sites through verification of process knowledge. The WIPP experimental program and waste characterization are primarily aimed at obtaining data to support evaluation of compliance with 40 CFR Part 191 (3), to demonstrate the representativeness of the experimental wastes for their gas generation potential, and to verify that the wastes emplaced at WIPP for experimental purposes are the wastes described in the No-Migration Variance Petition (5). The occurrence of VOCs and/or toxic metals in the wastes should not affect the gas generation rate or gas generation potential of the nonhazardous constituents. Therefore, the wastes used in the Bin-Scale and Alcove tests (1,2,4) need not be representative of the inventory with respect to the hazardous components.

Table 2 lists the technical requirements for waste characterization of the inventory. The parameters in Table 2, and the technical justification for each, are listed below:

- Real-Time Radiography (RTR): This examination provides input on the major materials in the waste (e.g., metals, paper/cloth/plastic or sludge) which provides information on waste comparability. RTR is used by the sites to determine compliance with some waste acceptance and waste transportation criteria.

Examples of parameters that can be verified by RTR are the presence of free liquids, the waste physical form, and the presence of restricted items like sealed containers (greater than 1 gallon in size) and aerosols.

- Isotopic Distribution and Assay: These results are needed as inventory information for 40 CFR Part 191 (3) compliance efforts, and will be used to determine potential radiolytic gas generation rates.

TABLE 2
TECHNICAL REQUIREMENTS
FOR WASTE CHARACTERIZATION

PARAMETER	OBJECTIVE		
	40 CFR 191	40 CFR 268	VERIFICATION OF PROCESS KNOWLEDGE
RTR	YES	YES <i>11/10/91</i>	YES <i>?</i>
ISOTOPIC DISTRIBUTION AND ASSAY	YES	NR	YES
HEADSPACE GASES	NR	YES	YES
SOLID WASTE - VISUAL INSPECTION AND WEIGHING	YES	YES <i>7/17/91-4</i>	YES
SLUDGE - VOCs	NR	YES	YES
TOXIC METALS	NR	YES	YES
MAJOR CATIONS AND ANIONS, pH	YES	YES	YES

NR - Characterization not required for the parameter.

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**WASTE CHARACTERIZATION PROGRAM PLAN
FOR WIPP EXPERIMENTAL WASTE**

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PREFACE

This program plan is being issued by the DOE to reflect the current status of the waste characterization program. Not all methods of compliance with the requirements imposed by the regulators have been fully developed. Although the EPA has issued the Conditional No-Migration Determination for the WIPP, several activities have to be studied for recommendations of optimum courses of action.

Therefore, as the DOE determines compliance methodologies for the requirements of the No-Migration Determination and for the requirements of the New Mexico Environmental Improvement Division, this program plan will be revised and reissued as often as necessary. It should also be understood that the DOE will comply with all regulations prior to making any shipment of TRU waste to the WIPP for the experiments.

- Headspace Analysis: This is not directly used in PA analysis. It does provide an estimate of gas compositions in the waste container, which can give an indication of the dominant process occurring in a drum (e.g., production of CO₂ and depletion of O₂ due to radiolysis of paper/cloth). The presence of volatile organic compounds in the headspace of a drum can provide evidence of the presence of hazardous constituents in the waste.
- Visual Inspection and Weighing of Solid Waste: This provides data on the types and amounts of waste materials (e.g., paper towels, metal, etc., identified to the extent possible). The weight of all waste materials in a waste container will be reported for the first ten variables listed in Table 1, or noted as a material that differs from the ten categories of waste. The weights of these materials in each bin will be used to interpret gas generation data for input into PA calculations. Actual chemical analysis of the solid constituents is not needed in support of PA or the NMD (7).
- Sludge Analysis for Volatile Organic Compounds or Toxic Metals: This is not a concern for PA. Preliminary modeling in the NMVP (5) indicated that even with conservatively large estimates for these compounds (VOCs and toxic metals), migration beyond the unit boundary should not occur above health-based levels. The sludges, however, will be analyzed for VOCs and toxic metals in support of waste characterization activities to comply with RCRA requirements of each site.
- Major Cations and Anions and pH of Sludges: These properties need to be quantified because of their potential influences on radionuclide solubilities, and are necessary inputs into the PA calculations. These parameters may also influence the solubility of both VOCs and toxic metals.

The preceding text outlines the basis for the waste characterization data requirements described in Sections 2.2 and 2.3. Characterization efforts for other parameters, outside the scope of the described waste characterization effort, are discussed in Section 2.2.8. The characterization described in Section 2.2.8 is not a requirement for current activities, but will be performed as an additional check on process knowledge information and to provide data in support of RCRA characterization activities at the sites.

2.2 WASTE CHARACTERIZATION FOR BIN-SCALE TESTS

2.2.1 Introduction

The bin-scale tests require specific amounts of four different WIPP waste test types (1). These are:

1. High-Organic Newly Generated (HONG) wastes (less than 2 years old) _____
2. High-Organic Old wastes (HOOW) (more than 5 years old) filler
3. Low-Organic (LO) wastes AGC
4. Process Sludges (PS)

A summary flowchart of the waste characterization requirements for this waste is presented in Figure 2. Each of the steps in the flowchart is described in detail below. Each of the drums that will be repackaged into bins for the bin-scale tests must meet the waste characterization requirements.

2.2.2 Selection of Drums for Bin Tests

The rationale for the number of drum equivalents of waste needed in the bin-scale tests will be described in a supporting document to the test plans, SAND 90-2481 (to be published). Waste content codes are a subset of the four waste test types defined above, and the content codes that fit into each of the WIPP waste test types are listed in Table 3. The content codes are a waste classification system developed for transportation purposes and apply to each site (10).

Each drum of waste to be transported to the WIPP site is assigned a specific content code. The number of drums from each WIPP waste test type, and from each content code within a WIPP waste test type, needed for the bin tests is specified by the rationale document (12), and all waste drums for the bin-scale tests shall be selected as specified by that document. The drums that will be selected for preparation of a bin have to be chosen such that the bin meets the WIPP WAC (8) and the TRAMPAC (9). These criteria have been published and made available to the waste generator and storage sites. The methodology for selecting the drums for preparing a bin is presented in Figure 3.

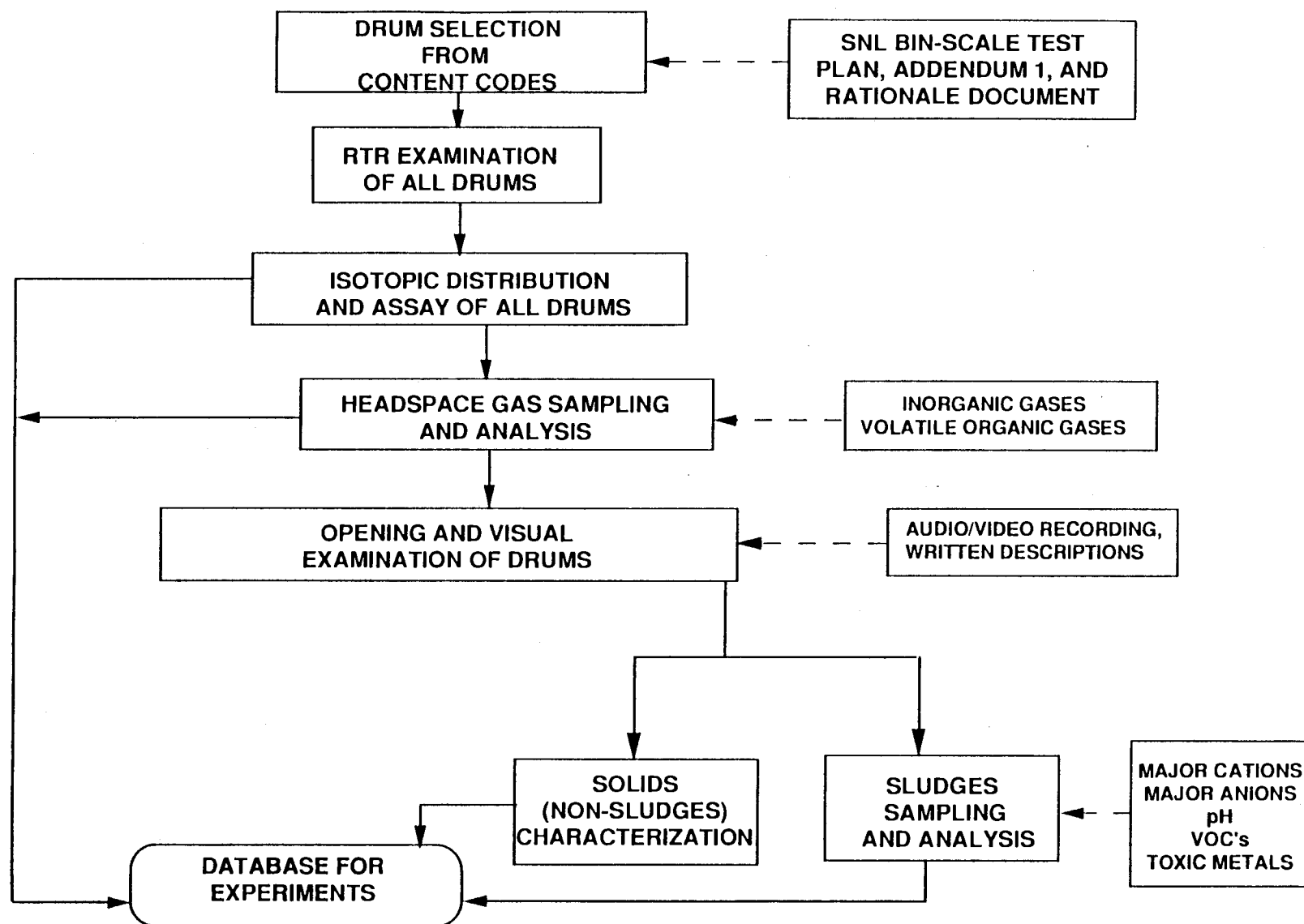


Figure 2. Waste Characterization Requirements for Bin-Scale Experiments

TABLE 3*
WIPP CH TRU WASTE TEST TYPES: TRUCON CODES CROSS-LISTING

<u>WIPP Waste</u> <u>Test Type</u>	<u>TRUCON Designation:</u>	
	<u>Waste Type</u>	<u>Content Codes (description)</u>
<u>HONG</u>	III (solid organics, newly generated)	116 (paper, plastic, cloth)
		119 (filters; mostly organic)
		121 (other organic solid waste)
		123 (leaded rubber gloves)
		125 (solid organic and inorganic waste)
		126 (cemented organic process solids)
<u>HOOW</u>	III (solid organics, retrievably stored)	216 (paper, plastic, cloth)
		219 (filters; mostly organic)
		221 (other organic solid waste)
		223 (leaded rubber gloves)
		225 (solid organic and inorganic waste)
		226 (cemented organic process solids)
<u>LO</u>	II (solid inorganics, newly gen. & [old])	115 [215] (graphite waste)
		117 [217] (metal waste)
		118 [218] (glass waste)
		122 [222] (inorganic solid waste)
		124 [224] (pyrochemical salt waste)
<u>PS</u>	I (solidified aqueous or homogeneous new and [old])	111 [211] (cemented/solidified sludges)
		112 [212] (solidified liquid organics)
		113 [213] (solidified organic lab waste)
		114 [214] (cemented inorganic particulates)

* Adapted from Molecke and Lappin, 1990 (Reference 4)

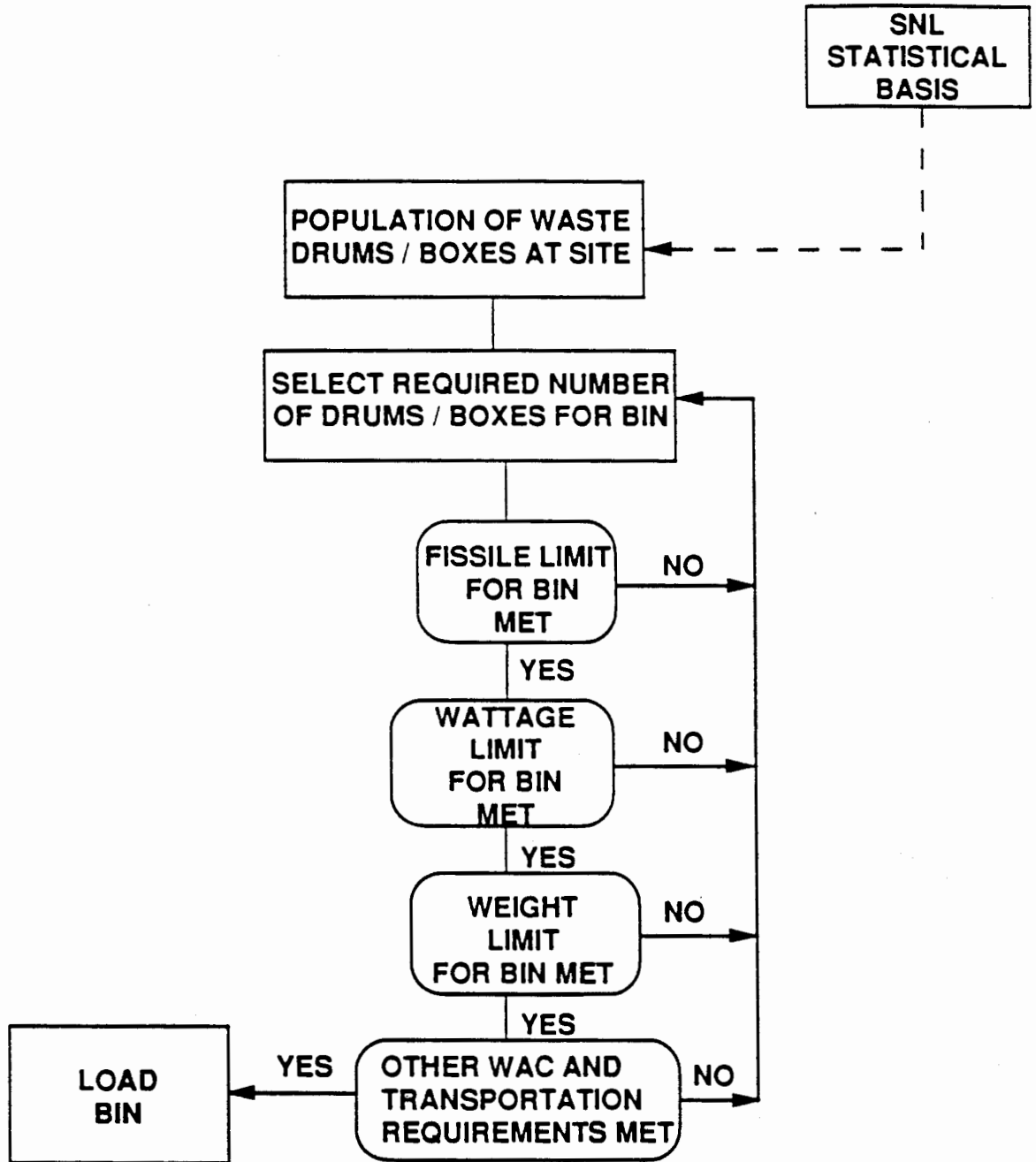


Figure 3. Criteria for Selection of Waste for Bins

2.2.3 Real Time Radiography Examination of Waste Containers

The first step after waste drum selection is examination by real-time radiography (RTR), which will be used to make a subjective verification of the following parameters:

- Content Code of the Waste
- Presence of Free Liquids and Estimate of Volume
- Contents Inventory
- Waste Packaging Configuration
- Containers That Could Contain Compressed Gases

The purpose of this RTR examination is to utilize a non-destructive examination (NDE) technique to obtain certain waste characterization data. Existing RTR tapes may be reviewed for appropriate data in lieu of re-examination if the data requirements of the QAPP can be satisfied. RTR examinations shall be performed only by trained and certified operators using approved procedures. N/D

Results of the RTR examination shall be documented and available as records for each drum, specifically with respect to the parameters mentioned above with an identifiable chain of responsibility available for each RTR record. The required RTR data documentation is provided in the QAPP.

2.2.4 Isotopic Distribution and Assay

Every drum shall be assayed. Assay measurement techniques and error determination are described in Appendix 1.3.7 of the TRUPACT-II SAR (7). Acceptable assay techniques and QA objectives are specified in the QAPP. Existing assay information may be used if the data requirements for assay in the QAPP can be achieved. Concentrations of isotopes that are not measured directly are calculated, using standard isotopic compositions of the radionuclide source material used in a particular building, or at a site based upon waste stream characterization (process knowledge). When bins are filled with waste unpacked from boxes, the bin will be assayed after closure. N/D

2.2.5 Requirements for Headspace Gas Samples

After a waste drum is set up in the sampling facility, a gas sample will be obtained from the headspace. Gas sampling of the headspace shall be performed by removing the drum lid and rigid drum liner lid (if present) and obtaining a gas sample from the headspace inside the first or second drum liner bag.

Gas analyses shall be performed using analytical methods that meet the QA objectives specified in the QAPP. Any deviations from the methods referenced in the QAPP must be detailed in the site-specific QAPjP. Analytical deliverables and QA objectives will be described in the system-wide QAPP under development, which will be reviewed by EPA OSW prior to initiation of sampling and analysis.

2.2.6 Preparation of Waste Drums for Visual Examination and Weighing

An audio video recording of the opening of the drum and the different stages of unpacking shall be performed for each drum. The video recording will focus on registering the drum contents after the drum is opened for bin preparation, details of waste packaging, and examination of the different waste packaging layers in the drum. A narration, specific to the activities of the process (e.g., "Drum Opened," "Liner Lid Removed," "Waste Bag Number XX Removed," etc.) shall accompany the video recording. Individual bags may be opened, sorted, and segregated, if necessary for purposes of waste characterization. There is a great need to identify and quantify all materials as precisely as possible. All contents unpacked from a drum shall be placed in the same bin unless the items are prohibited [e.g., by the WAC (8) or TRAMPAC (9)].

In addition to the video tape recording, each site must document the findings of the visual examination. This information must typically include a record of the following items:

- Site examining waste
- Date and time of examination
- Original date of closure of drum/box sampled
- Drum ID Number
- Content code of waste
- Waste test type
- Presence/absence of carbon composite filter
- Presence/absence of rigid drum liner (punctured/unpunctured)

- Number of liner bags
- Configuration of inner bags
- Number of individual bags or packages
- Content descriptions and weights of individual packages or items (if opened and sorted)
- Major differences with RTR examination, if applicable
- Date and time of bin closure
- Bin ID Number
- Name(s) of personnel performing examination

Descriptions of the solid contents of the drum shall be documented. The description can be brief but should clearly identify all discernable major items in the waste and classify each using the terminology of variables listed in Table 1. Individual bags, or packages, or contents of each bag within the drum shall be weighed, with their weights recorded. A brief written description of the contents of the bags shall contain an estimate of the amounts of each constituent in the bags based on the operator having completed the Visual Examination Training Program established by the DOE. The written records shall be supplemented with the video/audio recording. *WIP*

2.2.7 Requirements for Sludge Samples

Drums containing sludge materials (including solidified sludges) will be sampled to characterize the contents of the sludge with respect to major cations and anions and pH. Standard methods will be developed for the sampling and analysis of sludges to provide representative data for the analytes listed in Tables 4 and 5. All procedural modifications required to meet data quality objectives, specified in the system-wide QAPP for the analyses of TRU wastes, must be detailed in the site-specific QAPjP. Analytical deliverables will also be described in the QAPP (under development by the DOE). Analytical methods used in TRU waste characterization will be reviewed by the EPA/OSW prior to their use for analyses. *Call*

2.2.8 Additional Characterization of Sludge Samples

Sludge samples used in the bin-scale and alcove tests are not required to be analyzed for VOCs and toxic metals as part of the waste characterization (Section 2.1), in support of performance assessment, because these compounds are not expected to have an effect on gas generation rates. However, as further verification of site-specific process knowledge

TABLE 4
SLUDGE ANALYSES REQUIREMENTS FOR CATIONS

ANALYTE	DETECTION LIMIT
Sodium	50 ppm
Calcium	50 ppm
Magnesium	50 ppm
Iron	50 ppm
Potassium	50 ppm
Aluminum	50 ppm

TABLE 5
SLUDGE ANALYSES REQUIREMENTS FOR ANIONS

ANALYTE	DETECTION LIMIT
Nitrate	10 ppm
Phosphate	10 ppm
Chloride	10 ppm
Sulfate	20 ppm
Carbonate	10 ppm

information in support of RCRA, sludge samples from the bin-scale waste will be characterized for hazardous waste. Sampling and analysis procedures are being developed for the sludges. The hazardous waste data from the test waste will be used to verify process knowledge, satisfy site-specific RCRA requirements and for future comparison to data gathered by other sites as wastes continue to be generated. Method development is only in the preliminary stage; details of sludge sampling and analysis procedures are not available, but will be documented in a future revision of this document and a future revision of the system-wide QAPP.

2.3 WASTE CHARACTERIZATION FOR ALCOVE TESTS

2.3.1 Introduction

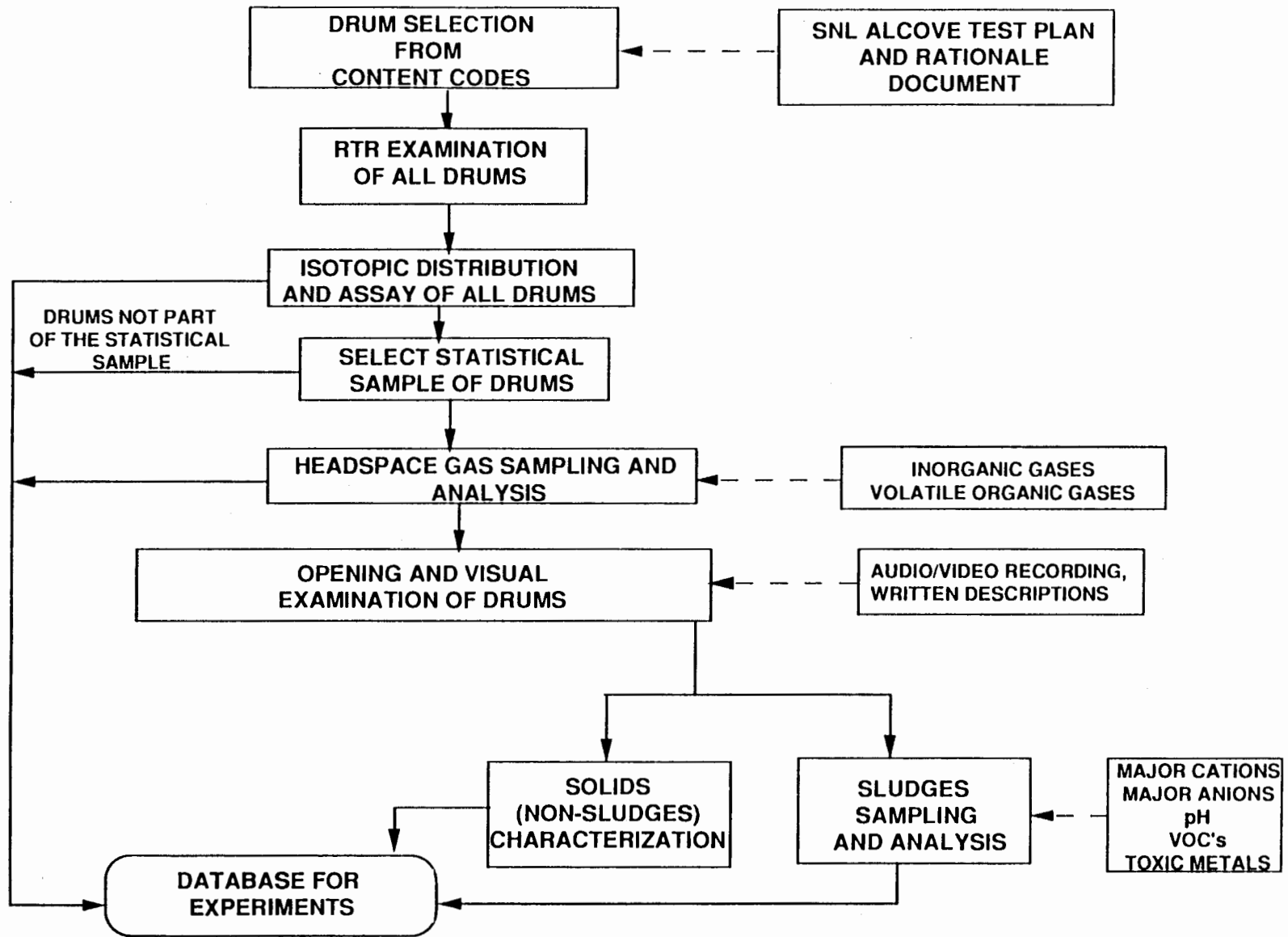
As described earlier in Section 2.0, the waste for the alcove tests is subdivided into "as received" waste and "specially prepared" waste. These wastes also fall into the same four WIPP waste test types as for the bin-scale tests (1). The number of drums belonging to each WIPP waste test type are defined in the test plan for the alcove tests (2). A summary flowchart of the characterization requirements for the alcove waste is presented in Figure 4. Each of the steps in the flowchart is described below. To avoid duplication, the bin-scale details presented in Section 2.2 are referenced where appropriate.

2.3.2 Selection of Drums for Alcove Tests

The waste drum equivalent volumes, by WIPP waste test type, needed per alcove are listed in Table 10.4 of the test plan for the alcoves (2). Content codes that fit into the WIPP waste test types are listed in Table 3 of this plan. Selection of drums or boxes within each WIPP waste test type will be random, the same way bin-scale test waste are randomly selected (Section 2.2.2). The same restrictions as for the bin-scale test waste (meeting both the WAC and the TRAMPAC requirements) apply to these drums/boxes.

2.3.3 Real Time Radiography Examination of Waste Containers

RTR examination is required for all the waste drums and boxes to be used for the alcove tests. The criteria will be identical to those for the bin-scale tests (Section 2.2.3) for direct and subsequent visual examinations (actual opening and unpacking of the waste drums documented by videotape records) can be used as verification of waste characterization in



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Figure 4. Waste Characterization Requirements for Alcove Experiments

cases where only RTR examination was performed, supported by limited sampling. comparison with results of the bin-scale tests. Correlations between the RTR examination

2.3.4 Isotopic Distribution and Assay

All drums to be used in the alcove tests shall be assayed or the sites may use existing assay data if the existing data meets the requirements of the QAPP. Assay measurement techniques and error determination are described in Appendix 1.3.7 of the TRUPACT-II SAR (9).

2.3.5 Requirements for Headspace Gas Samples

These requirements apply only to the statistical sample of the alcove drum population (as described in Section 1.5). Criteria are the same as for the waste for the bin-scale tests (Section 2.2.5). The size of the statistical sample will be dependent on the results from opening and characterizing drums/boxes for loading experimental bins.

2.3.6 Preparation of Waste Drums for Visual Examination and Weighing

These requirements apply only to the statistical sample of drums. Criteria are the same as for the waste for the bin-scale tests (Section 2.2.6).

2.3.7 Requirements for Sludge Samples

These requirements apply only to the statistical sample of drums. Criteria are the same as for the waste for the bin-scale tests (Section 2.2.7 and 2.2.8).

2.4 QUALITY ASSURANCE

The characterization program, including all the preparatory steps, inspections, examination, sampling, analytical activity, and records must be controlled in accordance with the QA requirements identified in the QAPP which corresponds to the QA requirements of EPA (12,13) and NQA-1 (14). The QAPP will address the QA requirements relative to sample size, preservation techniques, chain of custody, type of containers, holding times, and any other pertinent items. Modifications of EPA-approved test methods will be used, if possible, and verified. If modifications are necessary for personnel protection from the radioactivity, these modifications will be fully documented and submitted through the DOE HQ for

submittal to the EPA. The acceptability of all proposed methods will be demonstrated through the performance demonstration program. As any additional QA requirements are identified by NM-EID or the EPA, they will be coordinated between DOE and the regulator such that appropriate responses may be taken.

The QAPjPs developed at each participating site will provide a detailed description of the sampling and analytical functions, as well as additional quality related objectives, in accordance with the EPA Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (13), the criteria listed in Tables 4 and 5 of this program plan, and the system-wide QAPP under development. Characterization activities will be performed in conformance with QA requirements that will be specified in the QAPP. The QAPP will be submitted by the DOE HQ to the EPA for review. If off-site laboratories are used for conducting analyses, those laboratories must also prepare and submit a QAPjP covering their scope of work to the WACCC, and must participate successfully in any performance evaluations that are included in the program.

The participating sites will be responsible for identifying and performing the QA/QC tasks associated with the characterization and packaging activities, and must include those activities in the site-specific QAPjP submitted to the WACCC for approval. The WACCC will conduct audits and/or surveillances to assure that sites are in compliance with their approved site specific QAPjPs, prior to commencement of actual waste characterization activities and bin loading at all participating sites. The affected state and federal organizations and agencies will be requested to be present as observers during these activities.

3.0 REFERENCES

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4. Molecke, M.A., A.R. Lappin, "Test Plan Addendum #1: WIPP Bin-Scale CH TRU Waste Tests," SAND 90-2082, Sandia National Laboratories, December, 1990.
5. U.S. Department of Energy, "Waste Isolation Pilot Plant No-Migration Variance Petition," DOE/WIPP 89-003, U.S. Department of Energy, WIPP Project Office, Carlsbad, New Mexico., 1990.
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7. U.S. Environmental Protection Agency, "Conditional No-Migration Determination for the Department of Energy Waste Isolation Pilot Plant (WIPP)," Federal Register, Vol. 55, No. 220, pp 47700-47721, 1990.
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9. Nuclear Packaging, Inc., "TRUPACT-II Authorized Methods for Payload Control," Appendix 1.3.7, in Safety Analysis Report for the TRUPACT-II Shipping Package, Revision 4, Nuclear Packaging, Inc., Federal Way, Washington, August 1989, or as updated.
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12. U.S. Environmental Protection Agency, "Test Methods for Evaluating Solid Waste Physical/Chemical Methods," SW 846, 3rd edition, Office of Solid Waste and Emergency Response, Environmental Protection Agency, Washington, DC, November, 1986.
13. U.S. Environmental Protection Agency, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, Environmental Protection Agency, Washington, DC, February, 1983.
14. American Society of Mechanical Engineers, "Quality Assurance Program Requirements for Nuclear Facilities," ANSI/ASME NQA-1-1989, The American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY, 10017, 1989.

4.0 LIST OF ACRONYMS

CH-TRU	Contact-Handled Transuranic
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy-Headquarters
EEG	Environmental Evaluation Group
EID	Environmental Improvement Division, in New Mexico
EPA	U.S. Environmental Protection Agency
EPA-ORP	U.S. Environmental Protection Agency-Office of Radiation Programs
EPA-OSW	U.S. Environmental Protection Agency-Office of Solid Waste
HONG	High Organic Newly Generated Waste
HOOW	High Organic Old Waste
IAG	Interagency Agreement
LONG	Low Organic Newly Generated Waste
NMVP	No-Migration Variance Petition
PA	Performance Assessment
PS	Process Sludge (TRU waste)
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Program Plan
QAPjP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RTR	Real Time Radiography
SAR	Safety Analysis Report
SNL	Sandia National Laboratories
SOP	Standard Operating Procedures
TRU	Transuranic
TRAMPAC	TRUPACT-II Authorized Methods for Payload Control
TRUPACT-II	Transuranic Package Transporter-II
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WACCC	Waste Acceptance Criteria Certification Committee
WIPP	Waste Isolation Pilot Plant
WPO	WIPP Project Office (DOE)