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Waste Description Information for Transuranically Contaminated Wastes Stored at the Idaho National Engineering Laboratory

B. D. Ravio
G. K. Becker
T. H. Smith
G. L. Anderson

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Idaho National Engineering Laboratory
Waste Technology Planning and Projects
Lockheed Idaho Technologies Company
Idaho Falls Idaho 83415

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ABSTRACT

The Department of Energy is in the process of procuring private sector treatment services for transuranic-contaminated and mixed waste stored at the Idaho National Engineering Laboratory (INEL). This document has been prepared to provide current waste descriptions for preliminary design and estimation purposes. It provides summary and detailed description information for the transuranically-contaminated wastes stored at the INEL in terms of the physical, radiological, and chemical parameters defining the wastes. Waste description information is provided in the form of summary tables and detailed waste profile data in Appendices A and B. Various summary and detailed information tables on waste identification codes, waste materials description, waste storage configuration, waste containers, radionuclide contaminants, EPA-regulated hazardous contaminants, and physical and chemical waste compositions are provided.

CONTENTS

ABSTRACT iii

ACRONYMS xiii

1. INTRODUCTION 1-1

1.1 Background 1-2

1.2 Definitions 1-6

1.3 References 1-7

2. WASTE SUMMARY INFORMATION 2-1

3. WASTE MATRIX PHYSICAL AND CHEMICAL COMPOSITION CHARACTERIZATION 3-1

3.1 References 3-19

4. WASTE RADIOLOGICAL CHARACTERIZATION 4-1

4.1 Radiological Information Derived Primarily from Rocky Flats Plant Waste via the INEL Transuranic Waste Database Analysis 4-1

4.1.1 Alpha Data 4-13
4.1.2 Electron Data 4-27
4.1.3 Photon Data 4-27
4.1.4 Neutron Data 4-47

4.2 Information Derived via RWMIS Analysis 4-53

4.3 Refinement of Nonactinide Nuclide Inventory Using Information from Other Sources 4-61

4.3.1 Tritium 4-61
4.3.2 Nonactinides in Radiation Sources 4-63
4.3.3 Presence of Other Radionuclides 4-65

4.4 References 4-67

5. WASTE HAZARDOUS CHARACTERIZATION 5-1

6. INEL WASTE PROFILE SHEET FORMAT 6-1

6.1 Identification and Description 6-1

6.2 Storage 6-9

6.3 Waste Matrix Component Data 6-10

6.4 Radionuclide Contaminant and Alpha Activity Concentration Data 6-10

6.5 EPA Hazardous Contaminant Data 6-14

7. INFORMATION FOR USE WHEN NO OTHER WASTE DATA OR INFORMATION ARE AVAILABLE 7-1

8. WASTE PRESENT STORAGE LOCATION AND RETRIEVAL INFORMATION 8-1

8.1 SITE DESCRIPTION 8-1

8.1.1 INEL RWMC Site Background 8-1
8.1.2 Existing Alpha-contaminated Waste Capability 8-1
8.1.3 Sources of Alpha-contaminated Waste 8-1
8.1.4 Subsurface Disposal Area 8-4
8.1.5 Transuranic Storage Area 8-4
8.1.6 Support Facilities 8-4
8.1.7 Buildings 8-4
8.1.8 Railroad Spur 8-7
8.1.9 Stored Waste Examination Pilot Plant (SWEPP) (NDE/NDA Facility) 8-8
8.1.10 Trupact Loading Station (TLS) 8-8

8.2 Current Storage and Waste Characterization Information 8-8

9. REFERENCES 9-1

Appendix A—Detailed Information for Mixed and Non-mixed Alpha Low-Level Waste A-1

Appendix B—Detailed Information for Mixed and Non-mixed Transuranic Waste B-1

FIGURES

1-1. TSA Waste in Retrievable Storage 1-3

1-2. Typical TSA waste in boxes 1-4

1-3. Typical TSA waste in drums 1-4

2-1. Waste types at the INEL 2-2

2-2a. Generators of stored ALLW 2-3

2-2b. Generators of stored TRUW 2-3

2-3. Physical form of TSA waste 2-4

2-4a. Combustibility of ALLW 2-5

2-4b. Combustibility of TRUW 2-5

2-5. Waste matrix distribution of stored ALLW and TRUW 2-6

2-6. Known and suspect RH waste 2-8

2-7. Primary radionuclide activity distribution for TSA waste 2-9

2-8a. RCRA categories of mixed ALLW 2-10

2-8b. RCRA categories of mixed TRUW 2-10

3-1. Distribution of waste matrix by component 3-2

4-1. TSA Stored Waste Distribution by Alpha Activity Concentration Interval Number 4-24

4-2. TSA Stored Waste Distribution by Alpha Activity Concentration 4-25

4-3. Gamma spectrum of Am-241 parent at 15 years post purification 4-30

4-4. Gamma spectrum of Am-243 parent at 15 years post purification 4-31

4-5. Gamma spectrum of Np-237 parent at 15 years post purification 4-32

4-6. Gamma spectrum of Pu-236 parent at 15 years post purification 4-33

4-7. Gamma spectrum of Pu-238 parent at 15 years post purification 4-34

4-8. Gamma spectrum of Pu-239 parent at 15 years post purification 4-35

4-9. Gamma spectrum of Pu-240 parent at 15 years post purification 4-36

4-10. Gamma spectrum of Pu-241 parent at 15 years post purification 4-37

4-11. Gamma spectrum of Pu-242 parent at 15 years post purification 4-38

4-12. Gamma spectrum of Ra-226 parent at 15 years post purification 4-39

4-13. Gamma spectrum of Th-230 parent at 15 years post purification 4-40

4-14. Gamma spectrum of Th-232 parent at 15 years post purification 4-41

4-15. Gamma spectrum of U-233 parent at 15 years post purification 4-42

4-16. Gamma spectrum of U-235 parent at 15 years post purification 4-43

4-17. Gamma spectrum of U-238 parent at 15 years post purification 4-44

4-18. Gamma spectrum of heat source plutonium at 15 years post purification 4-45

4-19. Gamma spectrum of weapons grade plutonium at 15 years post purification 4-46

5-1. Distribution of identified RCRA contaminants 5-4

8-1. Map of the Transuranic Storage Area (TSA) of the RWMC at the INEL 8-2

8-2. Aerial Photo of RWMC. 8-3

8-3. Transuranic storage area at the RWMC 8-5

8-4. TSA Retrieval enclosure 8-6

8-5. Composite layout of TSA-1 extracted from Drawing Number 1375-BFG-705-2 8-9

8-6. Composite layout of TSA-2 extracted from Drawing Number 0980705-220 8-10

8-7. Composite layout of TSA-R extracted from Drawing Number 1570-RWMC-112-1 and subsequently updated. 8-11

8-8. TSA Waste in Retrievable Storage. 8-12

8-9. Typical TSA waste in boxes. 8-13

8-10. Typical TSA waste in drums 8-13

TABLES

2-1. Waste types stored at the INEL 2-2

2-2. Waste volume and mass by generator 2-3

2-3. Waste volume by physical form 2-4

2-4. Combustibility of waste 2-5

2-5. Distribution of primary waste matrix components 2-7

2-6. Waste suspect or known to contain remote-handled material 2-8

2-7. Inventory of primary radionuclides in TSA stored waste 2-9

2-8. RCRA categories of stored mixed ALLW and TRUW 2-10

2-9. Summary of special-case waste 2-11

2-10. Waste summary by identifier category 2-12

3-1. INEL alpha contaminated waste matrix composition summary by component 3-3

3-2. Chemical composition of waste constituents of the waste stored in the TSA 3-5

3-3. Chemical composition of the inert fraction of waste constituents stored in the TSA (expressed as a fraction of the inert chemicals) 3-7

3-4. Chemical composition of the inert fraction of waste constituents stored in the TSA (expressed as a fraction of the total constituent chemicals) 3-9

3-5. Particle size distribution and mean density of RWMC soil 3-11

3-6. Cation exchange capacity of RWMC soil 3-12

3-7. Mineral content of RWMC soil 3-13

3-8. Chemical composition of RWMC soil 3-14

3-9. Particle size distribution and mean density of Rocky Flats Plant soil 3-15

3-10. Cation exchange capacity of RFP soil 3-16

3-11. Mineral content of Rocky Flats Plant soil 3-17

3-12. Chemical composition of Rocky Flats Plant soil 3-18

4-1. Radionuclide summary for INEL TSA stored waste 4-3

4-2. Known remote handled waste in the ILTSF 4-9

4-3. TSA alpha low-level waste suspect as having some portion being remote handled 4-9

4-4. TSA transuranic waste suspect as having some portion being remote handled 4-10

4-5. Radionuclides and plutonium compounds for which data are reported 4-12

4-6. Nominal isotopic composition of plutonium compounds 4-12

4-7. Alpha activity due to one gram of TRU parent source material at 15 years post purification 4-14

4-8. Alpha activity due to one gram of non-TRU parent source material at 15 years post purification 4-14

4-9. Plutonium mixture summary for weapons grade plutonium (WG Pu/Pu-52) waste 4-16

4-10. Plutonium mixture summary for heat source plutonium (HS Pu/Pu-83) waste 4-18

4-11. Alpha activity at 15 year due to Pu-236 isotope 4-20

4-12. Alpha activity at 15 year due to Pu-238 isotope 4-20

4-13. Alpha activity at 15 year due to Pu-239 isotope 4-21

4-14. Alpha activity at 15 year due to Pu-240 isotope 4-21

4-15. Alpha activity at 15 year due to Pu-241 isotope 4-21

4-16. Alpha activity at 15 year due to Pu-242 isotope 4-22

4-17. Alpha activity at 15 year due to Am-241 isotope 4-22

4-18. TSA stored waste distribution by alpha concentration 4-23

4-19. TRU alpha activity concentration intervals 4-26

4-20. Total electron yield per gram parent material at 15 years post purification 4-28

4-21. Tabular data for gamma spectrum of Am-241 parent at 15 years post purification 4-30

4-22. Tabular data for gamma spectrum of Am-243 parent at 15 years post purification 4-31

4-23. Tabular data for gamma spectrum of Np-237 parent at 15 years post purification 4-32

4-24. Tabular data for gamma spectrum of Pu-236 parent at 15 years post purification 4-33

4-25. Tabular data for gamma spectrum of Pu-238 parent at 15 years post purification 4-34

4-26. Tabular data for gamma spectrum of Pu-239 parent at 15 years post purification 4-35

4-27. Tabular data for gamma spectrum of Pu-240 parent at 15 years post purification 4-36

4-28. Tabular data for gamma spectrum of Pu-241 parent at 15 years post purification 4-37

4-29. Tabular data for gamma spectrum of Pu-242 parent at 15 years post purification 4-38

4-30. Tabular data for gamma spectrum of Ra-226 parent at 15 years post purification 4-39

4-31. Tabular data for gamma spectrum of Th-230 parent at 15 years post purification 4-40

4-32. Tabular data for gamma spectrum of Th-232 parent at 15 years post purification 4-41

4-33. Tabular data for gamma spectrum of U-233 parent at 15 years post purification 4-42

4-34. Tabular data for gamma spectrum of U-235 parent at 15 years post purification 4-42

4-35. Tabular data for gamma spectrum of U-238 parent at 15 years post purification 4-44

4-36. Tabular data for gamma spectrum of heat source plutonium at 15 years post purification 4-45

4-37. Tabular data for gamma spectrum of weapons grade plutonium at 15 years post purification 4-46

4-38. Neutron yields for plutonium isotopes and ^{241}Am 4-49

4-39. Representative neutron yields per gram Pu 4-49

4-40. Neutron yields for uranium isotopes 4-50

4-41. Neutron yields for other nuclides 4-50

4-42. Average retrievably-stored waste neutron emission rates 4-52

4-43. Nuclide summary by shipment, volume, and decayed activity 4-54

4-44. Contact handled ALLW non-actinide activity 4-57

4-45. Contact handled TRUW non-actinide activity 4-58

4-46. Remote handled ALLW non-actinide activity 4-59

4-47. Remote handled TRUW non-actinide activity 4-60

4-48. Refined activity inventory for select nuclides 4-62

4-49. Nonactinides plus Ra-226 in radiation sources received from the Rocky Flats Plant 4-64

4-50. Estimated activities of C-14, Tc-99, and I-129 in stored waste 4-66

5-1. Historical TSA-stored waste hazardous information 5-2

5-2. Distribution of hazardous contaminants 5-3

5-3. Hazardous contaminants summary for TSA stored waste 5-5

6-1. Summary of waste identifier code and name 6-2

6-2. TRU alpha activity concentration intervals 6-12

8-1. Descriptions of waste containers expected to be retrieved from storage 8-14

8-2. Transuranic Storage Area (TSA) estimated waste inventory 8-16

8-3. TSA waste volume by storage location and content code 8-17

8-4. Cell location by container type, number, and volume 8-30

8-5. TSA disposal year by generator and container type 8-33

ACRONYMS

ACL	Analytical Chemical Laboratories
ALLMW	alpha low-level mixed waste
ALLW	alpha low-level waste; also referred to as a-LLW
ANL	Argonne National Laboratory
ANL-W	Argonne National Laboratory West
CH	contact-handled
CWS	Chemical Warfare Service
D&D	decontamination and decommissioning
DDW	decontamination and decommissioning waste
DOE	United States Department of Energy
EDF	Engineering Design File
EDTA	ethylenediaminetetraacetic acid
ENSDF	Evaluated Nuclear Structure Data File
EPA	United States Environmental Protection Agency
EWR	early waste retrieval
FFCA	Federal Facility Compliance Act
FRP	fiberglass-reinforced polyester
HEDL	Hanford Engineering and Development Laboratory
HEPA	high-efficiency particulate air
HLW	high-level waste
HS Pu	heat-source plutonium
ICPP	Idaho Chemical Processing Plant
ILTSF	Intermediate-Level Transuranic Storage Facility

IMWI	Idaho Mixed Waste Information (database)
IMWIR	Interim Mixed Waste Inventory Report (FFCA)
INEL	Idaho National Engineering Laboratory
LLMW	low-level mixed waste
LLW	low-level waste
LSA	low specific activity <100 nCi/g
MIBK	methyl-isobutyl ketone
MWIR	Mixed Waste Inventory Report (FFCA)
NDA	nondestructive assay
NWCF	New Waste Calcining Facility
PAN	passive-active neutron (assay system)
PCBs	polychlorinated biphenyls
PE	polyethylene
PTFE	Teflon
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposal
RFP	Rocky Flats Plant
RGW	research-generated waste
RH	remote-handled
Rn	radon
RPCs	residue process containers
SWBs	standard waste boxes
SWEPP	Stored Waste Examination Pilot Plant

TRAMPAC	Transuranic Package Transporter-II authorized methods for payload control
TRU	transuranium radionuclide
TRUMW	transuranic mixed waste
TRUW	transuranic waste
TSA	Transuranic Storage Area
TWDB	Transuranic Waste Database
U.S. EPA	United States Environmental Protection Agency
WAC	waste acceptance criteria
WG Pu	weapons-grade plutonium
WIPP	Waste Isolation Pilot Plant
WIPP WAC	Waste Isolation Pilot Plant Waste Acceptance Criteria

Waste Description Information for Transuranically-Contaminated Wastes Stored at the Idaho National Engineering Laboratory

1. INTRODUCTION

The Department of Energy is in the process of procuring private sector treatment services for transuranically-contaminated and mixed waste stored at the Idaho National Engineering Laboratory (INEL). This document was originally prepared in support of this DOE procurement strategy. This document provides summary and detailed description information for the transuranically-contaminated wastes stored at the INEL in terms of the physical, radiological, and chemical parameters defining the wastes and believed relevant for preparing treatment services and facilities proposals. This document updates and supplements the information previously provided in *Radiological, Physical, and Chemical Characterization of Low-Level Alpha-Contaminated Wastes Stored at the Idaho National Engineering Laboratory for Use in Conducting Feasibility Studies for Treatment Services*[1-1] and *Radiological, Physical, and Chemical Characterization of Transuranic Wastes Stored at the Idaho National Engineering Laboratory for Use in Conducting Feasibility Studies for Treatment Services*[1-2] and used for earlier private sector treatment service feasibility studies.[1-3]

This document provides current waste stream characterization information on the mixed and non-mixed alpha-contaminated low-level and transuranic waste stored at the INEL.

For the purposes of this document, the term *alpha low-level waste* refers to low-level waste containing, at the time of assay, less than or equal to 100 nCi/g of alpha-emitting transuranium radionuclides with half-lives greater than 20 years per gram of waste. The term *transuranic waste* refers to waste containing, at the time of assay, greater than 100 nCi/g of alpha-emitting transuranium radionuclides with half-lives greater than 20 years per gram of waste. The term *hazardous waste* refers to waste defined as hazardous according to the EPA.[1-4] Mixed wastes contain both radioactive and hazardous materials. Definitions for these and other selected terms used throughout this document are provided in Section 1.2

This document provides various summaries and rollups, as well as more detailed information. It is organized into nine sections. Following this introductory Section 1, Section 2 of this volume contains overall summary information describing the waste. Sections 3, 4, and 5 contain more detailed summary information for waste matrix, radionuclide, and hazardous characterization. Sections 6 and 7 contain descriptive format information related to the detailed waste information in Appendices A and B. Section 8 contains background and summary information on the current waste storage locations and relationships to waste characterization information. Section 9 lists references. Appendix A contains detailed information on the alpha-contaminated mixed and non-mixed low-level wastes. Appendix B contains detailed information on the alpha-contaminated mixed and non-mixed transuranic wastes. The detailed data in Appendices A and B are also available in electronic database format.

1.1 Background

From 1952 to 1970, wastes consisting of transuranically-contaminated solid wastes and low-level wastes were buried in a series of pits and trenches located within the Radioactive Waste Management Complex (RWMC) at the INEL. In 1970, burial of the transuranic-contaminated waste was discontinued and temporary above-ground storage initiated. The buried waste is located in the area now known as the Subsurface Disposal Area (SDA), and the storage location for the above-ground waste is at the Transuranic Storage Area (TSA) within the RWMC. The majority of the transuranic-contaminated waste is also believed contaminated with current EPA-regulated hazardous contaminants, and is therefore mixed waste under current regulatory definitions. This document provides summary and detailed characterization information for the above-ground transuranic stored (TSA) waste. Information concerning the buried waste is not included.

The wastes stored at the TSA are DOE laboratory and processing wastes primarily from Rocky Flats operations, but also include wastes from the INEL and various other DOE facilities. The wastes are typically heterogeneous mixtures of various solid materials including paper, cloth, plastic, rubber, glass, graphite, bricks, concrete, metals, nitrate salts, process sludges, miscellaneous components, and some absorbed liquids. Various RCRA[1-4] hazardous organics and metals, and alpha-emitting transuranic radionuclides (primary) are distributed throughout. Some TSCA[1-5] PCB-contaminated materials are present. These wastes are stored in drums, boxes, and bins. Most are capable of being contact-handled (radiation levels <200 mrem/hr), but some containers or contents may require remote handling due to high radiation levels.

Transuranic wastes stored within the TSA were generated by operations conducted for the U.S. Atomic Energy Commission (AEC), now the U.S. Department of Energy (DOE), and its successor agencies. The following facilities generated the majority of the TRU wastes placed in storage at the TSA: Rocky Flats Plant, Golden, Colorado; Mound Laboratory, Miamisburg, Ohio; Battelle Columbus Laboratories, Columbus, Ohio; Bettis Atomic Power Laboratory, West Mifflin, Pennsylvania; and Argonne National Laboratory-East, Argonne, Illinois. Small volumes of alpha-contaminated waste have also been generated by INEL operations. In addition, the INEL Initial Drum Retrieval (IDR) and Early Waste Retrieval (EWR) projects for characterizing buried waste contributed to waste placed in storage at the TSA.

Figure 1-1 shows placement of waste on a retrievable storage pad prior to bermed coverage. Figures 1-2 and 1-3 show representations of typical wastes packed in boxes and drums.

Data describing wastes stored at the INEL and other DOE facilities have been reported in several documents and databases. These have often been developed in response to regulatory reporting requirements such as those under the Federal Facility Compliance Act[1-6] and the Land Disposal Restriction Case-by-Case Extension requirements.[1-7] While informative in providing general physical, descriptive, and storage data, these information systems and documents generally lack sufficiently detailed information on the waste matrix materials chemical composition, radiological properties of the wastes, and quantification of hazardous constituents to enable treatment system and facility design. An objective of this waste description document is to provide information at a sufficiently quantitative level to be useable for

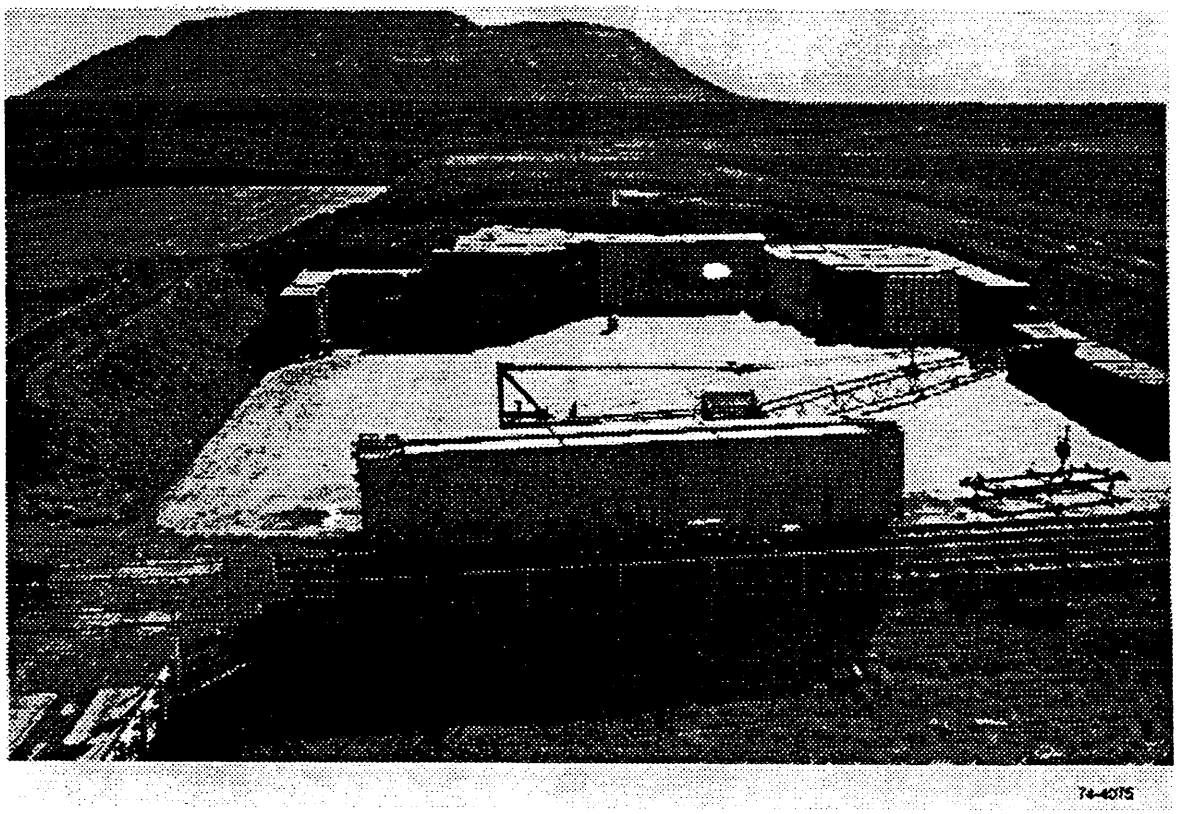

Figure 1-1. TSA Waste in Retrievable Storage.

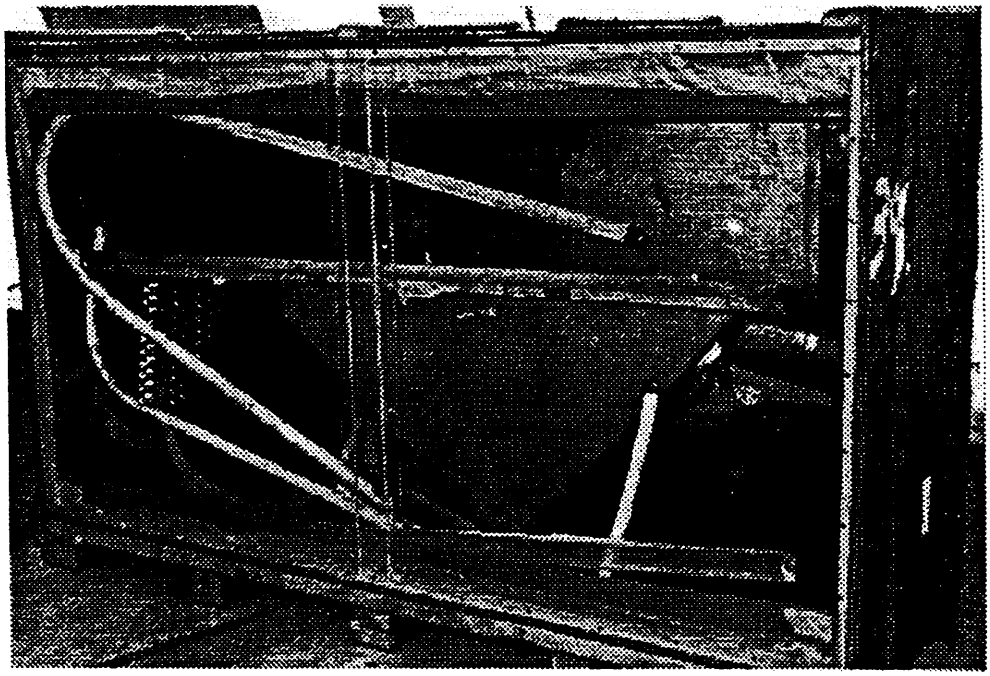

Figure 1-2. Typical TSA waste in boxes.

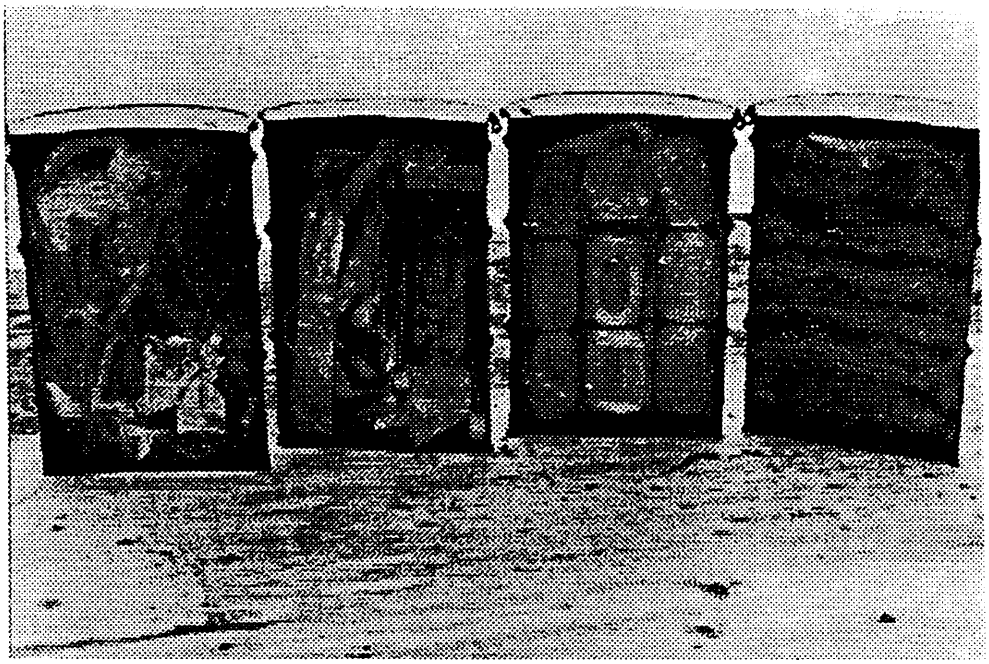

Figure 1-3. Typical TSA waste in drums.

developing preliminary designs and proposals for safe, efficient, and economical treatment of the INEL stored wastes. For this reason, information contained in this report provides baseline identification, storage, waste matrix composition, radiological, and hazardous properties of these wastes at a more detailed level.

The waste streams are defined at the content code level with waste parameter information derived from DOE waste management tracking databases, generator process knowledge, internal documents, and actual nondestructive and destructive sampling analysis of subsets of the wastes.

The identification information includes waste stream identifier codes, names, content codes, and descriptions. The storage information includes container types and quantity, waste volume, and mass. The waste matrix information includes waste mixture component materials masses, volumes, and estimates on material chemical compositions. The radiological constituents information includes estimates on alpha, beta, gamma, and neutron activity. The hazardous constituents information includes EPA-regulated RCRA and TSCA hazardous contaminants identification and estimated quantities.

The waste description information presented in this report is based upon current compilations of information available in the INEL waste management databases based primarily upon generators' shipping records, and supplemented by engineering evaluations of these records, other records, generator process knowledge, and nondestructive and destructive sampling analyses of subsets of the containerized wastes. The waste types in terms of locations, containers, bulk matrix materials, and total volumes and masses are believed to be reasonably well known from current information. The distributions of materials within and among containers is, however, much more variable and uncertain. The potential for unreported items exists.

The total amounts (mass/activity) of radionuclides and hazardous constituents are small in comparison to the bulk matrix waste materials. The presence and defined amounts of radionuclides and hazardous constituents have been conservatively estimated from available data using best engineering judgment. It should be clear, however, that there is much greater potential for error or uncertainty in defining the amounts of small-quantity constituents.

The information in this document represents the best available description of these wastes at this time for treatment system design and review purposes. It should be clearly recognized, however, that there are many sources of uncertainty and variability present, both from the heterogeneous nature of the wastes and from gaps in the original generator's records, which provide the majority of the information concerning the wastes. These uncertainties and variabilities must be accommodated within the treatment process system/facility design.

It is expected that additional information characterizing the wastes for treatment processing and licensing may be needed and can be obtained. However, the type and level of detail necessary will be dependent in large measure on the treatment system capability and can be best identified within the treatment system design process.

It is also expected that ongoing DOE efforts to improve the information databases for defining the existing waste description will continue, and updated/refined information will be made available as appropriate.

1.2 Definitions

For the purposes of this document, the following definitions apply and are consistent with DOE Order 5820.2A, Radioactive Waste Management.[1-8]

Alpha Low-Level Mixed Waste (ALLMW). Alpha low-level waste also containing hazardous constituents as defined by the Resource Conservation and Recovery Act.

Alpha Low-Level Waste (ALLW). Low-level waste containing, at the time of assay, less than or equal to 100 nCi/g of alpha-emitting transuranium radionuclides with half-lives greater than 20 years per gram of waste. The acronym a-LLW is also used to designate alpha low-level waste.

Contact-Handled Transuranic Waste (CH). Packaged transuranic waste whose external surface dose rate does not exceed 200 mrem per hour.

Hazardous Waste. Those wastes that are designated hazardous by EPA regulations in accordance with 40 CFR 261.[1-9]

High-Level Waste (HLW). The highly-radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing any solid waste derived from the liquid that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation. This definition is derived from 10 CFR 60.2[1-10] which states, "High-level radioactive waste or HLW means: (1) irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted."

Low-Level Mixed Waste (LLMW). Low-level waste also containing hazardous constituents as defined by the Resource Conservation and Recovery Act.

Low-Level Waste (LLW). Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent fuel or 11e(2) byproduct material as defined by DOE Order 5820.2A. Test specimens of fissionable material irradiated only for research and development, and not for the production of power or plutonium, may be classified as low-level waste provided the concentration of transuranic is less than 100 nCi/g of waste.

Mixed Waste. Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act, respectively.

Package. The packaging, together with its radioactive contents, as presented for transport. (10 CFR 71.4[1-10]/49 CFR 173.403[1-11]).

Packaging. The assembly of components necessary to ensure compliance with packaging requirements of 49 CFR Subpart 1.[1-11] It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shock. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging. (10 CFR 71.4[1-10]/49 CFR 173.403[1-11]).

Radioactive Waste. Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering costs of recovery.

Remote-Handled Transuranic Waste (RH). Packaged transuranic waste whose external surface dose rate exceeds 200 mrem per hour. Test specimens of fissionable material irradiated only for research and development purposes, and not for the production of power or plutonium, may be classified as remote-handled transuranic waste.

Transuranic Mixed Waste (TRUMW). Transuranic waste also containing hazardous constituents as defined by the Resource Conservation and Recovery Act.

Transuranic Waste (TRUW). Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than twenty years and concentrations greater than 100 nCi/g of waste at the time of assay. The terms transuranic-contaminated and alpha-contaminated are used interchangeably in this report

Transuranium Radionuclide (TRU). Any radionuclide having an atomic number greater than ninety-two.

Waste Container. Any receptacle (i.e., drums, boxes, bins) used to contain radioactive waste.

1.3 References

1-1. M. L. Apel, et al., *Radiological, Physical, and Chemical Characterization of Low Level Alpha Contaminated Wastes Stored at the Idaho National Engineering Laboratory*, EGG-RWMC-11189, Rev 0, March 1994.

1-2. M. L. Apel, et al., *Radiological, Physical, and Chemical Characterization of Transuranic Wastes Stored at the Idaho National Engineering Laboratory*, EGG-RWMC-11190, Rev 0, March 1994.

1-3. *Statement of Work for a Feasibility Study on Treatment Services for Alpha-Contaminated Mixed Low Level Wastes*, December 15, 1993, as included in RFP DE-RP07-94ID13278, *Private Sector Waste Treatment Facility Feasibility Study*, dated December 20, 1993.

1-4. Resource Conservation and Recovery Act of 1976, as amended, (Public Law 94-580).

1-5. Toxic Substance Control Act of 1976, as amended, (Public Law 94-469).

1-6. Federal Facility Compliance Act of 1992, as amended, (Public Law 102-386).

1-7. U.S. Department of Energy, *Land Disposal Restriction Case-by-Case Extension Application for Radioactive Mixed Wastes*, as submitted to the U.S. Environmental Protection Agency, October, 1991.

1-8. U.S. Department of Energy Order 5820.2A, "Radioactive Waste Management," Office of Defense Waste and Transportation Management, U.S. Department of Energy, Washington, D.C., September 26, 1988

1-9. Code of Federal Regulations, Title 40, "Protection of the Environment," Office of the Federal Register National Archives and Records Administration, July 1, 1991.

1-10. Code of Federal Regulations, Title 10, "Energy," Office of the Federal Register National Archives and Records Administration, July 1, 1993.

1-11. Code of Federal Regulations, Title 49, "Transportation," Office of the Federal Register National Archives and Records Administration, October 1, 1992.