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Radioactive Waste Shipments to Hanford Retrievable Storage from Westinghouse Advanced Reactors and Nuclear Fuels Divisions, Cheswick, Pennsylvania

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EXECUTIVE SUMMARY

During the next two decades the transuranic (TRU) waste now stored in the burial trenches and storage facilities at the Hanford Site in southeastern Washington State is to be retrieved, processed at the Waste Receiving and Processing Facility, and shipped to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico for final disposal. Approximately 5.7 percent of the TRU waste to be retrieved for shipment to WIPP was generated by the decontamination and decommissioning (D&D) of the Westinghouse Advanced Reactors Division (WARD) and the Westinghouse Nuclear Fuels Division (WNFD) in Cheswick, Pennsylvania and shipped to the Hanford Site for storage. This report characterizes these radioactive solid wastes using process knowledge, existing records, and oral history interviews.

Both the WARD and the WNFD operated facilities at Westinghouse Electric Corporation's Cheswick Site in western Pennsylvania. The WARD operated two nuclear fuel laboratories, the Plutonium Laboratory (Building 7) and the Advanced Fuels Laboratory (Building 8). These operations were complimented by the Plutonium Fuels Development Laboratory (PFDL), also in Building 8, which was operated by WNFD for the development and fabrication of Light Water Recycle Fuel. Not only was the site shared, but building, analytical services, license administration, safeguard compliances, security, health physics monitoring and many other day-to-day operating requirements also were shared between the two divisions. Section 2.0 provides further details of the physical plant, facility operations, process description, and current status.

The WARD/WNFD waste shipped to the Hanford Site for burial between 1980 and 1984 resulted from the D&D of the plutonium facilities at the Cheswick Site. The PFDL, operated by WNFD, had been producing light water reactor fuel on a development and pilot-plant scale for the past 10 years. The Plutonium Laboratory and the Advanced Fuels Laboratory were operated by WARD to fabricate fast breeder reactor fuel on a development scale. The Plutonium Laboratory provided process and fabrication development and characterization of mixed uranium-carbide fuel materials and fuel elements. Uranium-plutonium oxide fuel assemblies were fabricated in the Advanced Fuels Laboratory. The types and estimated quantities of waste resulting from the D&D of the WARD/WNFD facilities are discussed in detail in Section 3.0.

The D&D of the WARD/WNFD facilities required the removal of all process equipment, associated glovebox-type containment structures, glovebox ventilation ductwork and filtration systems, and associated service items. Before packaging, laboratory and process items were disassembled and then segregated into specific categories, which were derived from burial site and transportation criteria. Each item was then prepared for packaging according to the requirements of its classification. A detailed discussion of the packaging and handling procedures used for the radioactive waste shipped from the Cheswick to the Hanford Site is provided in Section 4.0.

Information on the radioactive wastes generated by the D&D of WARD and WNFD can be found in existing documents and databases. The most important of these are the Solid Waste Information and Tracking System database and Solid Waste Burial Records. Facility personnel also provide excellent information about past waste generation and the procedures used to handle that waste. Section 5.0 was compiled using these sources to characterize the transuranic wastes generated by WARD and WNFD.

Between 1980 and 1984, one thousand two hundred forty-five containers of radioactive solid waste generated during the D&D of the WARD and WNFD facilities were shipped to the Hanford Site to be stored. These containers represent more than 311,000 Kg of waste and occupy 927 m^3 of space. Section 5.0 provides an in-depth look at this waste including the following:

- Weight and volume of the waste
- Container types and numbers
- Physical description of the waste
- Radiological Components
- Isotopes present in waste
- Hazardous Constituents
- Current Storage/Disposal Locations.

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LIST OF TERMS

AEC	Atomic Energy Commission (now DOE)
AFL	Advanced Fuels Laboratory
CSB	corrugated steel boxes
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EBR-II	Experimental Breeder Reactor - II
Ecology	Washington State Department of Ecology
EMD	Electro-Mechanical Division (Westinghouse Electric Corporation)
EPA	U.S. Environmental Protection Agency
FFTF	Fast Flux Test Facility
FRP	Fiberglass Reinforced Polyester Plywood Box
FTR	Fast Test Reactor
GETR	General Electric Test Reactor
HEPA	High Efficiency Particulate Air
IAD	Immediate Action Directive
LLW	Low Level Waste
LMFBR	Liquid Metal Fast Breeder Reactor
MW	Mixed Waste
NRC	Nuclear Regulatory Commission
PFDL	Plutonium Fuels Development Laboratory
PVC	Polyvinyl Chloride
R-SWIMS	Richland Solid Waste Information Management Systems
RHO	Rockwell Hanford Operations
RCRA	Resource Conservation and Recovery Act
SDAR	Storage/Disposal Approval Record
SWBR	Solid Waste Burial Record
SWITS	Solid Waste Information and Tracking System
SWSDR	Solid Waste Storage and Disposal Record
TRU	Transuranic
WAC	Waste Acceptance Criteria
WARD	Westinghouse Advanced Reactors Division
WIPP	Waste Isolation Pilot Plant
WNFD	Westinghouse Nuclear Fuels Division
WRAP	Waste Receiving and Processing Facility

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1.0 INTRODUCTION

1.1 PURPOSE

This report characterizes the radioactive solid wastes sent to the Hanford Site by the Westinghouse Advanced Reactors Division (WARD) and the Westinghouse Nuclear Fuels Division (WNFD). These wastes were generated between 1980 and 1984, primarily as a result of the decontamination and decommissioning (D&D) of WARD and WNFD nuclear fuels facilities located at Cheswick, Pennsylvania. Previously published Hanford Site documents and the Solid Waste Information and Tracking System (SWITS) database have not differentiated between wastes sent to the Hanford Site from WARD and WNFD, but instead refer to all waste shipped from Cheswick after 1979 as originating at WARD.

The emphasis of this document is on solid wastes that are or will be managed by the Restoration and Upgrades Program at Westinghouse Hanford Company (Westinghouse Hanford). Solid waste, as defined in this document, is any containerized or self-contained material that has been declared waste. Characterization of the radioactive solid wastes sent to the Hanford Site by WARD and WNFD is of particular interest in the planning of transuranic (TRU) waste retrieval operations and the Waste Receiving and Processing (WRAP) facility because these wastes account for approximately 5.7% of the total volume of TRU waste currently stored at the Hanford Site.

It should be noted that radioactive solid waste generated during routine operations at Cheswick before 1980 also was sent to the Hanford Site. This waste may have been redesignated as originating from the Hanford Site facility that received the waste shipment from offsite. Alternately, it may have been shipped to the commercial nuclear waste disposal facility at the Hanford Site, now operated by U.S. Ecology. The U.S. Ecology records are incomplete, but there is documentation that the waste from Cheswick for the year 1979 was sent to the commercial disposal site rather than the U.S. Department of Energy (DOE) disposal facility.

1.2 BACKGROUND

Since 1944, the production of defense related materials at the Hanford Site and other offsite locations has generated radioactive wastes. The bulk of these wastes have been disposed of or stored in the 200 East and 200 West Area burial grounds and waste storage facilities.

Between 1944 and 1970, both TRU and low-level wastes (LLW) were disposed of in shallow land trenches with no attempt to segregate these materials by their chemical or radioactive natures. In 1970, the Atomic Energy Commission (AEC, now the DOE) directed that AEC sites segregate "waste with known or detectable contamination of transuranium nuclides" from other waste types (*Immediate Action Directive* [IAD] 0511-21 [Appendix A in Duncan 1991). Transuranic radionuclides are those with an atomic number greater than 92. The AEC further directed that these wastes be packaged and stored as contamination-free packages for at least 20 years. The 20-year interim storage was to allow time to study permanent disposal options for TRU-contaminated wastes.

The Immediate Action Directive (IAD) did not provide a detailed definition for TRU waste in 1970. AEC contractors implemented the IAD to the best of their ability with the instrumentation then available. In 1973, the *Atomic Energy Commission Manual* (AEC 1973) further defined TRU waste as material contaminated with certain alpha-emitting radionuclides with half-lives greater than 20 years and activity greater than 10 nCi/g. The radionuclides included were ^{233}U and its daughter products as well as plutonium and nuclides with the exception of ^{238}Pu and ^{241}Pu. In 1982, the TRU waste segregation limits were raised to 100 nCi/g and included ^{238}Pu and ^{241}Pu according to DOE Order 5820.1, *Management of Transuranic Material* (DOE 1982).

In addition to radioactive materials, a wide variety of chemicals can be found in the solid wastes that are stored or disposed of at the Hanford Site. Many of these chemicals are currently classified as dangerous or hazardous by the U. S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology). When dangerous or hazardous wastes are found in radioactive waste they are termed 'mixed' wastes (MW).

During the time much of the MW now located at the Hanford Site was generated, there were no definitions or regulations governing the storage, disposal, or documentation of MWs. In 1987, the DOE issued a mixed byproduct ruling stating that the hazardous components of mixed waste are regulated by the *Resource Conservation and Recovery Act* (RCRA) (DOE 1987). In November 1987 the EPA authorized Ecology to regulate the hazardous constituents of mixed waste at the Hanford Site (EPA 1991).

During the next two decades the TRU waste now stored in the burial trenches and storage facilities at the Hanford Site is to be retrieved, processed at the WRAP Facility, and shipped to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico for final disposal. Approximately 5.7 percent of the total volume of TRU waste to be retrieved for shipment to WIPP was generated at Cheswick by WARD and WNFD and transported to the Hanford Site for interim storage.

1.3 SOURCES

Data for this study were compiled from a variety of sources. Each of the major sources used is listed below with a few explanatory notes. Greater detail on each of the data sources can be found in the body of this document as the information from each is discussed.

Documents that describe pertinent WARD and WNFD processes and experiments, including *Westinghouse Plutonium Fuels Development Laboratory* (WNFD undated), *Decontamination and Decommissioning of the Westinghouse Nuclear Fuel Facility at Cheswick, PA* (Denero et al. 1984) and *Decontamination and Decommissioning of Advanced Reactors Fuel Laboratories at Cheswick, PA* (Adams et al. 1982), were used to determine the solid wastes that were generated at Cheswick and sent for storage at the Hanford Site between 1980 and 1984.

Documents that describe Waste Packaging and Handling Procedures, including the *Hanford Site Radioactive Solid Waste Acceptance Criteria* (WAC) (Willis and Triner 1991), were used to describe packaging and handling practices.

Interviews with former WARD and WNFD personnel were used to gather information regarding unusual waste contents and historical waste handling and packaging procedures.

Characterization data were primarily derived from the SWITS database. The SWITS database was created in 1991, primarily with the solid waste data from the Richland Solid Waste Information Management System (R-SWIMS). The SWITS database contains information about radioactive wastes, both TRU and LLW, buried or stored in the 200 Areas since 1970. Data in SWITS were originally taken from *Solid Waste Burial Records* (SWBR) and their replacements, the *Solid Waste Storage and Disposal Records* (SWSDR). Both SWBRs and SWSDRs, which will be jointly referred to as 'burial records' in this document, often contain supplementary forms such as shipment manifests, Nuclear Regulatory Commission (NRC) 741 Forms, etc.

Hazardous waste components were determined using information from the SWITS database, SWBRs, SWSDRs, and personnel interviews. Additional information was obtained from *Reactive and Unstable Chemicals in Transuranic Retrievable Waste at the Hanford Site*, WHC-EP-0603 (Reddinger 1992) and an internal report examining hazardous components of solid waste.

1.4 SCOPE

The major sections of this document and the topics they cover are outlined briefly below. Because of the number of tables and figures included in this report, they appear at the end of each section.

Section 2.0 provides a brief description of the Cheswick physical plant, its location, and the operations that occurred there. A short history of the significant WARD and WNFD operations and the facilities' current status follows this description.

Section 3.0 identifies the solid waste streams that arose from pertinent WARD and WNFD D&D activities. The types and amounts of solid waste that may have been generated from each of the waste streams are estimated.

Section 4.0 discusses the waste handling and packaging procedures used for WARD and WNFD wastes shipped to the Hanford Site. Historical changes in waste handling, packaging, and record keeping also are reviewed in this section.

Section 5.0 contains the results of a search for actual waste container data including database searches, literature reviews, and personnel interviews. This section describes what is known about the physical, radiological, and hazardous characteristics of the radioactive solid waste from WARD and WNFD.

Section 6.0 lists the references used in the compilation of this report.

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2.0 DESCRIPTION OF THE SITE

Both the WARD and the WNFD operated facilities at Westinghouse Electric Corporation's Cheswick Site in western Pennsylvania. The WARD operated two nuclear fuel laboratories, the Plutonium Laboratory (Building 7) and the Advanced Fuels Laboratory (Building 8). These operations were complimented by the Plutonium Fuels Development Laboratory (PFDL), also in Building 8, which was operated by WNFD for the development and fabrication of Light Water Recycle Fuel. Not only was the site shared, but building, analytical services, license administration, safeguard compliances, security, health physics monitoring and many other day-to-day operating requirements also were shared between the two divisions.

2.1 LOCATION

Westinghouse Electric Corporation's Cheswick Site is located in the southwest section of Pennsylvania in Allegheny County. Situated about 16 km (10 mi) northeast of Pittsburgh in Harmar Township, the Site is bounded by the town of Cheswick to the west and the borough of Acmetonia to the South. The Site is situated on a plot of approximately 50.6 ha (125 acres) and is about one mile from the Allegheny River at an elevation of 61 m (200 ft) above the river level. The area around the Site is primarily hilly with a rural area to the north and commercial and residential areas to the east, south, and west. Figure 2-1 shows the general location of the Cheswick Site.

The Cheswick Site is a multi-building complex that, in the 1970's and early 1980's, consisted of ten separate buildings. The Site included manufacturing facilities for nuclear components, nuclear fuel fabrication facilities, nuclear experimental laboratory facilities, and nuclear decontamination facilities. A layout of the buildings is shown in Figure 2-2. The WARD and WNFD occupied Buildings 7 and 8, located at the south end of the Cheswick Site. The following list indicates the type of activity in the remaining buildings during this period:

Building No. 1	Electro-Mechanical Division (EMD) offices
Building No. 2	EMD Manufacturing
Building No. 3	EMD Offices
Building No. 4	EMD Manufacturing
Building No. 5	EMD Manufacturing - Valve Product
Building No. 6	Vacant
Building No. 9	EMD Pump Repair
Building No. 10	WNFD, PFDL Receiving and Security Building.

2.1 PHYSICAL PLANT

Building 7 areas occupied by WARD and the entire Building 8 were decontaminated and decommissioned beginning in 1979. This section describes these buildings and the facilities they contained.

2.2.1 Building 7

In 1966, the WARD Plutonium Laboratory was established within Building 7 for the purpose of process and fabrication development and characterization of mixed uranium-plutonium carbide fuel materials and fuel elements.

Building 7 was a two-story building with offices located on the second floor. Contained on the ground floor were the laboratory, cleaning room, sodium room, tool crib, dark room, locker room, and an office. A floor plan for Building 7 is shown in Figure 2-3.

Part of Building 7 was also occupied by the WNFD, including a Uranium Oxide Laboratory. This laboratory did not contribute to the D&D waste sent to the Hanford Site.

2.2.2 Building 8

The PFDL was a three-million dollar facility that was used primarily to develop the production processes necessary for the economical fabrication of plutonium-containing fuel elements. It consisted of approximately 1,488 m^2 (16,000 ft^2) on the ground floor of Building 8 that was used for the fabrication of uranium-plutonium fuels. The second floor, or penthouse, provided 595 m^2 (6,400 ft^2) of floor space for facility support systems such as duct and high-efficiency particulate air (HEPA) filters, ventilation fans, a cooling water recirculatory system, and process acid make-up tanks. Figure 2-4 shows the general arrangement of the ground floor of Building 8 as it was arranged at the onset of the D&D activities. The WNFD operations occupied all of the facility with the exception of Area J, which was a former WARD laboratory, the Advanced Fuels Laboratory.

A brief description of Building 8, Areas A through J (see Figure 2-4), is provided below (WNFD undated).

1. Chemical Processing Laboratory
   This area served two purposes: chemical conversion of plutonium nitrate solution to plutonium dioxide powder and recovering and recycling plutonium contained in the various waste materials generated throughout the plant.

2. Ceramic Processing Laboratory
   In this area, plutonium dioxide powder was blended with uranium dioxide powder. Facilities for pressing pellets, sintering at high temperature, grinding, inspecting, and tube loading were provided.

3. Welding Laboratory
   Equipment for inserting and welding plugs into the ends of the fuel pellet tubes was located here, as was the vibratory compactor equipment.

4. Inspection Area
   This is where completed fuel rods were inspected to ensure their integrity.

5. Metallurgical Laboratory
Various microscopic examinations of fuel pellets, weld specimens, and powder samples were conducted in this laboratory to ensure consistent quality during production.

6. Process Development Laboratory
This area was used for conducting experimentation and development on promising chemical process techniques.

7. Instrumental Analysis and Analytical Laboratories
These two laboratories provided self-sufficient capability for chemical and instrumental analyses of the samples required for quality control.

8. Equipment Mock-Up Area
All equipment which was to be placed within a glovebox was assembled and tested in this area to ensure proper operation.

9. Shipping and Receiving Area
Materials and equipment entered and left the facility through this area.

10. Fast Breeder Reactor Oxide Facility
This laboratory, which was operated by WARD, was used for fabricating small, specialized fuel rods, which were to be tested in support of development work on the fast breeder reactor.

2.3 OPERATIONS

A general discussion of the operations at the WARD and WNFD can be found in the sections below. A summary of the principal activities at WARD and WNFD during the period from 1975 to 1980 is provided in Table 2-1.

2.3.1 Nuclear Fuels Division

The major activities of the Cheswick Site's WNFD, which began operations in the late 1960's, are listed below:

- Fabrication of demonstration fuel rods
- Development of equipment and technologies for the fabrication of advanced plutonium-bearing fuels and fuel rod assemblies
- Production of light water and fast breeder reactor fuels on a development and pilot-plant scale
- Fabrication process of a full scale recycle fuels plant
- Analytical and radiochemistry process development

- Application of modern safeguards and security systems
- Scrap recovery operations.

In the WNFD operations, plutonium oxide (PuO_2) powder and natural uranium oxide (UO_2) powder were weighed and mechanically blended to produce a homogeneous powder. The plutonium fissile content of the mixed oxide material ranged from 1.5 to 3.5 percent for most light water reactor applications. After blending, the mixed oxide powder was prepressed (slugged) into large tablets that were granulated to form a coarse powder suitable for further processing. The granulated powder was mixed with a die lubricant and then pressed into green (unsintered) fuel pellets approximately 1.0 cm (0.4 in) in diameter and 1.8 cm (0.7 in) long. These pellets were sintered at a high temperature in a reducing atmosphere and, after cooling, were ground to a specified diameter. The ground pellets were inspected for proper dimensions, density, and chemical properties. Fuel rods were then loaded by inserting the required quantity of inspected and accepted pellets into a Zircaloy tube welded at one end. The fuel rods were sealed by welding a plug onto the open end. Inspection of fuel rods for integrity (by X-ray and leak checking) and dimensional compliance completed the fabrication process.

Scrap pellets, powder, and other process wastes were processed through a scrap recovery operation to reclaim the plutonium. The material was dissolved in heated nitric acid to produce a solution containing plutonium, uranium and other impurities. This solution was fed through ion-exchange columns to recover the plutonium as $Pu(NO_3)_4$. Plutonium oxalate then was precipitated from the nitrate solution and converted to PuO_2 for recycling into the fuel pellet manufacturing process (Denero et al. 1984).

In 1979, the Cheswick Site's WNFD facilities were closed, and activities to decontaminate the facilities so that they could be released for unrestricted use began.

2.3.2 Advanced Reactors Division

The WARD Plutonium Laboratory (Building 7) was established in 1966 for process and fabrication development and characterization of mixed uranium-plutonium carbide fuel materials and fuel elements. Sodium bonded fuel pins were fabricated from 1967 and 1969 for irradiation testing in the General Electric Test reactor (GETR) and in the Experimental Breeder Reactor-II (EBR-II).

In 1969, the AEC decided to phase out support of carbide fuels for the Liquid Metal Fast Breeder Reactor (LMFBR) applications and emphasize the development of oxide fuels. The Plutonium Oxide Laboratory was developed in Building (8) PFDL to support this work. Several uranium, plutonium oxide fuel assemblies were fabricated in this facility between 1969 and 1973 for irradiation testing in EBR-II.

Extensive facility modifications were made by WARD after it became a participant in the LMFBR Advanced Fuels Program in 1974. These modifications were made primarily in the Building 8 fabrication area to allow the fabrication of uranium, plutonium carbide fuel for testing in EBR-II.

In the late 1970's facility modifications were made to increase throughput and provide the capability for the fabrication of longer Fast Test Reactor (FTR) type fuel pins. In addition, a separate fuel fabrication facility was established for the fabrication of blanket fuel rods. Blanket rod assemblies were tested at both EBR-II and FTR.

With the announcement that the DOE had decided to conclude test fuel fabrication activity at the WARD Fuel Fabrication Facilities late in 1979, a decision was made to completely D&D these facilities simultaneously with the WNFD facilities.

2.4 DESCRIPTION OF THE DECONTAMINATION AND DECOMMISSIONING PROCESS

The D&D process operations that took place at the WARD and WNFD facilities are described below.

2.4.1 Westinghouse Advanced Reactor Division Decontamination and Decommissioning Work Scope

The general work scope for the D&D of the WARD Fuel Laboratories at the Cheswick Site is described below. The D&D activities were accomplished in the following four phases.

2.4.1.1 Phase 1

- Preparation of documents and necessary paperwork.
- Packaging and shipping of all special nuclear materials in an acceptable form to a reprocessing agency.

2.4.1.2 Phase 2

- Decontamination of all facilities, gloveboxes, and equipment.
- Loading of generated waste into bins, barrels, and strong wooden boxes.

2.4.1.3 Phase 3

- Shipping of all bins, barrels, and boxes containing waste to the designated burial site.
- Removal of utility services from the laboratories.

2.4.1.4 Phase 4

- Final survey of remaining facilities and certification for nonrestricted use.

- Preparation of final report.

These four phases of work were conducted in accordance with applicable regulations for D&D of research facilities and applicable regulations for packaging, transportation, and burial and storage of radioactive materials. The final result was that the Advanced Fuel Laboratories met the requirements of the American Natonal Standards Institute (ANSI 1978) and were released for unrestricted use.

In addition to the four D&D phases briefly outlined above, WARD shared the D&D operations of the Chemistry Laboratory in Building 8 with WNFD. The D&D of this facility was included in the work scope discussed below in Section 2.4.2.

2.4.2 Westinghouse Nuclear Fuels Division Decontamination and Decommissioning Work Scope

The D&D activities performed by WNFD were done according to a series of detailed plans and procedures. These guidance documents were written to ensure continuity as the work progressed. A general summary of WNFD D&D operations follows.

Clean, nonessential equipment and services were removed from the laboratory as a preventative measure against contamination when full decommissioning operations began. Contaminated equipment was removed from gloveboxes and packaged for disposal. The interiors of the empty gloveboxes and hoods were decontaminated using special detergents and painted to fix any residual contamination in place. Concurrent with these activities, part of the facility was rearranged to accommodate a dismantling room. This dismantling room was used for cutting or sectioning standard-type gloveboxes and other contaminated items, allowing greater contamination control than in situ operations. In addition, special procedures were required to handle some nonstandard enclosures and equipment (such as the gloveboxes containing large, heavy storage tanks) and the sintering furnace complex.

Upon completion of these activities, efforts were concentrated on the facility. Air ducts, filters, and piping were sectioned in place and packaged for disposal. The Penthouse area contained potentially contaminated exhausts, ventilation ducts, and filtration units, which required special procedures for surveying and handling, particularly in the removal of large equipment items, such as the cooling water system and acid storage tanks. The dismantling room was then decontaminated and decommissioned. The final facility decommissioning activity was the removal of the suspect waste system with its associated underground tanks and piping.

2.5 CURRENT STATUS

The Cheswick Site is now occupied by Westinghouse EMD and no longer fabricates plutonium-containing fuel elements. Building 7 was decontaminated and decommissioned and converted to other use. After the D&D of Building 8, it was returned to unrestricted use and then razed. The area that was formerly occupied by Building 8 is now an empty field.

Figure 2-1. General Site Location.

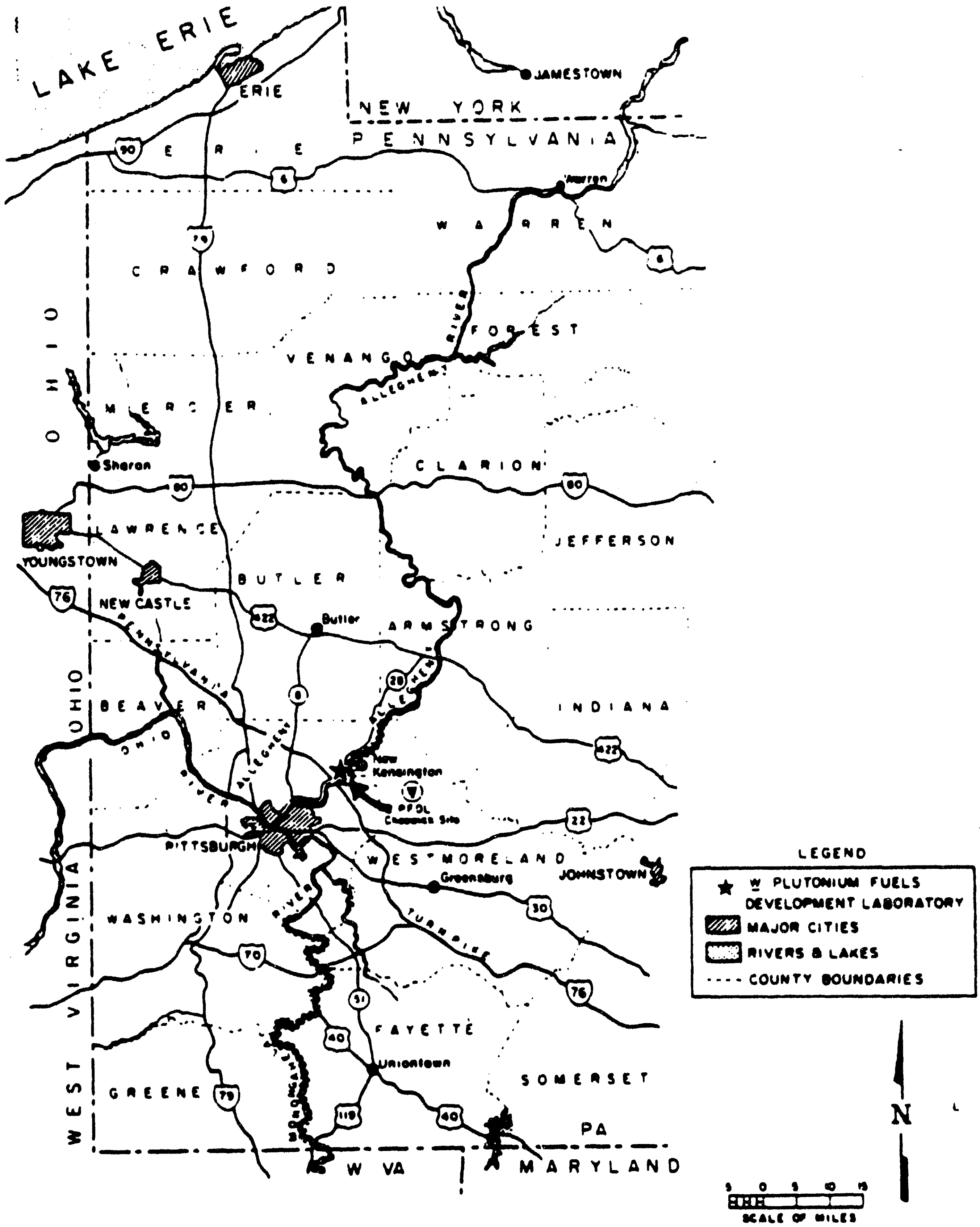
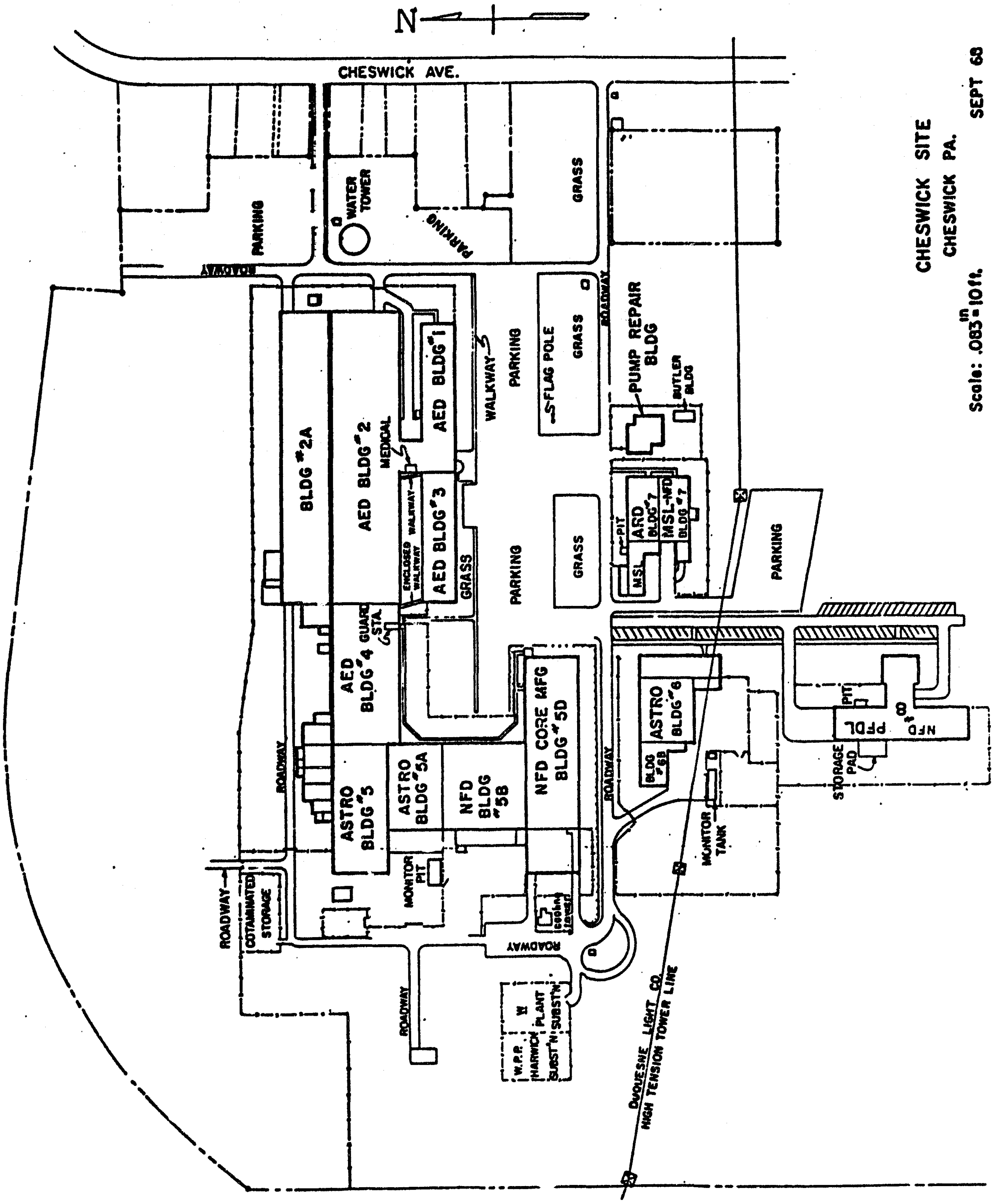


Figure 2-2. Map of the Cheswick Site.



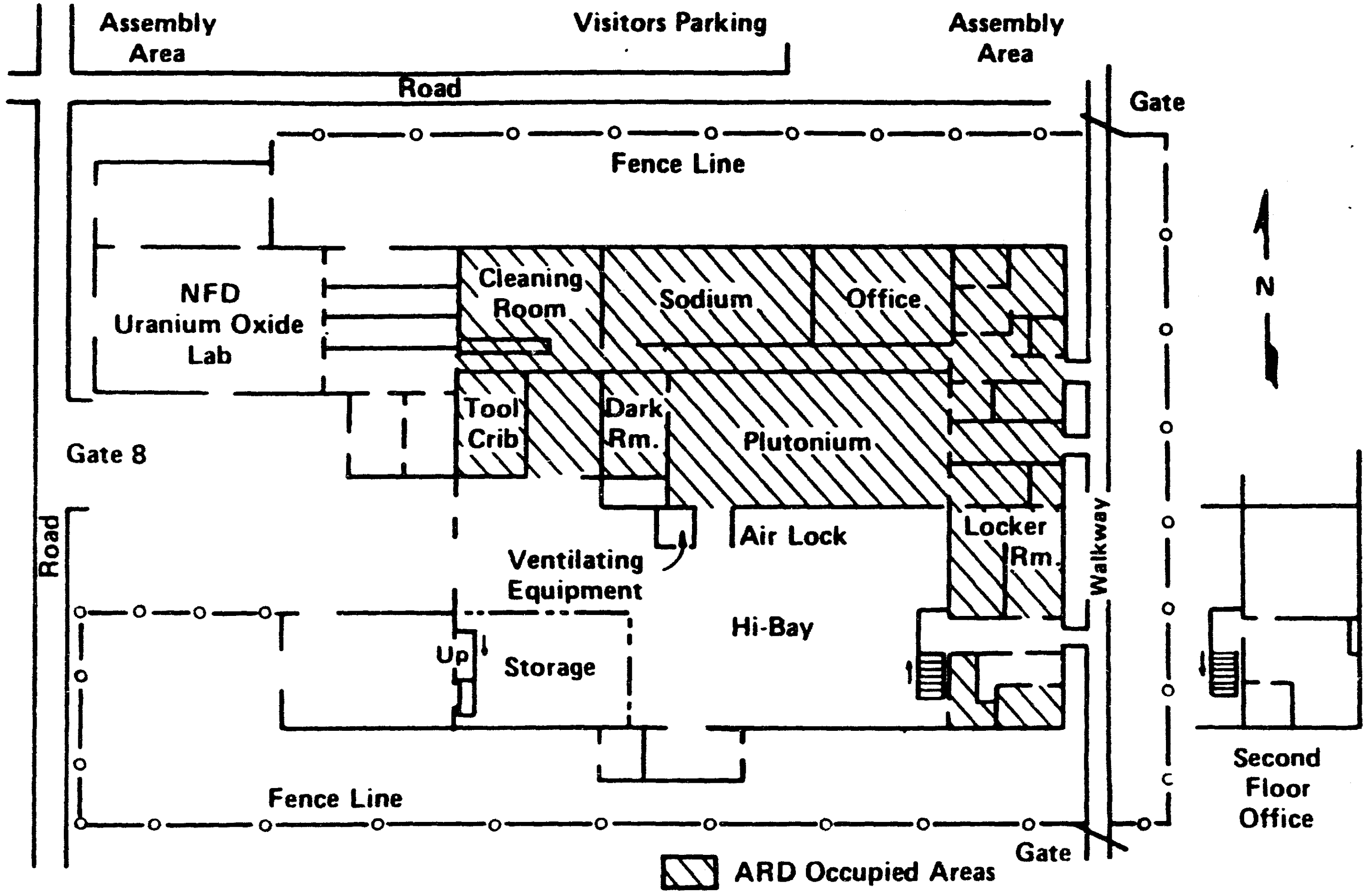


Figure 2-3. Plutonium Laboratory (Building 7) Floor Plan.

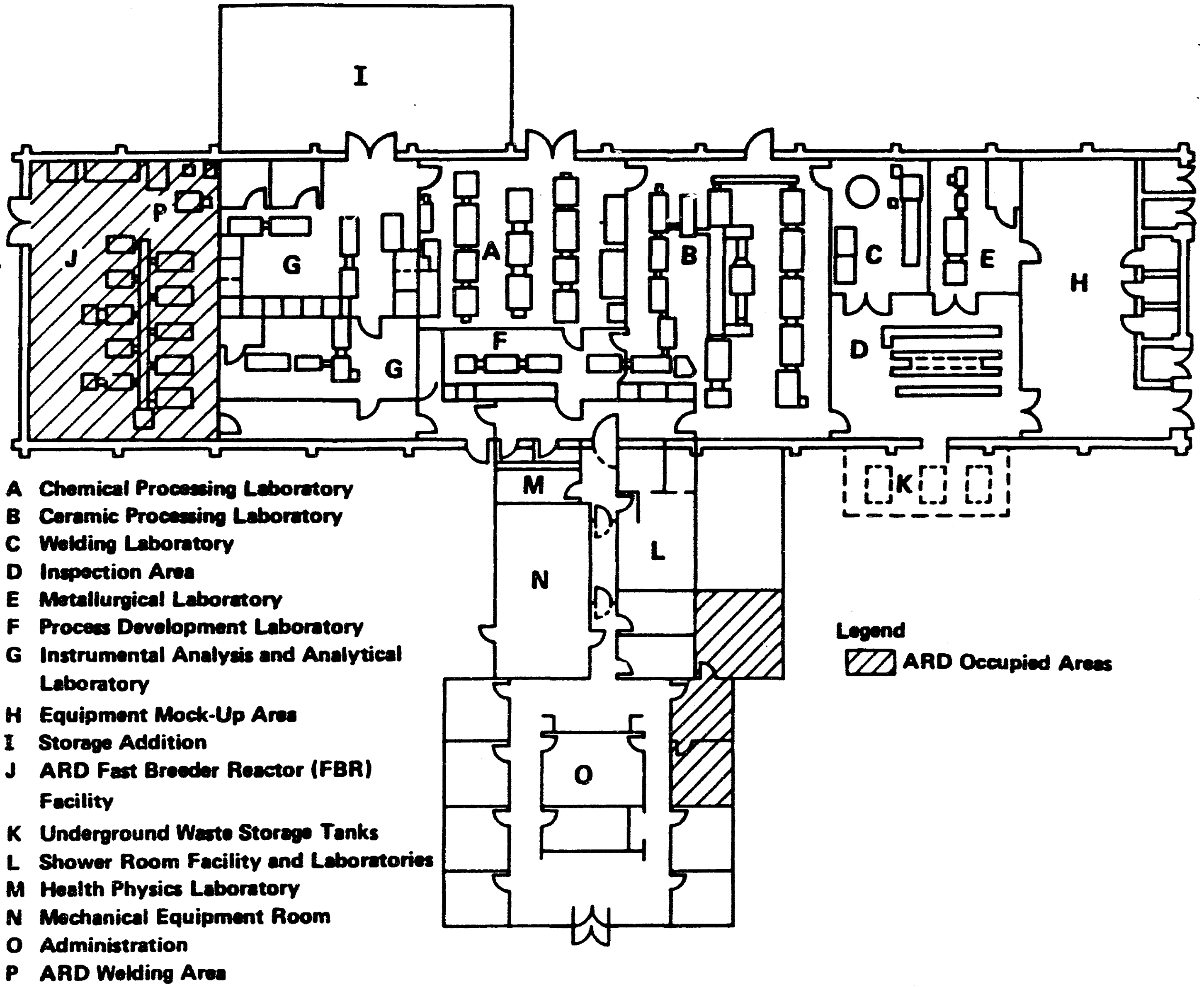


Figure 2-4. PFDL (Building 8) Floor Plan.

Table 2-1. Summary of Principal Operations.*

1975	During this year, WNFD fabricated the fuel for the TRINO power reactor in Italy. This plutonium had the highest Pu^{241} content and, therefore, had the highest radiation levels associated with it. WARD converted their facility to carbide fuel fabrication and began fabrication work with plutonium towards the end of the year.
1976	WNFD did not fabricate any fuel during the year. Shielding material in the form vinyl-lead and leaded glass was added to many WNFD boxes. WARD continued fabrication of carbide fuel pins for test pin radiation experiments.
1977	WNFD fabricated fuel for the Beznau power reactor in Switzerland during the year. WARD continued fuel pin fabrication through the year. A study was undertaken about mid-year to identify and quantify the radiation exposure associated with each step in the WARD operation.
1978	WNFD did not fabricate any fuel during the year. WARD fabricated a relatively large quantity of fuel during the year. About mid-year WARD converted over to using the higher exposure level plutonium.
1979	During the first three quarters, WNFD concentrated on gross cleanup of gloveboxes as part of the facility decontamination effort. The last quarter primarily involved a scrap recovery run in preparation for returning material. WARD continued fabrication of fuel pins through mid-year using a higher burnup plutonium fuel. Towards the end of the year WARD operations began to focus on cleaning gloveboxes and packaging fuel for shipping off-site.
1980	The bulk of the fuel inventory was removed in the first quarter of 1980. Gross contamination and removal of gloveboxes in the WARD laboratory in Building 8 took place during the last three quarters.

*Adams et al. 1982.
WARD = Westinghouse Advanced Reactors Division
WNFD = Westinghouse Nuclear Fuels Division.

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3.0 WASTE GENERATION

The WARD/WNFD waste shipped to the Hanford Site for burial between 1980 and 1984 resulted from the D&D of the plutonium facilities at the Cheswick Site. The PFDL, operated by WNFD, had been producing light water and fast breeder reactor fuel on a development and pilot-plant scale for the past 10 years. The Plutonium Laboratory and the Advanced Fuels Laboratory were operated by WARD. The Plutonium Laboratory provided process and fabrication development and characterization of mixed uranium-carbide fuel materials and fuel elements. Uranium-plutonium oxide fuel assemblies were fabricated in the Advanced Fuels Laboratory.

In addition to the D&D wastes shipped to the Hanford Site in the early 1980's, waste shipments resulting from routine operations were sent to the Hanford Site between 1975 and 1979. These shipments are summarized in Table 3-1. These wastes were either redesignated as waste from the facility that received the waste or shipped to the commercial nuclear waste disposal facility on the Hanford Site, and are not designated as WARD/WNFD waste in the SWITS database. WARD wastes typically averaged about 10 percent of the total waste as reported in Table 3-1 (Adams et al. 1982); it is assumed the remaining 90 percent resulted from WNFD activities.

Waste items generated during the D&D program at WARD and WNFD were classified as 'contaminated' or 'clean' in accordance with the facility's operating license and the criteria specified for releasing materials for uncontrolled use. 'Contaminated' waste was further classified as TRU or non-TRU depending on whether the concentration of the alpha emitting transuranium contaminants was greater than 10 nCi/g or less than 10 nCi/g, respectively (Adams et al. 1982).

Noncombustible, solid radioactive wastes consisted of contaminated materials and equipment (such as gloveboxes, hoods, ductwork, etc.) and other miscellaneous (such as filters, residues resulting from air and water purification, ion-exchange beds, rags, etc.) generated during the D&D process (Adams et al. 1982). Combustible waste items included sheeting, gloves, pre-filter media, polyethylene bottles, shoecovers, and decontamination wipes. Other contaminated wastes include paper, wood, plastic, metal, floor sweepings, and similar items (Adams et al. 1982).

Shipments of TRU waste from WARD to the Hanford Site are summarized in Table 3-2. Wastes were shipped in DOT 17C drums, M-III bins, and Fiberglass Reinforced Polyester (FRP) Plywood Boxes. Eleven Poly Panther and 21 Super Tiger shipping cask shipments were made to the DOE/Richland, Washington burial site from WARD beginning on September 29, 1980 and ending on October 6, 1981. According to a WARD D&D report, (Adams et al. 1982) the shipments consisted of 232 drums, 35 bins (plus one non-TRU bin), and 21 FRP plywood boxes with a total burial volume of 463 m^3 (16,530 ft^3) and 1,006 Ci of radioactivity.

A summary of TRU waste shipments from WNFD to the Hanford Site is provided in Table 3-3. TRU waste shipments consisted of 678 drums, 56 corrugated steel boxes (CSBs), and two FRP plywood boxes, with a total burial volume of 517.6 m^3 (18,487 ft^3) and 6,014 Ci of radioactivity.

The non-TRU waste shipped from WNFD to the Hanford Site is summarized in Table 3-4. Two non-TRU waste shipments were made from WNFD. They consisted of a total of 220 55-gallon drums with a volume of 46.2 m^3 (1,650 ft^3) and 33.5 mCi of radioactivity (Denero et al. 1984).

Table 3-1. Summary of Waste Shipment to the Hanford Site from Cheswick Fuel Laboratories[1]--1975 through 1979[2].

Year	Month	Volume (ft^3)	Containers	Type of Material
1975	November	315	42 drums	TRU waste
	December	324.5	37 drums, 5 cartons	TRU, U waste
Annual Total (2 shipments)		639.5 ft^3	79 drums, 5 cartons	
1976	February	315	42 drums	TRU waste
	March	329.6	36 drums, 4 boxes	TRU waste
	April	303.8	35 drums, 4 boxes	TRU waste
	May	315	42 drums	TRU waste
	June	315	42 drums	TRU waste
	November	299.1	30 drums, 7 boxes	TRU waste
Annual Total (6 shipments)		1877.5 ft^3	227 drums, 15 boxes	
1977	February	315.0	42 drums	TRU waste
	June	315.2	30 drums, 5 boxes	TRU waste
	October	310.2	32 drums, 9 boxes	TRU waste
Annual Total (3 shipments)		940.4 ft^3	104 drums, 14 boxes	
1978	March	315	42 drums	Pu, U
	July	315	42 drums	Pu, U, Th
Annual Total (2 shipments)		630	84 drums	
1979	September	315	42 drums	TRU waste
Annual Total (1 shipment)		315	42 drums	

[1]Not designated as WARD/WNFD.
[2]Adams et al. 1982.
TRU = Transuranic.

Table 3-2. Summary of WARD-designated TRU Waste Shipments from WARD* made to the U.S. Department of Energy Richland Burial Site.

Package	Quantity Shipped	Waste Volume (ft^3)	Burial Volume[1]	Quantity		Activity (ci)
				Pu	U	
U.S. Department of Transportation 17C (55-gallon drums)	232	1,539[2]	1,740	442	935	517
M-III Bins	35[3]	4,375[4]	8,820[5]	416	378	484
Fiberglass Reinforced Polyester Plywood Box	21	2,869[6]	5,970	4	6	5
Total	288	8,783	16,530	862	1,319	1,006

NOTES:

1. Based on external dimensions of burial package.
2. Based on 4.1 ft^3 per prefoamed drum and 7.5 ft^3 per unfoamed drum.
3. In addition, 1 M-III bin containing 125 ft^3 of nontransuranic waste was shipped.
4. Based on 125 ft^3 per M-III bin.
5. Based on 252 ft^3 per corrugated steel box (CSB).
6. Based on dimensions of maximum envelope occupied by glovebox.

*Adams et al. 1982.
TRU = transuranic
WARD = Westinghouse Advanced Reactors Division.

Table 3-3. Summary of WNFD-Designated TRU Waste Shipments from WNFD to the Hanford Site for Burial.*

Package	Quantity Shipped	Weight Shipped (lbs)	Volume Shipped (ft³)	Quantity (g)		Activity (Ci)
				Pu	U	
55-Gallon Drums	678	136,708	5,085	847	85	2,702.1912
Corrugated steel boxes	56	269,077	12,712	1,120	41	3,252.8537
Fiberglass Reinforced Polyester Plywood Boxes	2	9,868	690	56	36	59.0140
Total	736.0	415,653	18,484	2,023	162	6,014.0589

*Denero et al. 1984.
TRU = transuranic
WARD = Westinghouse Advanced Reactors Division.

Table 3-4. Summary of Non-TRU Waste Shipment from WNFD Cheswick Site to the Hanford Site for Burial.*

Shipment	Quantity (55-Gallon Drums) Shipped	Radioactivity Shipped (mCi)	Weight Shipped (lbs)	Volume Shipped (ft³)
1	150	46.11278	19,157	1125
2	70	46.12186	14,359	525
Total	220	92.23464	33,516	1650

*Denero et al. 1984.
TRU = transuranic
WARD = Westinghouse Advanced Reactors Division.

4.0 SOLID WASTE HANDLING PRACTICES AND PROCEDURES

The D&D of the WARD/WNFD facilities required the removal of all process equipment, the associated glovebox-type containment structures, the glovebox ventilation ductwork and filtration systems, and associated service items. Before packaging, laboratory and process items were disassembled and then segregated into specific categories which were derived from burial site and transportation criteria. Each item was then prepared for packaging according to the requirements of its classification. The waste classification system and packaging procedures for approved packages are described below.

4.1 WASTE CLASSIFICATION SYSTEM

Each item in the WARD and WNFD facilities was categorized as clean, non-TRU (low specific activity), or TRU depending upon the level of contamination; some items were decontaminated to change their category. The clean items required no additional segregation or packaging before disposal at a sanitary landfill.

Retrievable storage at the DOE's Hanford burial site required the combustible waste items to be segregated from the noncombustible items. Waste items with both combustible and noncombustible components not easily separable were treated as combustible waste. This requirement applied to all TRU waste.

Additionally, use of the Super Tiger Model 6400 overpack required that hard and soft wastes be segregated. Hard waste items were defined as those items rigid enough to be forced through the plastic bagging materials unless suitably blunted or padded. Soft waste items were defined as items that can be compressed to conform to the package without padding. Waste items with both hard and soft components that were not easily separable were treated as hard waste.

Special case items that included liquids (i.e., aqueous and organic) and poisons (eg., mercury) were set aside for special handling procedures (Denero et al. 1984).

Figure 4-1 presents the waste management scheme for the D&D program at the WARD Plutonium Laboratories (Adams et al. 1982). The waste from the WNFD was managed in the same manner, with the exception that CSBs were used in place of the M-III steel bins (Denero et al. 1984).

4.2 HANDLING AND PACKAGING OF TRU WASTE

The following containers were used for the disposal of the TRU waste resulting from the D&D of the Cheswick Site WARD and WNFD facilities: DOT 17C or 17H galvanized 55-gallon drum, the FRP box, the M-III steel storage bin, and the corrugated steel box (CSB). The containers were overpacked by N-55, the Super Tiger, or the Poly Panther container. The types of waste packaged in these containers and the procedures used during the packaging process are described in this section.

4.2.1 55-Gallon Drums

Combustible (i.e., soft) waste items from WARD and WNFD included sheeting, gloves, paper, prefilter media, polyethylene bottles, shoe covers, and decontamination wipes. These items were double-bagged in 12-mil thick, heat-sealed, polyvinyl chloride (PVC) plastic bagging material and placed inside the drum with a 12-mil thick, heat-sealed PVC drum liner.

Noncombustible (i.e., hard) waste items from WARD and WNFD, such as tools and equipment from gloveboxes and hoods, or parts of the piping and ductwork from the production process, were wiped or brushed clean. Sharp edges or protrusions, which might tear the plastic bagging, were padded with polyethylene foam, taped and double-bagged in 12-mil, heat-sealed PVC bagging material. Unvented aerosol cans used for spray paint and window cleaner were also disposed of as waste. Pipe, tubing, and similar objects were bundled into packages with a 76 cm (30 in.) length by 20 cm (8 in.) diameter maximum. The packages were then loaded into a prefoamed 55-gal drum with a 5-cm (2-in.) annular thickness and a 7.6-cm (3-in.) end thickness (top and bottom) of polyurethane foam. The drum was lined with a 12-mil, heat-sealable PVC liner before foaming. The use of polyurethane foam was a requirement for the Super Tiger. Drums transported by the Poly Panther Overpack were not required to be prefoamed (Adams et al. 1982).

Organic liquid wastes (e.g., lubricant, hydraulic fluids, paints) were absorbed on a quantity of absorbent equivalent to twice that required to completely absorb the liquid. The absorbed liquid was then placed into one-gallon polyurethane bottles with screw-top caps. Bottles of organic liquid waste from WARD were then double-bagged in 12-mil thick, heat-sealed PVC and placed in prefoamed drums lined with a 12-mil, heat-sealable PVC liner (Adams et al. 1982). Bottles of organic liquid waste originating from WNFD were not placed in prefoamed drums, but were double-bagged, placed in a lined drum, and surrounded by more absorbent (Denero et ai. 1984).

Inorganic aqueous liquid waste from WARD and WNFD were solidified in concrete in a 30-gal plastic fiber pack. The fiber pack was heat-sealed within a 12-mil PVC bag, which in turn was centered within a 55-gal drum lined with a 12-mil heat-sealable liner and filled with absorbent (Adams et al. 1982).

Archive waste materials were cemented and placed in 55-gal drums. The drums were foamed in place in a CSB.

Mercury was mixed with Fisher Scientific's Mercury Absorbent Powder to form an amalgam, which was double-bagged and surrounded by a minimum of 15 cm (6 in.) of concrete in a galvanized, 55-gallon drum. The drum contained no other waste and the liner and drum were sealed (Denero et al. 1984).

4.2.2 Fiberglass Reinforced Polyester Plywood Boxes*

Gloveboxes removed from WARD facilities were decontaminated, smeared, and fixed before being foamed in place in FRP plywood boxes.

The following operational sequence was used for decontaminating the box interiors: (1) dry brush all surfaces and collect residual powder; (2) dry wipe all surfaces with oil impregnated paper cloths, repeating as necessary; (3) apply "Nutek 600 EL" (diluted 20:1 with water) to all surfaces using hand spray bottle and wipe with dry paper cloths; (4) survey surfaces and repeat cleaning steps as required; (5) replace gloves with bag 'stumps;' (6) apply 'Clear Coat' fixant using pressure sprayer; and (7) survey surfaces for smearable and fixed contamination and repeat fixant application, if necessary.

After the box interiors were decontaminated and fixed, equipment, such as sintering, calcining and vacuum furnaces attached to some boxes by "O" ring flanges, was removed from the box ends and floors under carefully controlled, tented conditions. The openings were sealed with blind flanges fitted with "O" rings. The boxes were disconnected from the exhaust system, and the central tunnel, glove ports, and bag parts were closed off with protective covers.

Seven different styles of FRP plywood boxes were designed and custom fitted to accommodate various sized whole gloveboxes. The top and front of the FRP plywood box were removed and the glovebox was loaded into the box. The glovebox was centered and completely surrounded by foam-in-place polyurethane foam, with a minimum thickness of 1.3 cm (1/2 in.). The seams of the top and front panels were sealed by applying several layers of fiberglass reinforced polyester to a thickness of 0.32 cm (1/8 in.) minimum. This resulted in a waterproof package completely encased with reinforced polyester with a design lifetime of 20 years after burial. Twenty-one WARD gloveboxes were packaged in this manner (Adams et al. 1982).

Contaminated waste items too large to fit into drums were placed in FRP plywood boxes. Waste items were decontaminated, coated with a fixing agent, and then double-bagged. The inaccessible areas were filled with polyurethane foam to fix the contamination. The double-bagged waste items were then loaded into the FRP plywood box and foamed in place. Figure 4-2 is a photograph of a WNFD analytical laboratory hood being loaded into an FRP plywood box. The lid was then glued and nailed in place and the seam was sealed with fiberglass reinforced polyester resin (Denero et al. 1984).

Combustible waste items from WARD were placed within two heat-sealed 12-mil thick PVC bags which, in turn, were placed into the M-III bin. It should be noted that the M-III bin was overpacked in a 2.1 m x 2.1 m x 1.8 m (7 ft x 7 ft x 6 ft) CSB before burial. This effectively doubled the burial volume.

Non-combustible waste items from WARD that were too large for 55-gal drums, were wiped clean, and sharp corners and protrusions were padded with polyethylene foam

*Note: The abbreviation 'FRP' at WARD and WNFD was assumed to mean 'Fiberglass Reinforced Plywood.' At the Hanford Site 'FRP' is 'Fiberglass Reinforced Polyester.'

and tape. These items were placed within two heat-sealed, 12-mil thick PVC bags before loading into the M-III bins. Foam-in-place polyurethane foam was used to prevent objects from shifting during handling and transportation.

55-gallon drums containing absorbed, organic TRU liquid waste were placed into the M-III bin and foamed in place.

4.2.3 Corrugated Steel Boxes

Contaminated gloveboxes from the WNFD were decontaminated and fixed before packaging. Gross decontamination consisted of removing all visible surface dirt, the objective being to achieve a shiny metallic surface. Starting conditions of gloveboxes varied from being heavily coated with cement residue from waste solidification operations to being visually clean.

Initial efforts in cleaning dirty gloveboxes were directed toward removing the surface dirt by scraping, wiping, abrading, and brushing. This was performed manually for the most part; occasionally, a wire brush mounted in a drill motor was used. Putty knives, paint scrapers, and screwdrivers were used for scraping. Abrading materials used included wire brushes, plastic bristle brushes, and abrasive pads. Absorbent paper wipes were used for surface cleaning. NUTEC 600 EL was found to be successful in removing dirt, grease, and radiological contamination from surfaces and recesses. The NUTEC was applied liberally from hand-operated spray bottles and used with abrasive pads and wipes.

The procedure for gross contamination consisted of repeated cleaning until there was no visible dirt and the cleaning solution showed no discoloration. The interior isolation doors were removed to eliminate them as a source of contamination hold-up. The transfer tunnels that connected the glovebox to adjacent boxes (46-cm [18-in.] diameter rigid plastic pipe contained inside plastic bags affixed to bag ports on each glovebox) were removed, and new bags were installed on the transfer ports to isolate the box being decontaminated.

During the gross decontamination of a glovebox, three of the four HEPA exhaust filters were removed, the inlets were blanked off, and the fourth filter was replaced with a clean filter.

Repeated thorough flushings of window gaskets and glove port rings did not always prove adequate to remove the loose contamination as measured by alpha smears. Even when there was no visual contamination, there was a tendency for these corners and recesses to retain some contamination that would spread if it was disturbed once it was dry. If after repeated attempts at decontamination the problem still persisted, the corners were sealed with a silicon-base caulk such as GE SILASTIC or DOW RTV. Once the cleaning liquid failed to show discoloration when sprayed around windows and glove ports, it was found that no further significant reduction in contamination could be achieved in those areas. Near the time that it appeared that a box was clean, all old gloves and bags were removed from the glove ports and clean gloves, bags, and bag stubs were installed in locations as needed. If the exhaust filter appeared dirty, it was changed again.

At this point in the glovebox decontamination process, the interior was allowed to dry, and it was checked for loose contamination. If the level was below 150,000 alpha dpm/cm^2, the glove ports and windows would be caulked, and the box would be prepared for fixing. Contamination levels above 150,000 alpha dpm/cm^2 necessitated additional decontamination steps until the level was lowered sufficiently or until the level failed to decrease by more than 10 percent.

Final fixing was accomplished by spraying surfaces with a quick-drying nonflammable coating, OAKITE CLEAR COAT. The primary ingredient of this coating material was a polyvinyl alcohol. Spraying was done using a standard compressed air paint sprayer (BINKS Model 62). Spray gun nozzles were affixed to plastic bag stubs on the glovebox glove ports. At least one nozzle was mounted on each side of a glovebox for the purpose of spraying the interior of the glovebox. After decontamination of the glovebox and verification that the loose alpha contamination had been reduced to acceptable levels, all interior surfaces of the glovebox were sprayed. Once the fixing was complete, the glovebox was disconnected from all utilities and removed from its position in the glovebox line.

The gloveboxes were broken down into sections before packaging. The windows were removed and separately packaged in two 12-mil thick PVC bags. The inner bag was tape-sealed, and the outer bag was heat-sealed. Glovebox panels were cut to dimensions to fit inside CSBs. All sharp or protruding objects were removed, blunted, or protected with packaging material. The glovebox panels were bundled such that internal glovebox surfaces were facing inward (see Figure 4-3). Cut glovebox panels from not more than one glovebox and the glovebox window were foamed in place within the box. Blocking or dunnage was placed within the box to ensure a 2.54-cm (1-in.) foam barrier on the sides and bottom of the box (Denero et al. 1984).

Decontaminated equipment wastes from WNFD that were too large to fit into a 55-gal drum (with legs or other readily removable appendages removed) were loaded into CSBs. Equipment waste surfaces were decontaminated and fixed. Before fixing of contamination, all sharp or protruding objects were removed or blunted. Pipe caps, gasketed blind flanges, covers, etc. were installed wherever possible. The waste then was enclosed in a tight-fitting box constructed of one-inch thick plywood. The space between the equipment and the box was filled with a minimum of 1.27-cm (1/2 in.) thickness of foam.

55-gallon drums from WNFD containing glovebox filters, soft waste items, and solidified liquid waste were loaded into CSBs. Figure 4-4 is a picture of 55-gal drums being foamed in place within a CSB.

4.2.4 Overpacks

The Model N-55 Overpack is a double-walled foam-filled steel container used to enclose a 55-gal drum. The outside dimensions of the N-55 are 147 cm (58 in.) high by 81.3 cm (32 in.) in diameter. After a drum was loaded in the N-55, a gasketed lid was clamped to the body. Figure 4-5 shows galvanized drums being loaded into the N-55 overpack (Denero et al. 1984).

The Super Tiger, also described as the Model 6400 Overpack, was a double-walled foam-filled container. The external dimensions were approximately 2.4 m (8 ft) by 6.1 m (20 ft). The lid, or cover, was held in place with steel bolts. Only one overpack was attached to a flatbed trailer for each shipment. The CSBs or FRP plywood boxes were loaded into the overpack and braced with inflated bags to prevent movement during transport. An FRP plywood box being loaded into a Super Tiger is shown in Figure 4-6 (Denero et al. 1984).

The Poly Panther, also called the Model 6272 Overpack, is a Type B transportation overpack certified by the NRC. Originally, it was intended to use the Poly Panther for transporting only M-III bins. Subsequently, its use was extended to the shipment of 55-gal drums as well (Adams et al. 1982).

4.3 HANDLING AND PACKAGING OF NON-TRU WASTE

Non-TRU waste items were either placed inside plastic bags or their contaminated inner surfaces were sealed with tape, plastic, flanges, or caps. Combustible and noncombustible waste items were packaged together to maximize packaging. The non-TRU waste from WNFD was sealed within steel drums, while all the non-TRU waste from WARD was contained within one M-III bin.

4.4 HISTORICAL WASTE HANDLING AND PACKAGING PROCEDURES

Eleven historical waste packaging manuals were reviewed for information regarding packaging and labeling requirements for the TRU waste sent to retrievable storage at the Hanford Site. These manuals covered requirements from 1974 through 1988.

Packaging requirements have changed over time and have become more stringent. Table 4-1 summarizes TRU storage requirements for the Hanford Site from 1974 through 1988. The columns in Table 4-1 are not symmetrical; when a definition or requirement is consistent between manuals, text is shared under several document number columns. A blank spot indicates that no requirements or definition are found in that manual. Definitions (i.e., hazardous and toxic materials) change from manual to manual and so require reference to each particular manual.

Some of the more significant changes that have occurred in the past 20 years with regard to the packaging, handling, and record keeping for radioactive wastes that apply to waste received from the Cheswick Site's WARD and WNFD follow.

1. The definition of TRU waste has changed since 1970, and the designation of waste packages as TRU also has changed. From 1970 to 1973 TRU segregation was based on generator practice. From 1974 until 1982, TRU waste was segregated if the concentration of TRU was greater than 10 nCi/g. In 1982, the current 100 nCi/g definition for TRU waste was implemented by the DOE.

2. Because of the varied contents of the waste containers, chemical reactions can occur. Gases may accumulate, including hydrogen which can contribute to fire and/or explosion. Since 1982, waste materials that generate H_2, O_2, or NO_x are prohibited unless drums have been permanently fitted with vent clips to allow continual release of gases or include catalyst packs to recombine any hydrogen that may be produced.

3. Criticality specifications limited the amount of TRU to less than 250 g/55-gal drum from 1975 to 1978 and to 200 g/drum after that time. Before 1975 the criticality limit on drums and cartons was 400 grams.

4. Originally, waste burial records for TRU were not done for individual containers, but for entire shipments. In 1982, TRU burial and storage records began to be based on an individual container basis. The entry of unique data for each waste container into the R-SWIMS database was not fully implemented until 1984. During the R-SWIMS re-entry program, historical TRU records were converted to an individual basis so that today there is one SWITS record for each TRU container stored at the Hanford Site.

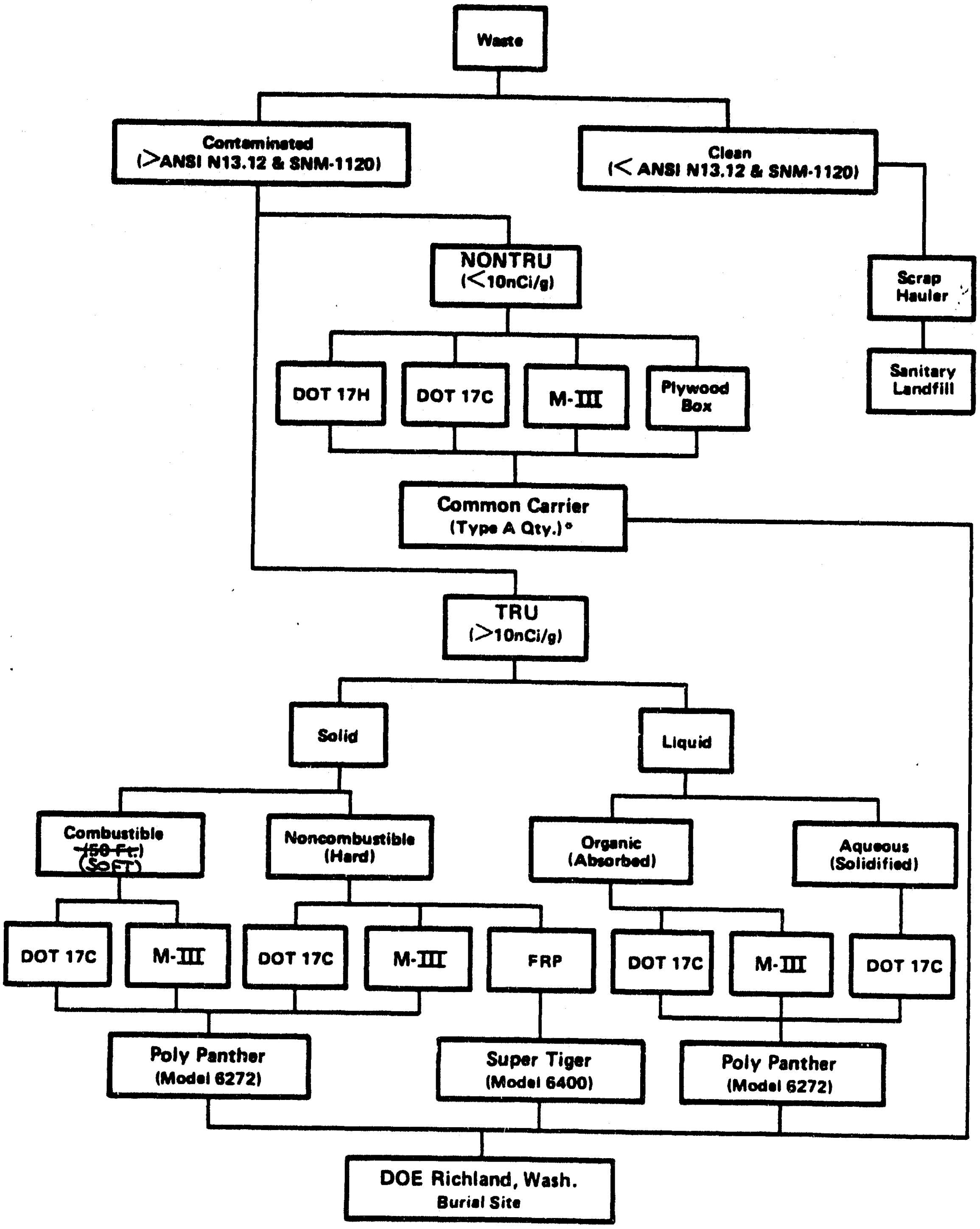
   The conversion from group data to individual container data required some assumptions about the containers in the group to be made. Chief among these assumptions was that an even distribution of radiological and hazardous constituents existed among the members of the group.

   LLW records are still kept for multiple containers rather than for individual containers.

5. Information on the hazardous constituents of waste containers was not required before 1986. During the R-SWIMS re-entry program any available information from the SWBRs was added. However, this information is limited.

6. Between 1972 and 1978, combustible and non-combustible waste components were segregated. Although the SWITS database did not retain a data field for this information, it was added to the physical contents description field.

Figure 4-1. Waste Management Scheme for Decontamination and Decommissioning Program at Westinghouse Advanced Reactors Division Plutonium Laboratories.



* If Quantity Is Type B, A Type B Overpack Must Be Used

Figure 4-2. Plastic-Wrapped Analytical Laboratory Hood Being Loaded into Fiberglass Reinforced Polyester Container.

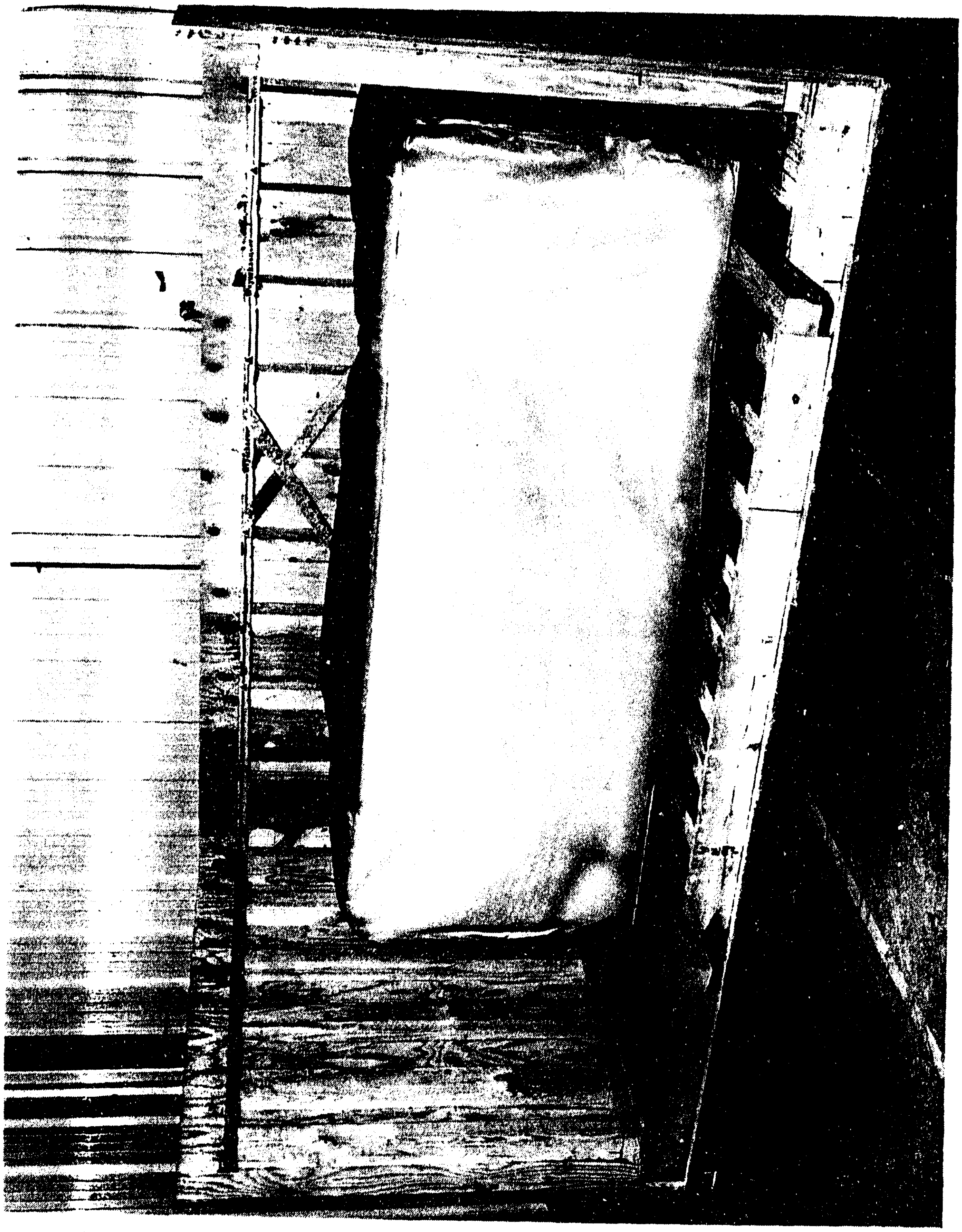


Figure 4-3. Plastic-Wrapped Cut Glovebox Sections Stored on Pallets.

Figure 4-4. Loading of a Corrugated Steel Box Container - Foaming 55-Gallon Drums in Place.

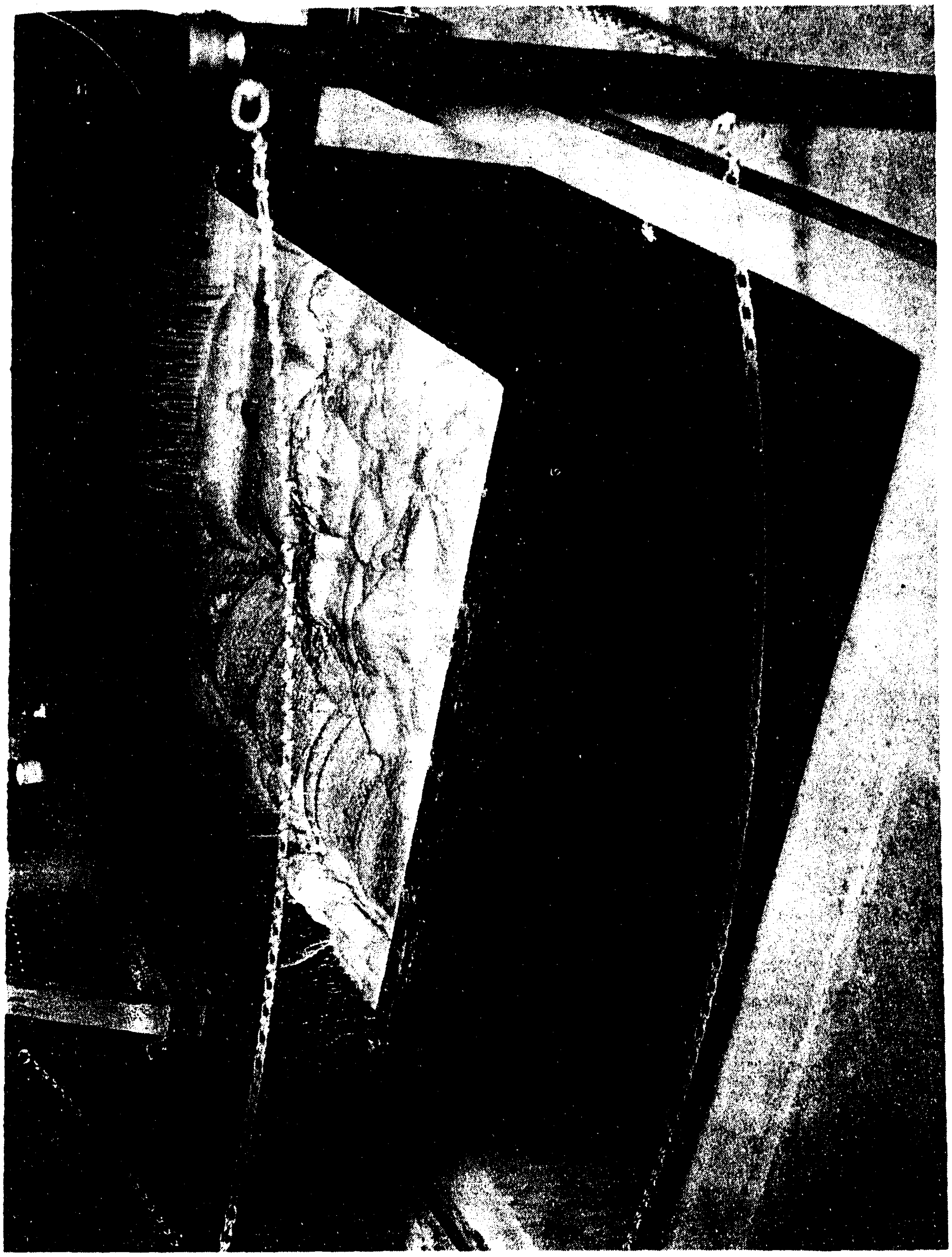


Figure 4-5. Loading Galvanized Drums into Model N-55 Overpacks.

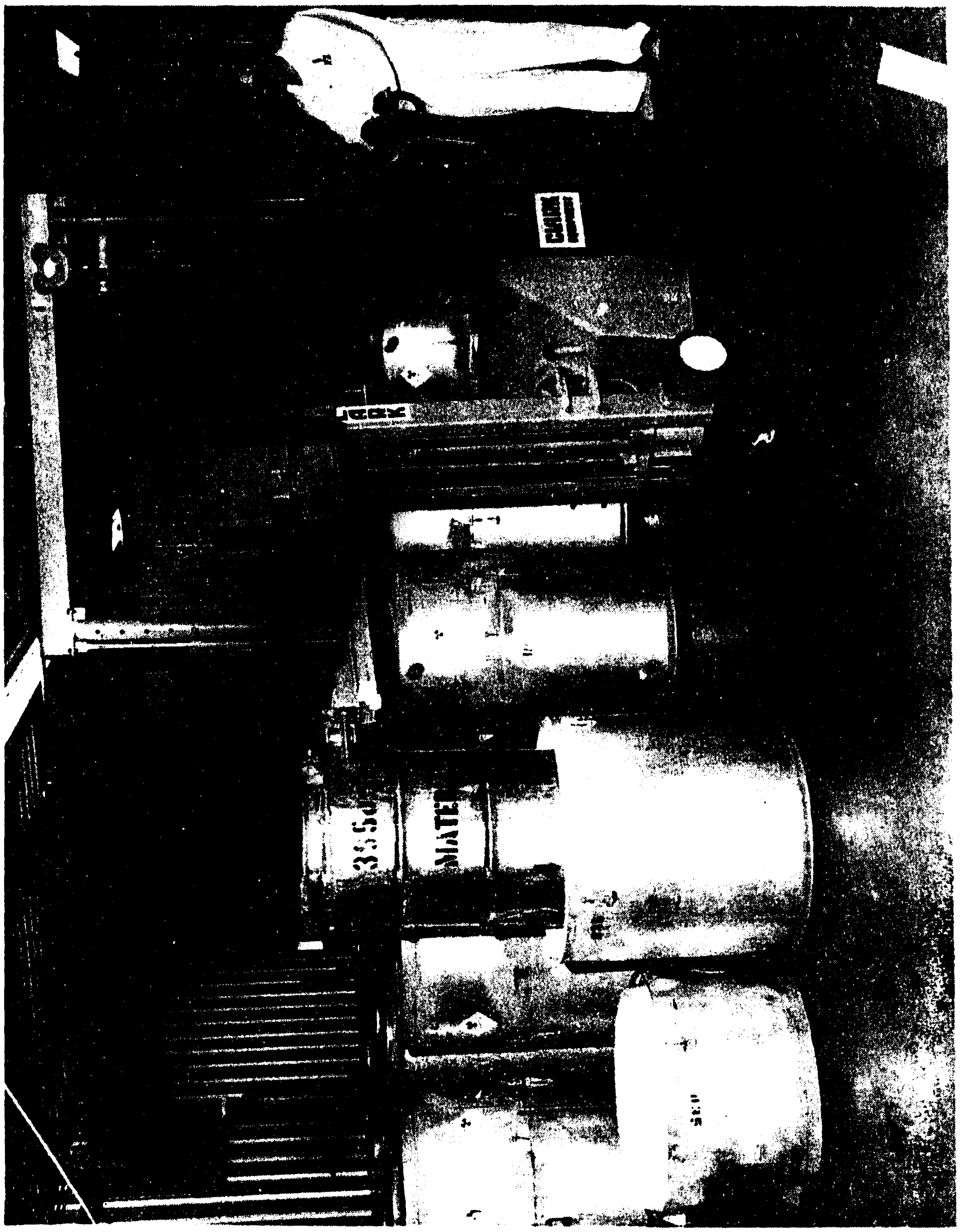
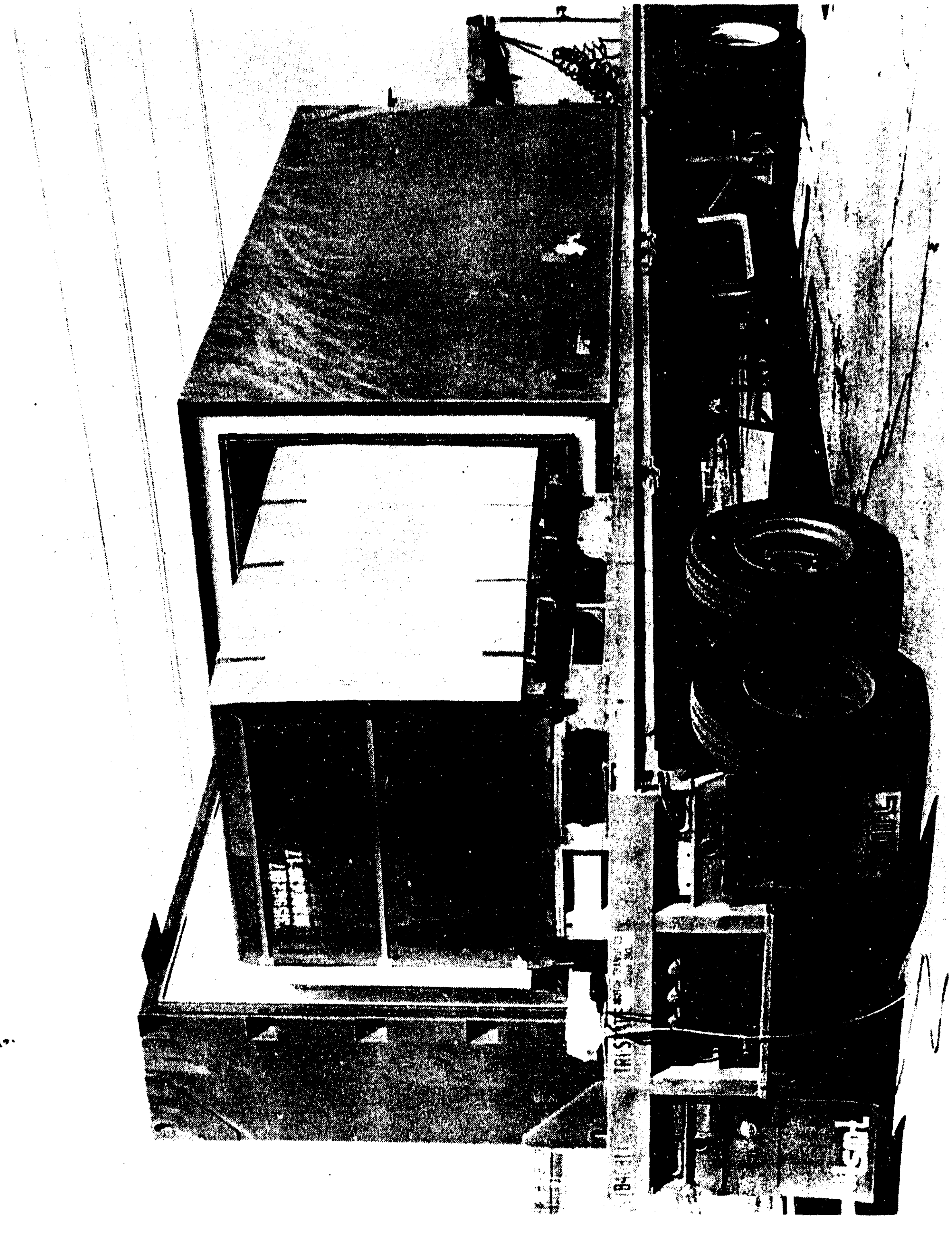


Figure 4-6. Fiberglass Reinforced Polyester Container Being Loaded into a Model 6400 Overpack.



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Document				
ARH-3032 4/74 - 4/77	ARH-3032, Rev. 1 4/77 - 7/78	ARH-3032 Rev. 1 Sup 1 8/78 - 12/78	ARH-3032 Rev. 1 Supp. 2 12/78 - 5/80	R
TRU				
Waste containing plutonium and/or other transuranium nuclides in concentrations greater than 10 nCi/g.	Waste containing or suspect of containing Pu and/or other transuranium nuclides in concentrations greater than 10 nCi/g.			Waste contai radionuclides concentration
Prohibited wastes types				
Liquid wastes must be packaged with sufficient inert absorbent so that liquid will not flow if container is breached			No free liquids	No free liquid
	Liquid organic waste-free or absorbed is prohibited (includes animal carcasses).		Liquid organic waste-free or absorbed is prohibited (includes all oils and animal carcasses).	Animal carcas waste with fl packaged. Li with special a
	Flammable absorbed liquids prohibited from disposal in caissons.		Damp or wet wastes with highly combustible or explosive liquids prohibited.	Flammable liq
	Unreacted Alkali Metals prohibited.			
			Expl	
			Pyro	
		TRU waste packages shall be of a nature that no radioactive material escapes as a result of a breach of the container; pressurization of the container shall not occur and the container shall maintain its integrity for a period of 20 years. If a container is vented to prevent pressurization the vent shall equal or exceed a HEPA filter with regard to minimizing passage of radiation.		Materials that amounts of g
	Hazardous and toxic materials must be treated before burial.			Hazardous an
	Exterior surfaces must be free from smearable contamination-fixation allowed.			Exterior surfac smearably co

Table 4-1. TRU Storage Requirements for the Hanford Site. (3 sheets)

umbers and dates				
IO-MA-222 /80 - 6/82	RHO-MA-222 6/82 Revision 6/82 - 6/83	RHO-MA-222 Rev 1 6/83 - 3/84	RHO-MA-222 Rev. 2* 7/84 - 8/86*	RHO-MA-222, Rev. 2 7/84 - 8/86*
definition				
ing or suspect of containing transuranium alpha-emitting vith half-lives greater than 100 years or 233 U in greater than 10 nCi/g.		Document Unavailable	Waste containing alpha-emitting radionuclides with atomic numbers greater than 92 and half-lives greater than 20 years or 226 Ra or 233 U in concentrations greater than 100 nCi/g.	
and packaging requirements				
- except liquid organic wastes.			No free liquids - except liquid organic wastes	No free liquids
ies accepted if packaged per requirements. Liquid organic shpoint greater than 150°F accepted if properly labeled and uid organic waste with flashpoint less than 150°F accepted pproval.			Animal carcasses accepted if packaged per requirements.	
ids free or absorbed with flashpoints below 150°F prohibited			Sludges cannot contain free liquids.	
			Unreacted Alkali metals prohibited with exceptions.	
sives Prohibited			Pyrophorics and explosives prohibited except metal fines.	Explosives prohibited.
horics prohibited				Pyrophorics prohibited.
			Gas cylinders containing radioactive gases prohibited. Empty cylinders accepted if permanently vented.	Compressed gases prohibited.
generate significant s are prohibited.	Waste materials that generate H_2, O_2 or NOx are prohibited unless permanently vented or catalyst package in container.		Waste materials that generate H_2, O_2 or NOx are prohibited unless permanently vented or catalyst package in container.	Waste containers that could repressurize to greater than 7 psi within 25 years require venting through HEPA filters.
toxic materials accepted on case by case basis.			Hazardous and Toxic materials must be treated to meet the waste acceptance criteria for disposal.	
s must be from lamination.	Exterior surfaces free from smearable contamination-fixation allowed.		Exterior surfaces free from smearable contamination-fixation allowed.	Removable surface contamination limits fixation is not acceptable.
				Flammable solids (metal fines) must be mixed with chemically stable material to produce a solidified waste matrix (glass, concrete, etc.)

Document:				
ARH-3032 4/74 - 4/77	ARH-3032, Rev. 1 4/77 - 7/78	ARH-3032 Rev. 1 Sup 1 8/78 - 12/78	ARH-3032 Rev. 1 Supp. 2 12/78 - 6/80	R
Prohibited waste types a				
	Contamination that is easily airborne must be in an inner liner.			Loose contar the container
Be requires double containment.				Double conta TRU waste a accepted fro Be and Hg re containment.
				'Liquid Organ packaged in container (5- overpackaged with a rigid p filled to the t times the abs absorb the vo containers.
				Animal waste 55-gallon dru mil. plastic lin gas generatio sufficient abs liquids two ti absorbent req liquid present from the deca
Labeling				
Waste packages must be suitably labeled so that containers can be identified by cross-reference to permanent records.				Waste packag labeled so tha identified by c permanent re packages con labeled 'trans waste'
Be must be labeled.	Be must be labeled.	Be must be labeled.	Be must be labeled.	DOT Class "B labeled (Be &

Table 4-1. TRU Storage Requirements for the Hanford Site. (3 sheets)

...umbers and dates				
HO-MA-222 5/80 - 6/82	RHO-MA-222 6/82 Revision 6/82 - 6/83	RHO-MA-222 Rev 1 6/83 - 3/84	RHO-MA-222 Rev. 2* 7/84 - 8/86*	RHO-MA-222, Rev. 2 7/84 - 8/86*
...d packaging requirements (cont.)				
...ination must be stabilized or contained so that the surface of ... remains free of detectable loose contamination.			Loose contamination must be stabilized or contained so that the surface of the container remains free of detectable loose contamination.	Powders, ashes and similar particulates must be immobilized in concrete, glass or similar solidified matrix if > 1 weight % of the matrix weight is particulates < 10 microns in diameter or if > 15 weight % is < 200 microns in diameter.
...nment required for all ...d for all waste ...1 offsite generators. ...uired double	Double containment required for all TRU waste. Double containment is required for Cd and Hg. Be, Cd, and Hg must be packaged with at least 6" of concrete on all sides.		Double containment required for all TRU waste. Double containment is required for Cd and Hg. Be, Cd, and Hg must be packaged with at least 6 in. of concrete on all sides.	Double containment required for all TRU waste. Be, Cd, Hg and other class 6 poisons must be immobilized in concrete for burial.
...c' waste must be ...sealed liquid-tight ...0 gallon), ...in 55-gallon drum ...lyethylene liner and ...p with at least two ...rbent required to ...ume of liquid in the	'Liquid Organic' waste must be packaged unabsorbed in a sealed liquid-tight container (5-10 gallon), overpackaged in 55-gallon drum with a rigid polyethylene liner and filled to the top with at least two times the absorbent required to absorb the volume of liquid in the containers.		'Liquid Organic' waste must be packaged unabsorbed in a sealed liquid-tight container (5-10 gallon), overpackaged in 55-gallon drum with a rigid polyethylene liner and filled to the top with at least two times the absorbent required to absorb the volume of liquid in the containers.	Liquid organic waste must be solidified for storage or disposal. Exceptions are considered on a case by case basis.
...must be packaged in a ...n with a minimum 4 ...r, treated to suppress ..., and surrounded by ...rbent to prevent free ...es amount of ...ired to absorb any ...or that may result ...process.	Animal waste must be packaged in a 55-gallon drum with a minimum 4 mil. plastic liner, treated to suppress gas generation, and surrounded by two times amount of absorbent required to absorb any liquid present or that may result from the decay process.		Animal waste must be packaged in a 55-gallon drum with a minimum 4-mil. plastic liner, treated to suppress gas generation, and surrounded by two times amount of absorbent required to absorb any liquid present or that may result from the decay process.	
...requirements				
...s must be suitably ...containers can be ...oss-reference to ...ords. Waste ...aining TRU must be ...ranic' or 'transuranic	Waste packages must be suitably labeled so that containers can be identified by cross-reference to permanent records.		Waste packages must be suitably labeled so that containers can be identified by cross-reference to permanent records.	
...Poisons must be ...Hg).	Be, Cd and Hg must be labeled.		Be, Cd and Hg must be labeled.	

Docume				
ARH-3032 4/74 - 4/77	ARH-3032, Rev. 1 4/77 - 7/78	ARH-3032 Rev. 1 Sup 1 8/78 - 12/78	ARH-3032 Rev. 1 Supp. 2 12/78 - 5/80	
Labeling				
	Hazardous and toxic waste must be labeled.			
				'Liquid Or
				'Animal W
				'Fissile Mat tamper ind contents in Drums con quantity in and lid.

NOTE: For the period of 1970 through April 1974, document numbers are unknown.

*Includes RHO-MA-222, Rev. 3, 3A, and 4. The changes made in these revisions are general and do not affect the packaging, storage or dispo WHC-EP-0062, Rev. 0 (Willis and Triner 1991).

DOT = U.S. Department of Transportation.

HEPA = High Efficiency Particulate Air.

TRU = transuranic.

Table 4-1. TRU Storage Requirements for the Hanford Site. (3 sheets)

numbers and dates:				
RHO-MA-222 5/80 - 6/82	RHO-MA-222 6/82 Revision 6/82 - 6/83	RHO-MA-222 Rev 1 6/83 - 3/84	RHO-MA-222 Rev. 2* 7/84 - 8/85*	RHO-MA-222, Rev. 2 7/84 - 8/85*
equirements ([illegible])				
	DOT labels required for all classes of waste that apply to the package.		DOT labels and color coding required on all waste packages.	
nics' must be labeled.	'Liquid Organics' must be labeled and must have flashpoint range listed on label.		'Liquid Organics' must be labeled and must have flashpoint range listed on label.	
te' must be labeled.	'Animal Waste' must be labeled.		'Animal Waste' must be labeled.	
ial' label and Type "E" sting seal required if ude 1 or more grams. ining Pu must have Pu rams posted on the side	'Fissile Material' label required if contents include 1 or more grams. Pu quantity must be labeled if 1 or more grams of Pu is in the container.		'Fissile Material' label required if contents include 1 or more grams. Pu quantity must be labeled if 1 or more grams of Pu is in the container.	

requirements of TRU unstable or reactive wastes specifically. The requirements listed under Rev. 2 of RHO-MA-222 are effective up to the effective date of

5.0 CHARACTERIZATION OF RETRIEVABLY STORED SOLID WASTE GENERATED BY WESTINGHOUSE ADVANCED REACTOR DIVISION

The information found in this section is based primarily on data from the SWITS database. This database, which incorporated the older R-SWIMS database, is used to track information on radioactive and other wastes stored or disposed at the Hanford Site. Radioactive solid waste packages have been tracked since 1970. In the intervening years, changes in the requirements and regulations governing radioactive wastes have left their mark in the quantity and quality of the data tracked in this database. Caveats are included in the text to alert the reader to changes that may affect the interpretation of the data provided.

The bulk of the data provided is limited to information about the TRU waste that was generated at WARD/WNFD; however, some general information on the non-TRU waste is included for completeness. Tables 5-1 and 5-2 present TRU and non-TRU waste generation summaries, sorted by container type and year. Since initial retrieval efforts and WRAP 1 will focus on 55-gal drums, these containers are considered separately from all other container types. Therefore, the term 'other containers' in this report will refer to all container types, except 55-gal drums, combined. The term 'drum' refers to 55-gal drums only.

It should be noted that the SWITS database does not distinguish between waste received from WARD and WNFD, and waste from the D&D of both division's facilities is designated as WARD waste. As a general rule of thumb, WARD waste was sent to the Hanford Site between 1980 and 1982, and WNFD waste was sent between 1982 and 1984. Also, routine operational waste received from the Cheswick Site before 1980 is not designated in the database as being generated offsite. Instead it appears that these wastes were re-designated as waste generated by the facility that received the waste from Cheswick (possibly Building 325 or 234-5Z) or else shipped to the commercial nuclear waste disposal facility at the Hanford Site.

The original SWITS data that form the basis for most of the tables and figures in this section can be found in Appendix A. Each computer run is preceded by the query used to generate the data.

5.1 SUMMARY OF WARD/WNFD WASTE GENERATION

5.1.1 Waste Stored in 55-Gallon Steel Drums

The most common waste container for TRU waste stored at the Hanford Site is the 55-gal steel drum. The drums used are either DOT 17C or 17H produced from sheet drums with minimum wall thicknesses of 0.135 cm (.053 in.) and 0.109 cm (.043 in.), respectively.

The 1970 Immediate Action Directive (AEC 1970) stipulated that TRU wastes be packaged and stored as contamination-free packages for at least 20 years. The 20-year interim was to allow time to study permanent disposal options for TRU contaminated wastes. As more of the 55-gal drums reach and exceed the 20-year storage mark, more attention has been given to ascertaining the condition of these drums. A discussion of the previous studies of steel drum corrosion and degradation can be found in WHC-0225, Rev. 1 (Anderson, et al. 1991) and WHC-SA-1450FP, Rev. 1 (Duncan et al. 1993).

Table 5-3 contains waste summary data for 55-gal drums of radioactive waste generated at WARD/WNFD for storage at the Hanford Site between 1980 and 1984. The upper portion of this table indicates the number, total weight, and total volume of TRU waste drums. TRU mixed waste drums also are indicated. The same information for non-TRU waste follows. At the bottom of the table are the relative percentages of TRU and non-TRU wastes by container number, weight, and volume. Figures 5-1 through 5-3 present this information graphically.

5.1.1.1 Number of Drums. Between 1980 and 1984, 1,130 55-gal drums of radioactive waste were generated by the D&D of WARD/WNFD and sent to the Hanford Site for storage. This total includes 220 drums of non-TRU waste and 910 drums of TRU waste. The total number of radioactive mixed waste drums is 137. Figure 5-1 provides a graph of the number of 55-gallon drums of TRU and non-TRU at WARD/WNFD by year.

5.1.1.2 Weight. Between 1980 and 1984, approximately 83,497 kg of TRU waste and 15,205 kg of non-TRU waste was generated at WARD/WNFD and stored in 55-gal drums. Figure 5-2 presents the total weight of both TRU and non-TRU radioactive wastes stored annually in 55-gal drums.

5.1.1.3 Volume. The total volume of TRU waste generated at WARD/WNFD and stored in 55-gal drums is 192.4 m^3. The total volume of non-TRU radioactive waste generated at WARD/WNFD and stored in 55-gal drums is 46.8 m^3. The volume of TRU and non-TRU waste generated between 1980 and 1984 at WARD/WNFD and stored in 55-gal drums is shown in Figure 5-3. All 55-gal drums have a volume of .21 m^3.

5.1.2 Waste Stored in Containers Other Than 55-Gallon Steel Drums

Radioactive solid wastes have been stored or disposed of in a wide variety of containers other than 55-gal steel drums. In this discussion these containers will be referred to as 'other containers.' Container types used for solid waste generated during the D&D of WARD/WNFD and stored at the Hanford Site include the following:

- FRP plywood boxes
- metal boxes, cartons, and cases.

Table 5-4 summarizes the waste data for containers of radioactive waste other than 55-gal drums that were generated at WARD/WNFD for storage at the Hanford Site between 1980 and 1984. The upper portion of this table indicates the number, total weight, and total volume of TRU waste stored in other containers. The number of other containers of TRU mixed waste also is provided. The same information for non-TRU waste follows. At the bottom of this table are the relative percentages of TRU and non-TRU wastes by container number, weight, and volume. Figures 5-4 through 5-6 present these data graphically.

The amount of waste received in 1980 was minimal as the D&D activities were just beginning. Waste shipments increased in 1982, when the WNFD D&D begun. The amounts of waste continued to increase in 1982 and 1983 as the D&D activities were completed.

During the years 1980, 1981, and 1982, all of the waste shipped in 55-gal drums was classified as TRU. In 1983, part of this waste was non-TRU, and by 1984, all the waste sent to the Hanford Site from WARD/WNFD in 55-gal drums was non-TRU.

5.1.2.1 Number of Other Containers. Between 1980 and 1984, 115 other containers of radioactive waste were generated at WARD/WNFD for storage at the Hanford Site. Of these containers, 114 hold TRU waste while 1 contains non-TRU. Figure 5-4 is a graph of the number of other containers of TRU and non-TRU waste generated at WARD/WNFD for storage at the Hanford Site by year. The largest number of other containers containing TRU waste was generated in 1982 with 37 containers.

5.1.2.2 Weight. Between 1980 and 1984, 212,426 kg of radioactive solid waste was generated at WARD/WNFD and placed in containers other than 55-gal drums for storage at the Hanford Site. This total weight includes 211,436 kg of TRU and 990 kg of non-TRU contaminated material. Figure 5-5 depicts the weight of TRU and non-TRU waste stored in containers other than 55-gal drums on an annual basis.

5.1.2.3 Volume. The volume of waste generated at WARD/WNFD and packaged in containers other than 55-gal drums for storage at the Hanford Site from 1980 through 1984 is 687.5 m^3. Transuranic wastes account for 684.0 m^3 of the total volume; non-TRU wastes account for 3.5 m^3. Figure 5-6 shows annual volumes of TRU and non-TRU wastes generated by WARD/WNFD and packaged in containers other than 55-gal drums.

5.1.3 Summary of Waste Generation Rates at Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Between 1980 and 1984

5.1.3.1 Number of Waste Containers. Between 1980 and 1984, there were 1,245 containers of radioactive solid waste generated at WARD/WNFD. Fifty-five gallon drums account for 91 percent of this total; other containers account for the remaining 9 percent. Section 5.2, below, describes the container types used in greater detail.

Overall, waste designated as TRU is stored in about 82 percent of the containers generated between 1980 and 1984. Non-TRU waste can be found in 18 percent of the containers. Figure 5-7 shows the total numbers of TRU and non-TRU waste containers generated at WARD/WNFD on an annual basis during this period.

5.1.3.2 Total Weight. More than 311,128 kg of the radioactive solid waste stored at the Hanford Site was generated at WARD/WNFD between 1980 and 1984. Waste packaged in 55-gal drums accounts for about 32 percent of the total weight of waste from WARD/WNFD, with 68 percent of the total weight comprised of waste packaged in some other type of waste container.

Waste designated as TRU comprises 95 percent of the total weight while waste designated as non-TRU makes up the remainder. Figure 5-8 provides a graph of the total weight of TRU and non-TRU waste generated at WARD/WNFD on a yearly basis between 1980 and 1984.

5.1.3.3 Total Volume. Between 1980 and 1984, exactly 926.7 m^3 of the radioactive solid wastes stored at the Hanford Site were generated at WARD/WNFD. Twenty-six percent of this volume is comprised of 55-gal drums; the remaining 74 percent of the volume is made up of other container types.

As was seen when looking at the total number and weight of containers, waste designated as TRU accounts for a relatively large portion, i.e., 95 percent, of the total waste volume, while non-TRU waste accounts for the remaining 5 percent. Figure 5-9 shows the total volume of TRU and non-TRU waste generated at WARD/WNFD between 1980 and 1984 on a yearly basis.

5.2 WASTE CONTAINERS

5.2.1 Transuranic Waste Containers

Table 5-1 provides a summary of the TRU waste generated annually at WARD/WNFD from 1980 to 1984, sorted by container type. The greatest number of containers are 55-gal drums. The percentages for all container types and the weight of these containers are shown for each year in this table.

5.2.2 Non-Transuranic Waste Containers

Table 5-2 provides a summary by container type of the non-TRU waste stored at the Hanford Site that was generated by WARD/WNFD from 1980 to 1984. Metal drums, barrels, and kegs were the most common containers used accounting for more than 99 percent of the total non-TRU waste count. The only other storage containers used for non-TRU waste were metal boxes, cartons, and cases. The greatest weight of non-TRU waste, 94 percent is stored in metal drums, barrels, and kegs.

5.3 TRANSURANIC WASTE STORAGE LOCATIONS

Table 5-5 provides the storage locations for TRU waste packaged in 55-gallon drums by year. All the drums were stored in a single location, 218-W-4C. Storage locations for TRU waste packaged in other containers are shown in Table 5-6. A summary of WARD/WNFD D&D TRU waste storage, by storage location, follows.

5.3.1 218-W-3A

Burial Ground 218-W-3A consists of 14 earthen-bottom, gravel filled trenches, with waste emplaced from May 1970 to April 1988. A total of 23 containers other than 55-gal drums were emplaced here in 1980 and 1982.

5.3.2 218-W-4C

Burial Ground 218-W-4C consists of six trenches, with the first waste emplaced in March 1978. Ninety-one TRU waste drums were sent to this area in 1980 and 1984. Waste containers recorded as having hazardous constituents were buried here in 1981 and 1982.

5.4 PHYSICAL CONTENTS OF TRANSURANIC WASTE CONTAINERS

The physical contents for 55-gal drums of TRU waste stored in 218-W-4C are shown in Table 5-7. The top portion of each table indicates the number of drums for which a given component is listed; the bottom portion of the table indicates the percentage of the total drums, which that number represents.

The physical contents for TRU waste containers other than 55-gal drums can be found in Tables 5-8 and 5-9.

In addition to the physical contents identified in the SWITS database, personnel from WNFD indicated several components that also were part of the solid waste stream. These items were two granite slabs used for support under balances and borated glass raschig rings.

5.5 RADIOLOGICAL DESCRIPTION OF WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION SOLID WASTE

Table 5-10 shows the number of TRU grams stored in 55-gal drums each year by storage location; Table 5-11 provides the same information for TRU containers other than 55-gal drums. Figure 5-10 combines the information on these tables in a graph that shows the total grams of TRU present in waste packages from WARD/WNFD by year.

5.6 RADIOACTIVE ISOTOPES PRESENT IN WARD/WNFD SOLID WASTE

Information on radioactive isotopes was obtained from the SWITS database and the SWBRs. Listed in Table 5-12 are isotopes known to be in the WARD/WNFD solid waste stream.

5.7 HAZARDOUS CONSTITUENTS OF SOLID WASTE GENERATED BY WESTINGHOUSE ADVANCED REACTORS DIVISION/ WESTINGHOUSE NUCLEAR FUELS DIVISION

This section provides a review of the data on the hazardous components found in the SWITS database and on the original burial records. Because information on the non-radioactive, hazardous chemicals in waste containers was not required on burial records before 1987, information before that date could be incomplete.

5.7.1 Solid Waste Information and Tracking System

Information about hazardous constituents of the solid waste from WARD/WNFD is limited in the years before 1987 because of the recording and tracking practices of the time. According to the SWITS database, only 146 drums from WARD/WNFD are designated as MW. These drums account for 12 percent of the total drum count.

Table 5-13 presents the number of TRU MW drums stored in 218-W-4C by year. The contents of these mixed waste 55-gal drums are shown in Table 5-14. Table 5-15 represents the number of TRU MW containers other than 55-gal drums stored by location and year. The contents of these MW containers are shown in Table 5-16.

5.7.2 Burial Records

The SWBR or SWSDR for a given container is the source of waste container information abstracted for the SWITS database. Often these records will have more detailed information on the hazardous components of a waste container than is found in SWITS. Additional data also can be found on the supplementary forms often attached to the SWBR or SWSDR. These supplementary documents include Uniform Hazardous Waste Manifests, Contents Inventory Sheets, NRC 741 Forms, and Storage/Disposal Approval Records (SDAR).

The following hazardous constituents were determined to be present in WARD/WNFD waste stored at the Hanford Site:

- Asbestos
- Oil
- Organic Material.

Table 5-17 contains a summary of the information obtained from the burial records. The presence of asbestos-containing waste material was included in the summary tables despite the fact that it is not considered to be MW.

Though paint is not considered a hazardous constituent in the SWITS database, it may contain some hazardous elements. Paint was recorded on SWBRs as being present in 196 55-gal drums and 3 other containers received from WARD/WNFD between 1980 and 1984.

5.7.3 Interviews with Westinghouse Advanced Reactors Division/ Westinghouse Nuclear Fuels Division Facilities Personnel

From the information gained in interviews with WARD/WNFD personnel, a list of known or suspected components in the solid waste stream has been compiled. As much information as possible concerning the quantity, form, packaging, and relevant use of each of the constituents was provided by the interviewees and listed in Table 5-18.

Figure 5-1. Number of 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

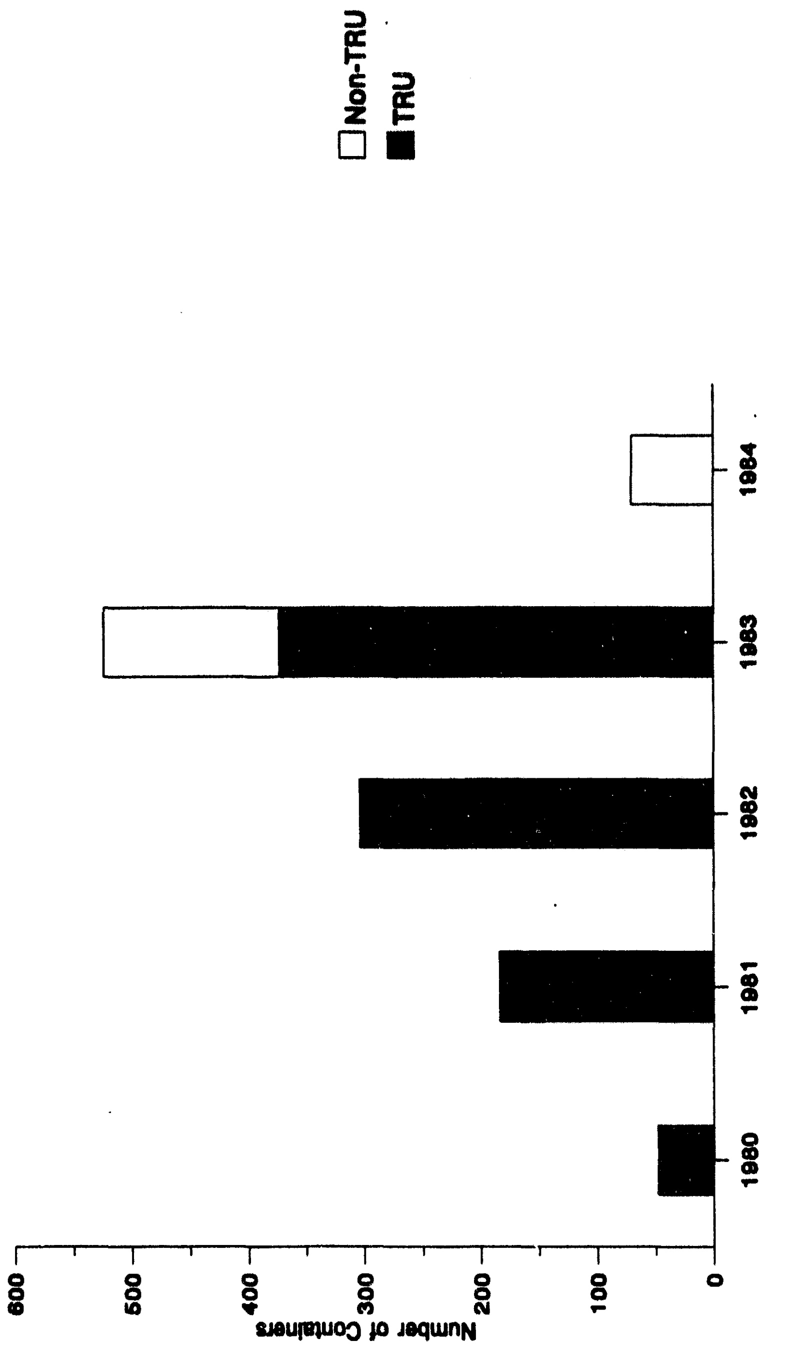

Figure 5-2. Weight of 55-Gallon Drum Waste.

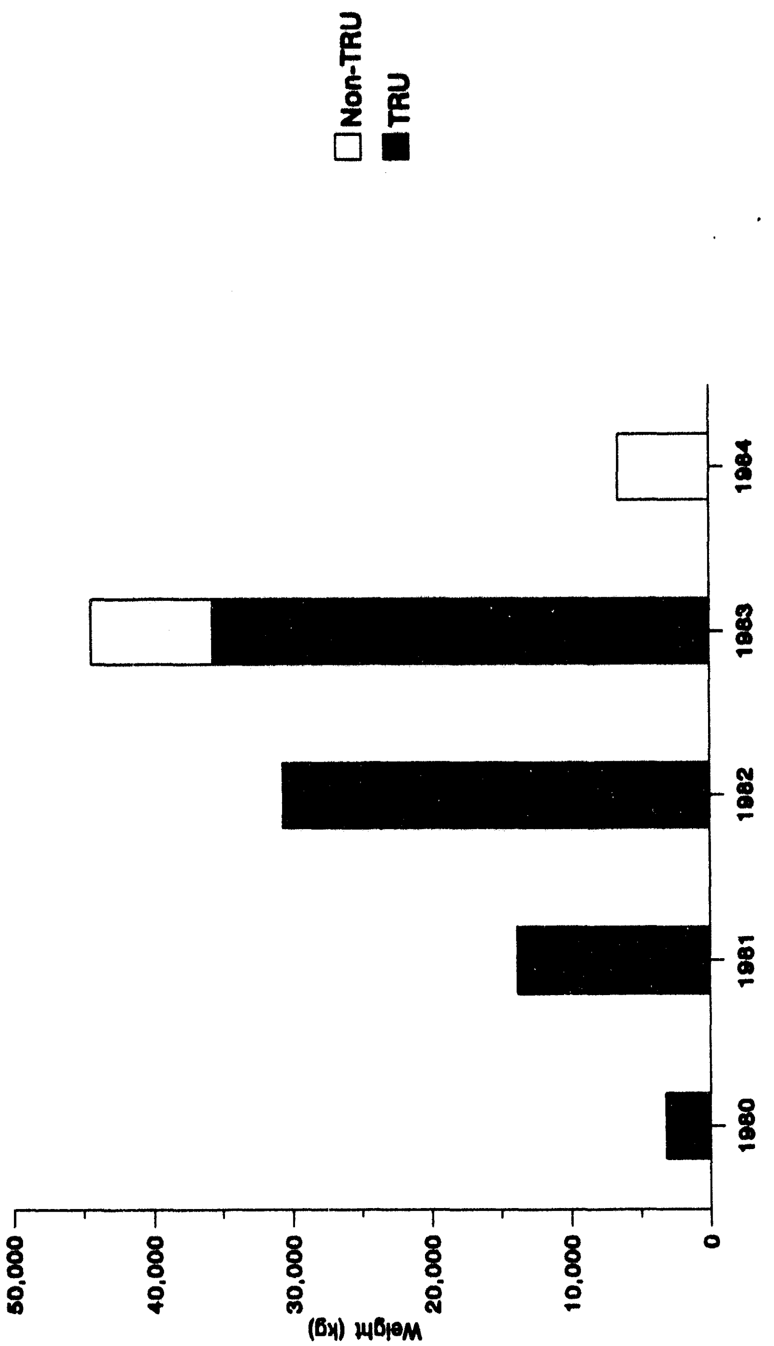

Figure 5-3. Volume of 55-Gallon Drums Waste.

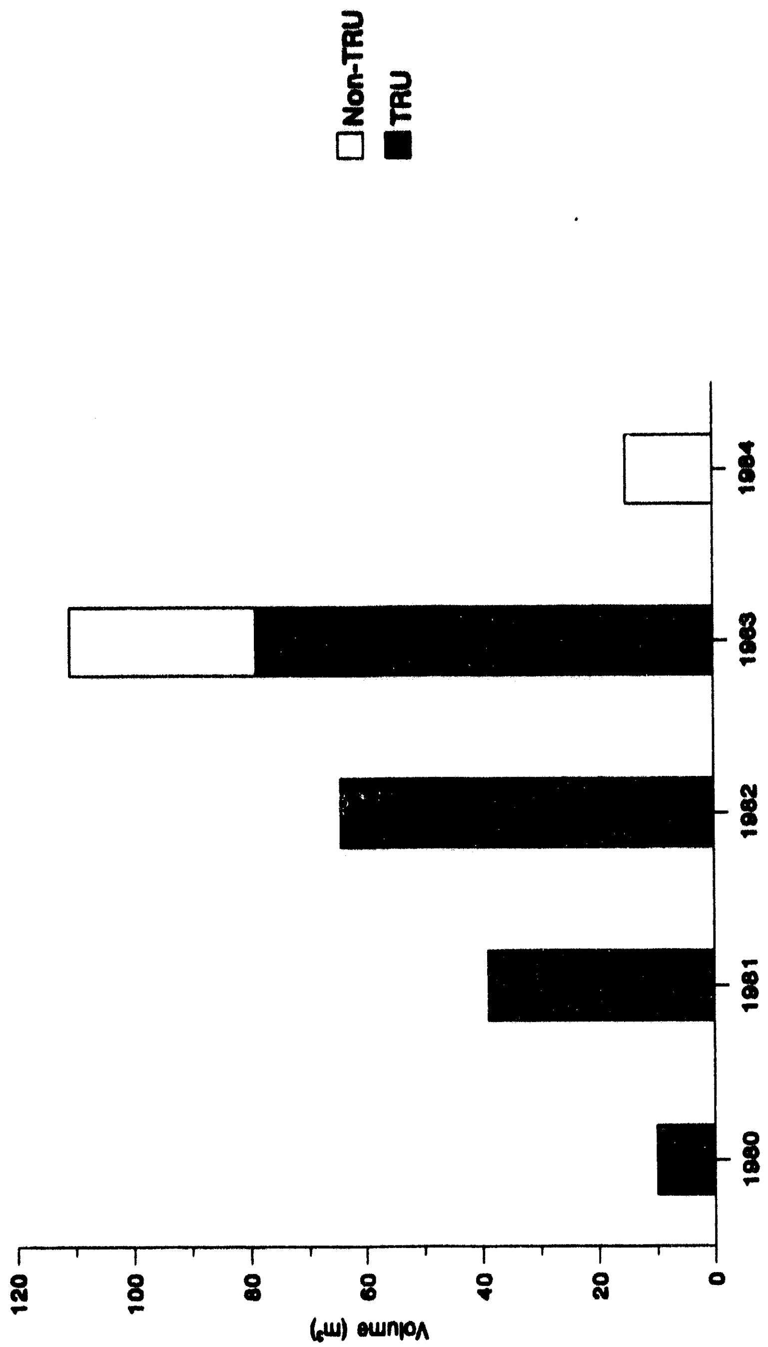

Figure 5-4. Number of Other Containers from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

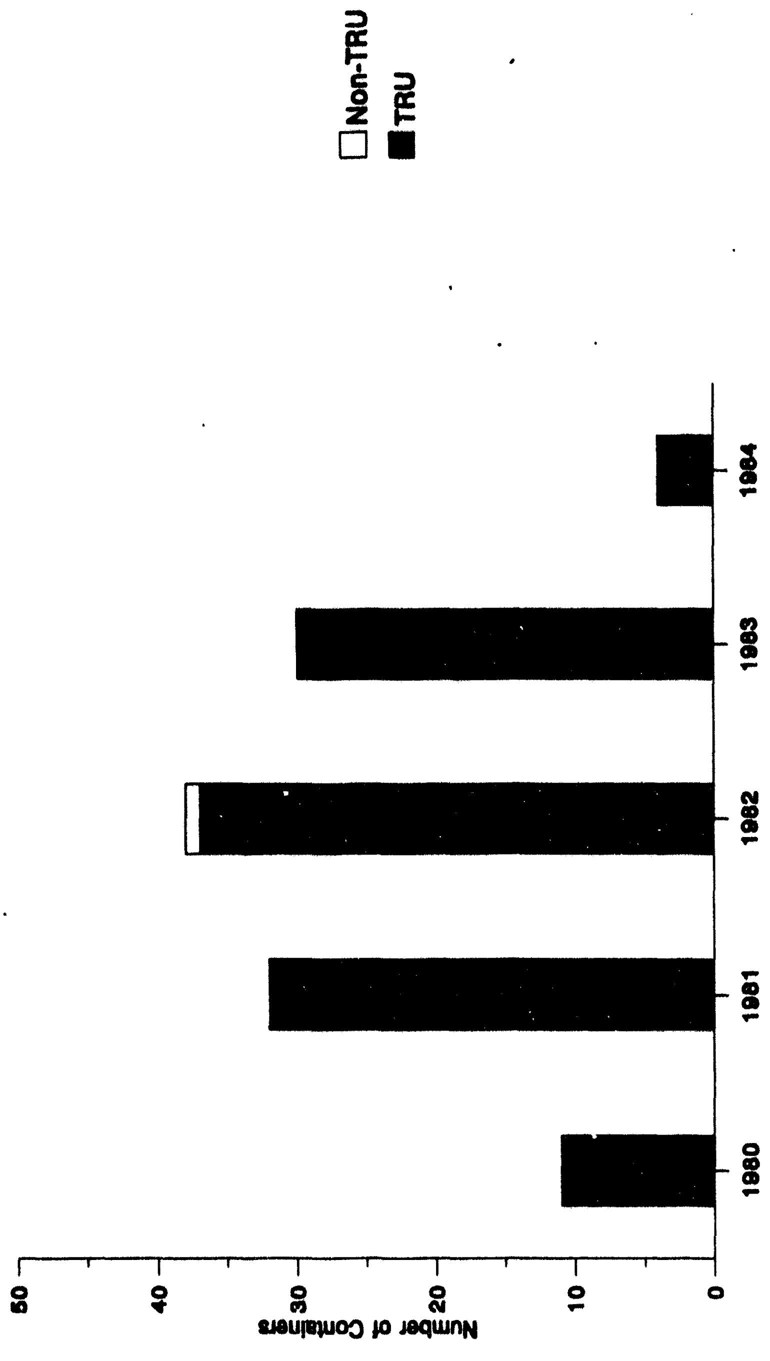

Figure 5-5. Weight of Other Containers from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

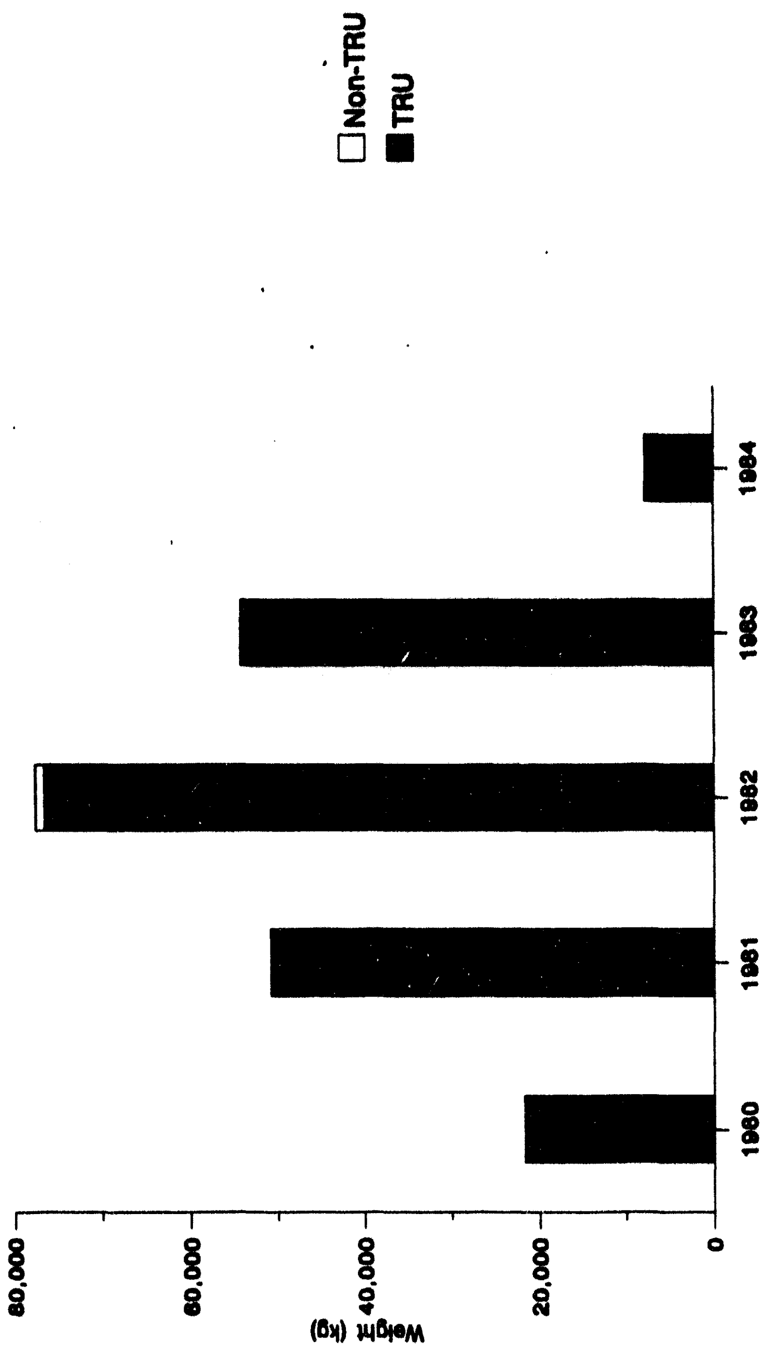

Figure 5-6. Volume of Other Containers from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

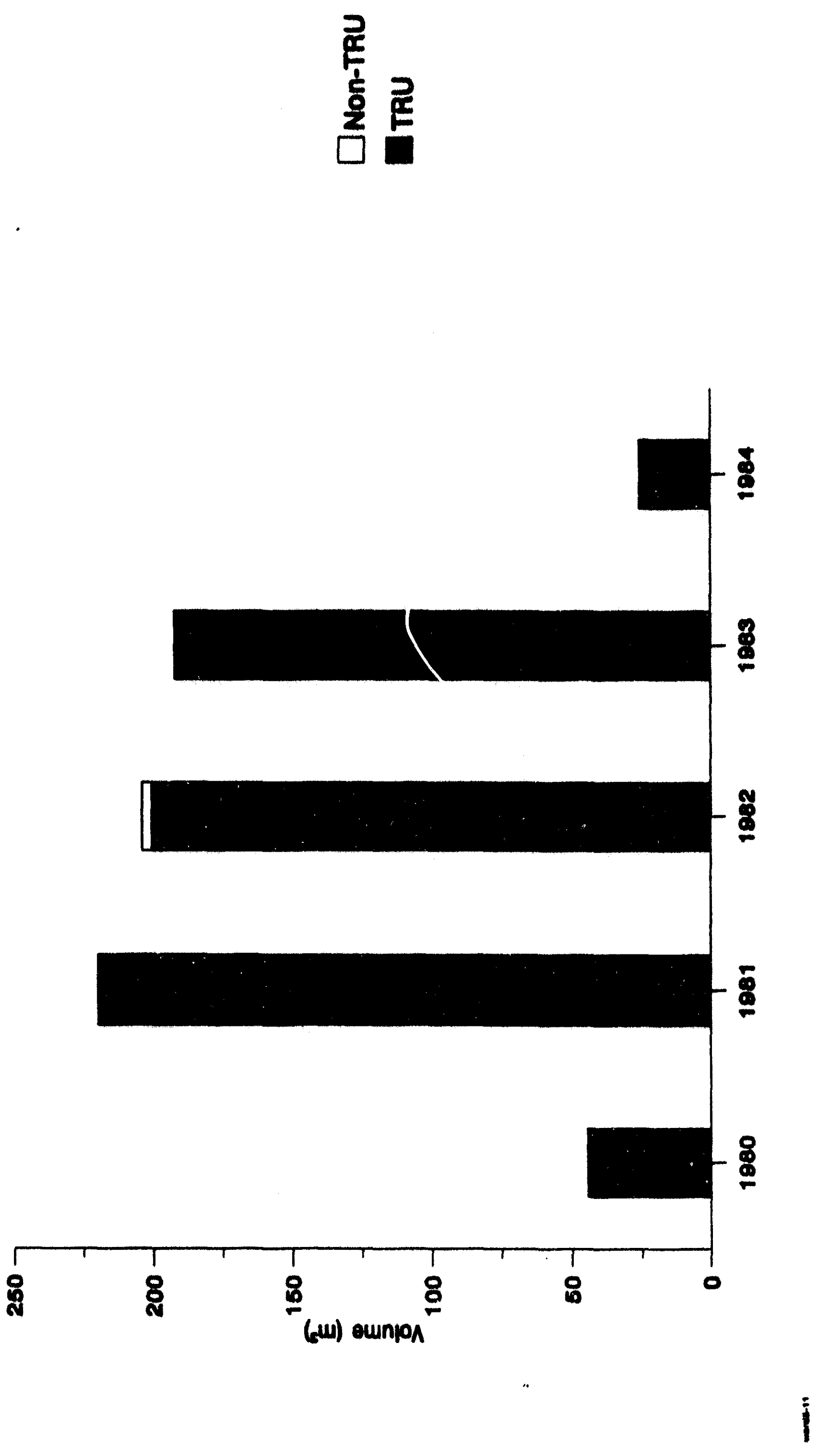

Figure 5-7. Total Number of Waste Containers from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

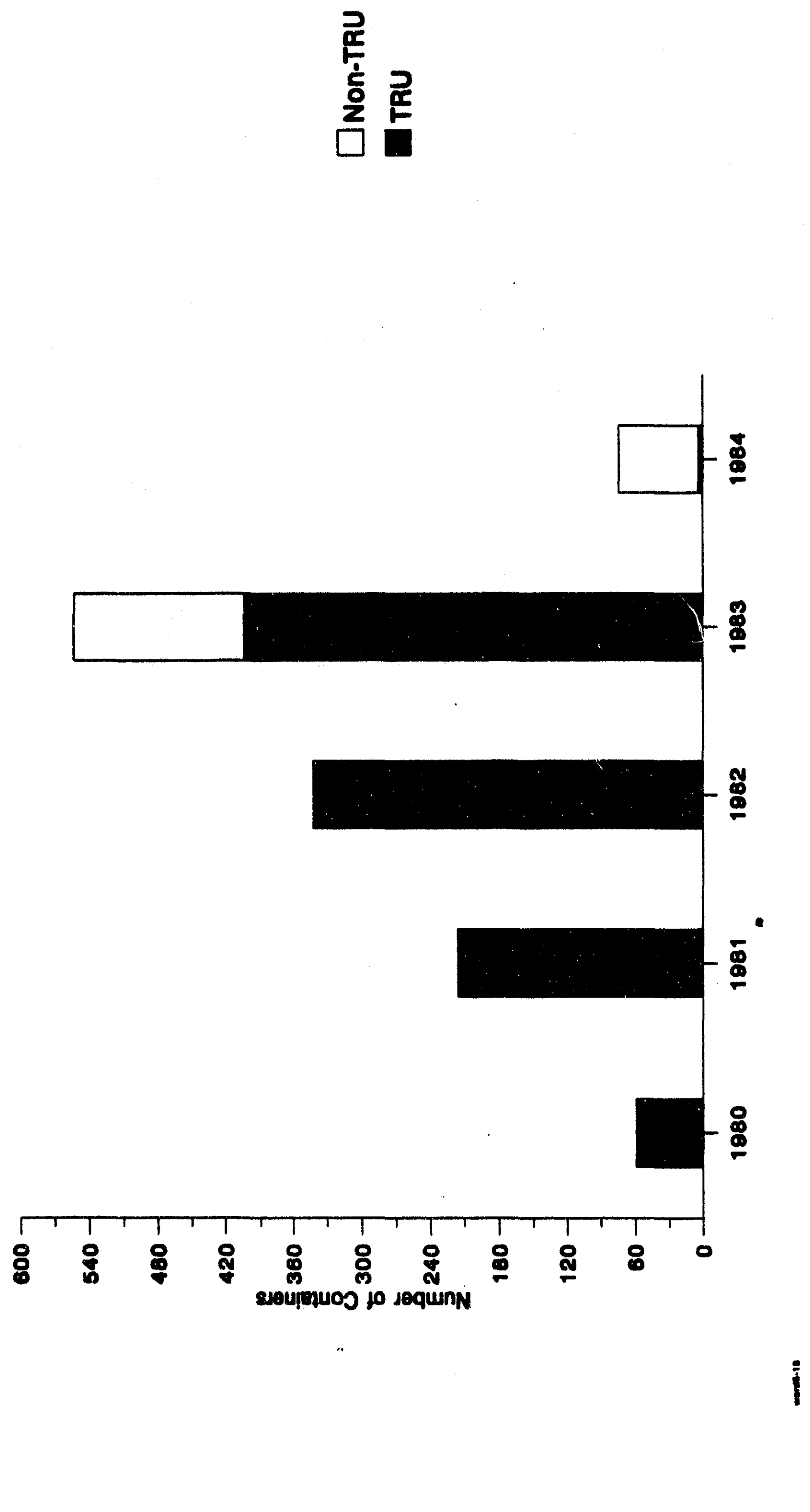

Figure 5-8. Total Weight of Waste Containers from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

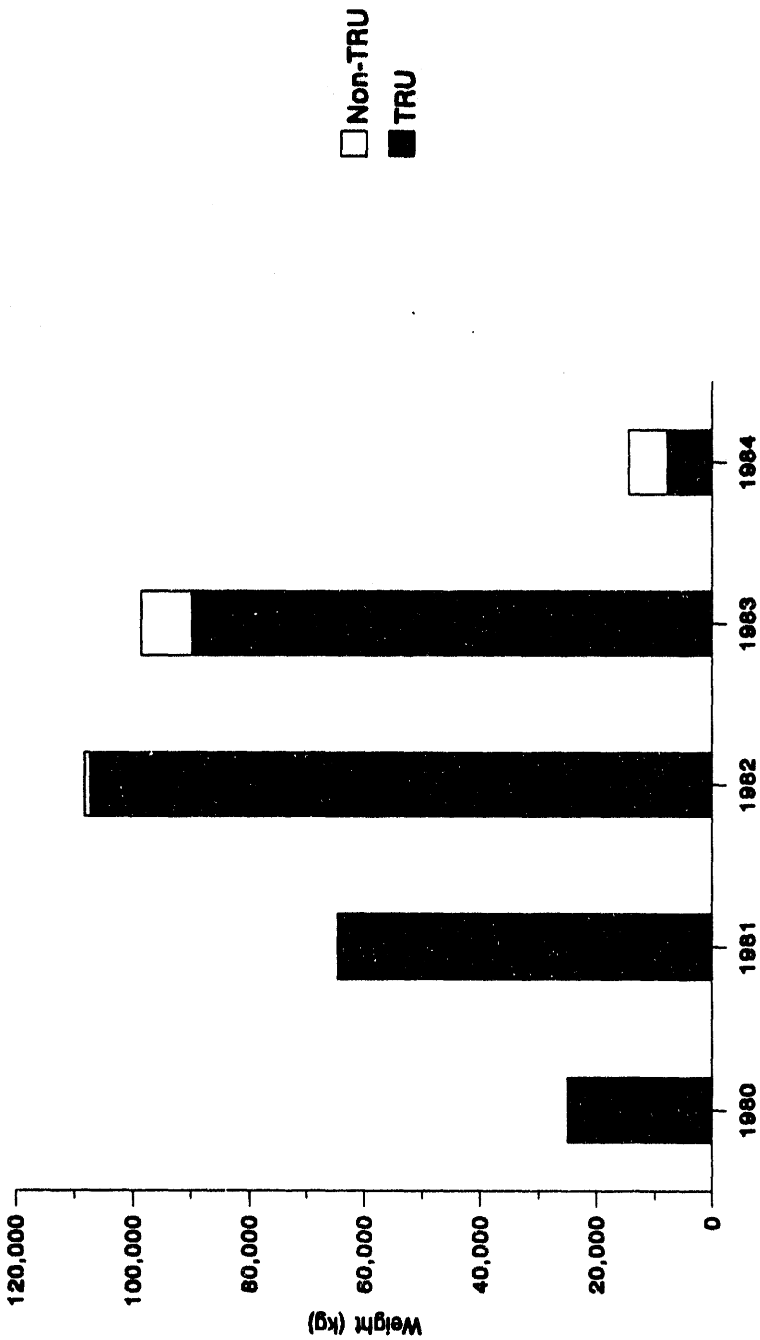

Figure 5-9. Total Volume of Waste Containers from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

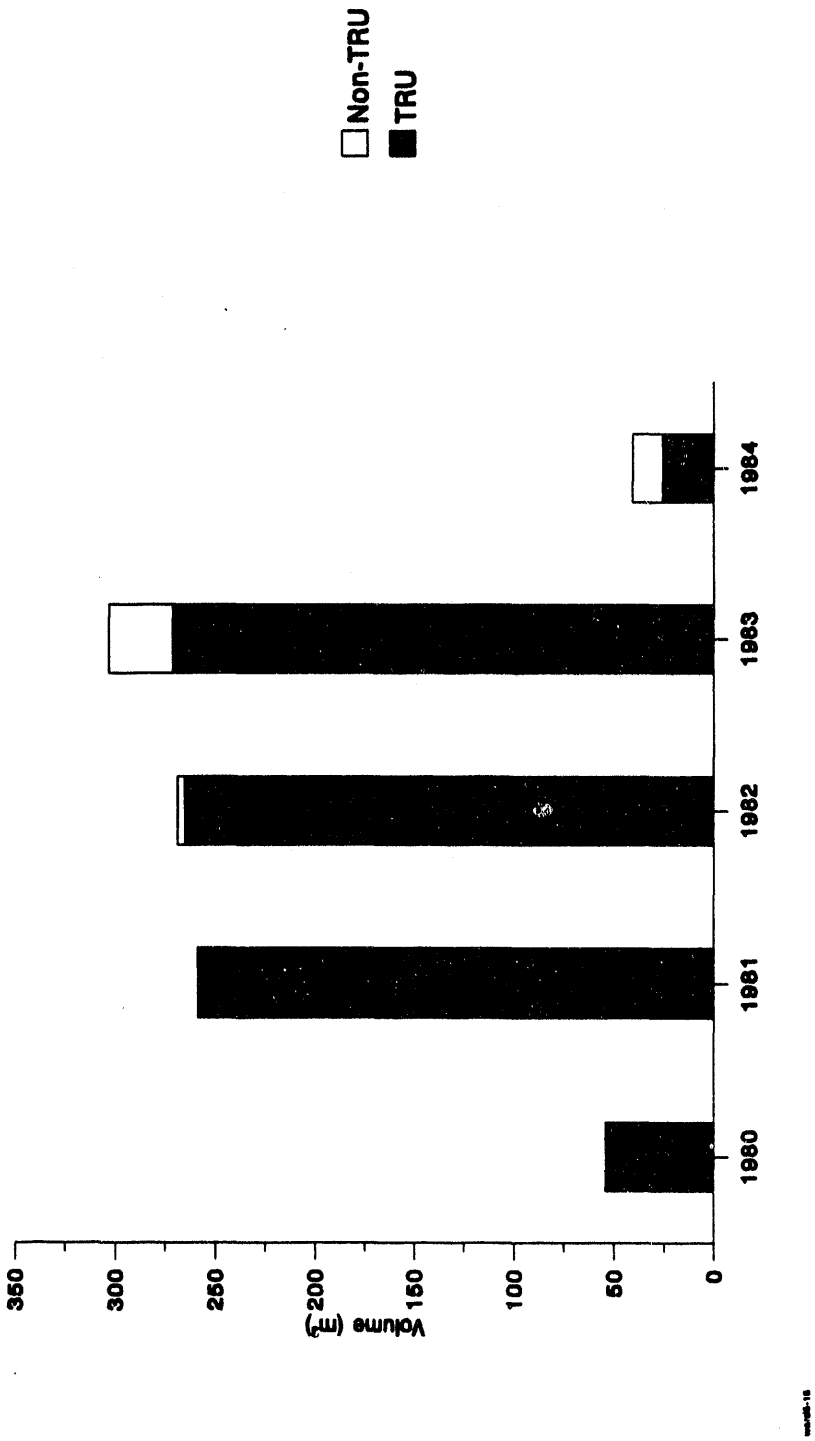

Figure 5-10. Grams of Transuranic Waste from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

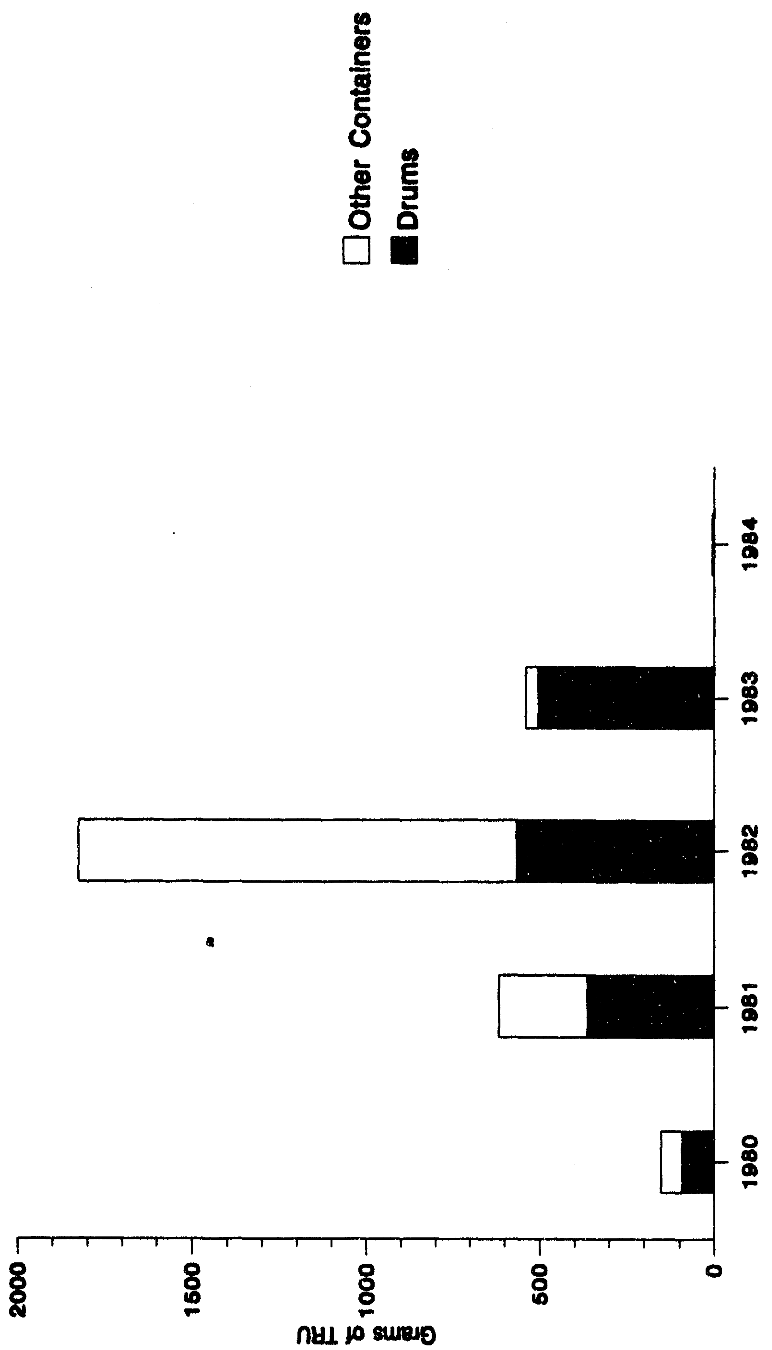

Table 5-1. Transuranic Waste Generated at Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division by Container Type and Year. (2 sheets)

Container Type	Container Size	Number of Containers	Percent of Total	Weight (kg)	Percent Weight	Volume (m³)	Percent Volume
1980							
Fiberglass Reinforced Polyester Plywood Boxes	5.8 by 5.8 by 9.6 ft	1	1.7	1,886	7.5	9.1	16.7
Metal Boxes, Cartons, Cases	4 by 5 by 6 ft	10	16.9	19,886	79.5	35.4	64.8
Metal Drums, Barrels, Kegs	55-gal	48	81.4	3,249	13.0	10.1	18.5
Total		59		25,021		54.6	
1981							
Fiberglass Reinforced Polyester Plywood Boxes	4.6 by 5.1 by 11.8 ft	1	0.5	1,967	3.0	7.8	3.0
	5.3 by 5.7 by 7.3 ft	3	1.4	4,295	6.6	18.6	7.2
	5.3 by 5.7 by 9.8 ft	6	2.8	10,826	16.7	50.5	19.5
	5.5 by 5.7 by 11.2 ft	2	0.9	4,392	6.8	19.7	7.6
	5.8 by 5.8 by 10.6 ft	2	0.9	3,900	6.0	20.1	7.8
	5.8 by 5.8 by 9.6 ft	6	2.8	11,136	17.2	54.6	21.1
	6 by 6.1 by 9.6 ft	1	0.5	1,947	3.0	9.9	3.8
Metal Boxes, Cartons, Cases	* 4 by 5 by 6 ft	2	0.9	1,761	2.7	7.1	2.7
	4 by 5 by 6 ft	9	4.2	10,628	16.4	31.9	12.3
Metal Drums, Barrels, Kegs	* 55-gal	72	33.3	6,030	9.3	15.3	5.9
	55-gal	112	51.9	7,834	12.1	23.6	9.1
Total		216		64,716		259.1	

Table 5-1. Transuranic Waste Generated at Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division by Container Type and Year. (2 sheets)

Container Type	Container Size	Number of Containers	Percent of Total	Weight (kg)	Percent Weight	Volume (m^3)	Percent Volume
1982							
Fiberglass Reinforced Polyester Plywood Boxes	5.5 by 5.7 by 11.2 ft	1	0.3	2,212	2.1	9.8	3.7
Metal Boxes, Cartons, Cases	* 4 by 5 by 6 ft	7	2.1	8,136	7.6	24.8	9.3
	4 by 5 by 6 ft	9	2.6	9,442	8.8	37.6	14.2
	6 by 6 by 7 ft	20	5.9	56,914	53.0	128.6	48.5
Metal Drums, Barrels, Kegs	* 55-gal	63	18.5	4,402	4.1	13.4	5.0
	55-gal	241	70.7	26,261	24.4	51.1	19.3
Total		341		107,367		265.3	
1983							
Metal Boxes, Cartons, Cases	4 by 5 by 6 ft	25	6.2	44,582	49.6	160.7	59.2
	6 by 6 by 7 ft	5	1.2	9,653	10.7	32.1	11.8
Metal Drums, Barrels, Kegs	* 55-gal	2	0.5	142	0.2	0.4	0.1
	55-gal	372	92.1	35,578	39.6	78.4	28.9
Total		404		89,955		271.6	
1984							
Metal Boxes, Cartons, Cases	4 by 5 by 6 ft	4	100	7,872	100	25.7	100
Total		4		7,872		25.7	

*These containers hold mixed waste.

Table 5-2. NonTransuranic Waste Generated at Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division by Container Type and Year.

Container Type	Container Size	Container Number	Percent of Total	Weight (kg)	Percent Weight	Volume (m^3)	Percent Volume
1980							
1981							
1982							
Metal Boxes, Cartons, Cases	4x5x6 ft	1	100	990	100%	3.5	100
Total		1		990		3.5	
1983							
Metal Drums, Barrels, Kegs	55-gal	150	100%	8691	100%	31.9	100
Total		150		8691		31.9	
1984							
Metal Drums, Barrels, Kegs	55-gal	70	100	6514	100%	14.9	100
Total		70		6514		14.9	

Table 5-3. Waste Summary Data for 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

	1980	1981	1982	1983	1984
Distribution					
TRU count	48	184	304	374	
TRU wt (kg)	3,249	13,865	30,663	35,720	
TRU vol (m^3)	10.1	39.0	64.4	78.9	
TRU MW count		72	63	2	
Non-TRU count				150	70
Non-TRU wt (kg)				8,691	6,514
Non-TRU vol (m^3)				31.9	14.9
Percentage					
TRU by count	100	100	100	71	0
Non-TRU by count	0	0	0	29	100
Wt TRU	100	100	100	80	0
Wt Non-TRU	0	0	0	20	100
Vol TRU	100	100	100	71	0
Vol Non-TRU	0	0	0	29	100
MW TRU by count		39	21	0.5	

MW = Mixed Waste
TRU = Transuranic.

Table 5-4. Waste Summary Data for Containers Other Than 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division.

	1980	1981	1982	1983	1984
Distribution					
TRU count	11	32	37	30	4
TRU wt (kg)	21,772	50,852	76,704	54,235	7,873
TRU vol (m^3)	44.5	220.2	200.8	192.8	25.7
TRU MW count		2	7		
Non-TRU count			1		
Non-TRU wt (kg)			990		
Non-TRU vol (m^3)			3.5		
Percentage					
TRU by count	100	100	97.4	100	100
Non-TRU by count	0	0	2.6	0	0
Wt TRU	100	100	98.7	100	100
Wt Non-TRU	0	0	1.3	0	0
Vol TRU	100	100	98.3	100	100
Vol Non-TRU	0	0	1.7	0	0
MW TRU by count		6.3	18.9		
Grams of TRU					
Other Containers	58.7	252.1	1,260.9	34.0	4.0
Drums	93.0	364.3	566.7	505.0	0.0

MW = Mixed Waste
TRU = Transuranic.

Table 5-5. Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Transuranic Waste in 55-Gallon Drums: Drum Count by Storage Location.

	1980	1981	1982	1983	1984
218-W-4C	48	184	304	374	

Table 5-6. Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Transuranic Waste in Containers Other than 55-Gallon Drums: Drum Count by Storage Location.

	1980	1981	1982	1983	1984
218-W-3A	1	21	1		
218-W-4C	10	11	36	30	4

Table 5-7. Distribution and Percentage of Transuranic 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Physical Contents by Storage Location - 218-W-4C. (2 sheets)

	1980	1981	1982	1983	1984
Distribution					
Absorbent/Kitty Litter/Vermiculite		95	172	59	
Asbestos			23	46	
Cement		88	45	120	
Ceramics			197		
Cloth/Rags/Nylon	32	112	264	91	
Concrete				57	
Dirt/Soil/Diatomaceous Earth				13	
Fiberglass			135		
Foam/Styrofoam			15		
Glass	1	95	197	145	
Insulation, Non-Asbestos		23			
Leather			75	112	
Metal/Iron/Galvanized/Sheet	16	162	210	270	
Miscellaneous/Unknown/Other	32	45			
Oils		72		2	
Organics			63		
Paints/Lucite		64	59	198	
Paper/Cardboard	48	183	300	292	
Plaster				22	
Plastic/Polyurethane	48	184	300	316	
Rock/Gravel		48			
Rubber	32	159	286	281	
Sheetrock				58	
Wood/Lumber/Plywood	32	101	269	220	

Table 5-7. Distribution and Percentage of Transuranic 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Physical Contents by Storage Location - 218-W-4C. (2 sheets)

	1980	1981	1982	1983	1984
Percentage					
Absorbent/Kitty Litter/Vermiculite		52	57	16	
Asbestos			8	12	
Cement		48	15	32	
Ceramics			65		
Cloth/Rags/Nylon	67	61	87	24	
Concrete				15	
Dirt/Soil/Diatomaceous Earth				3	
Fiberglass			44		
Foam/Styrofoam			5		
Glass	2	52	65	39	
Insulation, Non-Asbestos		13			
Leather			25	30	
Metal/Iron/Galvanized/Sheet	33	88	69	72	
Miscellaneous/Unknown/Other	67	24			
Oils		39		1	
Organics			21		
Paints/Lucite		35	19	53	
Paper/Cardboard	100	99	99	78	
Plaster				6	
Plastic/Polyurethane	100	100	99	84	
Rock/Gravel		26			
Rubber	67	86	94	75	
Sheetrock				16	
Wood/Lumber/Plywood	67	55	88	59	

Table 5-8. Distribution and Percentage of Transuranic Containers Other than 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division: Physical Contents by Storage Location - 218-W-3A.

	1980	1981	1982	1983	1984
Distribution					
Graphite		1			
Metal/Iron/Galvanized/Sheet	1	21	1		
Paper/Cardboard		1			
Plastic/Polyurethane	1	21			
Rubber		1			
Percentage					
Graphite		5			
Metal/Iron/Galvanized/Sheet	100	100	100		
Paper/Cardboard		5			
Plastic/Polyurethane	100	100			
Rubber		5			

Table 5-9. Distribution and Percentage of Transuranic Containers Other than 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division: Physical Contents by Storage Location - 218-W-4C. (2 sheets)

	1980	1981	1982	1983	1984
Distribution					
Absorbent/Kitty Litter/Vermiculite		8	7		
Brick/Firebrick			1		
Cement		4	3		
Cloth/Rags/Nylon		8	13		
Concrete			7		
Glass	5	10	6	3	
Metal/Iron/Galvanized/Sheet	10	11	28	28	4
Oils		1	2		
Organics		2	5		
Paints/Lucite		3			
Paper/Cardboard	10	11	14	9	
Plastic/Polyurethane	5	11	25	19	4
Rock/Gravel		6	1		
Rubber	5	11	14	2	
Wood/Lumber/Plywood	10	10	15	11	

Table 5-9. Distribution and Percentage of Transuranic Containers Other than 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division: Physical Contents by Storage Location - 218-W-4C. (2 sheets)

	1980	1981	1982	1983	1984
Percentage					
Absorbent/Kitty Litter/Vermiculite		73	19		
Brick/Firebrick			3		
Cement		36	8		
Cloth/Rags/Nylon		73	36		
Concrete			19		
Glass	50	91	17	10	
Metal/Iron/Galvanized/Sheet	100	100	78	93	100
Oils		9	6		
Organics		18	14		
Paints/Lucite		27			
Paper/Cardboard	100	100	39	30	
Plastic/Polyurethane	50	100	69	63	100
Rock/Gravel		55	3		
Rubber	50	100	39	7	
Wood/Lumber/Plywood	100	91	42	37	

Table 5-10. Transuranic Waste in 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Total Grams by Storage Location.

	1980	1981	1982	1983	1984
218-W-4C	93.00	364.32	566.68	505.03	

Table 5-11. Transuranic Waste in Containers Other Than 55-Gallon Drums: Total Grams by Storage Location.

	1980	1981	1982	1983	1984
218-W-3A	1.00	63.61	0.22		
218-W-4C	57.69	188.45	1,260.67	34.00	4.00
Total	58.69	252.06	1,260.89	34.00	4.00

Table 5-12. Identified Isotopes.

Element	Isotopes
Plutonium	Isotopes ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu were all listed on SWBRs. The SWITS database shows Pu was contained in 59 burial containers in 1980, 216 containers in 1981, 341 containers in 1982, 344 containers in 1983, and 4 containers in 1984.
Thorium	^{232}Th was contained in one burial container in 1981.
Uranium	Depleted, natural, and enriched uranium were all contained in WARD/WNFD waste. The SWITS database lists depleted uranium in 63 containers in 1981, 2 containers in 1982, and 3 containers in 1983. Enriched uranium was listed in 41 containers in 1980, 186 containers in 1981, 36 containers in 1982, and 10 containers in 1983. Natural uranium was contained in 3 containers in 1981, 226 containers in 1982, 304 containers in 1983, and 4 containers in 1984.

Table 5-13. Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Transuranic Mixed Waste in 55-Gallon Drums: Drum Count by Storage Location.

	1980	1981	1982	1983	1984
218-W-4C		72	63	2	

Table 5-14. Distribution and Percentage of Transuranic 55-Gallon Drums from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Hazardous Constituents by Storage Location - 218-W-4C.

	1980	1981	1982	1983	1984
Distribution					
Asbestos			1		
Oils		58		2	
Organics		13	63		
Percentage					
Asbestos			0.3		
Oils		32		0.5	
Organics		7	21		

Table 5-15. Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division Transuranic Mixed Waste in Containers Other Than 55-Gallon Drums: Container Count by Storage Location.

	1980	1981	1982	1983	1984
218-W-3A					
218-W-4C		2	7		

Table 5-16. Distribution and Percentage of Transuranic Containers Other Than 55-Gallon Drums: Hazardous Constituents by Storage Location - 218-W-4C.

	1980	1981	1982	1983	1984
Distribution					
Oil			1		
Organics		1	1		
Percentage					
Oil			3		
Organics		9	3		

Table 5-17. Summary of Information from Solid Waste Storage Disposal Records for Transuranic Wastes with Hazardous Contents from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division. (3 sheets)

Date Accepted	Pin Number	Burial Record Number	Hazardous Constituents	Waste Codes	Weight (kg)	Volume (%)*
08/10/81	A-064	WARD-WEC-81-3	ORGANIC MATERIAL			
08/10/81	A-015	WARD-WEC-81-3	ORGANIC			
08/10/81	A-018	WARD-WEC-81-3	ORGANIC			
08/10/81	A-022	WARD-WEC-81-3	ORGANIC			
08/10/81	A-054	WARD-WEC-81-3	ORGANIC			
08/10/81	A-056	WARD-WEC-81-3	ORGANIC			
09/14/82	RRM-3389-4-1	WARD-WEC-82-1	ORGANIC			
10/14/82	NFD-224	WARD-WEC-82-4	ORGANIC			5.15
10/14/82	NFD-225	WARD-WEC-82-4	ORGANIC			5.15
10/14/82	NFD-226	WARD-WEC-82-4	ORGANIC			5.15
10/14/82	NFD-230	WARD-WEC-82-4	ORGANIC			5.15
10/15/82	NFD-268	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-269	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-270	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-271	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-272	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-273	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-274	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-275	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-276	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-277	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-278	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-279	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-283	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-287	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-288	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-290	WARD-WEC-82-8	ASBESTOS			1.12

Table 5-17. Summary of Information from Solid Waste Storage Disposal Records for Transuranic Wastes with Hazardous Contents from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division. (3 sheets)

Date Accepted	Pin Number	Burial Record Number	Hazardous Constituents	Waste Codes	Weight (kg)	Volume (%)*
10/15/82	NFD-293	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-296	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-298	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-311	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-312	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-315	WARD-WEC-82-8	ASBESTOS			1.12
10/15/82	NFD-310	WARD-WEC-82-8	ASBESTOS			1.12
12/13/82	A-061	WARD-WEC-82-9	ORGANIC			
12/13/82	A-076	WARD-WEC-82-9	ORGANIC			
12/13/82	A-081	WARD-WEC-82-9	ORGANIC			
04/11/83	NFD-299	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-301	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-303	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-316	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-317	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-318	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-325	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-328	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-331	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-333	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-334	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-337	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-341	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-343	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-345	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-346	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-348	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-349	WARD-WEC-83-7	ASBESTOS			0.11

Table 5-17. Summary of Information from Solid Waste Storage Disposal Records for Transuranic Wastes with Hazardous Contents from Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division. (3 sheets)

Date Accepted	Pin Number	Burial Record Number	Hazardous Constituents	Waste Codes	Weight (kg)	Volume (%)*
04/11/83	NFD-350	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-351	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-352	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-353	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-354	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-355	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-356	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-357	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-358	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-359	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-361	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-362	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-363	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-364	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-365	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-367	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-368	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-369	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-371	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-373	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-374	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-375	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-376	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-378	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-379	WARD-WEC-83-7	ASBESTOS			0.11
04/11/83	NFD-380	WARD-WEC-83-7	ASBESTOS			0.11

*Volume percents represent entire shipment, rather than individual containers.

Table 5-18. Descriptions of Hazardous Constituents.

Constituent	Description
Aerosol Cans	Unvented aerosol cans are expected to be in the solid waste stream. The cans were used for spray paint and window cleaner.
Asbestos	This was used in the sintering furnace in the form of insulation, fiber work, and fiberboard rock.
Hydraulic Fluids	This was absorbed in diatomaceous earth (Speedi-Dri/Floor-Dri). The amount of absorbent used was equivalent to twice that required to completely absorb the liquid. The absorbed liquid was put in 1-gal poly bottles.
Ion Exchange Resins	Resins were stabilized by solidification in cement.
Lead	Lead in the form of shot and glass lining is expected in the waste stream. It was probably removed from WARD gloveboxes when they were cleaned out.
Mercury	Packaging procedures indicated that mercury was to be mixed with an absorbent powder to form an amalgam. It was then double-bagged and loaded in a 55-gal drum surrounded by a minimum six inches of concrete.
Nitric Acid	All liquids were absorbed with Speedi-Dri/Floor-Dri.
NUTEC 600 EL	Used as a cleaning fluid, diluted 20:1 with water.
Oakite	A clear coat used to fix contamination on equipment. The main ingredient of Oakite is polyvinyl alcohol. The Material Safety Data Sheet for Oakite appears in Appendix B.
Oils	Oils taken from two gloveboxes and disassembled presses were absorbed with Speedi Dri/Floor Dri and put in 1-gal poly bottles.
Organic Materials	Paint and strip ease were taken from walls, floors, and ceilings of the WARD/WNFD facilities during D&D. Absorbed organic materials have flash point range of 227 to 238 °C (440 to 460 °F).
Oxalic Acid	This was absorbed with Speedi-Dri/Floor-Dri.
TURCO	This was a cleaning solution. (TURCO is a trademark of Turco Products, Inc., Carson, CA.)

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APPENDIX A

DATA ON WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION WASTE GENERATION FROM THE SOLID WASTE INFORMATION TRACKING SYSTEM

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DON'T SAY IT --- *Write It !*

Date:

To: Judy Pattmeyer

From: Solid Waste Engineering Data Management Group
N3-11 6-4394/6-4020

Re: SWITS DATA REQUEST

Attached for your information and use is the data which you requested. This data represents best available information regarding wastes currently in storage at the Hanford Site. I trust the information will be suitable to your needs.

Requests for information from the Solid Waste Information and Tracking System (SWITS) are normally relatively limited in scope, requesting specific data fields or summary data. The responses to these requests undergo review during data collection, summary and response preparation.

The response to this request represents a simple reproduction of the SWITS Database. Transmittal of this information is made with the following disclaimers:

1) The information contained in this transmittal is raw data, and represents information provided to Solid Waste Engineering (SWE) on burial records or other documents. This data has not been validated.

2) The information contained in this transmittal is subject to change without notice. Continual update of SWITS information and improvement of the software system make it impossible to ensure consistency of this data with the database after transmittal.

3) This information is current as of 12/11/92.

If I can be of further assistance to you, do not hesitate to call me.

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DATA ON WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION WASTE GENERATION FROM THE SOLID WASTE INFORMATION TRACKING SYSTEM

The information found in this appendix is from the Solid Waste Information and Tracking System (SWITS) database. This database incorporates the older Richland Solid Waste Information Management Systems (R-SWIMS) database and is used to track information on radioactive and other wastes stored or disposed at the Hanford Site.

Each SWITS data run in this appendix is preceded by the query used to generate the data. A brief explanation of the run and any additional information needed to understand the data presented also is included.

The bulk of the data provided is limited to information about transuranic (TRU) waste generated at Westinghouse Advanced Reactors Division/Westinghouse Nuclear Fuels Division (WARD/WNFD); however, some general information on the non-TRU waste is included for completeness. The term non-TRU is used, instead of low-level waste (LLW), because a small percentage of the waste has been designated only as not TRU. It is believed that most, if not all, of the non-TRU waste is LLW.

The data runs in this appendix are further segregated by waste container type. Because initial retrieval efforts and the Waste Receiving and Processing (WRAP) Facility 1 will focus on 55-gal drums, these container types are considered separately. Unless stated otherwise, the units in these SWITS runs are cubic meters (m^3) for volume and kilograms (kg) for weight.

Some general information about SWITS database and the codes used follows. Please note the disclaimer found on the next page.

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APPENDIX A.1

CONTAINER NUMBER AND WEIGHT OF TRANSURANIC WASTE IN 55-GALLON DRUMS BY WASTE TYPE

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CONTAINER NUMBER AND WEIGHT OF TRANSURANIC WASTE IN 55-GALLON DRUMS BY WASTE TYPE

This data run gives an overall look at the waste types, container numbers and total weight (in kg) of the radioactive wastes generated at WARD/WNFD on a yearly basis. These data are for wastes stored in 55-gal drums only. The meanings of primary and secondary waste codes can be found in the introductory materials for this appendix.

The data in the average weight column should be taken cautiously, especially for LLW codes. Concern is warranted because LLW records are still done on a batch basis. This means that one weight datum may be the composite weight for a group of drums. The computer program used simply divided the sum of all weight values by the number of values used to compute the total weight, not the actual number of containers that that value represents.

From 1970 until 1978 individual container weights were not required for TRU drums. During the data re-entry program in the mid-1980's standard weights were assigned for all container types; 55-gal drums were given a standard weight of 68 kg. This is why the average weight/drum for TRU is so consistent during this period.

APPENDIX A.2

WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION TRANSURANIC WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION, SIZE, YEAR, AND PRIMARY WASTE TYPE

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WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION TRANSURANIC WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION, SIZE, YEAR, AND PRIMARY WASTE TYPE

This sub-appendix provides information on WARD/WNFD TRU waste containers, weight, volume, and primary waste type stored at various TRU waste storage facilities on the Hanford Site. The data provides the TRU waste generation from the WARD/WNFD Facilities by year.

The presence of hazardous constituents in a radioactive waste drum designates the waste as 'Mixed' (primary waste code "M"); remaining radioactive drums have "R" waste code designation.

APPENDIX A.3

WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION NON-TRANSURANIC WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION, SIZE, YEAR, AND PRIMARY WASTE TYPE

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WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION NON-TRANSURANIC WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION, SIZE, YEAR, AND PRIMARY WASTE TYPE

This sub-appendix provides information on WESTINGHOUSE ADVANCED REACTORS DIVISION/WNFD non-TRU waste containers, weight, volume, and primary waste type stored at various waste storage facilities on the Hanford Site. The data provides the non-TRU waste generation from the WARD/WNFD Facilities by year.

APPENDIX A.4

RADIOLOGICAL DATA FOR TRANSURANIC WASTE CONTAINERS SORTED BY DATE, PRIMARY WASTE TYPE, AND STORAGE FACILITY

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RADIOLOGICAL DATA FOR TRANSURANIC WASTE CONTAINERS SORTED BY DATE, PRIMARY WASTE TYPE, AND STORAGE FACILITY

This sub-appendix summarizes the radiological data for all TRU waste containers generated at WARD/WNFD. Specifically, this computer run provides the total grams of TRU elements in a given container type in a given year. In addition, the average gram loading for a given container type in a given year has been calculated.

In 1991 and 1992 the number of curies (Ci) of alpha radiation was included on the Solid Waste Burial Records (SWBR). Since the WARD/WNFD waste generation data is all from 1980 to 1984, these columns contain blank entries. The 'Max Dose' column contains the highest value recorded for a given container in a given year, in mrem/hour.

Additional information about the isotopes present in WARD/WNFD waste containers can be found in sub-appendices A.9 and A.10.

APPENDIX A.5

PHYSICAL CONTENTS DESCRIPTION FOR WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION 55-GALLON DRUMS CONTAINING TRANSURANIC WASTE SORTED BY DATE, PRIMARY WASTE TYPE, AND STORAGE FACILITY

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PHYSICAL CONTENTS DESCRIPTION FOR WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION 55-GALLON DRUMS CONTAINING TRANSURANIC WASTE SORTED BY DATE, PRIMARY WASTE TYPE, AND STORAGE FACILITY

This sub-appendix describes the physical contents of the 55-gal drums of TRU waste generated by WARD/WNFD. Before 1978, physical contents were not required on the burial records, so a great many of the early records list the contents of the drum as 'Miscellaneous.'

The printout for this computer run sorts the contents data by storage facility, date and primary waste type. The introduction to Appendix A contains a table of waste codes and their meanings.

APPENDIX A.6

PHYSICAL CONTENTS DESCRIPTION FOR WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION TRANSURANIC WASTE CONTAINERS OTHER THAN 55-GALLON DRUMS SORTED BY DATE, PRIMARY WASTE TYPE, AND STORAGE FACILITY

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PHYSICAL CONTENTS DESCRIPTION FOR WESTINGHOUSE ADVANCED REACTORS DIVISION/WESTINGHOUSE NUCLEAR FUELS DIVISION TRANSURANIC WASTE CONTAINERS OTHER THAN 55-GALLON DRUMS SORTED BY DATE, PRIMARY WASTE TYPE, AND STORAGE FACILITY

This sub-appendix describes the physical contents of the TRU waste containers other than 55-gal drums generated at WARD/WNFD. Before 1978, physical contents were not required on the burial records, so a great many of the early records list the contents of the drum as 'Miscellaneous.'

The printout for this computer run sorts the contents data by storage facility, date and primary waste type. The introduction to Appendix A contains a table of waste codes and their meanings.

APPENDIX A.7

HAZARDOUS CONSTITUENTS OF 55-GALLON DRUMS CONTAINING TRANSURANIC WASTE

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HAZARDOUS CONSTITUENTS OF 55-GALLON DRUMS CONTAINING TRANSURANIC WASTE

The presence of hazardous constituents in a radioactive waste drum designates the waste as 'Mixed' (primary waste code "M"). In this sub-appendix the hazardous contents of 55-gal drums generated at WARD/WNFD are sorted by storage facility.

Information concerning the hazardous constituents of waste containers was not required before 1986. During the R-SWIMS data re-entry program in the mid-1980's an attempt was made to add any available information on the hazardous materials present, however, this information was limited.

APPENDIX A.8

HAZARDOUS CONSTITUENTS OF TRANSURANIC WASTE CONTAINERS OTHER THAN 55-GALLON DRUMS

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HAZARDOUS CONSTITUENTS OF TRANSURANIC WASTE CONTAINERS OTHER THAN 55-GALLON DRUMS

The presence of hazardous constituents in a radioactive waste drum designates the waste as 'Mixed' (primary waste code "M"). No hazardous constituents are listed in containers other than 55-gal drums generated at WARD/WNFD therefore this run did not reveal any hazardous information.

APPENDIX A.9

ISOTOPES LISTED IN 55-GALLON DRUMS CONTAINING TRANSURANIC WASTES

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ISOTOPES LISTED IN 55-GALLON DRUMS CONTAINING TRANSURANIC WASTES

This sub-appendix contains a listing of the SWITS isotope information for TRU waste from WARD/WNFD stored in 55-gal drums. The isotope field in SWITS contains several types of information:

- Specific isotope (e.g., Am-241, Np-237, U-233, Pu-238)
- Generic isotope listings (e.g., Pu, uranium-enriched, uranium-depleted.)
- Plutonium-239 Fissile Gram Equivalents (Pu239 FSL GR equiv).
- Total - alpha
- Total Beta/Gamma.

This computer run contains the isotope field listing along with the number of TRU waste drums with that listing. The run is sorted by storage facility and year.

APPENDIX A.10

ISOTOPES LISTED IN TRANSURANIC CONTAINERS OTHER THAN 55-GALLON DRUMS

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ISOTOPES LISTED IN TRANSURANIC CONTAINERS OTHER THAN 55-GALLON DRUMS

This sub-appendix contains a listing of the SWITS isotope information for TRU waste from WARD/WNFD stored in containers other than 55-gal drums. The isotope field in SWITS contains the following types of information:

- Specific isotope (e.g., Am-241, Np-237, U-233, Pu-238)
- Generic isotope listings (e.g., Pu, uranium-enriched, uranium-depleted)
- Plutonium-239 Equivalent Curies (PE-CI)
- Total-alpha
- Total Beta/Gamma
- PE-Ci (Plutonium Equivalent Curies).

This computer run contains the isotope field listing along with the number of TRU waste containers with that listing. The run is sorted by storage facility and year.

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APPENDIX B

MATERIAL SAFETY DATA SHEET FOR OAKITE CLEAR COAT

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SENT BY:OAKITE B.H. : 4-15-93 : 7:18AM : CUSTOMER SERVICE-412 963 5547 :# 2/ 7

Oakite

3558

MATERIAL SAFETY DATA SHEET

PRODUCT CODE: 3558
OAKITE CLEAR COAT ✓
124-GA-1281

HMIS 2 0 0 H

SECTION I

TRADE NAME	OAKITE CLEAR COAT	EMERGENCY TELEPHONE NUMBER: (800) 424-9300 (CHEMTREC)
CHEMICAL NAME AND SYNONYMS	NA; Mixture.	
MANUFACTURER'S NAME AND TELEPHONE NO.	OAKITE PRODUCTS INC. (908) 464-6900 (8am-5pm)	
ADDRESS	50 Valley Road Berkeley Heights NJ 07922	

SECTION II - HAZARDOUS INGREDIENTS

	CAS NO.	% BY WT	ACGIH TLV (TWA)	OSHA PEL (TWA)	UNITS
Acrylic emulsion	Trademark	30-40	NE	NE	
2-Methoxyethanol(+) -(skin)	0000109864	<5	5	50	ppm
Dimethylaminoethanol	0000108010	<5	NE	NE	
Non-hazardous ingredients		Bal.			

Unidentified ingredients are considered not hazardous under Federal Hazard Communication Standard (29 CFR 1910.1200).

All component of this material are on the US TSCA Inventory.

(+) This product contains ingredient(s) identified in Section II with (+) which are subject to the reporting requirements of section 313 of SARA Title III and 40 CFR 372.

SECTION III - PHYSICAL DATA

BOILING POINT (F)	NE	SPECIFIC GRAVITY (H20=1)	1.022
VAPOR PRESSURE (mm Hg)	<18	Bulk Density	8.5 lb/gal
VAPOR DENSITY (Air=1)	>1	PERCENT VOLATILE	

Oakite Products, Inc. warrants that the product or products described herein will conform with its published specifications. The products supplied by Oakite and information related to them are intended for use by buyers having necessary industrial skill and knowledge. Buyers should undertake sufficient verification and testing to determine the suitability of the Oakite materials for their own particular purpose. Since buyer's conditions of use of products are beyond Oakite's control, Oakite does not warrant any recommendations and information for the use of such products. OAKITE DISCLAIMS ALL OTHER WARRANTIES INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE IN CONNECTION WITH THE USE OF ITS PRODUCTS.

NA - Not Applicable NE - Not Established

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Oakite

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MATERIAL SAFETY DATA SHEET

SOLUBILITY IN WATER	Complete	BY VOLUME(%) Excludes H2O	<5
EVAPORATION RATE (BuAc=1)	<1	PH	
APPEARANCE AND ODOR	Translucent, colorless liquid; ammonia odor.	Concentrate	9.0

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used): None
FLAMMABLE LIMITS: LEL: NA UEL: NA

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, or foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear Self-Contained Breathing Apparatus (SCBA).

UNUSUAL FIRE AND EXPLOSION HAZARDS: See Section VII.(WHMIS)
See Section VI.(U.S.)

SECTION V - HEALTH HAZARD INFORMATION

ROUTE(S) OF ENTRY:	INHALATION:	SKIN:	INGESTION:
	x	x	x

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known
SYMPTOMS/EFFECTS OF OVEREXPOSURE:
Respiratory irritaion. High concentrations may produce headache, dizziness, and nausea. Prolonged or repeated skin contact may lead to drying, irritation and dermatitis. Possible skin absorption. Chronic overexposure to methoxyethanol has caused kidney damage and adverse reproductive effects in test animals.

FIRST AID

EYES: Immediately flush eyes with plenty of water for at least 15 minutes while holding eyelids open. Get prompt medical attention.

SKIN: Remove contaminated clothing. Wash thoroughly with soap and water. If irritation persists get medical attention. Wash clothing before reuse.

INGESTION: Contact local poison control center or physician IMMEDIATELY!

INHALATION: Move victim to fresh air and restore breathing if necessary. Stay with victim until emergency medical help arrives.

NA - Not Applicable NE - Not Established

Oakite

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MATERIAL SAFETY DATA SHEET

SECTION VI - REACTIVITY DATA

STABILITY: NORMALLY STABLE
Avoid extreme heat.
INCOMPATIBLE MATERIALS: Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Combustion may produce Carbon monoxide, Carbon dioxide.

SECTION VII - SPILL OR LEAK PROCEDURES

PROCEDURES: Wear personal protective equipment (See Section VIII). Ventilate area. Remove all heat and ignition sources. Clean up with noncombustible absorbant material.

WASTE DISPOSAL METHOD: Dispose of in accordance with Local State and Federal regulations.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY: Not normally required. If TLV is exceeded, or for symptoms of overexposure, wear a NIOSH-approved organic vapor respirator with a dust and mist pre-filter.

EYEWEAR: If splash potential exists wear chemical splash goggles or faceshield.

CLOTHING/GLOVES: Wear chemical-resistant gloves and clothing as needed to prevent skin contact.

VENTILATION: Local exhaust may be necessary for some handling/use conditions. Specific needs should be addressed by supervisory or health/safety personnel.

SECTION IX - SPECIAL PRECAUTIONS

Store in closed container in cool well-ventilated area. This product does not contain any carcinogens (at 0.1% or greater) as defined by IARC, NTP, or OSHA.

NA - Not Applicable NE - Not Established

Oakite

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MATERIAL SAFETY DATA SHEET

APPROVAL	Michael Chang	Mgr. Health & Environmental Dept.	06/25/1992
	NAME	TITLE	DATE

NA - Not Applicable NE - Not Established

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F.13437R4-885

OAKITE

PRODUCT PROFILE

OAKITE PRODUCTS INC., 50 VALLEY ROAD, BERKELEY HEIGHTS, N.J. 07922
OAKITE PRODUCTS OF CANADA, LTD., 115 EAST DR., BRAMALEA, ONT. L6T 1B7
Subsidiaries and Distributors World-wide Cable: OAKITE, BerkeleyHeights

TECHNICAL DATA

OAKITE CLEAR COAT™: Provides a clear, hard, film over metal surfaces.

PRIMARY APPLICATION

Oakite Clear Coat provides a hard, colorless transparent film over polished and unpolished metal surfaces. It is applicable by spray, immersion, flow-on, brush or roller to all metals. It also provides a clear protective film on thoroughly cured concrete as well as on stone.

Oakite Clear Coat contains no phosphates or chromates and requires no special drying procedures (air dries in fifteen minutes).

Clear Coat should be used only on indoor surfaces. It's not for use on floors.

CHEMICAL CHARACTERISTICS

chemical composition	alkaline water-soluble resins and inhibitors
physical form	hazy-pale blue to milky-white
odor	sweet
specific gravity	1.019 at 20°C (68°F), ASTM 1298
bulk density	1019 g/ℓ at 20°C (8.5 lbs/gal at 68°F)
viscosity	5 to 6 cps, Brookfield Spindle 1, 60 rpm at 20°C (68°F)
flash point	52°C (126°F), Pensky-Martens Closed Cup
foaming tendency	moderate at full strength
recommended diluent	may be diluted with water
maximum dilution	1 part water: 4 parts Clear Coat
behavior in hard water	not applicable
rinsability	see application procedure
biodegradable surfactants	not applicable (non-surfactant material)
phosphate-free	yes
normal working concentrations	normally, full strength
normal working temperatures	room temperature
pH at working concentrations	9.7 full strength
effect of working solutions on metals	applicable on all metals used as recommended

APPLICATION PROCEDURE

Surface Preparation: Surfaces should be thoroughly precleaned with a suitable Oakite detergent to remove shop soils, grease, oil, oxides and other soils. Follow with a thorough rinse. For best results, allow to dry before applying Oakite Clear Coat.

For optimum corrosion resistance, parts may be dipped in a 1/8 of 1% by volume of water solution, Oakite FH at 66° to 82°C (150° to 180°F). Allow to dry. Then apply the Clear Coat.

Spray: Clear Coat may be sprayed full strength with suction cup, gravity tank or pressure pot methods using conventional paint spray equipment, or through an air-operated spray gun. Suggested atomizing pressure for suction and gravity tank is 3 kg/cm² (40 psi); for pressure pot, 3 kg/cm² (40 psi) atomizing pressure and 0.4 kg/cm² (5 psi) fluid pressure. It is important to apply a continuous wet pass and overlap each pass when spraying. When dry, the film will be even in appearance and sheen.

Immersion, Flow-On, Hand Roll: Oakite Clear Coat may be applied full strength by dipping, flow or hose-on, or hand rolling with a short nap mohair roller.

Drying: The applied film will dry within 10 to 15 minutes but may be speeded up by baking or forced air drying. Overnight drying will provide optimum abrasion resistance.

Removal: Dried-on films are easily removed with any high pH material such as Oakite FLEETLINE™ JC5 or Oakite 220 NP.

Solution Control: Titrating should not normally be required.

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NOTES ON USE

For improved corrosion resistance, particularly on high carbon steels, the following procedure is suggested:

1. For every 370 liters (100 gallons) of Oakite Clear Coat solution, dilute 1/2 liter (one pint) of Oakite FH with 1 3/4 liters (1/2 gallon) of water and neutralize with 5 1/2 liters (5 1/2 quarts) of household ammonia. If concentrated commercial ammonia is used, 6 1/2 liters (1 3/4 gallons) of water should be used for dilution and 3/4 liter (1 1/2 pints) of concentrated ammonia for neutralization.
2. Add the neutralized Oakite FH solution to the Oakite Clear Coat slowly, with vigorous mechanical agitation. If slight yellow beading occurs, this may be removed from work by blowing off with compressed air.

Tanks should be constructed of low carbon steel or stainless steel.

Heating Clear Coat prior to application may adversely affect its performance and inhibitive characteristics.

Heating Clear Coat coated parts after its application is not detrimental. The coating will become tacky, but will harden to its original finish upon cooling.

Acid or acidic materials should not come in contact with the Clear Coat solution at any time as the resin portion is not suitable in acidic media.

Dry surfaces are preferable for optimum results. If parts are treated wet, sufficient time for water displacement should be allowed. A coating of Clear Coat will increase slightly the dimension of parts by weight and coating thickness.

Safety and Handling Precautions: Oakite Clear Coat is a mildly alkaline combustible material. It is harmful if swallowed or inhaled. Direct contact causes irritation of eyes. Prolonged contact may cause skin irritation. Keep concentrate away from heat, sparks, open flame and strong oxidants. Avoid prolonged or repeated breathing of vapors or mist. Use only with adequate ventilation. Do not get in eyes. Avoid pro[illegible]peated skin contact. Wash thoroughly after handling. Do not take internally.

[illegible]on of Contact: For eyes, flush with plenty of water for at least 15 minutes. If eyes are ir[illegible]ted, get medi[illegible]attention. For skin, wash thoroughly with soap and water. For inhalation, remove [illegible]rom exposure. If swallowed, give several glasses of water or milk to drink. Contact a physician.

EXCEPTION: Never give anything by mouth to an unconscious person.

KEEP OUT OF REACH OF CHILDREN.

DISPOSAL

Oakite Clear Coat solutions are normally consumed in use. Any excess may be solidified; allow solids to settle, remove and haul away. Dilute and discharge remaining solution in accordance with federal, state and local regulations. Do not discharge spent material with acidic waste or acid materials.

PACKAGING

Packaged inside poly container in non-returnable fiber drum as follows:

large drum: 208 liters (55 U.S. gallons)
small drum: 76 liters (20 U.S. gallons)

SHIPMENT

May be shipped by any common carrier. Freight classification is "Combustible Liquid, NOS, NA 1993, Paint Adhesive Resin NOIBN." Product Code No: 3558.

STORAGE

Store in a cool place out of direct sunlight and away from heat. Before opening drum, relieve any pressure build-up by loosening bung slowly. Keep container tightly closed when not in use. Keep from freezing.

effect of high temperature storage	volatile; keep below 38°C (100°F)
effect of low temperature storage	freezes at -10°C (15°F); restores on thawing
effect of prolonged storage	no adverse effect

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