ALCOVE TEST PLAN

PRE-DECISIONAL DRAFT

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APPROVAL/CONCURRENCE PAGE

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DEFINITION OF ACRONYMS

ALARA	As Low As Reasonably Achievable
AGB	Alcove Gas Barrier
CAM	Continuous Air Monitor
CFR	Code of Federal Regulations
CH	Contact Handled
CY	Calendar Year
DOE	Department of Energy
DRZ	Disturbed Rock Zone
EPA	Environmental Protection Agency
FR	Federal Register
FSAR	Facility Safety Analysis Report
FTIR	Fourier Transform Infrared
FY	Fiscal Year
GC-MS	Gas Chromatograph - Mass Spectrometer
GGP	Gas Generation Program
INEL	Idaho National Engineering Laboratory
NMD	No-Migration Determination
NRC	Nuclear Regulatory Commission
PA	Performance Assessment
ppm	Parts per million
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
QAPjP	Site Specific Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RMA	Radioactive Materials Area
STP	Source Term Program
SWB	Standard Waste Box
TA	Test Alcove
TNAD	Technical Needs Assessment Document
TRUPACT II	Transuranic Package Transporter
TRUCON	TRUPACT Content Codes
TRU	Transuranic (Atomic Number > 92)
TSD	Treatment, Storage, and Disposal
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WACCC	Waste Acceptance Criteria Certification Committee
WID	Waste Isolation Division/Westinghouse Electric Corp.
WIPP	Waste Isolation Pilot Plant

1.0 INTRODUCTION AND REVISION HISTORY

The primary purpose for alcove tests, as originally proposed, was to address issues related to impacts of gas generation on repository performance over the Transitional and Long-Term Timeframes of the repository. As such, the proposed tests specifically targeted the demonstration of compliance with 40 CFR 191, Subpart B. The original alcove test plan, published in January, 1990 (Ref. 1), addressed more data requirements, and identified the need for about 3850 drum-equivalents of contact handled (CH) transuranic (TRU) waste to be evaluated in as many as six alcoves.

During the latter part of 1992, the U. S. Department of Energy (DOE) initiated a reassessment of the gas-generation and source-term technical information needs to support regulatory compliance evaluations for the Waste Isolation Pilot Plant (WIPP) for the Disposal, Decommissioning, and Post-Closure Phases of the repository. The WIPP Gas-Generation Program (GGP) and the Source-Term Program (STP) are designed to satisfy technical information needs through the development and implementation of laboratory-based and field experiments, and through the development and application of calculational models to interpret experimental data and simulate repository behavior. The scientific and technical rationale for these programs are presented in the "Gas-Generation and Source-Term Programs: Technical Needs Assessment for the Waste Isolation Pilot Plant Test Phase" (TNAD) (Ref. 2) and include correlating the repository-scale phases and panel-scale timeframes listed in the TNAD to the applicable regulations, the regulatory-driven technical information needs, the tests and modeling efforts performed to address those needs, and the overall regulatory compliance evaluation of the WIPP.

The scope of the TNAD is limited to addressing technical information needs of the STP, GGP, and subsets of the WIPP Test Phase Programs (Ref. 3) to support compliance with the applicable regulatory requirements. In addition to the regulatory-based information needs identified herein, certain operational data will also be derived as an additional benefit in the conduct of this experiment. These operational data needs will be summarized in this document.

The originally proposed WIPP experimental test program has been reassessed to focus on:

- An integrated approach with more reliance on laboratory tests and the development of a gas-generation model,
- An approach that addresses larger possible uncertainties in WIPP inventory projections, and
- An expanded scope for demonstrating compliance with the applicable standards

for disposal of TRU and TRU-mixed wastes.

The DOE has currently identified one alcove of CH-TRU waste and one reference alcove as constituting an effective and appropriate baseline testing program (Ref. 2, Page ES-3). The baseline program consists of two tiers of alcove experiments: Specifically Planned and Conditionally Planned Tests. The DOE has identified a contingency for an additional alcove to address wastes such as solidified sludges that may not have been included in the baseline alcove, should the need emerge. It must be emphasized that the DOE intends for current test planning to be subjected to periodic revision. This document will be periodically reviewed and amended to reflect changes in the experimental programs and regulatory environments.

2.0 REGULATORY REQUIREMENTS

The relevant regulatory requirements for WIPP are found in 40 CFR Part 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes* (Ref. 4), and the RCRA regulations codified in 40 CFR Parts 264, 265, 268, and 270 (Ref. 5-8). These regulatory drivers for performing simulated and TRU-waste experiments during the WIPP Test Phase are discussed in the TNAD (Ref. 2, Chapter 2) and the WIPP Test Phase Plan (Ref. 3, Chapter 2). A short synopsis is provided in this section of the regulations and associated technical data needs, that the Alcove Test will address.

2.1 Regulatory Background

The Test Phase is designed to provide information regarding both the long-term impact of the WIPP on the environment and any potential impacts during waste emplacement and repository decommissioning, and thus, it is planned for demonstrating compliance with applicable regulatory requirements. The following discussion provides a concise overview of those governing regulations for which the Alcove Test will provide data in support of demonstrating compliance for the WIPP.

The Resource Conservation and Recovery Act (RCRA) (Ref. 22) governs the generation, transportation, treatment, storage, and disposal of hazardous or mixed wastes. RCRA permits, issued in accordance with requirements of 40 CFR Part 270, are required for facilities which treat, store, or dispose (TSD) of hazardous wastes. A RCRA Permit application has been submitted to the State of New Mexico, which has been delegated RCRA responsibility by the Environmental Protection Agency (EPA).

The requirements of 40 CFR 264, Subpart X, "Standards for Owners and Operators of Hazardous Waste TSD Facilities, Miscellaneous Units," apply to the WIPP (Ref. 5). The Miscellaneous Units section of the RCRA standard was created by the EPA to encompass facilities that could not be effectively permitted under the other technical standards in 40 CFR Part 264. Essentially, these are unique facilities that do not meet the definition of a container, tank, surface impoundment, pile, land treatment unit, landfill, incinerator, boiler, industrial furnace, or underground injection well. The EPA has stated that repositories in salt formations qualify as miscellaneous units. The EPA has also imposed the general facilities standards of 40 CFR Part 264 on miscellaneous units, and the miscellaneous units must comply with specified environmental performance standards. The owner/operator must demonstrate through modeling, testing, or other means that the facility operations are protective of human health and the environment. For the WIPP facility, the methods for demonstrating compliance with the environmental performance standards are included in the RCRA permit application. For the Test Phase, this involves addressing the air pathway. The miscellaneous unit permit will regulate the facility for up to 30 years after the completion of closure.

The RCRA land disposal restrictions of 40 CFR Part 268 generally prohibit the emplacement of untreated hazardous waste or hazardous constituents in or on the land. However, 40 CFR 268.6 provides for petitioning to allow for land disposal of prohibited wastes under the specific conditions that the applicant demonstrate that the hazardous constituents do not migrate beyond the disposal-unit boundary in concentrations above health-based limits. The DOE successfully petitioned the EPA for a No-Migration Determination (NMD) for the WIPP Test Phase (Ref. 9). As part of that NMD, the EPA indicated their intent to interpret "no-migration" to mean that constituents released from the unit do not exceed health-based standards at the point where they exit from the unit. An additional NMD will be required to cover the Disposal, Decommissioning, and Post-Closure Phases of the WIPP repository.

2.2 Regulatory Drivers for the WIPP Experimental Program

The primary regulations controlling the technical data needs to be addressed by the GGP and STP are 40 CFR 268.6; 40 CFR 264, Subpart X; and 40 CFR 191, Subparts A and B. Listed below is a synopsis of those data needs that have been identified and discussed in more detail in the TNAD:

40 CFR 268.6 – Gas-generation rates and species under both ventilated and long-term repository conditions, as well as hazardous waste constituent source terms, are necessary to support compliance analyses for 40 CFR 268.6 no-migration standards. The two following conditions require evaluation:

- Release of hazardous waste constituents to both the repository air and across the top of salt in the Salado Formation during the Ventilated Timeframe and the early part of the Transitional Timeframe, and

- Release of hazardous waste constituents beyond the unit boundary by air or fluid pathways that might develop in the repository during the latter part of the Transitional Timeframe and the entire Long-Term Timeframe.

40 CFR 264, Subpart X - The primary regulatory concern is that the closure seals and methods used for the waste-emplacement panels meet environmental performance standards. The following information is needed to support compliance evaluations:

- Gas-generation rates and species for the Ventilated and Transitional Timeframes, and the early part of the Long-Term Timeframe,

- Volatile organic compounds (VOC) release data (both rate and species) from a population of containerized wastes that can occur in a room/panel headspace, and

- Credible and defensible knowledge of the interaction of waste/repository degradation processes in the Ventilated and Transitional Timeframes and the early part of the Long-Term Timeframe for the development of an effective seal design and closure method.

Compliance Standards for VOC Releases

The "no migration" demonstration [§268.6(a)] must show through modeling and monitoring that releases of hazardous waste constituents will not exceed health-based levels for ground water, surface water, soil, and air. All disposal units must meet the environmental performance standards for releases from the facility. An assessment must be made of the *cumulative impact* of waste and other sources of contamination [§264.601(c)(5)]. Therefore, the RCRA hazardous waste emissions would be prohibited from migrating beyond the "no migration" unit boundary above the established health based levels, while the cumulative material releases from a direct exposure pathway to an environmental receptor cannot be above the same level.

The reference alcove will be used to assess a bulk emission source term from the commercial chemical compounds in the reference materials. By comparing VOC emissions from the test and reference alcoves, a more appropriate demonstration of "no-migration" monitoring can be made.

40 CFR 191, Subparts A and B - Technical data needs to support compliance evaluations for 40 CFR 191, Subpart A, include gas-generation species and rate information for the Ventilated and Transitional Timeframes. Evaluation of the following is needed to support a demonstration of compliance with 40 CFR 191, Subpart B:

- Gas-generation species and rate information for the Transitional and Long-Term

Timeframes,

- Total expected gas production for the Transitional and Long-Term Timeframes of the waste-emplacement panels in the repository,

- Possible synergistic and/or antagonistic reactions among waste-degradation mechanisms and materials,

- Effects of waste-degradation reactions on the general chemical conditions that affect the radioactive and hazardous-constituent source terms, and

- Experimentally derived estimates of ranges of released concentrations (from the source) of all radioactive elements which are anticipated to significantly contribute to the radionuclide source term for performance assessment.

Table 2-1 summarizes the technical data needs listed above and identifies the calculations/models that will be used in support of achieving regulatory compliance and the Test Phase Program tasks that will provide the information/data needs (Ref. 2, Chapter 2). As indicated in Table 2-1, and discussed in the TNAD:

- Calculations will be used to estimate the source term that would be expected to occur from populations of waste containers in the WIPP underground during the Waste-Emplacement Phase of the repository, when routine handling and emplacement of waste containers in rooms is expected prior to disposal of waste.

- These calculations would be similar to those used in the No-Migration Variance Petition (Ref. 10), but using updated information on Volatile Organic Compound (VOC) concentrations in the headspace of waste continuers from the Waste Characterization Program (Ref. 11).

- Data/information measured during the Alcove Test will be used to demonstrate that the calculated headspace source term (HS1; Table 2-1) reasonably predicts the releases from a population of TRU waste containers.

TABLE 2-1. Summary of Technical Data Needs for Regulatory Compliance (Ref. 2)

Regulation	Timeframe	Calculation/Model	Technical Data Needs	Program Category
264, Subpart X	Ventilated	Calculation of VOC Releases from As-Received Waste Containers in WIPP	• VOC Data from Room/Panel Headspace (HS1) Release from Population of Drums	• Alcove of CH-TRU Waste
		Gas-Generation Model	• Gas-Generation Rates vs. Time* • Gas-Generation Species vs. Time*	• Estimates from Literature Review
	Transitional	Gas-Generation Model	• Gas-Generation Rates vs. Time* • Gas-Generation Species vs. Time*	• Laboratory Gas-Generation Data • Humid Bins of CH-TRU Waste
		Calculation of VOC Releases from As-Received Waste Containers in WIPP	• VOC Data from Room/Panel Headspace (HS1) Release from Populations of Drums.*	• Alcove of CH-TRU Waste
		Calculation of Expected VOC Headspace Concentration in a WIPP Room/Panel after Breaching of Waste Containers	• Estimate of VOC Concentration in Headspace (HS2) of Waste Containers	• VOC Headspace Data from Waste Characterization Program
268.6	Ventilated	Calculation of VOC Releases from As-Received Waste Containers in WIPP	• VOC Data from Room/Panel Headspace (HS1) Release from Population of Drums	• Alcove of CH-TRU Waste
		Gas-Generation Model	• Gas-Generation Rates vs. Time* • Gas-Generation Species vs. Time*	• Estimates from Literature Review
	Transitional	Gas-Generation Model	• Gas-Generation Rates vs. Time* • Gas-Generation Species vs. Time*	• Laboratory Gas-Generation Data • Humid Bins of CH-TRU Waste
		Calculation of VOC Releases from As-Received Waste Containers in WIPP	• VOC Data from Room/Panel Headspace (HS1) Release from Populations of Drums*	• Alcove of CH-TRU Waste
		Calculation of Expected VOC Headspace Concentration in a WIPP Room/Panel after Breaching of Waste Containers	• Estimate of VOC Concentration in Headspace (HS2) of Waste Containers	• VOC Headspace Data from Waste Characterization Program

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<table>
<tr><th>Regulation</th><th>Timeframe</th><th>Calculation/Model</th><th>Technical Data Needs</th><th>Program Category</th></tr>
<tr><td rowspan="3"></td><td rowspan="3">Long-Term</td><td>Gas-Generation Model</td><td>• Gas-Generation Rates*
• Gas-Generation Species*
• Gas-Generation Potential*</td><td>• Laboratory Gas-Generation Data
• Inundated/Humid Bins of CH-TRU Waste
• Inundated/Humid Bins of Simulated Waste</td></tr>
<tr><td>Calculation of Expected VOC Headspace Concentration in a WIPP Room/Panel after Breaching of Waste Containers</td><td>• Estimate of VOC Concentration in Headspace (HS2) of Waste Containers</td><td>• VOC Headspace Data from Waste Characterization Program</td></tr>
<tr><td>Calculation of Expected Concentration of Hazardous Constituents in Brine</td><td>• Estimate of Expected Concentration of Hazardous Constituents in Brine</td><td>• Estimates of Literature Review
• Contingency for Lab Experiments</td></tr>
<tr><td rowspan="2">191, Subpart A</td><td>Ventilated</td><td>Gas-Generation Model</td><td>• Gas-Generation Rate
• Gas-Generation Species</td><td>• Estimates from Literature Review</td></tr>
<tr><td>Transitional</td><td>Gas-Generation Model</td><td>• Gas-Generation Rate vs. Time*
• Gas-Generation Species vs. Time*</td><td>• Laboratory Gas-Generation Data
• Humid Bins of CH-TRU Waste</td></tr>
<tr><td rowspan="3">191, Subpart B</td><td>Transitional</td><td>Gas-Generation Model</td><td>• Gas-Generation Rate vs. Time*
• Gas-Generation Species vs. Time*</td><td>• Laboratory Gas-Generation Data
• Humid Bins of CH-TRU Waste</td></tr>
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• Gas-Generation Potential*</td><td>• Laboratory Gas-Generation Data
• Inundated/Humid Bins of CH-TRU Waste
• Inundated/Humid Bins of Simulated Wastes</td></tr>
<tr><td>Source-Term Model</td><td>• Predicted Actinide Concentrations in Brine</td><td>• Actinide Disposal Room Chemistry Laboratory Studies
• Actinide Source-Term Waste Tests</td></tr>
</table>

*Primary information needs for compliance (bin and alcove tests)

3.0 ALCOVE TEST OBJECTIVES

The primary objectives of the alcove tests are as follows:

1. To develop an understanding of the amounts and types of gases (including VOCs and flammable gases) that will be released into the alcove head-space by leakage through waste container lid seals, lid gaskets, and filters.

2. To measure the net headspace gas release rates and compositions from a relatively large volume of as-received CH-TRU wastes in an in situ disposal array under actual Disposal-Phase (Ventilated and early Transitional Timeframes) repository environment (as received contents evolving [or driven] to humid repository conditions). To the extent possible, the population of waste containers will be represented by those TRUCON codes (DOE, 1991e) that dominate the wastes to be shipped from the RFP and INEL to the WIPP during the Disposal Phase.

3. To correlate the measured headspace gas release rates at the alcove scale to the headspace concentrations measured at the waste generators, and to predictions made from the laboratory and bin-scale programs addressing similar repository timeframes. Because of the waste volumes that will be used in the test, however, it will not likely be possible to determine whether any significant decreases (or increases) in release rates measured relative to expected values are a result of interactions among waste types or interactions between the gas phase and the accessible portions of the Salado Formation.

4. To measure the release rates of VOCs from a significant population of waste containers to provide useful evaluation of the model that will be used to predict concentrations of headspace gases in sealed rooms. Such data may serve to verify or modify a source term for calculations if the conservative estimates from the model prove unacceptable.

Additional objectives of the Alcove Tests are:

5. To evaluate, to the extent possible, the change in rates of radiolytic gas generation (especially hydrogen generation) as a function of time.

6. To evaluate the effects of increased humidity on both gas generation and headspace gas release rates after the alcove is sealed.

7. To evaluate factors key to seal effectiveness and the demonstration of panel post-closure monitoring capability, (as required for both 40 CFR 264, Subpart X, and 40 CFR 268.6).

8. To evaluate, to the extent possible, the net rate of loss of gases by permeation and by leakage through cracks and fissures in the rock salt.

9. Though not a specific test objective, the alcove test will represent the only emplacement of CH-TRU waste in a disposal-array geometry during the Test Phase Timeframe. It provides a means to gain incidental operational experience in handling real waste at the WIPP, to simulate disposal room conditions, and to check out safety monitoring systems. As such, it represents an exceptional opportunity to verify the ability at WIPP to safely manage real waste under disposal room conditions within the anticipated regulatory and permitting constraints.

10. To distinguish between gaseous emissions from the waste material, the waste packaging, the repository construction materials, and the repository salt matrix.

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4.0 SUMMARY OF THE ALCOVE EXPERIMENT

The Alcove Test is an experiment that is designed to measure the net quantities and chemical compositions of gases that are released from a large array of waste drums that are stored under anticipated disposal room conditions. The experiment will be conducted underground at the WIPP site under conditions that will replicate as closely as possible the environment expected to be present in the WIPP during waste-emplacement operations.

The revised alcove (and bin-scale) test matrix consists of three tiers of experiments, with the baseline program defined by the first two tiers (Ref. 2, Page ES-3). The Alcove part of the CH-TRU and simulated field tests is:

- **Specifically Planned Test(s):** Two alcoves have been identified for the specific tests. One alcove will contain CH-TRU waste to confirm VOC release rates for the Ventilated and early part of the Transitional Timeframes. A second reference alcove will contain an equal number of the same types of waste containers, plastic bags, and shipping materials (empty waste packages) as are contained in the test alcove. This alcove will provide baseline data for the gases released by the packaging and shipping materials. (A third alcove may be needed. This alcove will be empty and will be used as a reference to establish baseline measurements for temperature, pressure, relative humidity, and gases emitted by the mined rock salt interbeds and the empty waste packages.)

- **Conditionally Planned Test(s):** No alcoves have been identified under this tier of testing.

- **Contingency Test(s):** An additional alcove test could be implemented if testing of additional waste types are mandated. Bin-scale and/or alcove TRU and/or simulated waste tests are all options for the contingency tier.

Information needed to support definition of a gaseous source term during the Ventilated Timeframe and early part of the Transitional Timeframe will be calculated based on VOCs measured in waste containers. Data from the alcove experiment will be used to assess the ability of the VOC model to predict releases/VOCs over time.

The alcoves will have height, width, depth dimensions of 13 x 25 x 100 feet. This will provide a storage volume of nominally one-fourth that of a typical disposal room. The test alcove will be filled with about one thousand 55-gallon drum-equivalents of CH-TRU waste. The alcove will not be backfilled. A second waste alcove is referenced in the Technical Needs Assessment Document (Ref. 2, Section 4.2). The third test alcove is listed in the contingency plan and would be used for waste types such as solidified wastes if the waste characterization techniques for solidified wastes have not been sufficiently developed for inclusive of solidified wastes in the first test alcove.

Two major requirements of the Alcove Test Program are to design, fabricate, test, and install a Gas Barrier System and a Gas Management/Sampling System. The Gas Barrier System will provide a seal sufficient to control leakage of gases from the alcove and retard mine air from entering the alcove while providing ports for gas piping and ducts, instrument cables, and personnel access. A considerable amount of work on gas barriers has already been accomplished by Westinghouse and Sandia National Laboratory personnel (Ref. 12). The plan for sealing the alcove in this experiment proposes using a modification of the Alcove Gas Barrier (AGB) concept used on room "Q" at the WIPP site (Ref. 13). Bulkheads, similar to those used with the AGB, will be used with a less complicated sleeve design.

The Alcove Test will use CH-TRU and TRU-mixed waste contained in 55-gallon steel drums, Standard Waste Boxes (SWBs), or any other certified waste container. The waste containers will contain only unmodified CH-TRU waste, without additives. "Unmodified" means the waste will be disturbed as little as possible (i.e., no visual inspection will be performed). Wastes used in the test program will be selected, characterized and shipped from the Idaho National Engineering Laboratory (INEL) and/or the Rocky Flats Plant (RFP).

Waste containers will be chosen to fill an alcove based on Waste Types, as defined in the No-Migration Determination (Ref. 9). The proportion of each waste type emplaced in an alcove will be based on the volumes of retrievably-stored wastes documented in the "U.S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities and Technologies" (Ref. 14). If sampling and analysis procedures for solidified wastes have not been fully developed by initiation of alcove loading of wastes, a second contingency alcove could be implemented for solidified wastes.

The results of the alcove tests will provide data to assess the quantities and chemical compositions of gases in waste emplacement rooms during the early Transitional Timeframe. The data can also provide information, obtained under actual conditions, about what gases workers will be exposed to while waste is being emplaced in the disposal rooms at the WIPP, and will provide information on the impacts of these gases on both the short-term and long-term safe operation and containment capability of the WIPP facility. The measured headspace concentrations for VOCs in individual waste containers will be used, in combination with specific assumptions and previously measured diffusion rates to calculate estimated VOC release rates from populations of drums in the WIPP. The results of the Alcove Test can be used to assess the adequacy with which the calculations, based on headspace and filter diffusion data, predict the release of VOCs inside the WIPP. Because the data obtained from the alcove tests can be used in the assessment of environmental and worker safety impacts during repository operations, the data are directly relevant to compliance with standards contained in 40 CFR 264, Subpart X.

5.0 EXPERIMENTAL PROCESS DESCRIPTION

The primary purpose of the alcove test is to provide data to assess the release of hazardous constituents (VOCs) from a large population of CH-TRU waste stored under anticipated repository conditions, and to evaluate the consequential impacts on the WIPP, relative to environmental, safety, and health regulations, i.e., 40 CFR 268.6 and 40 CFR 264 Subpart X.

The Alcove Test Program involves the sampling and analysis of gases released from a population of CH-TRU and TRU-mixed waste which has been emplaced within an isolated, atmosphere-monitored test alcove in the underground WIPP facility. Data to be obtained include the net quantities and compositions of gases resulting from various CH-TRU waste degradation mechanisms that appear in the headspace of an alcove. By performing the test underground the study can evaluate the net effects of possible interactions of these gases with the waste materials and with the rock salt in the alcove to simulate repository conditions during the Ventilated Timeframe and early Transitional Timeframe (Ref. 2).

The alcove experiment to be conducted underground at the WIPP site will represent as closely as possible disposal room conditions. Exceptions are that no backfill will be placed in the alcove and some air circulation will be necessary to obtain gas samples that are as representative as possible of the alcove atmosphere. The specific Alcove Test Program specifies one alcove to be filled with waste. Two reference alcoves may be needed. One reference alcove will contain an equal number of waste containers, plastic bags, and shipping materials as the test alcove. By monitoring the gases released by the container and shipping materials, a better prediction can be made for the types and compositions of gases emitted by the actual CH-TRU waste in the test alcove. The second alcove will be empty and will provide baseline data for temperature, pressure, relative humidity, and will provide reference data for the types and compositions of gases emitted by the rock salt. All alcoves will be mined in the salt with one blind end and one open end to be sealed with a leak-resistant gas barrier. Each alcove will be about one-third the length and will have about one-fourth the volume of a standard-size WIPP waste storage room. A detailed description of the proposed alcove is provided in Section 6.

5.1 Waste Characterization

Each container of CH-TRU waste will be characterized as much as possible without actually opening the drum or removing the waste. The objective is to leave those gases that have already accumulated in the drums undisturbed. Waste characterization techniques to be performed on each drum of waste include: weighing the drums, obtaining a drum headspace gas sample through the filter in the drum lid, non-destructive assay (radionuclide quantification), and real-time radiography. Any information that is available from process knowledge and similar historical records will be evaluated for its usefulness in characterization of the waste, and will be included as appropriate. Waste characterization and associated preparation work will be conducted by the waste generator sites that produce or store the wastes and prepare them for shipment to the WIPP for testing.

5.2 Waste Degradation Mechanisms

Gases can be released from CH-TRU wastes by multiple waste degradation mechanisms and associated processes. The three major mechanisms predicted to occur with typical CH-TRU wastes are radiolysis, microbial degradation, and corrosion. Radiolysis is expected to be the dominant gas generation mechanism for the duration of the alcove test. The target gas analytes for the alcove test include the VOCs and the permanent gases of importance to gas generation mechanisms. Specific target analytes and their respective detection limits are given in Table 9-1. Those gases which are required for the demonstration of no-migration (Ref. 9, Page 47710-47111) or which are expected to be volumetrically significant contributors to gas generation will be monitored in the alcove test. Monitoring will also be conducted for any added tracer gases.

The gases expected to be of major importance to the alcove test are those which are generated or consumed by the waste degradation processes named above or those which are generated or consumed as a result of activities and natural processes in the repository. If pressure changes in the alcove atmosphere cannot be accounted for by changes in the concentrations of the target gases, additional investigative analyses may be performed.

Because one of the objectives of the alcove test is to support demonstration of compliance with NMD requirements, target VOCs will initially be limited to those of importance to this demonstration. Unanticipated VOCs contributing more than one percent of the total will be added to the target list.

Net gas quantities and compositions are expected to be impacted by the time evolution of factors such as oxygen consumption, sorption of VOCs by the rock salt material, etc. These effects will be evaluated as a function of time.

5.3 General Process Descriptions

Gas samples from the test alcove will be periodically analyzed at planned frequencies using a selection of appropriate analytical methods (see Section 6.4). Time dependent gas data will be recorded in a manner that will permit changes in compositions as a function of time to be monitored. The analyses of VOCs released at concentration levels.above the minimum concentration shown in Table 9.1 will allow the calculation of their rates of generation and/or depletion to be made.

Instrumentation associated with the alcoves includes gas sampling and injection ports, thermocouples, pressure gages, humidity sensors, pressure-relief valves, and oxygen-specific detectors. The instruments will be closely monitored by use of recorders and computers where needed. Spare or redundant systems will be available where necessary. Instrumentation is discussed in more detail in Section 6. The maximum allowable gas leak rate from the test alcove should be no greater than one percent of the alcove volume per week (Ref. 1, Section 9.1). Gas leakage will occur by gas escaping through fractures in the rock salt formation and by leakage past the alcove barrier seal. Because of the potential gas leakage and the predicted low gas generation rates by waste degradation (Ref. 1, Section 10.2), no significant pressure buildup is anticipated within the test alcoves. Tracer gases will be used to quantify the extent of the leakage and to allow correction where possible.

Activities associated with the Alcove Test Program that need urgent attention are the waste selection and characterization. Some engineering development will be required to modify the existing AGB design to apply to the alcoves described in this test plan. The alcoves need to be mined and prepared. Alcove preparation includes the installation of a gas sampling system and sensors as well as the installation of the gas barrier. Test equipment, instruments, and associated supplies need to be procured. Some lead time will be required for the procurement and installation of gas barrier materials. Instrumentation and operating equipment will need to be assembled, checked out, and calibrated prior to use. Operating procedures must be written and approved, and personnel need to be trained in the operations for the experiment. The Alcove Test Program is being designed for the experimental efforts to continue for at least 5 years. The lead time required to complete the activities mentioned above can add another one to two years to the experiment.

More detailed descriptions of the alcove tests can be found in various sections of this test plan. Conceptual and scientific details necessary for initiating the tests, including most supporting background information, are included. Engineering designs and work packages for supporting components of this test are referenced whenever possible. Technical details (such as the final design of the gas barrier and the gas management system) will be developed.

5.4 Waste Selection Basis

One of the primary objectives of the Alcove test is to monitor the concentration of VOCs in an alcove headspace resulting from the migration of the gases from the emplaced waste containers. A headspace gas sample will be obtained from every waste container (without removal of the lid) prior to shipment and emplacement in the alcove. Using laboratory derived VOC diffusion rates through the filters used on the waste containers, the anticipated migration of VOCs from the waste containers and the resulting increase in concentration within the alcove headspace over time can be calculated.

In an effort to obtain information about the anticipated releases of VOCs expected from an "average" population of waste, the target mixture of waste for the test is that mixture of waste that is anticipated to be disposed of in WIPP. However, if programmatic difficulties occur that do not allow the attainment of the mixture calculated (see Table 5.1), this will not invalidate the Alcove Test.

The "U.S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities and Technologies" Report (180-Day Report) (Ref. 14) is considered the best source of information for identification and quantification of existing and yet-to-be generated TRU-mixed waste streams. The current version, April 1993, which is in review by the DOE waste generator/storage sites, has been used for the waste selection process for the Alcove Test. The volumes for retrievably-stored waste have been used for these calculations since this is the waste that is anticipated to make up the majority of the population in the Alcove Test.

The waste forms chosen for the Alcove Test should possess the following characteristics:

- The types and quantities of waste forms should approximate that expected in an "average" waste disposal room.

- Some of the waste forms chosen should contain most, if not all, the expected hazardous waste codes for volatile organic compounds (VOCs) that are anticipated to occur in the waste.

Table 5.1 summarizes the target percentages of waste to be included in the Alcove Test by Waste Type, as defined in the TRUCON (Ref. 15, Introduction). The "Waste Type" has been used as the classification system for the Alcove Test, since that is what was adopted by the EPA Office of Solid Waste (OSW) in the Conditional No-Migration Determination for WIPP during the test phase (Ref. 9, Page 47710 - 47111). The details of the waste streams used to calculate the percentages of Waste Types in Table 5.1 are contained in the 180-Day Report (Ref. 14) and summarized in Table 5.2

The methodology for calculating the relative quantities of different waste forms needed for the Alcove Test follows:

- Each TRU waste stream listed from the 180-Day Report in Table 5.2

was assigned a <u>tentative</u> Waste Type (Column #8, Table 5.2) by the WIPP Project Integration Office based on the information presented in the 180-Day Report.

- The total volume for each Waste Type was summed from those individual waste streams that were classified in one of the four Waste Types (i.e., I, II, III, or IV) of the 100+ waste streams in Table 5.2. The percentage of each Waste Type was calculated and is summarized in Table 5.1.

As indicated above, the actual mixture of waste types could vary but the target mixture is presented in Table 5.1. Listed below are several other assumptions incorporated into the methodology:

- Within a Waste Type, waste containers can be chosen from any of the TRUCON Codes listed in Table 5.1. The Waste Type classification system originated as a result of the process to obtain a Certificate of Compliance for the TRUPACT-II with the Nuclear Regulatory Commission (Ref. 16). The Waste Type system is based on the potential to generate gas by radiolysis. Since the Alcove test is designed to represent the Ventilated and Early Transitional Timeframes, radiolysis is still anticipated to be the dominant mechanism for generating gas in the waste containers.

- The current plans are to utilize waste that is in retrievable storage at the INEL and/or at the RFP. Some newly-generated waste from RFP may be included, as available. Listed below is a short discussion of some potential issues from using pre-dominantly RFP wastes:

  - The RFP wastes are predominately Pu-239 Weapons Grade isotopic mix (Ref. 17, Page 99). There may be some concern for not including any Pu-238 wastes in the test. All wastes that are acceptable for transport in TRUPACT-II have to conform to the wattage limits in the TRUCON (Ref. 15, Tables 6-1, 6-2, 6-3). Therefore, there should be no significant difference in radiolytical gas generation potential between Pu-238 and Pu-239 wastes.

  - Examination of Table 5.2, Column 11, indicates that waste streams from RFP and INEL, where RFP waste dominates, have all four spent-solvent EPA hazardous waste codes (i.e., F001, F002, F003, F004, and F005A) that are listed for any of the 100+ waste streams in the 180-Day Report (Ref. 14). Also, RFP and INEL have the highest percentage of waste streams with spent solvent-related hazardous waste codes. This indicates that the choice of dominantly RFP waste (at RFP and/or INEL) would probably result in an higher percentage of waste containers in an alcove with VOCs present in the headspace.

- Another potential comment about this test plan is that no remote handled (RH) TRU is included. RH TRU is currently prohibited from testing at WIPP during the Test Phase by the WIPP Land Withdrawal Bill enacted in late 1992 (Ref. 18, Page 4784). Even if RH TRU waste could be considered as part of the tests, examination of Table 5.2 demonstrates that none of the RH TRU waste streams have spent solvent hazardous waste code assignments. Once again, the utilization of RFP waste would probably err on the conservative side with a higher percentage of waste containers with spent solvent hazardous waste codes.

- No "modified" waste forms, other than those required to meet the current WIPP Waste Acceptance Criteria (Ref. 19), are included in this test matrix. Processing of waste per one or more of the treatments discussed in the Final Report of the Engineered Alternatives Task Force (Ref. 20) or the 180-Day Report (Ref. 14) would tend to decrease the overall VOC source term in the waste, therefore, utilization of "non-modified" (other than to meet the WIPP-WAC) would probably err on the conservative side, with a higher percentage of waste containers with spent solvent gases present.

- The 180-Day Report documents only those waste streams that have been classified as TRU mixed. There are some existing wastes in the DOE TRU system that are not TRU mixed which will be included in the Alcove Test. These wastes, as well as much of the newly generated wastes, would tend to have fewer or no VOCs associated with the waste stream. During the selection process for the alcoves, the identification of a waste stream as TRU-mixed or TRU (non-mixed) will not be used as a criteria. At WIPP, containers of TRU-mixed and TRU waste will be managed the same.

Table 5.1. Target Percentages of Waste Volumes for Alcove Experiment by Waste Type

WASTE TYPE*	TARGET PERCENTAGE FOR ALCOVE	TRUCON CONTENTS INCLUDED IN WASTE TYPE**
I	26.5	111/211, 114/214,
II	18.6	115/215, 117/217, 118/218, 122/222, 124/224
III	51.7	116/216, 119/219, 121/221, 123/223, 125/225
IV	3.2	112/212, 113/213

* Waste Type is defined in the Introduction Chapter of the "TRUPACT-II Content Code (TRUCON)," WIPP/DOE 89-004, Revision 6 (1992) document. The Waste Type classification was used by Environmental Protection Agency Office of Solid Waste (EPA/OSW) to define regulatory requirements for maximum and average concentrations of volatile organic compounds (VOCs) in the headspace of waste containers for receipt of waste at WIPP. These requirements were defined on pages 47710-47711 in the "Conditional No-Migration Determination for the Department of Energy Waste Isolation Pilot Plant (WIPP)," Title 55, Federal Register, Vol. 55, No. 47700 (55FR47700), November 4, 1990.

** All waste streams reported in the April 1993 version of the "U. S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities and Technologies," DOE/NMB-1100, are not contained in the TRUCON document (Ref. 15). Prior to shipment to WIPP the DOE TRU waste generator/storage sites will have to provide waste characterization and packaging information to the Nuclear Regulatory Commission for approval, prior to incorporation of those waste streams into the TRUCON document.

TABLE 5.2
Waste Stream Data

	A	B	C	M	N	S	T	U	V	W	AM
1	Column #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
2				FFCA 180-Day							
3				Total Stored Mixed Inventory		U.S. DOE 180-Day Report		Waste			
4	WMIS ID	FAC	WASTE TITLE	(kg)	(m3)	Volume	Page	Type	CODE	CH/RH	F00X EPA CODES
5	1160	AE	IFR LAB SCALE ELECTRON REFIN	264.1	0.44	3	ANL-E-WPS-19	I	ISP	CH	
6	853	AE	RADIOACTIVE CORROSIVE WAS	1680	1.5	3	ANL-E-WPS-5	I	AL	CH	
7	ANL-177T	AW	LEAD SHIELD PLUGS, TRU	2826.5	0.251	2	ANL-W-WPS-34	II	EL	RH	
8	ANL-180T	AW	SODIUM - TRU	126.1	0.14	2	ANL-W-WPS-36	I	RM	RH	
9	ANL-182T	AW	SODIUM POTASSIUM - NAK - TR	5	0.006	2	ANL-W-WPS-38	I	RM	RH	
10	ANL-241T	AW	TRU - CD - HOT CELL WASTE	na	0.2	2	ANL-W-WPS-40	III	HD	RH	
11	ANL-243T	AW	ELEMENT HARDWARE FCF WAS	0	0	2	ANL-W-WPS-42	II	ISP	RH	
12	ANL-246	AW	ELECTROREFINER STRIPPER CAD	0	0	2	ANL-W-WPS-32	II	MULT	RH	
13	ANL-246T	AW	ELECTROREFINER INSOLUBLES	0	0	2	ANL-W-WPS-44	I	MULT	RH	
14	IDEGG-102T	IN	UNCEMENTED INORGANIC SLUD	5085252	4969.3	2	INEL-WPS-262	I	ISP	CH	F001,F002,F003
15	IDEGG-109T	IN	BENELEX PLEXIGLASS - (TRU)	23164.8	38.7	2	INEL-WPS-264	III	HD	CH	F001
16	IDEGG-112T	IN	CEMENTED SLUDGES (TRU)	818899.9	792	2	INEL-WPS-266	IV	OSP	CH	F001,F002,F003
17	IDEGG-114T	IN	COMBUSTIBLES (TRU)	2608280	10352	2	INEL-WPS-268	III	HD	CH	F001,F002,F003
18	IDEGG-115T	IN	CONCRETE-BRICK (TRU)	69170	130	2	INEL-WPS-270	II	ID	CH	F001,F002
19	IDEGG-118T	IN	FILTERS - TRU	1032433	3031	2	INEL-WPS-272	III	HD	CH	F001,F002
20	IDEGG-119T	IN	GLASS (TRU)	269857.1	619	2	INEL-WPS-274	II	ID	CH	F001,F002,F003
21	IDEGG-120T	IN	GLOVEBOX GLOVES (TRU)	160579.9	260	2	INEL-WPS-276	III	HD	CH	F001,F002
22	IDEGG-132T	IN	METALS (TRU)	3510034	7622.9	2	INEL-TRU-278	II	HD	CH	F001,F002
23	IDEGG-134T	IN	MISCELLANEOUS (PAPER, META	349900	1087	2	INEL-WPS-280	III	HD	CH	F001,F002
24	IDEGG-137T	IN	NON METAL MOLDS & CRUCIBL	360299.8	395	2	INEL-WPS-282	II	ID	CH	F001,F002
25	IDEGG-141T	IN	PARTICULATE WASTES (TRU)	110003.9	82	2	INEL-WPS-284	I	ISP	CH	F001,F002,F003,F004
26	IDEGG-142T	IN	TRU CONTAMINATED LEAD DEB	1800	5.5	2	INEL-WPS-286	III	HD	RH	
27	IDEGG-144T	IN	RADIOACTIVE SOURCES - (TRU)	56717.2	100	2	INEL-WPS-288	II	ID	RH	
28	IDEGG-145T	IN	RESINS (TRU)	34622.7	57	2	INEL-WPS-290	III	ISP	CH	F001,F002
29	IDEGG-146T	IN	SALTS (TRU)	4179.9	9	2	INEL-WPS-292	II	ISP	CH	F001
30	IDEGG-158T	IN	UNCEMENTED ORGANIC SLUDG	643237.7	579.7	2	INEL-WPS-294	IV	OSP	CH	F001,F002,F004
31	IDEGG-287T	IN	UNCATEGORIZED (TRU)	3932740	7092	2	INEL-WPS-296	???	TBD	CH	????
32	IDEGG-288T	IN	UNKNOWN (TRU)	160828.9	378	2	INEL-WPS-297	???	TBD	CH	????
33	IDEGG-291T	IN	TRU HEAVY METAL SLUDGE	1071.8	2.1	2	INEL-WPS-298	I	ISP	RH	
34	2089	LA	SCRAP METAL - SODIUM	na	110.1	3	LANL-WPS-19	I	RM	CH	
35	2091	LA	PROCESS RESIDUE - CHROMIUM	na	115.9	3	LALN-WPS-20	I	CS	CH	
36	2100	LA	LEAD SHIELDING AND DEBRIS	na	2050.5	3	LANL-WPS-24	III	HD	CH	
37	2103	LA	CEMENTED PROCESS SLUDGE,	na	15.2	3	LANL-WPS-26	II	HD	CH	
38	2159	LA	DECONTAMINATION WASTE - F	na	276.3	3	LANL-WPS-37	III	HD	CH	F001,F002
39	2160	LA	DEWATERED TREATMENT SLUD	na	1088.2	3	LANL-WPS-39	I	HD	CH	F001,F002,F005A
40	2166	LA	CEMENTED PROCESS SLUDGE -	na	183.9	3	LANL-WPS-41	I	ISP	CH	F001,F002,F005A
41	2195	LA	LEAD WASTE	na	153.5	3	LANL-WPS-61	III	HD	CH	
42	2196	LA	DECONTAMINATION WASTE	na	1183.6	3	LANL-WPS-63	III	HD	CH	F001,F002
43	2197	LA	CEMENTED PROCESS SLUDGE	na	2868.3	3	LANL-WPS-65	I	ISP	CH	F001,F002,F005A
44	2198	LA	DEWATERED TREATMENT SLUD	na	148.1	3	LANL-WPS-67	I	HD	CH	F001,F002,F005A
45	2444	LL	TRU MIXED INORGANIC METAL	1609	1	2	LLNL-WPS-38	II	ID	CH/RH	
46	2446	LL	TRU MIXED HALOGENATED SOL	262	0.3	2	LLNL-WPS-40	IV	OL	CH/RH	F002
47	2448	LL	TRU MIXED SULFURIC ACID	591	0.6	2	LLNL-WPS-42	I	AL	CH/RH	
48	833	MD	CORROSIVES - TRU	1003.6	2	4	MOUND-WPS-5	I	CS	CH	

TABLE 5.2
Waste Stream Data

	A	B	C	M	N	S	T	U	V	W	AM
1	Column #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
2				FFCA 180-Day							
3				Total Stored Mixed Inventory		U.S. DOE 180-Day Report		Waste			
4	WMIS ID	FAC	WASTE TITLE	(kg)	(m3)	Volume	Page	Type	CODE	CH/RH	F00X EPA CODES
49	835	MD	LEAD - TRU	404.5	1.1	4	MOUND-WPS-7	III	EL	CH	
50	2500	NL	CH TRU WASTES	172493	662	5	ORNL-WPS-58	III	MULT	CH	
51	307	NL	EVAPORATOR SERVICE TANK S	308000	220	5	ORNL-WPS-8	I	MULT	RH	
52	317	NL	MELTON VALLEY STORAGE TAN	546000	390	5	ORNL-WPS-13	I	MULT	RH	
53	330	NL	INACTIVE WASTE STORAGE TA	110000	110	5	ORNL-WPS-15	IV??	MULT	RH	
54	331	NL	RH TRU WASTES	963735	110.7	5	ORNL-WPS-17	III	MULT	RH	
55	2	NT	NTS STORED, TRU WASTE FRO	204663	612	3	NTS-WPS-3	III	HD	CH	F001,F002,F003
56	14	PA	TRANSURANIC WASTE LIQUID	7511	7.5	3	PGDP-WPS-29	I	AL	CH	
57	15	PA	TRU AND TECHNETIUM WASTE	6040	6	3	PGDP-WPS-31	I	ISP	CH	
58	2	RF	MISCELLANEOUS LIQUIDS/TRU	na	14.5	3	RFP-WPS-128	I	AL	CH	
59	106	RF	PCB (SOLIDS)/LLW MIXED	na	0.21	2	RFP-WPS-3	III	MULT	CH	F001
60	114	RF	SOIL AND CLEANUP DEBRIS/TR	na	2.1	2	RFP-WPS-17	III	ID	CH	F001,F002,F005A
61	116	RF	AQUEOUS SLUDGE/TRU MIXED	na	143.4	2	RFP-WPS-21	I	ISP	CH	F001,F002,F005A
62	117	RF	METAL/TRU MIXED	na	83.1	2	RFP-WPS-23	II	ID	CH	F001,F002
63	118	RF	COMBUSTIBLE WASTE/TRU MIX	na	372	2	RFP-WPS-25	III	ID	CH	F001,F002,F005A
64	119	RF	SOLIDIFIED ORGANICS/TRU MIX	na	111.3	2	RFP-WPS-27	IV	MULT	CH	F001,F002
65	2048	RF	GLASS TRU-MIXED	na	12.1	2	RFP-WPS-106	II	ID	CH	F001,F002
66	2247	RF	MG OXIDE CRUCIBLES/TRU MIX	na	48.3	2	RFP-WPS-114	II	ISP	CH	
67	2376	RF	INSULATION/TRU MIXED (IDC 4	na	0.63	2	RFP-WPS-116	II	ID	CH	F001,F002
68	2377	RF	MISC. PU RECOVERY BY-PRODU	na	158.3	2	RFP-WPS-118	II	MULT	CH	
69	2379	RF	SAND, SLAG & CRUCIBLE/TRU	na	54.7	2	RFP-WPS-120	II	ISP	CH	
70	2388	RF	COARSE GRAPHITE/TRU MIXED	na	0.42	2	RFP-WPS-122	II	ISP	CH	
71	2402	RF	CALCIUM METAL - IDC 333	na	0.21	2	RFP-WPS-132	I	RM	CH	
72	347	RF	USED ABSORBENT TRU MIXED (	na	0.21	2	RFP-WPS-53	II	ISP	CH	F001
73	349	RF	LEAD/TRU MIXED	na	3.8	2	RFP-WPS-57	II	EL	CH	
74	350	RF	LEADED GLOVES/TRU MIXED	na	21	2	RFP-WPS-59	III	ID	CH	
75	353	RF	GROUND GLASS/TRU MIXED	na	2.1	2	RFP-WPS-65	II	ID	CH	
76	354	RF	PARTICULATE-SLUDGE/TRU MIX	na	43.7	2	RFP-WPS-67	I	ISP	CH	F001,F002,F005A
77	358	RF	FIREBRICK-PULVERIZED OR FINE	na	11.1	2	RFP-WPS-73	II	ISP	CH	F001,F002,F005A
78	360	RF	HEAVY METAL (NON-SS)/TRU M	na	5.5	2	RFP-WPS-75	II	ID	CH	
79	361	RF	SOLIDIFIED LAB WASTE/TRU MI	na	1.3	2	RFP-WPS-77	IV	CS	CH	
80	362	RF	FILTER WASTE/TRU MIXED	na	132.1	2	RFP-WPS-79	III	ID	CH	F001,F002,F005A
81	363	RF	INCINERATOR ASH/TRU MIXED	na	234.3	2	RFP-WPS-81	I	ISP	CH	F001,F002,F005A
82	364	RF	LEADED GLOVES/ACID CONTAM	na	27.7	2	RFP-WPS-83	III	ID	CH	
83	1000	RL	RADIOACTIVE LEAD SOLIDS, TR	570	0.57	5	HANF-WPS-168	II	EL	CH	
84	1001	RL	ORGANIC RMW PCB LIQUIDS >	2100	2.1	5	HANF-WPS-170	IV	LPM	CH	
85	1002	RL	SOLVENT/TC METAL INORG. SO	2100	2.1	5	HANF-WPS-172	II	HD	CH	F001
86	1003	RL	SOLVENT/TC METAL ORG. SOLI	8280	8.3	5	HANF-WPS-174	III	HD	CH	F001,F003
87	2477	RL	WA NON-TC/SOLV; ORG. SOLID	2100	2.1	5	HANF-WPS-195	III	OD	CH	
88	548	RL	DST PFP TRU SOLIDS	404000	269	5	HANF-WPS-27	I	AL	RH	
89	553	RL	DST PUREX SOLID CRW SOLIDS	3472200	2498	5	HANF-WPS-33	I	AL	RH	
90	988	RL	TC METAL INORGANIC SOLID D	9660	9.7	5	HANF-WPS-144	II	HD	CH	
91	989	RL	TC METAL INORGANIC SOLID D	7980	8	5	HANF-WPS-146	II	HD	CH	
92	990	RL	TC METAL INORGANIC SOLID D	66180	66.2	5	HANF-WPS-148	II	HD	CH	

PRE-DECISIONAL DRAFT

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Waste Stream Data

	A	B	C	M	N	S	T	U	V	W	AM
1	Column #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
2				FFCA 180-Day							
3				Total Stored Mixed Inventory		U.S. DOE 180-Day Report		Waste			
4	WMIS ID	FAC	WASTE TITLE	(kg)	(m3)	Volume	Page	Type	CODE	CH/RH	F00X EPA CODES
93	991	RL	TC METAL ORGANIC SOLID DEB	29810	29.8	5	HANF-WPS-150	III	HD	CH	
94	992	RL	TC METAL ORGANIC SOLID DEB	3150	3.2	5	HANF-WPS-152	III	HD	CH	
95	993	RL	TC METAL ORGANIC SOLID DEB	3170	3.2	5	HANF-WPS-154	III	HD	CH	
96	994	RL	NON-TC MET/SOLVENT ORG. S	4640	4.6	5	HANF-WPS-156	III	HD	CH	
97	995	RL	LEAD ACID BATTERIES, TRU	630	0.63	5	HANF-WPS-158	II	BATT	CH	
98	996	RL	LEAD ACID BATTERIES, TRU (HG	420	0.42	5	HANF-WPS-160	II	BATT	CH	
99	997	RL	RADIOACTIVE LEAD SOLIDS, TR	26910	26.9	5	HANF-WPS-162	II	EL	CH	
100	998	RL	RADIOACTIVE LEAD GLASS SOL	420	0.42	5	HANF-WPS-164	II	HD	CH	
101	999	RL	RADIOACTIVE LEAD SOLIDS, TR	210	0.21	5	HANF-WPS-166	II	EL	CH	
102	2258	SA	TRANSURANIC WASTE	na	0.95	3	SNL/CA-WPS-230	III	OTHER	CH/RH	
103	131	SR	MIXED TTA/XYLENE	2	0.01	5	SRS-WPS-13	IV	OL	CH	
104	2695	SR	TRI-BUTYL-PHOSPHATE & N-PA	1210.4	1.3024	5	SRS-WPS-91	IV	OL	CH	
105	2704	SR	ROCKY FLATS INCINERATOR AS	30.8	0.008	5	SRS-WPS-133	I	ISP	CH	
106	911	SR	THIRDS TRU WASTE	10419	45.3	5	SRS-WPS-65	III	OD	CH	
107	912	SR	SOLVENT TRU WASTE	1139765	4355.5	5	SRS-WPS-58	III	OD	CH	F001,F002,F003,F005
108	2404	WV	TRU LEAD	680.9	0.454	3	WVDP-WPS-47	II	EL	CH	
109											
110											
111						% Waste Type					
112				Waste Type I	13399.20	26.5					
113				Waste Type II	9384.22	18.6					
114				Waste Type III	26093.96	51.7					
115				Waste Type IV	1598.01	3.2					
116				Unk	7470.00						
117				Total (-Unk)	50475.39						
135											
136	FOOTNOTES TO SPREADSHEET "ALCOVE.XLS"										
137											
138	Column #1 - Waste management Information System (WMIS) ID number for waste stream; a few very small swaste sites have not been included										
139	Column #2 - Two letter abbriviation for TRU waste generator and/or storage sites: Argonne National Laboratory - East (AE); Argonne National Laboratory - West (AW);										
140	Idaho National Engineering Laboratory; Los Alamos National Laboratory (LA); Lawerence Livermore National Laboratory (LL); Mound Laboratory (MD);										
141	Oak Ridge National Laboratory (NL); Nevada Test Site (NT); Paducah Gaseous Diffusion Plant (PA); Rocky Flats Plant (RF); Hanford Site (RL);										
142	Sandia Natioal Laboratories/NM; Savannah River Site (SR); Waste Isolation Pilot Plant (WP); West Valley Demonstration Project (WV).										
143	Column #3 - Name of individual waste stream (abbriveated in some cases).										
144	Column#4 - Total mass of waste identified in a particular waste stream (from 180-Day Report)										
145	Column#5 - Total volume of waste identified in a particular waste stream (from 180-Day Report)										
146	Column #6 - Volume number in 180-Day Report from which information is derived.										
147	Column #7 - Begining page number in 180-Day Report for waste stream identified in Column #1.										
148	Column #8 - Estimated Waste Type for particular waste stream in 180-Day Report; Waste Type determined by WIPP Project Integration Office.										
149	Column #9 - Abbreviated coding describing treatability group for a waste stream: Inorganic sludges/perticulates (ISP); Aqueous liquid (AL); Elemental lead (EL);										
150	Reactive metals (RM); Heterogeonous debris (HD); Multiple (MULT); Organic sludges/particulates (OSP); Inorganic debris (ID); To be determined (TBD);										
151	Cemented Solids (CS); Organic Liquid (OL); Laboratroy packs with metals (LPM); Organic Debris (OD); Batteries (BATT); Other (OTHER).										
152	Column#10 - Contact Handled (CH); Remotre Handled (RH).										
153	Column #11 - Indicates which waste streams have been identified as having the hazardous waste codes F001, F002, F003, F004, or F005A (spent solvents).										

6.0 INSTRUMENTATION, TEST EQUIPMENT AND FACILITIES

This section describes the details and requirements for managing and sampling the gases in the alcove atmosphere. It also describes the sensors and associated instrumentation that will be required to provide additional information necessary to analyze the gaseous behavior inside the alcove.

6.1 Description of the Gas Management/Sampling System

The gas management/sampling system will provide the capability to assure:

- that the contamination of the alcove atmosphere with air from the mine (or some other external gas source other than the host rock) is minimized,
- that the gases released by decomposition of the CH-TRU waste by the host rock remain in the alcove except for natural escape mechanisms,
- that all gas samples taken for analysis will be as representative as possible of gases being generated inside the alcove,
- and that no safety hazards develop during the conduct of the experiment.

The requirements for controlling and sampling the gases in the alcove atmosphere are described in this section along with preliminary details for analyzing the samples. In general, alcove sampling and analyses techniques for individual gas components will be patterned after those already developed for the bin-scale test.

6.1.1 Alcove Atmosphere Control

No initial modification of the alcove atmosphere will be made except for the possible introduction of tracer gases. The air trapped in the alcove at the time of sealing will constitute the initial atmosphere. The alcove will represent the initial aerobic environment in the early operational phase of the repository. Changes to the initial atmosphere caused by gases emitted due to waste degradation and other mechanisms will then be monitored and analyzed as a function of time.

The basic physical properties of temperature, pressure, and relative humidity of the alcove will be monitored to provide the ancillary data required to understand the behavior of the gases in the alcove atmosphere.

The Transitional Timeframe will begin when the alcove is sealed. The internal gas atmosphere of the alcove is predicted to transition from an aerobic to anaerobic condition (Ref. 2), and the relative humidity inside the alcove is expected to increase to approximately 70 percent (Ref. 3), similar to that predicted for a typical disposal room. The exact time required to reach an equilibrium for these conditions is unknown. The relative humidity should stabilize within the first year after closure of the alcove. The change from an aerobic to anaerobic condition could take much longer.

After the waste has been emplaced, the atmosphere within the alcove will be isolated to ensure that the conditions in the alcove represent, as closely as possible, those of a typical disposal room. The alcove pressure will be monitored continuously but no attempts are planned to adjust or control this pressure except as required by safety concerns.

Changes observed in gaseous content in the waste-filled alcove will be compared to data obtained from the reference alcove. The reference alcove will provide baseline or background data for comparison and correction purposes. These changes, in the internal gas atmosphere within the test alcove, will be a function of the gas generation or consumption mechanisms occurring inside the alcove and gas leakage into or out of the alcove. The net gas leakage rates from the alcove are unknown at this time but the paths will be predominantly through fractures in the salt disturbed rock zone (DRZ) and through the alcove gas barrier.

Specific requirements of the alcove Gas Control System:

- ensure representative sampling of the gases that comprise the alcove atmosphere
- permit the injection of gases such as tracers
- permit the detection of target gases and tracer gases within the alcove

After the gas barrier and gas-monitoring system hardware have been installed, the gaseous atmosphere in each test alcove will be closely monitored for the following reasons:

- to monitor the types and concentrations of VOCs in the alcove atmosphere and to monitor the change in concentration of each VOC for the duration of the experiment
- to monitor the concentration of gases of significance to flammability including hydrogen, oxygen, and methane, in the

alcove atmosphere

- to observe and measure the rate of change from oxic (> 10 ppm oxygen) to anoxic (< 10 ppm oxygen) conditions if the transition occurs during the experiment

- to observe and measure the rate of change of relative humidity within the alcove

- to monitor and control (if necessary) the internal pressures within the sealed alcove for both safety and test purposes, and

The gas control system for the sealed alcove will be designed for maintenance-free operation. Whenever possible, associated equipment will be located outside the alcove gas barrier and will be isolated by valves, switches, etc. The alcove gas barrier will be provided with ports to accommodate:

- the gas management system

- remote-reading absolute-pressure gauges

- piping and valves to permit controlling and relieving pressure in the alcove if needed

- remote-reading gauges for monitoring gas flow to measure the volume of gas released through the pressure relief valves

- solid-state oxygen sensors

- gas-sampling ports

- gas-injection ports

- connections to the oxygen-sensing system

6.3 Alcove Pressure

The alcove internal pressure will be ambient and will not be intentionally influenced by techniques such as adding nitrogen. The objective of the experiment is to measure the VOCs present in the alcove headspace under anticipated disposal room conditions (Ref. 2 & 3).

The gas control system will have the capability to inject tracer gases into the alcove. These tracer gases can be used to evaluate system losses so corrective measures can be taken or the losses interpreted in the data analysis.

Absolute pressure gages will be used in both the test alcove and the reference alcoves, and at all three bulkheads that make up the gas barrier. A gas differential pressure (psid) can be obtained by subtracting the absolute pressure of the baseline reference test alcove from the respective test alcove reading at the given reference time.

Gas pressure relief valves will be installed through the gas barrier to permit depressurization of the alcove should design safety pressure limits be approached. No significant pressure buildup is anticipated within the alcove, but continuous monitoring will confirm this assumption.

6.4 Gas Sampling and Analysis

All methods used for sampling and analysis will be documented and performed under approved, controlled procedures implementing the site Quality Assurance Project Plan (QAPjP) and the respective Laboratory Quality Assurance Program. Section 9.0 of this document identifies the analytes for the test and the respective Quality Assurance Objectives (QAOs).

Sampling Frequency

The initial sampling frequency will be daily. When no analyte varies by more than ten percent in three consecutive daily samples, the sampling will be decreased to weekly. When no analyte varies by more than ten percent in three consecutive weekly samples, the sampling will be decreased to monthly. If two consecutive samples show a greater than ten percent variation, the sampling frequency will be increased to the next frequency step until the criteria for relaxing the frequency are again met.

The percent variation for samples in a given comparison group will be determined from the ratio of the highest value to the lowest value. This ratio minus one will be expressed as a percentage and compared to the criteria for altering the sampling frequency.

Sample Collection

The gas management system described in Section 6.1 will provide for a slow sweep of gases from an inlet manifold to an outlet manifold. The design criteria of the system provides for minimal dead space and sampling that is as representative as possible of all volume elements of the alcove. Gas samples will be collected out of a mixing plenum downstream of the air mover in the gas management system.

Gas samples will be collected in evacuated ($\leq$0.05 mm Hg), SUMMA[R] passivated canisters. Samples will be of sufficient volume to meet the QAOs identified in Section 9.0 of this Alcove Test Plan. Projected volumes are 100 milliliters for gas samples and 250 milliliters for VOC samples.

Prior to use, all sampling canisters must meet the preparation criteria for gases or VOCs found in sections 7.4.1 and 7.5.1 of the QAPP (Ref. 6), respectively.

Analytical Methods

Several options are being considered for the analytical methods to be used in these alcove tests. These include both laboratory analyses of collected samples and in-situ analysis of gases in the alcove atmosphere or gas management system. The method selected will be that method which demonstrably meets QAOs while causing the least disturbance of the alcove atmosphere.

Tracer gases are proposed for potential use in the alcove tests. Analytical methods must be demonstrated to be effective for the candidate tracers at the desired levels before such tracers will be used.

Laboratory Analytical Methods

In the absence of alternative methods demonstrated to meet the test QAOs (Section 7.0), the analytical methods demonstrated for the Bin Test Program will be implemented for the Alcove Test Program. These methods include GC/MS for the VOCs and either Gas Mass Spec or GC for the other gases of interest. The laboratory performing the analyses must demonstrate the ability to achieve all QAOs and successfully participate in the applicable portions of the Performance Demonstration Program. The candidate methods are summarized in the QAPP, (Ref 21), Sections 7.4 and 7.5, and described in more detail in the Sampling and Analysis Guidance Manual.

In-Situ Methods

The availability of in-situ, non-intrusive methods which do not disturb alcove atmosphere will be investigated. If such methods can be demonstrated to meet the required QAOs and can be shown to be reliable over the planned duration of the test, such non-intrusive methods will be implemented.

An example of such a method is the use of Fourier Transform InfraRed (FTIR) for analysis of VOCs. This method is under investigation for use in analyzing the headspace of drums and in waste storage buildings. If the method can be adapted to the alcove test, analysis of samples for VOCs can be reduced to occasional confirmatory or special analyses. Analogous methods will be sought for each of the analytes of interest in the alcove test.

The investigation of potential non-intrusive methods will not affect the implementation of the gas management system. Even if non-intrusive methods were available for all target analytes, this system will be required for back-up analyses, special studies, and introduction of tracer gases.

Pursuit of non-intrusive analytical methods is considered advantageous for several reasons. The required gas exchange rate to be induced by the gas management system will be proportional to the rate of change in concentration of the target analytes. Non-intrusive methods may be available for only some of the gases. However, if the sampling frequency can thereby be reduced, flow rates in the gas management system can be reduced. This results in less disturbance of the alcove atmosphere, a desirable experimental outcome. Non-intrusive methods such as FTIR can also effectively analyze a larger sample. This lowers the experimental uncertainty which stems from taking small samples from a large gas volume.

No method will be implemented in the alcove tests unless it has been demonstrated to meet the required QAOs or is being tested against such a method simultaneously in use.

6.5 Thermocouple Installation

Based on experience in the WIPP underground, the temperature of the alcove is expected to be relatively stable in the range of 27° to 30° C. A sufficient number of thermocouples will be emplaced in each test alcove to accurately monitor and record the temperature and to determine the temperature gradients within the alcove. Present plans are to install 7 to 9 thermocouples per alcove. The exact number and locations of the thermocouples will be determined in the detailed design.

6.6 Gas Supply Systems

The gas supply will be located outside the test alcove and barrier in the access drift area. The gas supplies will include nitrogen for purging sample lines and tracer gases as required.

6.7 Data Acquisition System

Temperature, pressure, and relative humidity will be monitored on a continuous basis by the use of recorders, computers, or equivalent instrumentation that can provide a permanent record of the data.

All gages will be installed in duplicate to provide back-up gages in case of failure. In cases where remotely-read and manually-read gages exist, as with thermocouples, both will probably be used.

Hydrogen, oxygen and methane concentrations in the alcove will be periodically monitored using sensors and electronic analyzers for the specific gases.

6.8 Safety Features of the Gas Management System

Gas pressure relief valves will be installed to monitor the internal pressure of the test alcove and maintain the pressure within provided limits for safety and gas leakage purposes. Excessive pressure will be automatically released by the valves. Plans are to install two valves outside the barrier for the test alcove and each will be monitored and controlled. Time delay features (both hardware and software) will be included in the pressure relief control system to compensate for potential mine ambient pressure pulses which can be caused by actions such as movement in the waste shaft.

Gas flow/volume gages will be installed for each gas pressure relief valve system to monitor the volume of gases released by the pressure-relief valve systems when and if activated.

7.0 ALCOVE TEST REQUIREMENTS

This section provides current descriptions and details of the WIPP CH-TRU waste test alcoves.

7.1 Physical Plan and Description of Alcoves

One test alcove containing solid waste forms is specifically defined in the Technical Needs Assessment document (Ref. 2). A second test alcove to contain solidified waste forms is listed as a contingency if the solidified waste forms cannot be placed in the first test alcove. Existing plans are to use two reference alcoves. One reference will contain the same number of empty waste containers and packaging materials as the test alcove. This reference alcove will be used to determine the types and composition of gases released by degradation of the container and packaging materials. The test data obtained from this reference alcove will be compared to the data obtained from the test alcove to determine the types and quantities of gases that are released by the CH-TRU wastes. The second reference alcove will be empty and will provide baseline data for temperature, pressure, relative humidity, and gases emitted by the alcove.

The test and reference alcoves will be located in one of the managed Radioactive Materials Area of the underground. The test alcove will be a closed-end room, approximately 13 feet high, 25 feet wide, and 100 feet long. By comparison a standard WIPP disposal room is designed to be 13 feet high, 33 feet wide, and 300 feet long. (The more narrow configuration of the mined alcove is expected to increase its stability). Present plans are to install rockbolts in both the alcove and its access drift, before any waste is emplaced, to provide additional stability and increase the operational lifetime.

The access drift to the alcoves will be mined to dimensions appropriate for access and to accommodate the gas barrier. The dimensions, especially the length, of the alcove access drift will probably differ from those defined in Reference 1. The height and width must be sufficient to accommodate a forklift of sufficient size to emplace and retrieve the seven-drum waste packs. However, the cross-sectional dimensions of the opening will be kept as small as possible to facilitate sealing the alcove.

The test alcove will have one-third the length and about one-fourth of the volume of a standard WIPP disposal room. The capacity of the alcove will be nominally 1000 55-gallon drums-equivalents of waste. The waste containers will be stacked as received. Waste drums will be assembled in 7-packs. Existing plans call for four rows of 12 stacks plus two additional stacks. The seven packs of drums or SWBs will be stacked three high to simulate disposal room conditions. This arrangement results in 1050 drum-equivalents of waste being stored in the alcove.

The reference alcove will be identical to the test alcove except that it will contain no CH-TRU waste. The hardware and instrumentation in the reference alcove will be identical to the test alcove.

The surface finishes in the access-entry drift and alcove are not extremely critical and normal rib-mining tolerances will probably be adequate. Some smoothing may be required to obtain finishes comparable to those that exist in the mined waste rooms in WIPP Panel 1. Some surface rework may be required to facilitate the needs of the seal-closure such as rounding the corners of the access-entry drift

7.2 Preparation of the Alcoves (After Mining)

Several activities are required to be accomplished in each test alcove before the emplacement of CH-TRU waste and gas testing can begin. These steps include installation of piping for gas sampling and pressure relief, ventilation and exhaust ductwork, gages and sensors, associated wiring, and connections. Other alcove area preparation and outfitting requirements follows:

1. Radiological safety and control: Continuous Air Monitors (CAMs) to measure airborne particulate radioactivity, will be located in selected strategic areas of the alcoves and access drift/man-access areas. The alcoves will be located within a WIPP Radioactive Materials Area (RMA). Administrative controls for personnel access and monitoring procedures in this area will be based on existing current WIPP standard operating procedures.

2. Adequate test alcove and access drift lighting and electrical support: Adequate illumination must be provided to the working areas of the

access drifts. All electrical fixtures must be spark and explosion proof and must meet specified mine safety regulations. An adequate number of power outlets will be provided throughout the test area. Electrical grounding must be provided that meets required specifications. In addition, an accessible grounding bus should be provided so that miscellaneous instrumentation and test equipment can be electrically grounded by attachment to this bus using specified grounding clamps or equivalent.

7.2.1 Roof Rock Bolting and Wire Meshing

Assuring the retrievability of CH-TRU wastes emplaced in the test alcoves and meeting required safety criteria are items of major concern in the design of the alcove experiment. With proper design and preparation, the test alcoves can remain operationally safe for several years beyond the end of the test phase. Existing plans are to rock-bolt and add wire mesh to the alcove roof surfaces to extend the operational life of the room and provide additional assurance that routine waste retrievability can be accomplished if required.

7.2.2 Exhaust Systems, Gas Management System, Piping, Etc.

Any ductwork, exhaust systems, gas managenent system, piping and/or associated equipment required for gas collection and sampling must be installed, inspected, and made operational before wastes are emplaced in the alcove.

A gas management system will be installed to permit gas samples that are as representative as possible to be obtained from the alcove. The system will be similar in concept to that being used at EG&G Idaho to obtain gas samples from bins. The amount of hardware, piping, and the size and number of fixed sample ports will be established in the final design.

Piping will be installed to permit tracer gases to be injected into the alcoves. In addition, pressure relief piping and valves will be installed. (Any gases released from the test alcove via the pressure relief system during the course of the test program will be either collected in a container or will be vented directly to the mine ventilation-exhaust duct).

7.3 Alcove Test Construction Sequence

The reference alcove will be mined and prepared first. The reference alcove can be available for testing several weeks prior to finalizing the test alcove.

The reference alcove can be used to test the effectiveness of the gas barrier seal and check the operation of ancillary instrumentation while the test alcove is being prepared. Gas, temperature, and pressure baseline data collection can begin in the reference alcove before waste is emplaced in the test alcove.

8.0 DATA ACQUISITION PLAN

Data collection for the reference alcoves will begin as soon as the sensors and associated instrumentation are installed and working. Properties measured will be the temperature, pressure, and relative humidity. The atmosphere of the reference alcove containing waste containers and packaging materials will be monitored to evaluate the composition, quantities, and rates of gases released by those materials. These reference data should permit a determination of the gases released or consumed by the CH-TRU waste in the test alcove.

Data will be collected in the test alcove as waste is being emplaced. Properties measured will be the temperature, pressure, and relative humidity of the alcove. The room atmosphere will be monitored to evaluate the composition, quantity, and rates of VOCs and potentially flammable gases emitted by the waste drums. These data will help to evaluate conditions during the Ventilated Timeframe and will provide information relative to conditions in disposal rooms during waste emplacement operations.

Data collection will continue in the waste alcove after the waste drums have been emplaced and the gas barrier seal has been completed. The Transition Timeframe will begin as soon as the alcove is sealed, but no significant changes in the data pattern are expected for several months. The atmosphere of the waste alcove at the time of sealing will be approximately equivalent to mine air and the large volume in the alcove should mask the small amount of gas predicted (Ref. 1) to be emitted by the waste drums.

Alcove testing will continue throughout the test phase. By that time, it is expected that the system will be at a steady state and the alcove will be providing reliable information. A decision to continue the alcove test into the disposal phase has not been made. The results of performance assessment or any conditions imposed by EPA will serve as the principal input to this decision; therefore, the decision to continue the test is expected to be made at the end of the test phase. The final objective is to obtain a sufficient amount of experimental data to reliably predict the composition, quantities, and emission rates of VOCs and flammable gases released by the waste drums in the alcove with a sufficient degree of confidence to satisfy regulatory requirements.

Some data such as temperature and pressure will be recorded on a continuous basis. Gas samples will be obtained and evaluated on a periodic basis. The periods will be established by the trends in the observed data pattern. Sampling frequency is discussed in more detail in Section 6.1.3. After the data have been fully evaluated it will be documented and formally reported on a periodic (probably annual) basis.

8.1 Pretest Waste Characterization Data

All wastes used in the alcove test program will be characterized according to pre-established waste characterization plans. The methods will not significantly differ from those established to ship and dispose of waste at the WIPP with the exception that headspace gas samples will be obtained from all waste containers. Characterization will be implemented at the generator sites that provide waste for the Alcove Test Program. This characterization will include the weight of the drums, the radioactive constituents (determined by radioassay and process knowledge), radiography results (for waste form verification and non-conforming item screening) and drum headspace gas analysis. These data will be obtained at the generator sites, but copies will be provided to and maintained by the WID Waste Acceptance Group.

9.0 DATA QUALITY OBJECTIVES

The Data Quality Objectives (DQOs) for the Alcove Test Plan are determined by the intended interpretation of the gas generation data. This requires specification of a minimum acceptable quality for the waste characterization data supplied with the waste containers selected for inclusion in the alcove tests. It also requires specification of the minimum performance characteristics of all analytical tests to be performed in the alcove test program and minimum performance characteristics for all environmental and process monitoring activities supporting the alcove tests.

Waste Characterization Data

All wastes included in the Alcove Test Program must meet the criteria given below.

1. Wastes must be certified to meet all the effective criteria in the WAC (Ref. 19), as currently revised at the time shipment of the wastes to the WIPP.

2. Wastes must be certified to meet shipping criteria for shipping in the TRUPACT II shipping container as effective at the time of shipment of the wastes to WIPP.

3. The actual waste containers supplied must have been characterized by methods meeting all of the relevant QAOs in the QAPP (version effective at the time of finalization of the Alcove Test Plan) for the

following parameters:

a. Radioassay
b. Radiography
c. Gas Sampling and Analysis (Drum headspace only)
d. Headspace VOC Sampling and Analysis (Drum headspace only)

4. All characterization data required by the RCRA Part B Permit, Waste Analysis Plan, must be available from analysis of wastes as close as possible to the wastes supplied for the test. The actual containers supplied for the alcove tests shall not have been cored, opened, or otherwise disturbed for waste characterization analysis except for items 3c and 3d, above.

Alcove Analytical Tests

Quality Assurance Objectives for the actual analytical tests to be performed during the Alcove Test Program are listed in Table 9.1. These include criteria for the accuracy, precision, and detection limits for each target analyte.

Definitions and methods for demonstrating achievement of these QAOs can be found in the QAPP, Sections 3.5 and 12.

For those analytes included in the Performance Demonstration Program, the laboratory must demonstrate successful participation in the applicable portion of the program.

Environmental and Process Monitoring

Data Quality Objectives for all Environmental and Process Monitoring components of the Confinement Systems and Gas Management Systems for the Alcove Test Program will be included in the detailed design.

Table 9-1 Quality Assurance Objectives for Target Analytes for the Alcove Test Program

ANALYTE	ACCURACY[a]	PRECISION[b]	PRQL[c]
Acetone	≥70% and ≤130%	+25%	100 ppmv
Carbon Tetrachloride	≥70% and ≤130%	±25%	1 ppmv
Cyclohexane	≥70% and ≤130%	±25%	1 ppmv
1,2-Dichloroethane	≥70% and ≤130%	±25%	1 ppmv
Methylene Chloride	≥70% and ≤130%	±25%	1 ppmv
1,1,1-Trichloroethane	≥70% and ≤130%	±25%	1 ppmv
Trichloroethene	≥70% and ≤130%	±25%	1 ppmv
Freon 113	≥70% and ≤130%	±25%	1 ppmv
o-Xylene	≥70% and ≤130%	±25%	1 ppmv
			PRDL[d]
Hydrogen	≥90% and ≤110%	±10%	0.1 Vol.%
Nitrogen	≥90% and ≤110%	±10%	1.0 Vol.%
Oxygen	≥90% and ≤110%	±10%	0.1 Vol.%
Methane	≥90% and ≤110%	±10%	0.1 Vol.%
Carbon Dioxide	≥90% and ≤110%	±10%	0.1 Vol.%
Carbon Monoxide	≥90% and ≤110%	±10%	0.1 Vol.%
Argon	≥90% and ≤110%	±10%	0.1 Vol.%
Tracers	≥95% and ≤105%	±5%	1% of Initial Conc.[e]

[a] Accuracy is calculated as Percent Recovery.

[b] Precision is calculated as Percent Relative Standard Deviation.

[c] PRQL is the Program Required Quantitation Limit, calculated by formula analogous to Minimum Detection Limit.

[d] PRDL is the Program Required Detection Limit, calculated by formula analogous to Minimum Detection Limit.

[e] Tracers will be selected based on required chemical and physical properties. The calculated initial concentration of the tracers will be determined to provide the most useful range. The absolute value of the PRDLs will be established accordingly.

10.0 CONCEPT AND HARDWARE DESIGN ANALYSIS

This section provides details of the alcove gas barrier.

10.1 Description of the Gas Barrier

A gas barrier will be installed in the entrance to the alcove to seal the alcove to prevent mine air from entering the alcove and to minimize the escape of gases from the alcove. Several mechanisms exist for the release of gases from the alcove other than around the barrier seal. For example, leakage can occur by permeation through the walls of the alcove, through fractures in the rock salt, and through anhydride layers and seams beneath the floor and above the ceiling of the alcoves. (One of the objectives of the alcove experiment is to examine the loss of gasses through the rock salt). Gases that leak out of the alcove will escape into the ventilated mine drift access areas and/or into the rock salt formation itself.

The primary gas barrier concept being pursued for this alcove experiment will be a modified version of the Alcove Gas Barrier (AGB) concept used on room "Q" at the WIPP site (Ref 13).The AGB involved a cylindrical access drift and a rigid sleeve type seal construction, with three removable gas-tight aluminum bulkheads completing the seal. The bulkheads were located inside the AGB liner with one in the center and one at each end. Precast high strength concrete and high strength alloy steel structural elements formed the lining section. The AGB had a length of 48 feet. The outside diameter of the liner was 14 feet and the inside passageway had a ten feet diameter.

The proposed access drift for this test plan will have a rectangular cross-section that can be mined with existing WIPP equipment. The corners of the access drift will be rounded. Three steel bulkheads are planned although two may be sufficient. The bulkheads will be constructed of either stainless steel or plated carbon steel to prevent corrosion. The shape of the bulkheads can be circular or rectangular with rounded corners. (A circular bulkhead will provide the most uniform load distribution to support the forces resulting from creep of the rock salt walls.) Each bulkhead will be equipped with two independently inflatable rubber bladders around the circumference that will be used to complete the seal. One bladder is redundant and will be used as a spare in case the other fails. A steel sleeve will be grouted to the access drift walls to support each bulkhead and to provide a good contact surface for sealing. A sealant will be sprayed or painted over the grouted areas to provide a leak tight surface in those areas. The use of additional sleeves, other than to support the bulkheads in the access drift area, are not considered necessary. The predicted amount of creep by the rock salt in the access drift should not present a problem for up to ten years.

10.2 Design Requirements for the Alcove Gas Barrier

1. Materials used in the gas barrier and associated systems must not degrade and become inoperable within the systems design life due to exposure to materials and conditions available such as the rock salt, gases expected within the alcove (e.g., N_2, H_2, CO_2, CO, O_2, etc.), brine, and low-level radiation.

2. Sealing materials associated with the gas barrier such as grout, sealing compounds, and inflatable rubberized seal elements must be nearly impermeable to air/oxygen and must not themselves generate a significant amount of volatile, degassing products which could complicate the alcove gas analyses.

3. The gas barrier must be able to adequately seal the test alcove access-entry drift. The surface roughness of the salt and the rounded corners of the drift will be accounted for by grouting and the emplacement of metal (probably steel) sleeves to support the bulkheads.

4. The existing bulkhead design includes a dual pressurized seal arrangement that includes a redundant seal. The second seal will act as a spare in case the other fails during the test phase. The bulkheads used with the AGB were designed to be failure resistant for at least five years.

5. The pneumatic sealing arrangements (bladders) on the bulkheads will be monitored for internal pressure and maintained at a sufficiently high pressure to minimize leakage through or around the bladder material.

6. The seals on the existing bulkheads have the capability of being independently repressurized during test operation. These seals are actually small rubber bladders. The volumes are small enough to be insignificant compared to the alcove volume.

7. The gas barrier is designed to be able to withstand a back-pressure of up to 1.5 psid without components being moved out of their emplacement positions. A safety restraining device may be installed on the man-access side of the barrier, if deemed necessary by safety or operational requirements. (The alcove pressure will be monitored continuously but will not be controlled except to limit the maximum required by design safety regulations. This can be accomplished by pressure relief valves. No significant pressure buildup is predicted, but continuous monitoring will be available to provide additional assurance for safety.)

8. The barrier will contain adequate access ports for instrument cabling, pressure relief valving, gas management system and gas sampling connections. The barrier must support and provide personnel access for the retrieval of waste from the alcove.

9. The barrier will be designed to allow for continual rock salt drift creep-closure without failing for a minimum five year period. (This requirement is not intended to restrict design options or materials of construction).

10. The gas barrier must be designed fit within the alcove access-entry drift and should extend no more than 50 feet along the length of the drift.

    NOTE: The replacement of a gas barrier or seal after gas test initiation will be extremely difficult if not impossible to accomplish without releasing gases from the alcove which could bias or terminate the experiment. For this reason, the gas barrier design has included provisions for emplacement of an additional barrier downstream of the existing barrier should that barrier fail or require replacement.

11. The barrier design must be compact and uncomplicated. The complete assembly of an alcove barrier should take no more than six to eight weeks. If a rigid barrier is emplaced within three months after excavation it is anticipated that the DRZ in the salt will heal within three months thereafter (Ref. 13).

12. Fabrication and delivery time for purchased barrier materials must be adequate to meet WIPP needs and schedules.

    (Detailed engineering design, fabrication, and purchasing specifications, relative to the barrier design are the primary responsibility of WID engineering, and will be provided by the cognizant test engineer).

11.0 PROVISIONS FOR SIGNIFICANT EVENTS

Potential significant events related to the alcove tests could be the loss of electrical power, loss of a sensor, or loss of instrumentation. These will be discussed in the following paragraphs. The rate of change in the gas generation data will be slow enough for this experiment that any of the above outages should be repaired before significant effects are experienced with data collection.

The loss of electrical power in the underground at the WIPP is an unusual event and in most situations the power is restored within a few minutes of the outage. Backup power systems are available and will be provided for the alcove test. The loss of electrical power for a few days should have no significant effect on the gas data analysis. The effect on safety could be a problem only if the amount of VOCs or flammable gases in the alcove was near an upper limit when the outage occurs. The administration of the Alcove Test Program will not permit high concentrations to occur without appropriate action being taken.

Loss of a sensor can create problems but backup sensors will be available for all measurements. If both sensors fail, a decision will have to be made by the Alcove Test Program Cognizant Engineer as to whether or not a new sensor needs to be installed. Entry to the alcove is accessible through the portals provided through the bulkheads in the gas barrier. Any entry into the alcove, after the gas barrier has been emplaced will be coordinated with Safety personnel.

Loss of an instrument or data acquisition system will be a problem only if it occurs on an off shift where coverage is minimal. No significant effect is expected on the data unless the outage lasts for several days. Most of the instruments will have backup systems available, at least on a loan basis. All controls that involve safety related operations will have backups. If no backup is available, priority will be placed on repairing the system or purchasing a new one on an emergency basis. If problems should occur with gas sampling and analysis functions, backup laboratory capabilities will be retained.

Any other unusual or significant event that occurs will be resolved by the alcove Cognizant Engineer or a designated alternate. All unusual or significant events will be recorded in the alcove test log book for future reference.

12.0 QUALITY ASSURANCE

The alcove tests will be implemented in accordance with the WIPP QAPP (Ref. 21). This quality assurance plan meets the requirements of NQA-1-1986, DOE 5700.6C, Chapter 11 of the FSAR, WIPP DOE 87-007 QA Operations Program , and DOE WPO Management Directives. The QAPP has been approved by the DOE/WPO and is specific to the WIPP Project. Sites that will furnish waste for the alcove experiment are also subject to the QAPP and site specific versions of the QAPP will be written by each site.

All alcove test-related activities that are performed on a repetitive basis will have a specific procedure drafted and approved by the alcove Cognizant Engineer, by QA, and by any other specifically related organization such as Safety or Mining Operations. These procedures will be modified, updated, and reapproved as required. Equipment used to obtain data will be calibrated at a frequence and by methods described in written, approved standard Operating Procedures. Personnel who operate the equipment and perform the tests will be properly trained in the operation of the equipment and the test procedures.

Waste characterization data will be obtained at the generating sites and will meet the standards of the QAPP. Approved operating procedures will be available at each site to describe how the operations related to waste characterization are performed. Site specific QAPPs will be written by each site to show how the operating procedures meet the quality assurance objectives. Sites are audited periodically to verify that the operating procedures and their performance meet the quality assurance requirements.

13.0 SAFETY

Safety is a high priority at the WIPP site. The entire site is committed to the safety, protection, and well being of its personnel, general public, and physical assets. It is the WIPP's policy to 1) provide a safe and healthy workplace and condition for all WIPP employees, 2) ensure the safety and health of the public, and the protection of government property against accidental loss and damage, and 3) establish goals to eliminate risk, mishaps, and injuries.

The WIPP is bound by all applicable laws and regulations as specified in the WIPP Safety Manual (WP 12-1). This includes underground safety, radiological safety, and industrial safety.

Waste selection and characterization will adhere to safety requirements existing at either the INEL or RFP site.

13.1 Radiological Safety and Control

All operations involving radioactive materials will be conducted in a manner to protect the worker and minimize the potential for contamination. The ALARA concept will be followed. A radioactivity continuous air, particulate monitor (CAM), will be installed in the location adjacent to the alcove access drift area for personnel safety. The alcoves will be located within the WIPP Radioactive Materials Area, (RMA). Administrative already exist for personnel access and monitoring procedures and these procedures will be adhered to.

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21. Quality Assurance Program Plan for the Waste Isolation Pilot Plant Experimental-Waste Characterization Program, Current Revision, DOE/EM/48063, July 15, 1991

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