



DOE/WIPP 89 - 025
DRAFT Revision 0.2

**Waste Characterization Program Plan
for
WIPP Experimental Waste**

May 1991



Waste Isolation Pilot Plant

910503



WASTE CHARACTERIZATION PROGRAM PLAN
FOR
WIPP EXPERIMENTAL WASTE

APPROVALS:

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WIPP Experimental Waste**

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LIST OF ACRONYMS

CFR	Code of Federal Regulations
CH-TRU	Contact-Handled Transuranic
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy, Headquarters
DOE/WPO	U.S. Department of Energy, WIPP Project Office
EEG	Environmental Evaluation Group
EPA	U.S. Environmental Protection Agency
EPA/ORP	U.S. Environmental Protection Agency, Office of Radiation Programs
EPA/OSW	U.S. Environmental Protection Agency, Office of Solid Waste
HLW	High Level Waste
HWMR	Hazardous Waste Management Regulations
IAG	Interagency Agreement
LEL	Lower Explosion Limit
NMD	Conditional No-Migration Determination
NMED	New Mexico Environment Department
NMVP	No-Migration Variance Petition
NRC	Nuclear Regulatory Commission
PA	Performance Assessment
QAPP	Quality Assurance Program Plan
QAPjP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RTR	Real Time Radiography
SNL	Sandia National Laboratories
SOP	Standard Operating Procedure
TRAMPAC	TRUPACT-II Authorized Methods for Payload Control
TRU	Transuranic
TRUCON	TRUPACT-II Content Codes
TRUPACT-II	Transuranic Package Transporter-II
UEL	Upper Explosion Limit
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WACCC	Waste Acceptance Criteria Certification Committee
WAP	Waste Analysis Plan
WCP	Waste Characterization Program
WCPP	Waste Characterization Program Plan
WIPP	Waste Isolation Pilot Plant
WPP	Waste Profile Plan

1.0 INTRODUCTION

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The U.S. Department of Energy (DOE) has developed a transuranic (TRU) Waste Characterization Program (WCP) to support the test phase activities designed to determine compliance with several regulatory requirements that have been imposed on the Waste Isolation Pilot Plant (WIPP). This document is the Waste Characterization Program Plan (WCPP) that defines the tasks that are necessary to meet the applicable requirements and test phase criteria.

The TRU waste characterization activities will apply to both TRU and TRU mixed (mixed) waste. These wastes are generated as a result of defense-related activities at several DOE facilities. TRU waste is classified as mixed waste if it contains hazardous wastes as defined in 40 CFR Part 261 (EPA, 1989).

Waste characterization information derived from the implementation of this WCPP will be used to support the following regulatory requirements and test phase activities:

- Compliance with the Conditional No-Migration Determination (NMD) (EPA, 1990).
- Verification of waste characterization information for 40 CFR Part 265.13 (EPA, 1989)
- Verification that the assumed hazardous constituent concentrations in the hydrologic modeling for the No-Migration Variance Petition (NMVP) (DOE, 1990) do indeed represent conservative (high) values.
- Analysis of headspace gases from waste containers to confirm the assumptions made about the potential releases of volatile organic compounds (VOCs) during the experimental and operational periods (DOE, 1990; EPA, 1990).
- Collection of data as part of waste characterization activities to demonstrate long-term compliance with 40 CFR Part 191 (EPA, 1985) and applicable RCRA regulations.
- Demonstration that the waste used in the WIPP test phase is representative (in terms of gas generation controlling variables) of waste to be sent to WIPP for disposal.
- Verification that the experimental waste meets the WIPP Waste Acceptance Criteria (WAC) (DOE, 1989b) and the TRUPACT-II Authorized Methods for Payload Control (TRAMPAC, Appendix 1.3.7 of the TRUPACT-II Safety Analysis Report) (NuPac, 1990) before shipment to WIPP.

Knowledge of TRU and mixed waste at the DOE generator/storage sites is based on the following information:

- Process knowledge, which is the understanding of waste quantities and composition gained from a knowledge of the waste and the processes that generate them, and
- Sampling and analysis of the actual waste generated/stored at DOE sites.

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Process knowledge provides the central body of information used to characterize the waste which will be emplaced at WIPP. The sampling and analysis of TRU and mixed wastes during the test phase will provide additional analytical data to verify system-wide process knowledge information, and to demonstrate that the waste used in the test phase experiments is representative (in terms of gas generation controlling variables) of the waste to be emplaced in WIPP for disposal. These data will be obtained through the examination of a statistically selected fraction of the waste intended for shipment to WIPP for disposal. The examination of waste at the sites will be performed using the procedures outlined in this document and detailed in the Quality Assurance Program Plan for the Waste Isolation Pilot Plant Experimental-Waste Characterization Program (QAPP) (DOE, 1991a) and site-specific Quality Assurance Project Plans (QAPjPs).

This WCPP will be revised periodically as new requirements are identified.

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4 **2.0 SCOPE AND RESPONSIBILITIES**

5 The scope of this document is to define the WCP and the relationships among the agencies,
6 regulatory documents, and programmatic requirements associated with the characterization of
7 waste to be emplaced at WIPP. In this section, the agencies and organizations responsible for
8 elements of the WCP are identified, and descriptions of their responsibilities within the program
9 are provided below. WCP requirements are included in a number of documents based on
10 programmatic and regulatory requirements. Figure 1 indicates the relationships of these
11 documents to the program, and to each other.

12 **2.1 DEPARTMENT OF ENERGY**

- 13
- 14 • DOE - Office of Environmental Restoration and Waste Management (DOE-EM) - The
15 DOE-EM approves this document and the Quality Assurance Program Plan for the
16 Waste Isolation Pilot Plant Experimental-Waste Characterization Program (QAPP)
17 (DOE, 1991a).
 - 18
 - 19 • DOE/WIPP Project Office (DOE/WPO) - Overall management of the WIPP WCP is the
20 responsibility of DOE/WPO. In addition, DOE/WPO approves this document, the
21 QAPP, and Sandia National Laboratories (SNL) test plans (and addenda).
 - 22
 - 23 • Waste Acceptance Criteria Certification Committee (WACCC) - The WACCC will review
24 and approve generator/storage site-specific QAPPs and perform program surveillance
25 and audit functions. The WACCC is designated as the organization responsible for
26 observing and overseeing waste characterization activities with cooperative
27 participation by other organizations including the U.S. Environmental Protection
28 Agency (EPA), EPA Region VI, the New Mexico Environment Department (NMED), and
29 the Environmental Evaluation Group (EEG).
 - 30
 - 31 • DOE Contractors and Generator/Storage Sites - Waste characterization and sampling
32 activities will be performed by DOE site operators and will be overseen by the
33 contractors' QA organization, DOE Operations Offices, and the WACCC.
34 Generator/storage site waste characterization requirements described in this
35 document are based upon programmatic requirements found in the NMD, Bin-Scale
36 and Alcove Test Plans (Molecke, 1990a; Molecke, 1990b), and the Bin-Scale
37 Addendum (Molecke and Lappin, 1990).
 - 38

39 **2.2 EXTERNAL AGENCIES AND ORGANIZATIONS**

- 40
- 41 • EPA Office of Radiation Programs (EPA/ORP) - The EPA/ORP is the regulatory
42 agency responsible for administering 40 CFR Part 191, "Environmental Radiation
43 Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level
44 and Transuranic Radioactive Wastes."
 - 45

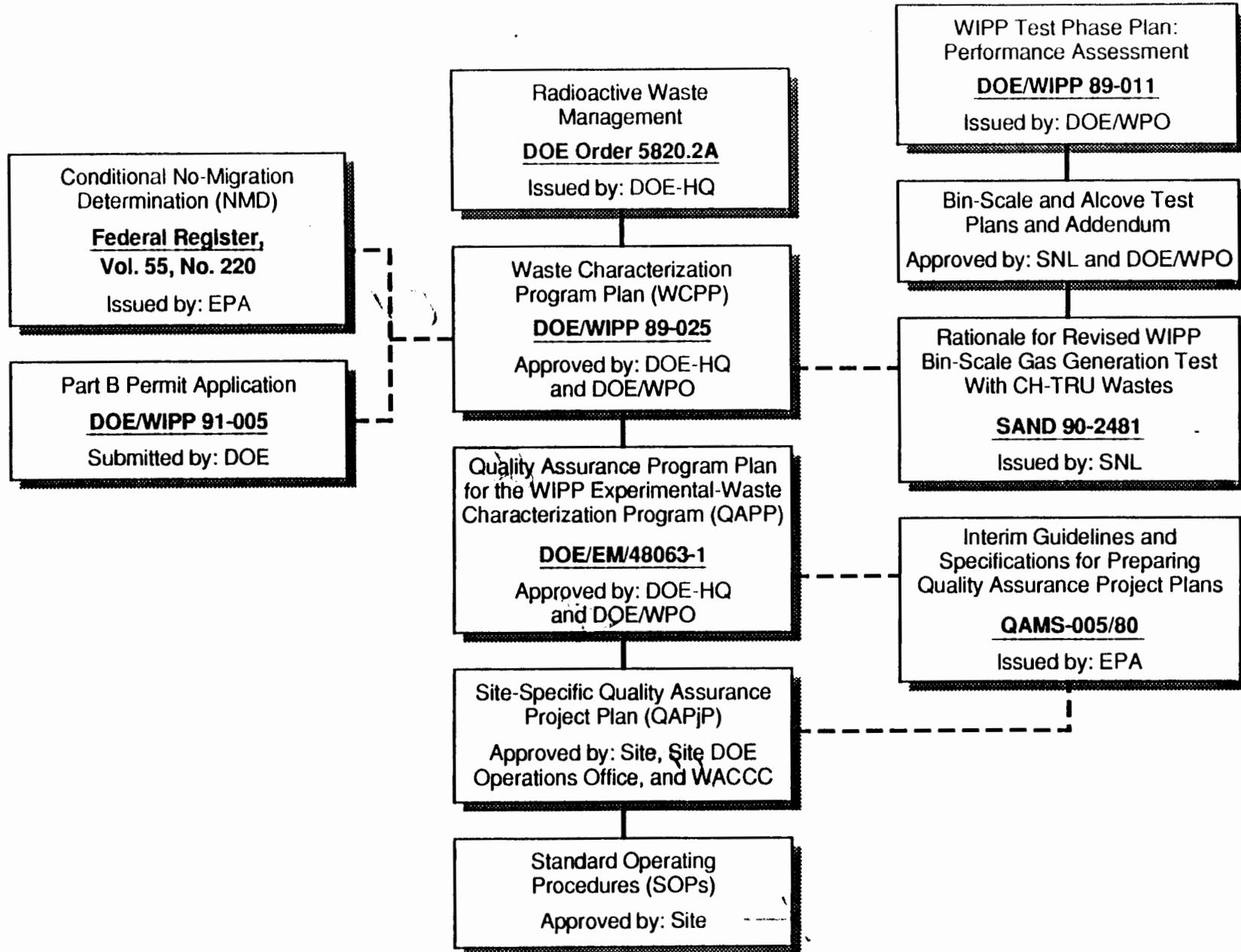


Figure 1. Documents Governing Waste Characterization

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- EPA Office of Solid Waste (EPA/OSW) - EPA/OSW issued the Conditional No-Migration Determination (NMD) (EPA, 1990) for WIPP. EPA/OSW is providing technical review for issues relating to compliance with the NMD.

EPA/OSW will be involved in the WCP throughout the development and implementation of sampling and analysis protocols. In addition to reviewing WIPP program plans, EPA/OSW will be asked to review and comment on DOE's proposed sampling and analysis methods documented in the QAPP.

- EPA Region VI - The EPA Region VI is responsible for the enforcement of the NMD.
- New Mexico Environment Department (NMED) - The NMED is the state agency in New Mexico authorized by the EPA to regulate mixed waste under the authority of RCRA.
- Environmental Evaluation Group (EEG) - The EEG is an organization created to provide independent technical review of all WIPP activities. The EEG is funded by DOE and functions under the New Mexico Institute of Mining and Technology.
- Agencies of Other States - This refers to states, other than New Mexico, in which DOE facilities are located and are participating in WIPP programs.

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3.0 WASTE CHARACTERIZATION PROGRAM

The DOE has developed the current WCP to obtain data to verify process knowledge in support of the regulatory requirements and test phase activities listed in Section 1.0. This information will be added to the existing waste characterization databases. This section describes the objectives of the current program.

Technical Requirements for Waste Characterization

Parameters and procedures considered in this document, how they relate to 40 CFR Part 191 (EPA, 1985) and 40 CFR Part 268 (EPA, 1989), and how they relate to verification of process knowledge, are presented in Table 1 and are described below.

- **Isotopic Distribution and Assay:** These results provide information necessary to determine both the total radionuclide quantity and the specific isotopes present in the waste. This information is used to assess 40 CFR Part 191 compliance and will be used to determine potential radiolytic gas generation rates.
- **Headspace Gas Analysis:** Headspace gas composition data can be used to determine:
 - The presence of nonflammable VOCs in the headspace of a drum which will be used to address the comparability requirement from the NMD (EPA, 1990).
 - Measurement of H₂, CH₄, and potentially flammable VOCs to address the flammability requirements in the NMD (EPA, 1990).
 - Identification of the dominant gas generation/consumption process occurring in a drum (e.g., production of CO₂ and depletion of O₂ due to radiolysis of paper/cloth).
- **Real-Time Radiography (RTR):** This video-based, x-ray examination provides general information about the waste components (e.g., metals, combustibles, or sludge). RTR is used by the sites to determine compliance with the WAC (DOE, 1989) and TRAMPAC criteria (NuPac, 1990). Examples of items that can be detected or determined by RTR are the presence of free liquids, the physical form of the waste, and the presence of prohibited items such as sealed containers greater than 4 liters in size.
- **Visual Inspection and Weighing of Solid Waste:** Visual inspection and weighing will provide data on the types and amounts of waste materials present in a waste container (e.g., paper towels, metal). The weight of all waste materials in a waste container will be reported for the first ten variables listed in Table 2. The quantities (by weight) of materials listed in Table 2 which are present in each container will be measured in support of the SNL experimental program (Molecke, 1990a, b; Molecke and Lappin, 1990) and performance assessment (PA) calculations.

TABLE 1. GENERAL TECHNICAL REQUIREMENTS FOR WASTE CHARACTERIZATION

PARAMETER	PROCEDURE	40 CFR PART 191	40 CFR PART 268	VERIFICATION OF PROCESS KNOWLEDGE
Isotopic Distribution and Assay	Radioassay	Yes	--	Yes
Headspace Gas Composition	Sampling and Analysis	--	Yes	Yes
3-2 Waste Component Materials/Waste Categories	RTR and/or Visual Inspection and Weighing	Yes	Yes	Yes
VOCs and Toxic Metals (Sludges)	To be determined	--	Yes	Yes
Major Cations and Anions, pH (Sludges)	To be determined	Yes	--	Yes

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TABLE 2

EXPECTED CONTROLLING VARIABLES FOR
GAS GENERATION BY CH TRU WASTES*

	<u>CONTROLLING VARIABLE</u>	<u>DESCRIPTION</u>
1.	Cellulosic Materials	paper, cloth, wood, filter media
2.	Plastics	bags, liners, wastes, Plexiglas, benelex
3.	Rubber Materials	gloves, aprons, wastes, generat
4.	Corroding Metal/Steels	drums, wastes, including stainless (high gas generation, high pH concerns)
5.	Corroding Metal/Aluminum	wastes
6.	"Non-Corroding" Metals	lead, copper, tantalum, etc. (significantly less hydrogen production)
7.	Solid Inorganic Materials	glasses, ceramics, graphite, etc.
8.	Inorganic Sludges	including sorbed water estimate
9.	Cements	including additives
10.	Other Organic Materials	resins, oils, organic sludges, solvents
11.	Total alpha curie content	(individual radionuclides also needed for PA)

*Lappin, et al., 1991.

- 1
- 2 • **Sludge Analysis for Volatile Organic Compounds and Toxic Metals:** Sludges
- 3 will be analyzed for VOCs and toxic metals, as required by the NMD (EPA, 1990),
- 4 and to verify RCRA waste characterization information provided by the DOE
- 5 generator/storage sites. In addition, analyses for these constituents will be used
- 6 in support of a long-term NMVP that will be submitted by DOE.
- 7
- 8 • **Major Cations and Anions and pH of Sludges:** These properties must be
- 9 quantified due to their influence on radionuclide solubilities, which are input into
- 10 PA calculations. In addition, these properties may influence the solubilities of
- 11 VOCs and toxic metals.
- 12

13 3.1 WASTE CHARACTERIZATION REQUIREMENTS FOR PERFORMANCE ASSESSMENT (PA)

14

15 In addition to laboratory experiments (Brush, 1990), SNL has developed tests to estimate the gas

16 generation rates of wastes to be emplaced at WIPP under simulated repository conditions.

17 These tests are detailed in the Bin-Scale Test Plan and Addendum (Molecke, 1990a; Molecke

18 and Lappin, 1990) and the Alcove Test Plan (Molecke, 1990b). These tests simulate both long-

19 term repository conditions (Bin-Scale Test) and post-closure, short-term repository conditions on

20 a room scale (Alcove Test). A fraction of the total DOE waste inventory will be tested in the bin-

21 scale and alcove experiments to provide data in support of performance assessment studies

22 being conducted by SNL. The composition of the test waste was chosen in an effort to study

23 waste which is representative (in terms of gas generation controlling variables) of TRU waste

24 throughout the DOE system.

25

26 The variables listed in Table 2 are used to analyze gas generation properties. These variables

27 are grouped by waste material characteristics that affect gas production from processes such

28 as bacterial, corrosive, and radiolytic mechanisms which may exist at WIPP after repository

29 closure. The first ten parameters represent potential sources for gas production. The eleventh

30 parameter (alpha curies) is not in itself a gas production source. However, it is an energy source

31 for radiolysis, which may produce gas. Alpha radiation from all TRU elements has approximately

32 the same energy associated with alpha decay. Therefore, equivalent alpha curies from different

33 transuranic elements should produce the same potential amount of gas.

34

35 Representativeness of the waste with respect to the variables in Table 2 refers only to overall

36 properties (e.g., the gas generation potential) and not to the amount of constituents present in

37 the waste. For example, if the maximum amount of cellulose (Variable 1 in Table 2) present

38 in a WIPP experimental drum is 50 kg, a drum of waste sampled at a site with 100 kg of

39 cellulose can still be included within the test waste acceptability envelope described below,

40 provided it does not contain materials which cannot be classified by any of the variables listed

41 in Table 2.

42

43 The occurrence of VOCs and/or toxic metals in the wastes is not expected to affect the gas

44 generation rate or gas generation potential of the nonhazardous waste components. Therefore,

45 there is no requirement that the wastes characterized for the Bin-Scale and Alcove Tests be

46 representative of the inventory with respect to hazardous constituents.

47

1
2 In the event that waste exists in the system that is not represented by the test waste (i.e., if the
3 potential gas generation properties of a waste cannot be classified by the variables in Table 2),
4 the following three options are available to qualify this "non-representative waste" for disposal at
5 WIPP:
6

7 • **OPTION 1**

- 8
9 - Process the non-representative waste to alter its properties such that it is
10 represented by the waste being tested in the experimental program. This option
11 modifies the non-conforming waste such that it can be included under the existing
12 acceptability envelope for gas generation potential.
13

14 • **OPTION 2**

- 15
16 - Test the non-representative waste under the conditions of the experimental waste
17 for the same test parameters, and include these results in the PA evaluations. This
18 option allows expansion of the existing acceptability envelope to include all waste
19 in the system, based upon acceptable results in the PA calculations..
20

21 • **OPTION 3**

- 22
23 - Based upon bounding analyses and knowledge of the waste (without actual gas
24 generation testing), demonstrate that the waste can be included in the PA studies.
25 This option allows expansion of the acceptability envelope (as in Option 2) but relies
26 on conservative analysis and assumptions instead of actual gas generation testing
27 of the waste. This option requires that sufficient information be available regarding
28 the properties of this waste to perform conservative analyses.
29

30 The SNL test plans specify waste characterization requirements in Section 8.3 of the Bin-Scale
31 Test Plan (Molecke, 1990a), in Sections 4.2 and 5.11 of the Bin-Scale Test Plan Addendum
32 (Molecke and Lappin, 1990), and in Section 10.4 of the Alcove Test Plan (Molecke, 1990b). The
33 test plans will be revised and updated as necessary to reflect changes in waste characterization
34 requirements and/or developments in experimental design. This document addresses the
35 present waste characterization requirements of the SNL test plans and may supersede some
36 analytical requirements in those test plans with respect to determining gas generation properties.
37

38 SNL is currently preparing a drum-scale leaching/solubility test plan. These experiments will be
39 performed in lieu of liquid sampling experiments detailed in the Bin Scale Test Plan (Molecke and
40 Lappin, 1990). Waste characterization requirements for the leaching/solubility test plan are
41 expected to be the same as those outlined in this document. Should SNL identify additional
42 requirements during development of the drum-scale leaching/solubility test plan, these
43 requirements will be incorporated into a revision of this document.
44

1
2 Waste Characterization Requirements to Demonstrate Representativeness of Waste
3

4 An objective of the WCP is to characterize waste used in experiments to demonstrate that the
5 gas generation properties of experimental waste are comparable to those of TRU waste in the
6 DOE system. This requires that all sites generate waste characterization data for comparison
7 with the test waste.
8

9 The basis for comparison of TRU waste in the DOE system is process knowledge, which
10 consists of the following:
11

- 12 • Process flow diagrams presented in the NMVP
- 13
- 14 • Information in the TRUPACT-II Content Codes (TRUCON) (DOE, 1991c) document and
15 chemical lists published in the NMVP (DOE, 1990)
- 16
- 17 • Records and documentation (including any waste analyses data) from generator/storage
18 sites.
19

20 Each DOE TRU waste generator/storage site must characterize a statistically selected portion
21 of their waste to verify their own process knowledge. TRU waste data collected during the WCP
22 will be compared with existing process knowledge information, as outlined above. These data
23 will be used to verify that assessments of the physical and chemical composition of the waste
24 are accurate (i.e., the percentages of materials listed in Table 2) or that conservative assumptions
25 have been made in cases where no previous analytical data exists.
26

27 A summary of the waste characterization requirements for the Bin-Scale Test waste is presented
28 in Figure 2. Each of the drums that will be repackaged into bins for the Bin-Scale Test must
29 meet all applicable waste characterization requirements.
30

31 Selection of Drums for Bin Tests
32

33 The number of drums from each WIPP waste test type, and from each content code within a
34 WIPP waste test type, which are required for the bin tests is specified in the SNL "rationale
35 document" (Lappin et al., 1991). All waste drums for the bin-scale tests shall be randomly
36 selected as specified by SNL in the rationale document. The drums that will be selected for
37 preparation of a bin must be chosen such that the bin meets WIPP-WAC (DOE, 1989b) and the
38 TRAMPAC (NuPac, 1990) criteria. These criteria have been published and made available to the
39 waste generator/storage sites.
40

41 Selection of Drums for Alcove Tests
42

43 Waste characterization requirements for the Alcove Test are shown in Figure 3. The waste drum
44 equivalent volumes needed per alcove are listed in Table 10.4 of the SNL Alcove Test Plan
45 (Molecke, 1990b). Selection of drums or boxes will be done randomly, as in the Bin-Scale Test.
46 The same restrictions that apply to Bin-Scale Test drums (meeting both the WAC and the
47 TRAMPAC requirements) apply to the drums/boxes used in the alcove tests.

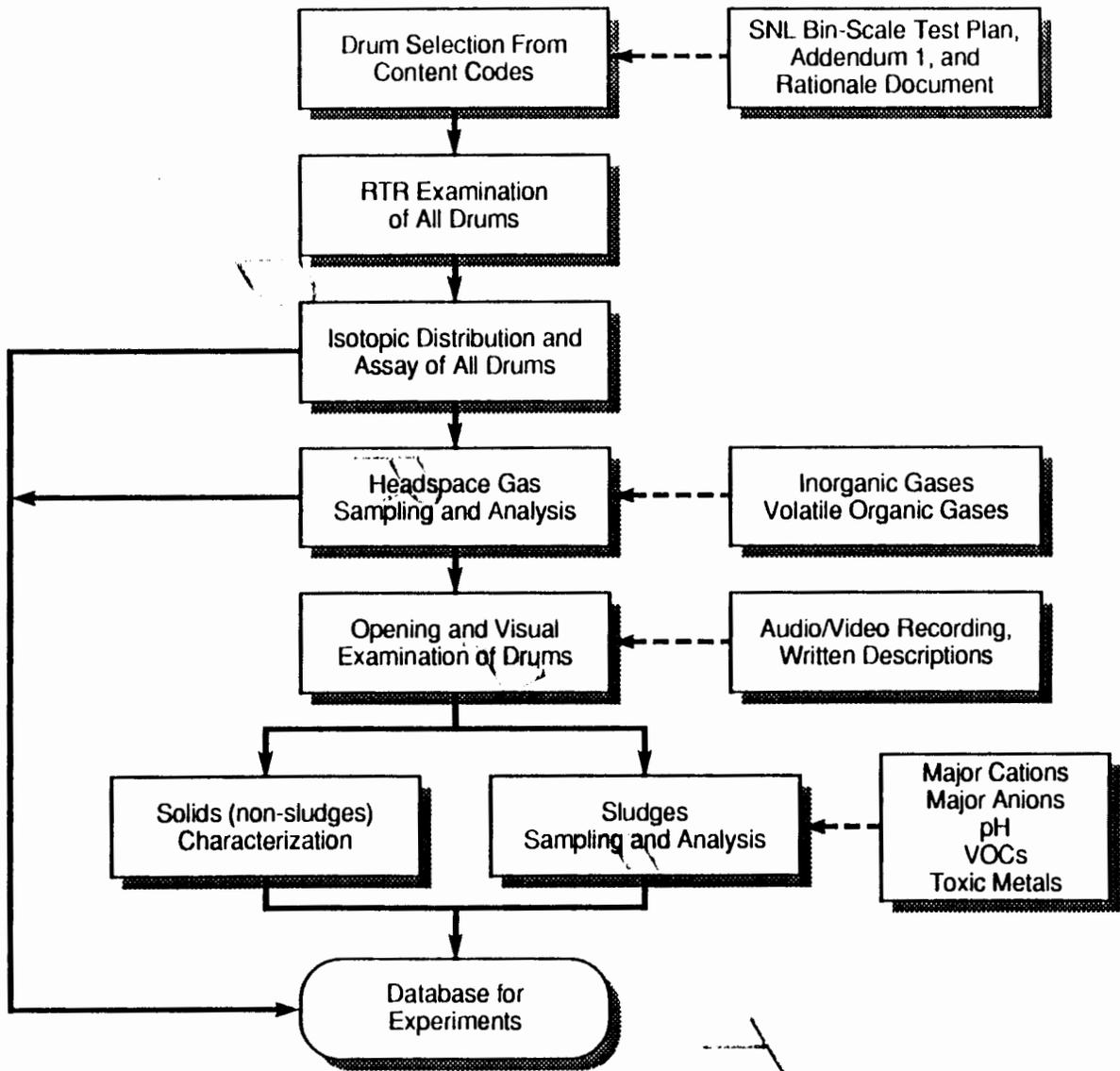


Figure 2. Waste Characterization Requirements for Bin Scale Experiments

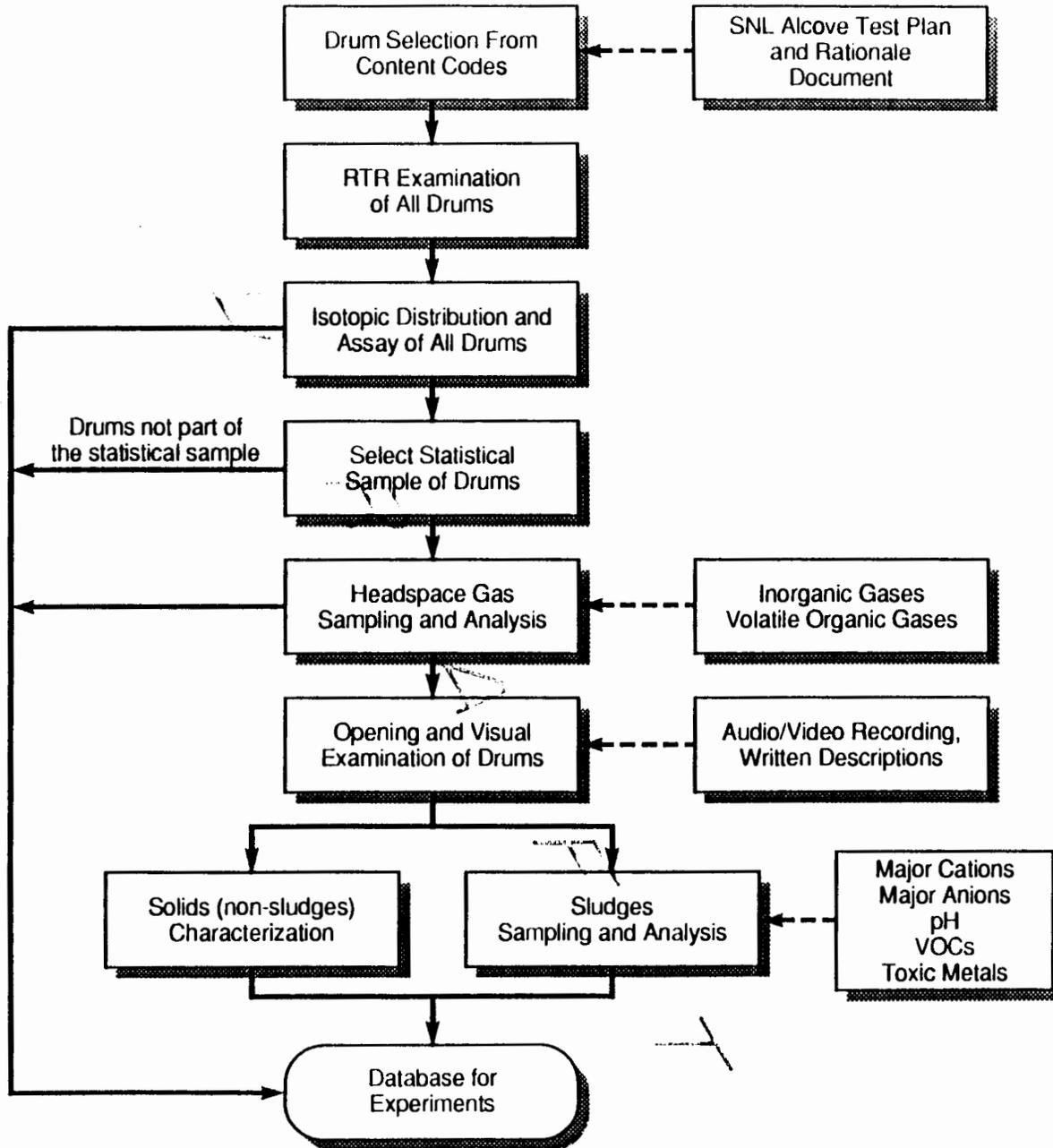


Figure 3. Waste Characterization Requirements for Alcove Experiments

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Statistical Sampling Requirements

All of the drum equivalent waste to be used in the Bin-Scale Test will be characterized according to the requirements described in this document and the QAPP. RTR and assay measurements will be used to provide data on all experimental waste (both bin-scale and alcove). A statistical sample of the drum equivalent waste to be used in the Alcove Test will be characterized in accordance with the requirements described in this document and the QAPP.

3.2 RCRA WASTE CHARACTERIZATION REQUIREMENTS

A portion of the waste destined for WIPP is mixed waste. Mixed waste is solid waste with transuranic elements and RCRA-regulated hazardous wastes. Waste is regulated as hazardous waste if it meets the following criteria:

- It is a listed waste as defined by New Mexico Hazardous Waste Management Regulations (HWMR-6), Part II, Subpart D; or is mixed with or derived from a listed waste;
- It exhibits a characteristic as defined by HWMR-6 Part II, Subpart C.

Waste which exhibits characteristics of ignitability, corrosivity, or reactivity (as defined by HWMR-6, Part II, sections 261.21, 261.22, or 261.23, respectively) will not be emplaced in the WIPP (DOE, 1991b).

Waste subject to the land disposal restrictions of HWMR-6, Pt. VIII, section 268 is proposed to be emplaced in the WIPP.

3.2.1 Conditional No-Migration Determination

The WIPP submitted a No-Migration Variance Petition (NMVP) (DOE, 1990) to the EPA Office of Solid Waste (EPA/QSW) to receive a variance from the EPA's Land Disposal Restrictions (40 CFR Part 268) (EPA, 1989). Very conservative (i.e., high) estimates for the potential concentration of VOCs and/or toxic metals were made for the source term for the long-term modeling of repository performance under undisturbed conditions. Also, estimates of VOCs in the headspace of waste drums were used to demonstrate near-term compliance with releases of VOCs during the experimental and operations periods. These VOC estimates were calculated from the sampling and analysis of approximately 200 drums of Rocky Flats Plant waste in storage at the Idaho National Engineering Laboratory (DOE, 1990).

The EPA published a Conditional No-Migration Determination (NMD) (EPA, 1990) to address the WIPP testing and experimental program. The NMD waste characterization requirements are summarized as follows:

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- **Flammability**

- Verify that any waste container does not exceed 50 percent of the lower explosion limit (LEL) for H₂ and CH₄ in any layer of confinement, when potentially flammable VOCs as a class are less than 500 ppm by volume prior to emplacement in WIPP. This requirement can be satisfied by measurement of the H₂ and CH₄ concentrations in the headspace and calculation of 50 percent LEL using the Le Chatelier Law (see glossary).
- If the potentially flammable VOCs occur in the headspace in concentrations greater than 500 ppm as a class, then a flame test must be performed prior to acceptance of that waste container for emplacement underground at WIPP.

- **Comparability (Nonflammable VOCs)**

- Any waste container that is sent directly to WIPP or any waste container that is loaded into a bin must meet the criteria that the headspace concentration within a waste container does not exceed two times (2X) the maximum concentration for the five nonflammable VOCs reported in the NMD (Table 2 of EPA, 1990).
- Any bin or other waste container that is sent to WIPP must meet the requirement that the headspace concentration within a package does not exceed ten times (10X) the average concentration of the three nonflammable VOCs reported in the NMD (Table 3 of EPA, 1990).
- Headspace gases must be analyzed for the VOCs listed in the NMD. If additional VOCs are detected, these must be added to the established list and quantified.

- **Representativeness**

- For the initial experimental waste, sampling will be performed in the container headspace, as well as the headspace of most layers of confinement (with waste). This is to ensure that representative data on the headspace gas concentrations in the container are obtained. For most non-flammable VOCs, the concentrations in the container headspace and in the inner confinement layers are expected to be similar. For gases like hydrogen, algorithms can be developed to conservatively predict the concentration gradients in a waste container. It is expected that once the representativeness of the container headspace sample is established, sampling of most inner confinement layers will not be necessary.
- EPA/OSW will require demonstration of comparability and representativeness for headspace gases throughout the DOE system to allow the results of this WCP to be extrapolated to the remainder of the TRU waste inventory. DOE will also be required to demonstrate that the content of waste sampled in the test phase is similar to the waste described in the NMVP.

1 Other Waste Characterization Requirements

2
3 In addition to headspace sampling and analyses, other waste characterization requirements
4 stipulated by the EPA in the NMD include the following:

- 5
- 6 • Analyses must be performed on sludges used in the test phase for toxic metals and
7 VOCs listed in the NMD (EPA, 1990). In addition, analysis of the sludges for major
8 cations and anions and pH will be performed since these variables can influence the
9 mobility of toxic metals in the sludges.
 - 10
 - 11 • Solid wastes must be characterized for the 11 gas generation controlling variables
12 identified in Table 2, Section 3.0 of this document. Quantification of these gas
13 generation variables is important because EPA considers production and release of
14 excess gas to be a viable mechanism by which hazardous constituents could migrate
15 from the repository during the test program.

16
17 3.2.2 Compliance With Other RCRA Regulations

18
19 As a miscellaneous unit (HWMR-6, Part V, Subpart X), WIPP must comply with HWMR-6, Part VI,
20 Sec. 265, while under interim status, and HWMR-6, Part V, Sec. 264, after the final RCRA permit
21 is issued. WIPP submitted Part A of the RCRA permit application to the New Mexico
22 Environment Department (NMED) in January of 1991, and Part B of the RCRA permit application
23 in February of 1991.

24
25 Certain activities undertaken through this program will provide the opportunity for verification of
26 process knowledge. The majority of information available on TRU mixed waste is based on
27 process knowledge. Process knowledge, in addition to the sampling and analytical criteria
28 described in this document, will be used to meet the RCRA waste analysis requirements for
29 WIPP under HWMR-6, Pt. VI, Sec. 265.13.

30
31 Generator/storage sites must develop waste-category-specific Waste Profile Plans (WPPs) to
32 provide waste characterization information on a specific waste stream, content code or
33 identification code (DOE, 1991b). The WPPs must include a description of the procedures used
34 to verify the hazardous constituents in the waste to the satisfaction of the NMED. The Waste
35 Analysis Plan (WAP) of the WIPP Part B permit application (DOE, 1991b) contains a general
36 methodology for developing WPPs. DOE/WPO will provide the generator/ storage sites with
37 prototype WPPs and specific guidance on how to document the required information.

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4.0 QUALITY ASSURANCE

The WCP will be conducted in accordance with NQA-1 (ASME, 1989), DOE Order 5820.2A, Radioactive Waste Management (DOE, 1988), and with the criteria identified in the QAPP (DOE, 1991a). In addition, the WACCC will serve in a review, approval and audit capacity for the QAPjPs.

Specifications set forth in this document do not relieve any program participant from the responsibility of complying with applicable Federal, State, and local regulations; DOE Orders; existing permits and Interagency Agreements; or any site-specific controls on operations.

As a specific requirement of the WCP, dosimetry data will be collected for all radiation-exposed personnel at all sites participating in the program. These records will be collected on the basis of specific activities. The records will be used to evaluate relative risks and benefits of waste treatment and handling options. Dosimetry information will be made available to DOE/WPO without identification of any personnel participating in the WCP. Evaluations resulting from these records will be provided to the EPA.

Analytical methods and procedures to be used in the WCP are documented in the QAPP (DOE, 1991a), which is the governing document for all analyses performed in support of the WCP. The QAPP is based upon analytical requirements identified in this document. The QAPP addresses regulatory and programmatic requirements relative to sample size, preservation techniques, chain of custody, type of containers, holding times, and any other pertinent requirements.

Each site supplying waste for the test phase is required to prepare a site-specific QAPjP detailing how the requirements outlined in this program plan, and the system-wide QAPP, are met by the site. The QAPjPs will provide a detailed description of the sampling and analytical functions, as well as additional site-specific quality related objectives, in accordance with:

- EPA Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA, 1983)
- Criteria listed in Table 1 of this WCPP
- Analytes listed in the system-wide QAPP (DOE, 1991a).

All site waste characterization activities will be performed in conformance with requirements specified in an approved QAPjP. If off-site laboratories are used to perform analyses associated with this WCP, those laboratories must prepare and submit a QAPjP for their scope of work. Off-site laboratory QAPjPs must be approved by the WACCC. All laboratories performing analyses for the WCP will participate in the Performance Demonstration Program which is detailed in the Performance Demonstration Program Plan (DOE, 1991d).

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Participating DOE sites will be responsible for identifying and performing the quality assurance/quality control tasks associated with characterization and packaging activities, and must include those activities in the site-specific QAPjP submitted to the WACCC for approval. WACCC personnel will conduct audit and/or surveillance functions to ensure that sites are in compliance with their approved site-specific QAPjPs. Affected state and federal organizations and agencies may be invited to participate as observers during the audit and surveillance activities.

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5.0 REFERENCES

1
2
3
4 American Society of Mechanical Engineers (ASME), 1989, "Quality Assurance Program
5 Requirements for Nuclear Facilities," NQA-1, American Society of Mechanical Engineers,
6 New York, New York.

7
8 Brush, L. H., "Test Plan for Laboratory and Modeling Studies of Repository and Radionuclide
9 Chemistry for the Waste Isolation Pilot Plant," SAND 90-0266, Sandia National Laboratories,
10 September 1990.

11
12 DOE - See U.S. Department of Energy.

13
14 EPA - See U.S. Environmental Protection Agency.

15
16 Hall, R. M., Jr., T. Watson, R. E. Schwartz, N. S. Bryson, and R. C. Davis, Jr., 1989, RCRA
17 Hazardous Wastes Handbook, Eighth Edition, Government Institutes, Inc., Rockville, Maryland.

18
19 Lappin, A. R., C. A. Gotway, M. A. Molecke, R. L. Hunter, and E. N. Lorusso, 1991, "Rationale
20 for Revised WIPP Bin-Scale Gas-Generation Test with Contact Handled Transuranic Wastes at
21 the Waste Isolation Pilot Plant," SAND90-2481, Sandia National Laboratories, Albuquerque, New
22 Mexico.

23
24 Molecke, M. A., 1990a, "Test Plan: WIPP Bin-Scale CH-TRU Waste Tests," Sandia National
25 Laboratories, Albuquerque, New Mexico.

26
27 Molecke, M. A., 1990b, "Test Plan: WIPP In Situ Alcove CH-TRU Waste Tests," Sandia National
28 Laboratories, Albuquerque, New Mexico.

29
30 Molecke, M. A., and A. R. Lappin, 1990, "Test Plan Addendum #1: WIPP Bin-Scale CH TRU
31 Waste Tests," SAND90-2082, Sandia National Laboratories, Albuquerque, New Mexico.

32
33 New Mexico Hazardous Waste Management Regulations (HWMR-6), 1991, Santa Fe, New
34 Mexico.

35
36 NuPac, 1990, "Safety Analysis Report for the TRUPACT-II Shipping Package," Appendix 1.3.7,
37 "TRUPACT-II Authorized Methods for Payload Control," Rev. 9, Nuclear Packaging, Inc., Federal
38 Way, Washington.

39
40 U.S. Department of Energy, 1991a, "Quality Assurance Program Plan for the Waste Isolation Pilot
41 Plant Experimental-Waste Characterization Program," DOE/EM/48063-1, Rev. 0, U.S. Department
42 of Energy, Washington, D.C., April 1991.

43
44

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1
2 U.S. Department of Energy, 1991b, "Resource Conservation and Recovery Act Part B Permit
3 Application," DOE/WIPP 91-005, U.S. Department of Energy, Carlsbad, New Mexico,
4 February 1991.

5
6
7 U.S. Department of Energy, 1991c, "TRUPACT-II Content Codes (TRUCON)," WIPP/DOE 89-004,
8 Rev. 5, U.S. Department of Energy, WIPP Project Office, Carlsbad, New Mexico.

9
10 U.S. Department of Energy, 1991d, "Performance Demonstration Program Plan for the WIPP
11 Experimental-Waste Characterization Program," DOE/WIPP 91-016, Waste Isolation Pilot Plant,
12 Carlsbad, New Mexico.

13
14 U.S. Department of Energy, 1990, "Waste Isolation Pilot Plant No-Migration Variance Petition,"
15 DOE/WIPP 89-003, Rev. 1, U.S. Department of Energy, WIPP Project Office, Carlsbad, New
16 Mexico.

17
18 U.S. Department of Energy, 1989a, "Draft Final Plan for the Waste Isolation Pilot Plant Test
19 Phase: Performance Assessment," DOE/WIPP 89-011, U.S. Department of Energy, WIPP Project
20 Office, Carlsbad, New Mexico.

21
22 U.S. Department of Energy, 1989b, "TRU Waste Acceptance Criteria for the Waste Isolation Pilot
23 Plant," WIPP/DOE-069, Revision 3, Westinghouse Electric Corporation, Waste Isolation Division,
24 Carlsbad, New Mexico.

25
26 U.S. Department of Energy, 1988, "Radioactive Waste Management," DOE Order 5820.2A,
27 September 28, 1988.

28
29 U.S. Environmental Protection Agency, 1990, "Conditional No-Migration Determination for the
30 Department of Energy Waste Isolation Pilot Plant (WIPP)," Federal Register, Vol. 55, No. 220,
31 November 1990, 47700-47721.

32
33 U.S. Environmental Protection Agency, 1989, Title 40, Code of Federal Regulations, U.S.
34 Environmental Protection Agency, Washington D.C.

35
36 U.S. Environmental Protection Agency, 1985 "Environmental Radiation Protection Standards for
37 Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive
38 Wastes," Title 40, Code of Federal Regulations, Part 191, (40 CFR 191), U.S. Environmental
39 Protection Agency, Washington D.C.

40
41 U.S. Environmental Protection Agency, 1983, "Interim Guidelines and Specifications for Preparing
42 Quality Assurance Project Plans," QAMS-005/80, Office of Monitoring Systems and Quality
43 Assurance, Office of Research and Development, U.S. Environmental Protection Agency,
44 Washington, D.C., February 1983.

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6.0 GLOSSARY

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4 **CH-TRU Waste** - Contact-Handled TRansUranic waste, packaged TRU waste for which the
5 external dose rate does not exceed 200 mrem per hour.
6

7 **Code of Federal Regulations (CFR)** - A documentation of the regulations implemented by the
8 executive departments of the federal government. The code is divided into 50 titles that
9 represent broad areas subject to federal regulation. Each title is divided into chapters that
10 usually bear the name of the issuing agency. Each chapter is further subdivided into parts
11 covering specific regulatory areas.
12

13 **Content Code** - A uniform system applied to waste forms to group those with similar
14 characteristics for purposes of shipment in TRUPACT-II containers.
15

16 **Drum equivalent** - The volume of waste that is equivalent to that present in a 55-gallon drum.
17

18 **Hazardous Waste** - Solid waste is regulated as hazardous waste if it is a listed waste as defined
19 by New Mexico Hazardous Waste Management Regulations (HWMR-6), Part II, Subpart D; or
20 is mixed with or derived from a listed waste; or it exhibits a characteristic as defined by HWMR-6
21 Part II, Subpart C.
22

23 **Land Disposal Restrictions** - Regulatory prohibition of the placement of untreated hazardous
24 waste in or on the land, as defined by 40 CFR Part 268.
25

26 **Layer of confinement** - A layer of confinement is a bagging layer that has waste inside that
27 layer.
28

29 **Le Chatelier's Law** - The explosion (flammable) limits of a mixture of several flammable gases
30 and vapors may be estimated if the explosion limits of the components are known. If P_i is the
31 volume fraction of component "i" in the mixture, the lower explosion (flammable) limit (LEL) for
32 the mixture is:
33

$$\text{LEL (mixture)} = \Sigma P_i / \Sigma (P_i / \text{LEL}_i)$$

34
35

36 and the upper explosion (flammable) limit (UEL) for the mixture is:
37

$$\text{UEL (mixture)} = \Sigma P_i / \Sigma (P_i / \text{UEL}_i)$$

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41 **Mixed waste** - Mixed waste is radioactive solid waste with RCRA-regulated hazardous waste.
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1 **Performance Assessment** - The process of assessing the compliance of a deep, geologic waste
2 repository with the Containment Requirements of 40 CFR Part 191 Subpart B. Performance
3 assessment is defined by Subpart B as an analysis that (1) identifies the processes and events
4 that might affect the disposal system, (2) examines the effects of these processes and events
5 on the performance of the disposal system, and (3) estimates the cumulative releases of
6 radionuclides, considering the associated uncertainties, caused by all significant processes and
7 events. These estimates are incorporated into an overall probability distribution of cumulative
8 release to the extent practicable (40 CFR Part 191.12(q)).
9

10 **Process Knowledge** - The understanding of waste quantities and composition gained from
11 knowledge of waste generation processes.
12

13 **Quality Assurance (QA)** - All those planned and systematic actions necessary to provide
14 adequate confidence that a facility, structure, system, or component will perform satisfactorily
15 and safely in service. The goal of quality assurance is to ensure that: research, development,
16 demonstration, scientific investigation, and production activities are performed in a controlled
17 manner; that components, systems, and processes are designed, developed, constructed,
18 tested, operated, and maintained according to engineering standards, quality practices, and
19 Technical Specifications/Operational Safety Requirements; and that resulting technology data
20 are valid and retrievable. Quality assurance includes quality control, which comprises all those
21 actions necessary to control and verify the features and characteristics of material, process,
22 product, or service to specified requirements.
23

24 **Quality Assurance Plan** - A document that contains or references the quality assurance
25 elements established for an activity, group of activities, a scientific investigation or a project and
26 describes how conformance with such requirements is to be ensured for structures, systems,
27 computer software, components, and their operation commensurate with (1) the scope,
28 complexity, duration, and importance to satisfactory performance; (2) the potential impact on
29 environment, safety and health; and (3) requirements for reliability and continuity of operation.
30

31 **Quality Control (QC)** - A routine application of procedures for controlling the monitoring
32 process. Quality Control is the responsibility of all those performing the hands-on operations in
33 the field, in the office, and in the laboratory.
34

35 **Radioactive Waste** - Solid, liquid, or gaseous material of negligible economic value that contains
36 radionuclides in excess of threshold quantities.
37

38 **Real-Time Radiography (RTR)** - A non-destructive, semiquantitative technique that involves X-
39 ray scanning of waste containers to identify and verify their contents.
40

41 **Solid Waste** - Discarded material as defined in 40 CFR 261.2 is solid waste. Solid waste
42 includes garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or
43 air pollution control facility and other discarded materials, including solid, liquid, semi-solid, or
44 contained gaseous materials resulting from industrial, commercial or other processes.
45 (Hall, et al., 1989)

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1 **Transuranic Radioactive Waste (TRU Waste)** - Radioactive waste that, without regard to source
2 or form, is contaminated with more than 100 nCi per gram of waste of alpha-emitting transuranic
3 isotopes with atomic numbers greater than 92 and half-lives greater than 20 yr, except for: (1)
4 High Level Waste (HLW); (2) wastes that the DOE has determined, with the concurrence of the
5 EPA Administrator, do not need the degree of isolation required by 40 CFR Part 191; or (3)
6 wastes that the Nuclear Regulatory Commission (NRC) has approved for disposal on a case-by-
7 case basis in accordance with 10 CFR Part 61. Heads of DOE field organizations can determine
8 that other alpha-contaminated wastes, peculiar to a specific site, must be managed as TRU
9 waste.

10
11 **TRU Mixed Waste** - Radioactive transuranic waste that contains hazardous constituents (as
12 defined by 40 CFR Part 261).

13
14 **Volatile Organic Compounds** - Compounds amenable to analysis by the purge and trap
15 technique. Used synonymously with purgeable compounds.

16
17 **Waste Form** - Refers to the physical form of the waste (e.g., solid, liquid, solidified). Provides
18 information on the waste contents, how the waste is processed, and on the chemistry of the
19 components.
20
21

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