Characterization of Past and Present Solid Waste Streams from 231-Z

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EXECUTIVE SUMMARY

During the next two decades the transuranic (TRU) wastes now stored in the burial trenches and storage facilities at the Hanford Site are to be retrieved, processed at the Waste Receiving and Processing Facility, and shipped to the Waste Isolation Pilot Plant near Carlsbad, New Mexico for final disposal. Over 8% of the TRU waste to be retrieved for shipment to the Waste Isolation Pilot Plant has been generated at the Plutonium Metallurgy Laboratory (231-Z) Facility.

The purpose of this report is to characterize the radioactive solid wastes generated by 231-Z using process knowledge, existing records and oral history interviews. For most of the period of interest in this report, the 231-Z Facility was operated by Pacific Northwest Laboratory who ran the facility from 1965 until 1984 when its operation was assumed by Rockwell Hanford Operations. At the present time, much of 231-Z is being used as office space by Westinghouse Hanford Company.

The 231-Z Facility is located in the 200 West Area of the Hanford Site adjacent to the Plutonium Finishing Plant. Research and development programs utilizing plutonium have been conducted at 231-Z in the fields of physical metallurgy, property determination, alloy development, and process development. Section 2.0 provides further details of the 231-Z physical plant, facility operations, facility history, and current status.

The following are sources of solid waste generation at the 231-Z Facility:

- General Weapons Development Program
- Process waste from gloveboxes
- Numerous classified research and development programs
- Advanced decontamination and decommissioning technologies, including sectioning, vibratory finishing, electropolishing, solution process, and small bench-scale work
- General laboratory procedures
- Foundry area

- Housekeeping activities
- Four cleanout campaigns.

The types and estimated quantities of waste resulting from these activities are discussed in detail in Section 3.0.

All solid wastes originating at 231-Z were packaged for onsite/offsite storage or disposal. The waste packages were designed to safely contain the waste during transportation and storage, and to meet the criteria of the storage/disposal unit. Waste packaging and reporting requirements have undergone significant changes throughout the history of 231-Z. Current and historical packaging and handling procedures for radioactive wastes at 231-Z Facility are provided in Section 4.0.

Information on the radioactive wastes generated at 231-Z can be found in a number of 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 radioactive wastes, especially TRU wastes, generated at 231-Z.

Between 1969 and 1988 3,971 containers of radioactive solid waste were generated at 231-Z. These containers represent over 700,000 kg (1,543,209.8 lb) of waste occupying 2,470 m³ (87,226.75 ft³) of space. Section 5.0 provides an indepth look at this waste including the following:

- Weight and volume of the waste
- Container types and numbers
- Physical description of the waste
- Radiological components
- Hazardous constituents
- Current storage/disposal locations.

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LIST OF TERMS

231-Z	Plutonium Metallurgy Laboratory
AEC	U.S. Atomic Energy Commission (now DOE)
D&D	decontamination and decommissioning
DMA	Division of Military Applications
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FFTF	Fast Flux Test Facility
FRP	fiberglass reinforced polyester
HEPA	high efficiency particulate air (filter)
HMS	Hanford Meteorology Station
HVAC	heating, ventilation, and air conditioning
IAD	immediate action directive
LLW	low-level waste
MW	mixed waste
NDA	nondestructive assay
NRC	U.S. Nuclear Regulatory Commission
ORM	other regulated material
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant
PIN	personal identification number
PNL	Pacific Northwest Laboratory
PUREX	Plutonium-Uranium Extraction (Plant)
R-SWIMS	Richland Solid Waste Information Management Systems
R&D	research and development
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
REDOX	Reduction Oxidation (plant)
RHO	Rockwell Hanford Operations
RMO	Radiation Monitoring Office
RTL	Research Technology Laboratory
SAR	safety analysis report
SGSAS	Segmented Gamma Scan Assay System
SNM	special nuclear material
S/S	sectioning and size reduction
SWBR	Solid Waste Burial Record
SWITS	Solid Waste Information and Tracking System
SWSDR	Solid Waste Storage and Disposal Record
TRU	transuranic
WHC	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing Facility

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to characterize, as far as possible, the solid waste generated by the Plutonium Metallurgy Laboratory (231-Z) Facility since its construction in 1944. Solid waste as defined in this document is any containerized or self-contained material that has been declared waste. This characterization is of particular interest in the planning of transuranic (TRU) waste retrieval and repackaging operations, because 231-Z has generated approximately 8.2% of the total volume of TRU waste currently stored at the Hanford Site. Liquid effluents are discussed briefly to provide a more complete picture of waste production at 231-Z.

1.2 BACKGROUND

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

In the period 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 U.S. Atomic Energy Commission (AEC, now the U.S. Department of Energy [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 [AEC 1970]). TRU 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 period was to allow time to study permanent disposal options for TRU contaminated wastes.

The 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 AEC 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 transplutonium nuclides, with the exception of ^{238}Pu and ^{241}Pu . In 1982 the TRU waste segregation limits were raised to 100 nCi/g by DOE Order 5820.1, *Management of Transuranic Material* (DOE 1982).

In addition to radioactive materials, Hanford Site production plants and support operations used a wide variety of chemicals. 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 wastes they are termed "mixed" wastes (MW).

During the time much of the MW at the Hanford Site was generated, there were no definitions or regulations governing the storage, disposal, or documentation of MW. In 1987 the DOE issued a mixed by-product ruling stating that the hazardous components of MW are regulated by the *Resource Conservation and Recovery Act of 1976* (RCRA) (10-CFR-962). In November 1987 the EPA authorized Ecology to regulate the hazardous constituents of MW on the Hanford Site.

During the next two decades the TRU waste now stored in the burial trenches and storage facilities is to be retrieved, processed at the Waste Receiving and Processing (WRAP) Facility, and shipped to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico for final disposal. Over 8% of the total volume of TRU waste to be retrieved for shipment to WIPP has been generated by the 231-Z Facility.

1.3 SOURCES

Data for this study were compiled from a variety of sources. Each of the major sources used is listed in following paragraphs 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 231-Z processes and experiments, including the *Safety Analysis Report* (SAR), *231-Z Building* (BNWL 1970), and the *200 Areas Fact Book* (RHO 1985) were used to determine the solid wastes that may have been generated at 231-Z during its 42-year history.

Documents that describe 231-Z Waste Packaging and Handling Procedures, including the *Hanford Site Radioactive Solid Waste Acceptance Criteria* (Willis and Triner 1991), were used to describe packaging and handling practices.

Interviews with current and former 231-Z personnel were used to gather information regarding unusual waste contents and historical waste handling and packaging procedures.

Characterization data were derived primarily from the Solid Waste Information and Tracking System (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 TRU and low-level radioactive wastes, buried or stored in the 200 Areas since 1970. Originally data in SWITS were taken from Solid Waste Burial Records (SWBRs) and their replacements, the Solid Waste Storage and Disposal Records (SWSDRs). Both SWBRs and SWSDRs, which will be jointly referred to as "burial records" in this document, often contain supplementary forms such as shipment manifests and U.S. Nuclear Regulatory Commission (NRC) 741 Forms.

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 in following paragraphs. 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 231-Z physical plant and the operations that occurred there. A short history of the significant occurrences and changes at 231-Z follows this description.

Section 3.0 identifies the solid waste streams that arose from 231-Z 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 at 231-Z. Historical changes in waste handling, packaging, and recordkeeping are also reviewed in this section.

Section 5.0 contains the results of a search for actual waste container data including database searches, literature review, and personnel interviews. This section describes what is known about the physical, radiological, and hazardous characteristics of the radioactive solid waste from 231-Z.

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

Appendix A contains the original SWITS data runs that form the basis for most of the tables and figures found in Section 5.0.

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2.0 DESCRIPTION OF THE 231-Z BUILDING

The 231-Z Building was used for metallurgical research on plutonium and its alloys. Fabrication development work was also conducted on plutonium parts and reactor fuels containing plutonium or other alpha emitting components. Large quantities of plutonium, from 100 to 200 kg (220.46 to 440.92 lb), were routinely handled and stored at this facility. Nearly all operations involved plutonium metal in the dry or unmoderated state. A photograph of the 231-Z Building is shown in Figure 2-1.

2.1 LOCATION

The 231-Z Building is located in the 200 West Area of the Hanford Site adjacent to the Plutonium Finishing Plant (PFP). Orientation of the 231-Z Building with respect to other installations in the 200 Areas is shown in Figure 2-2. The 200 West Area is situated near the center of the Hanford Site. The Hanford Site occupies 1,527,707.5 m² (365,000 acres) of arid steppe in the southeastern part of Washington State, approximately 72.42 km (45 miles) north of the Oregon border (Figure 2-4).

2.2 PHYSICAL PLANT

The 231-Z Facility is a two-story building of reinforced concrete and concrete block construction. The first floor has an area of approximately 2508.3 m² (27,000 ft²). During the period when the solid waste discussed in this report was generated, about 492.37 m² (5,300 ft²) of this floor was used for building service machinery, with the remaining 2,015.93 m² (21,700 ft²) used for laboratory area. The upper floor is essentially one large open bay with a floor area of approximately 2183.15 m² (23,500 ft²). Until 1987 this floor was used for piping, ventilation ducts, filter cages, miscellaneous storage, and supporting facilities (vacuum pumps, hydraulic equipment, etc.) for equipment on the first floor.

In addition to the main laboratory structure, there is a 278.7 m² (3,000 ft²) office extension of concrete block construction. This office building is attached to the laboratory structure and is isolated by air locks. The functional arrangement of the 231-Z Building during the period between 1960 and the early 1970's is shown in Figure 2-4. Figure 2-5 shows the current layout of the 231-Z Building's first floor.

2.3 OPERATIONS AT 231-Z

The 231-Z Facility was operated by DuPont from 1944 until 1947, General Electric from 1947 until 1965, and what is now the Pacific Northwest Laboratory (PNL) from 1965 until 1984 when its operation was taken over by Rockwell Hanford Operations (RHO). Currently it is used primarily for office space by the Westinghouse Hanford Company (WHC), which succeeded RHO in 1986 and is now the Hanford Site operations and engineering contractor.

Plutonium research and development has been conducted at 231-Z in the areas of physical metallurgy, property determination, alloy development, and process development. Research and development activities included melting, alloying, casting, machining, rolling, pressing, forging, electron beam welding, and vapor deposition of plutonium and plutonium alloys. Metallurgy research operations included metallography, electron microscopy, dilatometry, density determination, electron microprobe, X-ray diffraction, high temperature and high speed properties determination, and room temperature property determination. The operations performed at 231-Z involved quantities of plutonium ranging from small metallographic samples weighing a fraction of one gram to large parts weighing in the multi-kilogram range.

2.4 FACILITY HISTORY

The 231-Z Building was one of the original chemical separation facilities on the Hanford Site. Beginning operations in 1944, it was the location for the final step in a processing series to separate plutonium from irradiated fuel elements. The end product of this operation, a highly concentrated plutonium nitrate solution, was then shipped to the Los Alamos National Laboratory. This mission for 231-Z lasted through 1955 when the newly constructed PFP, also referred to as 234-5Z, assumed this role.

In 1956 the 231-Z Building began to evolve into a research facility, and process development and plutonium metallurgy personnel moved into the laboratory. The primary mission of the research team was to support nuclear device research and development. The special laboratory was outfitted with a double-filter exhaust system; contaminated drain systems; emergency detection and alarm equipment; and a special heating, ventilation, and air conditioning (HVAC) system for radiation zone work.

One of the jobs of the 231-Z research team was to build one-of-a-kind nuclear devices for testing. The device fabrication was done using designs provided by Lawrence Livermore National Laboratory. After fabrication and assembly of prototype devices, the devices were sent to Nevada for testing. After each Nevada test, there was a written evaluation of the device performance and of the personnel involved in its design and construction.

Design agency support at 231-Z increased following the Rocky Flats fire in 1969. Sponsorship of the work at 231-Z was 80 to 85% AEC, Division of Military Applications (DMA); 10% AEC Division of Physical Research; and 5 to 10% other, including services to other Hanford Site programs.

One of the successes of the research team at 231-Z was the development of a sputtering process. With the successful demonstration of sputtering in 1973, the Process Development Laboratory was remodeled to accommodate the new process. During the modification, a substantial amount of equipment and fixtures were torn out and disposed of as solid waste.

In January 1975 PNL was advised by the DMA of its intention to phase out the General Weapons Development Program. The sponsor subsequently gave \$4.8 million to the 231-Z program to tear out gloveboxes and refurbish the building. The majority of the

waste went out with the glovebox changeout. Approximately 56 gloveboxes and 9 pieces of large equipment were packaged in 19 fiberglass reinforced polyester (FRP) burial boxes during 1976, 1977, and 1978. These boxes were not moved to the burial grounds until 1980.

In 1978, as DMA work phaseout continued, new work began in 231-Z to develop advanced decontamination and decommissioning (D&D) technologies. This project, which ran from 1978 until 1981 and was cleaned up between 1983 and 1985, was separated into the following tasks:

- **Sectioning** — Done in a large walk-in glovebox that contained manipulators, a plasma cutting torch, and cranes
- **Vibratory Finishing** — Done in a large vibrating tub and was used for polishing, deburring, and cleaning a variety of items
- **Electropolishing** — Used rinse tanks for decontamination
- **Solution Processing** — Used an evaporator in a process that included ion exchange and solidification
- **Other** — Small, bench-scale work, including metallography.

A second major cleanout campaign ran from 1982 to 1984. Its primary mission was to continue disposing of waste stored in the 231-Z vaults. In 1982 all remaining operations were moved to the Research Technology Laboratories, RTL-2, and the Decontamination Program was terminated.

In 1984 a major portion of the 231-Z Building was transferred to RHO, along with landlord responsibilities for the entire facility. PNL maintained a small portion of the facility on a rental basis for limited research and development (R&D) work until 1985. At that time it was decided to terminate all R&D work in 231-Z. Two more cleanout campaigns in 1985 and 1986 were undertaken to continue the disposal of waste stored in the 231-Z vaults.

2.5 CURRENT STATUS

At the present time, much of the 231-Z Facility is being used as office space. The building still contains an inventory of TRU contaminated equipment and waste containers. These remaining waste items are listed in Table 2-1. A map of the areas where these waste items are located can be found in Figure 2-6.

Figure 2-1. The 231-Z Building.

Figure 2-2. 200 Areas — Orientation Map.

PUREX = Plutonium-Uranium Extraction (Plant)
 REDOX = Reduction Oxidation (Plant)

Figure 2-3. Hanford Site Map.

FFTF = Fast Flux Test Facility
 HMS = Hanford Meteorology Station
 I = Interstate
 PFP = Plutonium Finishing Plant
 PNL = Pacific Northwest Laboratory
 PUREX = Plutonium-Uranium Extraction (Plant)
 SR = State Route

Figure 2-4. Layout of 231-Z Building from 1960 to Early 1970's.

39305122.2

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231-2 BUILDING FIRST FLOOR

1/4" = 1'

NO.	DESCRIPTION	DATE	BY
1	DOOR	10-1-68	J. H. H.
2	DOOR	10-1-68	J. H. H.
3	DOOR	10-1-68	J. H. H.
4	DOOR	10-1-68	J. H. H.
5	DOOR	10-1-68	J. H. H.
6	DOOR	10-1-68	J. H. H.
7	DOOR	10-1-68	J. H. H.
8	DOOR	10-1-68	J. H. H.
9	DOOR	10-1-68	J. H. H.
10	DOOR	10-1-68	J. H. H.
11	DOOR	10-1-68	J. H. H.
12	DOOR	10-1-68	J. H. H.

Figure 2-6. Location of Waste Items in Pacific Northwest Laboratory's Isolated Facilities — 231-Z Building.

39305122.3

Table 2-1. Remaining TRU Waste Inventory at 231-Z.

Container identification number/description	Location	Grams of TRU	
		Plutonium	²⁴¹ Am
Burial boxes			
TMB-V-6	Room 45	10.3	--
TMB-V-7	Room 45	2.0	--
TMB-V-10	Room 45	1.0	--
TMB-V-11	Room 45	28.0	--
TMB-V-12	Room 45	5.0	--
TMB-V-13	Room 45	3.0	--
TMB-V-14	Room 45	30.0	--
TMB-V-15	Room 45	3.0	--
55-gallon drums			
PNL 186020	Room 46	9.6	--
PNL 186035	Room 46	0.2	--
PNL 186036	Room 46	2.1	--
PNL 188019	Room 46	0.1	--
PNL 188021	Room 46	0.9	--
PNL 188022	Room 46	1.2	--
PNL 188023	Room 46	4.9	--
Other equipment			
Glovebox, W 451639	Room 46	49.3	--
Glovebox, W 451681	Cell 3	15.9	--
Conveyor 22	Cell 3	5.0	--
Installed glovebox line	Cell 3	28.8	0.9
Acid purifier	Cell 4A	--	--
Evaporator	Cell 4	1.4	0.2
A, B, C, & D Evaporators	Cell 4	0.0	0.0
2 Gloveboxes	Cell 5A	0.0	0.2
Sump	Cell 5	10.0	1.4
Personnel air loc	Cell 5A	--	--
Glovebox	Cell 6A	--	--
Glovebox	Cell 6A	0.7	0.1
Rotofinisher	Cell 6B	--	0.1
Hood	Cell 6B	1.6	0.2
Total inventory		214.0 g Pu	2.9 g ²⁴¹ Am

3.0 WASTE GENERATION

The wastes generated by 231-Z past operations can be segregated into radiological or nonradiological wastes in gaseous, liquid, and solid forms.

3.1 RADIOLOGICAL WASTES

The radioactive wastes generated have been classified into five categories:

1. Gaseous
2. Low-level liquid
3. High-level liquid
4. Miscellaneous solids
5. Failed equipment.

The five category classification was developed based on the waste's potential radioactivity levels, methods of handling, and disposal procedures.

3.1.1 Gaseous Radioactive Wastes

The gaseous discharge points of the 231-Z Building were filtered by high efficiency, fire and moisture resistant, Type A filters. The use of these filters ensured against a contamination release to the environment in case of an accident involving a contamination release within one of the laboratory rooms. All glovebox gaseous effluents passed through secondary filters of equal quality before entering the exhaust duct. An air sample was located just before the exhaust fan. The filter from this sampler was changed and checked on a weekly basis.

3.1.2 Liquid Radioactive Waste

Throughout its operational history, 231-Z was never connected to tank farms. Occasionally liquid wastes were shipped by tank trucks to the 200 Area Tank Farms. The remainder of the liquid effluents were discharged to onsite ponds and cribs. The liquid effluents generated by 231-Z can be characterized as follows:

- Liquids from process drains, which were essentially free of radioactive contamination, were discharged to the U-10 swamp (Reduction Oxidation Plant [REDOX] pond). This swamp was isolated, covered, and backfilled with gravel in the late 1970's to early 1980's.
- Very low-level or potentially contaminated liquid wastes were discharged to the Z-16 crib. All of the drain lines leaving the facility and going to the sump tank area, weir box, and Z-16 crib were excavated and buried as contaminated waste in accordance with the *Detailed Plan for the Decontamination and Restoration of the 231-Z Facility* (BNWL 1976).

- Liquid wastes, containing mixed fission products, were discharged to the two 231-W-151 tanks located in a concrete pit to the east of the 231-Z Building. These were relatively small tanks that were routinely jetted to cribs.

The accommodation of the liquid effluent streams generates some solid wastes in the form of failed equipment, unplanned sludge accumulation and miscellaneous industrial maintenance wastes, which may or may not be contaminated with radioactivity.

3.1.3 Solid Radioactive Wastes

Solid wastes generated at 231-Z between 1969 and 1988 were segregated by their radioactivity levels into three categories: Nonradioactive, low-level, and TRU waste.

In 1969, the primary mission of 231-Z was military support, with 80 to 85% of the work under the sponsorship of DMA, 10% AEC Division of Research, and 5 to 10% other work. While the amount of military work composed 80 to 85% of the 231-Z support, the TRU contaminated waste generated by the facility was probably best represented by 90% defense or defense-related waste and 10% other. The defense-related work would represent plutonium with a ^{240}Pu content of 6% or less. In fact, many plutonium criticality standards used today are still based on criticality measurements made with 5% ^{240}Pu material.

With the cancellation of the weapons work in 1975, the facility was decontaminated and the gloveboxes removed. A phosphoric acid electropolishing decontamination facility was established by Pacific Northwest Laboratory in 1978. Later decontaminated work included the clean up and decontamination of at least 11 of the original 231-Z gloveboxes. Though a lot of the decontamination work was varied, most of it was defense-type equipment. Therefore, most of the contaminated waste generated by the facility was plutonium with an isotopic content of less than 6% ^{240}Pu . Solid wastes generated include section gloveboxes in boxes and metal containers, and solidified liquid waste in drums. The solidified waste included low-temperature, salt melt solids; absorbed liquid; and some drums of urea formaldehyde matrices.

3.2 NONRADIOLOGICAL WASTES

Cooling water used by vacuum systems, furnaces, and all 231-Z Building service equipment was drained into an underground line that emptied into the U-10 swamp (REDOX pond) located south of the 234-5Z Building. Solid nonradioactive wastes primarily consisted of ordinary trash originating outside of contaminated areas (e.g., offices, lunchrooms, and restrooms).

3.3 SOLID WASTE GENERATORS

During the 20-year time period (1965–84) that the 231-Z Building was operated by PNL, solid waste was generated by the following sources:

- General Weapons Development Program
- Process waste from gloveboxes
- Numerous classified R&D programs
- Advanced D&D technologies, including sectioning, vibratory finishing, electropolishing, solution process, and small bench-scale work
- General laboratory procedures
- Foundry areas
- Housekeeping activities
- Four cleanout campaigns.

3.3.1 Types of TRU Waste Generated

Solid TRU waste was generated by 231-Z processes such as metallurgical research on plutonium and its alloys, fabrication development work on plutonium components and reactor fuels containing plutonium or other alpha emitting materials, and advanced D&D technology. These wastes include the following types of materials:

- Spent and failed equipment and tools
- Housekeeping items such as metal cans, glass, paper, aerosol cans, rags, plastic bottles, wipes, and cardboard containers
- Glovebox maintenance materials such as high efficiency particulate air (HEPA) prefilters, glovebox gloves, cut out plastic bags, and other miscellaneous items
- Ventilation HEPA filters and associated ductwork
- Metal fines, turnings, and oxides that adhered to other glovebox waste
- Demolition and major equipment removal, such as gloveboxes, tanks, and piping
- Absorbed liquids, acids, bases, and process chemicals
- Processing items such as polypropylene wound filters and drum filter cloth

- Glovebox sections, associated ducts, tanks, refrigeration equipment, and reservoirs
- Absorbed contaminated lubricants, such as oils, and hydraulic fluids.

3.3.2 Types of Low-Level Waste

Until 1978 virtually all waste generated at 231-Z was disposed of as TRU waste. In approximately 1979, 231-Z implemented a nondestructive assay (NDA) system. However, relatively small amounts of waste were determined to be non-TRU as a result of the 10 nCi/g limit and conservative labeling practices. When the TRU limit changed to 100 nCi/g in 1982, the percentage of non-TRU waste increased to over 98%.

The majority of non-TRU waste was generated by room activities rather than by glovebox activities as in the case of TRU waste generation. Maintenance equipment with low levels of radioactive contamination were often able to be disposed of as non-TRU. When possible, the equipment was sent to other site operations for re-use, rather than for disposal as non-TRU waste.

3.3.3 Waste Generated by Cleanout Campaigns

Four distinct cleanout campaigns were conducted at the 231-Z Building beginning in 1975, 1982, 1985, and 1986, respectively. Each of these campaigns generated large quantities of waste, both non-TRU and TRU, to be sent to the burial grounds for storage. However, some of the waste remains in the 231-Z Building awaiting disposal (see Section 2.5).

There were 79 glovebox sections, representing a volume of 339.8 m³ (12,000 ft³), removed for burial as a result of the 1975 cleanout. While these gloveboxes were packaged for disposal, they were not transported to the burial grounds until 1980. Contaminated equipment such as vacuum pumps, hydraulic systems, and refrigeration equipment that were external to, but attached to the gloveboxes, were buried with the gloveboxes when practical. A variety of uncontaminated laboratory and ventilation equipment and instrumentation, which became obsolete as the restoration of the building progressed, were either excessed following standard property disposal procedures or sent to the 200 Area LLW burial grounds.

During the fiscal year 1986 cleanout campaign, a large amount of non-TRU waste was sent to the 200 Area LLW burial grounds. The waste is summarized as follows:

- Six truckloads of plastic wrapped waste, ~ 62.3 m³ (~ 2,200 ft³)
- Five plywood boxes containing waste, ~ 18.12 m³ (~ 640 ft³)
- Cardboard cartons containing waste, ~ 1.42 m³ (~ 50 ft³).

The disposal of disconnected gloveboxes was the most difficult task of the cleanout because of their classification as TRU waste. Eight gloveboxes were sectioned and loaded into eight TMB-V TRU burial containers. Electropolishing tanks, associated ventilation

ducting, the false floor, the greenhouse, and power supplies also were removed from the building for disposal. Figures 3-1 and 3-2 show the location of the major cleanout items on the first and second floors of the 231-Z Building, respectively.

Figure 3-1. Location of Major Cleanout Items Fiscal Year 1986 Campaign —
First Floor of the 231-Z Building.

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Figure 3-2. Location of Major Cleanout Items —
Second Floor of the 231-Z Building.

39305122.1

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4.0 SOLID WASTE HANDLING PRACTICES AND PROCEDURES

4.1 HISTORICAL SOLID WASTE CHARACTERIZATION

Solid radioactive waste handling, packaging, and characterization at the 231-Z Facility progressed through five general phases:

1. 1944-69
2. 1970-73
3. 1974-78
4. 1979-81
5. 1982-88.

During the first period, 1944-69, radioactive solid waste received very little attention as to characterization, packaging, sorting, or treating. Marginal records were maintained, with emphasis on the special nuclear material (SNM) operating laws. Since waste retrieval was not a factor for consideration, the radioactive waste burial containers were not chosen for their resistance to long-term corrosion, weathering, or degradation. The solid radioactive waste burial during this time period is not very definable with respect to today's intricate waste classification system.

The AEC directive establishing the basis for TRU waste, and the requirement for 20-year retrievable storage, was issued in 1970. From 1970 to 1973, the 231-Z Facility waste practice was to consider all waste to be TRU unless it could be determined otherwise. SWBRs were kept for all containers, although the information on physical contents and hazardous constituents was limited.

During the next period, 1974-78, the AEC TRU limit of 10 nCi/g was in effect, however, 231-Z did not have the assay capability to implement it. To be as conservative as possible, all solid radioactive wastes from 231-Z were considered to be TRU. Record keeping and waste packaging improved during this time period.

Before 1979, 231-Z waste was sometimes sent to the 234-5Z Building; one reason for this may have been NDA. Because of chain-of-custody policies, it is possible that some of this 231-Z waste may have been shipped to the burial grounds as 234-5Z waste.

In approximately 1979, the ability to assay waste packages accurately was implemented in the form of a Segmented Gamma Scan Assay System (SGSAS). With the 10 nCi/g TRU limit in effect through 1981, virtually all of the waste from 231-Z was characterized as TRU. At this time, entries on SWBRs began to be made on a per container basis, instead of a per shipment basis, improving the ability to characterize and categorize these wastes for retrieval.

In the last phase of 231-Z waste generation, 1982-88, the 100 nCi/g TRU limit was in effect. With this change in the TRU requirements, and with improved recording, packaging, and sorting practices, virtually all the waste was able to be categorized as low-level. Waste acceptance criteria were developed and improved at this time also.

RCRA requirements and other more strict compliance criteria have been applied to radioactive solid waste handling, packaging, characterization, and recordkeeping practices.

4.2 HISTORICAL WASTE PACKAGING AND HANDLING PROCEDURES

Eleven historical waste packaging manuals were reviewed for information regarding packaging and labeling requirements for TRU waste in 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 recordkeeping for radioactive wastes from 231-Z follow:

- The definition of TRU waste has changed since 1970, and the designation of waste packages as TRU has also changed. During the period 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.
- 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.
- Criticality specifications limited the amount of TRU to less than 250 g (8.82 oz) per 55-gal drum from 1975-78 and to 200 g/drum after that time. Before 1975 the criticality limit on drums and cartons was 400 g (14.11 oz).
- Individual container weights were not required before 1977; however, estimated weights for pre-1977 containers were added to the records in the R-SWIMS database during the data re-entry program in the mid-1980's. Standard weights were given for each container type. All 55-gal drums, for example, were given a value of 68 kg (149.91 lb).

- 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 to be made about the containers in the group. 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.

- 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.
- Physical descriptions of the waste contents were not required on the SWBR before 1978. SWITS records for waste buried before 1978 list the contents as "miscellaneous" in most cases. In more recent years the physical contents description has become more detailed. Many of the records now include the weight and volume percentages of a given component in the waste container.
- Between 1972 and 1978, combustible and noncombustible 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.
- The most common TRU waste container used at the Hanford Site is the 55-gal steel drum. U.S. Department of Transportation (DOT) 17C or 17H drums with minimum wall thicknesses of 0.134 cm (0.053 in.) and 0.109 cm (0.043 in.), respectively, were both used. Before 1982 most of the drums were painted, so there is approximately 0.0127 cm (0.005 in.) of paint on both the exterior and interior of the drums. In 1982, galvanized drums replaced the painted drums. Recycled 55-gal drums were also permitted for the storage of TRU waste from 1973 to 1978.
- Data for wastes generated before 1970 are not included in the SWITS database.

4.3 CURRENT WASTE HANDLING AND PACKAGING

As discussed in Section 2.5, there is still an inventory of radioactive waste to be cleaned out of the 231-Z Facility. Any waste disposed of by 231-Z will be packaged and handled in accordance with current waste generation guidelines as contained in WHC-EP-0063, Revision 3 (Willis and Triner 1991).

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Document r				
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 Sup. 2 12/78 - 5/80	RHO-M 5/80 -
TRU				
Waste containing plutonium and/or other TRU nuclides in concentrations greater than 10 nCi/g.	Waste containing or suspected of containing plutonium and/or other TRU nuclides in concentrations greater than 10 nCi/g.			Waste contain transuranium greater than 1 than 10 nCi/g.
Prohibited wastes type				
Liquid wastes must be packaged with sufficient inert absorbent so that liquid will not flow if container is breached.		No free liquids.	No free liquids	
	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 carcass requirements. > 150 °F acc Liquid organic with special a	
	Flammable absorbed liquids prohibited from disposal in caissons.	Damp or wet wastes with highly combustible or explosive liquids prohibited.	Flammable liqu below 150 °F	
	Unreacted alkali metals prohibited.			
			Explosive	
			Pyrophori	
		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 significant am gas are prohib

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

Numbers and dates				
RHO-MA-222 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*
definition				
ing or suspected of containing pha-emitting radionuclides with half-lives 0 years or ²³³ U in concentrations greater		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.
as accepted if packaged per Liquid organic waste with flash point ted if properly labeled and packaged. vaste with flash point <150 °F accepted proval.			Animal carcasses accepted if packaged per requirements.	
ds free or absorbed with flash points prohibited.			Sludges cannot contain free liquids.	
			Unreacted alkali metals prohibited with exceptions.	
prohibited.			Pyrophorics and explosives prohibited	Explosives prohibited.
prohibited.			except metal fines.	Pyrophorics prohibited.
			Gas cylinders containing radioactive gases prohibited. Empty cylinders accepted if permanently vented.	Compressed gases prohibited.
enerate unts of ed.	Waste materials that generate H ₂ , O ₂ , or NO _x are prohibited unless permanently vented or catalyst package in container.		Waste materials that generate H ₂ , O ₂ , or NO _x 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.

Document number				
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 Sup. 2 12/78 - 5/80	RHO-MA-2 5/80 - 6/81
Prohibited wastes types and				
	Hazardous and toxic materials must be treated prior to burial.			Hazardous and toxic materials must be treated prior to burial.
	Exterior surfaces must be free from smearable contamination - fixation allowed.			Exterior surfaces must be free from smearable contamination.
	Contamination that is easily airborne must be in an inner liner.			Loose contamination that the surface is detectable loose.
Beryllium requires double containment.				Double containment required for all TR and for all waste accepted from off generators. Beryllium, mercury requires double containment.

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

Numbers and dates				
2 2	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*
Packaging requirements (cont.)				
Hazardous materials accepted on case-by-case			Hazardous and toxic materials must be treated to meet the waste acceptance criteria for disposal.	
Must be ly	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.)
Waste must be stabilized or contained so the container remains free of 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 wt% of the matrix weight is particulates < 10 microns in diameter or if > 15 wt% is < 200 microns in diameter.
Double waste ite um and ouble	Double containment required for all TRU waste. Double containment is required for cadmium and mercury. Beryllium, cadmium, and mercury must be packaged with at least 6 in. of concrete on all sides.		Double containment required for all TRU waste. Double containment is required for cadmium and mercury. Beryllium, cadmium, and mercury must be packaged with at least 6 in. of concrete on all sides.	Double containment required for all TRU waste. Beryllium, cadmium, mercury, and other class B poisons must be immobilized in concrete for burial.

				Document
ARH-3032 Rev. 1 4/78 - 4/77	ARH-3032 Rev. 1 4/77 - 7/78	ARH-3032 Rev. 1 Sup. 1 8/78 - 12/78	ARH-3032 Rev. 1 Sup. 2 12/78 - 5/80	RHO-A 5/80

Prohibited wastes types a

	Animal waste packaged in drum with a 4-mil. plastic to suppress generation and surrounded by absorbent to liquids two times of absorbent absorb any liquid that may be the decay product.
	Liquid organic be packaged in liquid-tight container (5-10 gal), or in 55-gal drum rigid polyethylene and filled to at least two times absorbent surrounding the volume liquid in the container.

Labeling

Waste packages must be suitably labeled so that containers can be identified by cross-reference to permanent records.	Waste packages suitably labeled containers can be identified by cross-reference to permanent records. Waste containing TR labeled "transuranic".
Barvillium must be labeled.	DOT Class B must be labeled (and mercury).

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

Numbers and dates				
A-222 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*
Liquid packaging requirements (cont.)				
must be 55-gal minimum liner, treated sufficient prevent free ies amount quired to id present ult from ess.	Animal waste must be packaged in a 55-gal 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-gal 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.	
waste must a sealed tainer rpackaged with a ne liner e top with nes the ired to ume of ntainers.	Liquid organic waste must be packaged unabsorbed in a sealed liquid-tight container (5-10 gal), overpackaged in 55-gal 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 gal), overpackaged in 55-gal 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.
Labeling requirements				
es must be d so that be oss- ermanent e packages must be ranic" or aste".	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.	
oisons d (beryllium	Beryllium, cadmium, and mercury must be labeled.		Beryllium, cadmium, and mercury must be labeled.	

				Document n
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 Sup. 2 12/78 - 5/80	RHO-MA 5/80 - .
				Labeling re
	Hazardous and toxic waste must be labeled.			
				Liquid organics labeled.
				Animal waste .
				"Fissile Materi and Type "E" : indicating seal contents inclu more grams. i containing plut must have plut quantity in gra on the side an

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

*Includes RHO-MA-222, Rev. 3, 3A, and 4 (RHO 1980). The changes made in these revisions are general requirements listed under revision 2 of RHO-MA-222 (RHO 1980) are effective up to the effective date of WHC-EP

DOT = U.S. Department of Transportation.

HEPA = High-efficiency particulate air (filter).

TRU = Transuranic.

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

Numbers and dates				
222 /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*
Requirements (cont.)				
	DOT labels required for all classes of waste that apply to the package.		DOT labels and color coding required on all waste packages.	
must be	Liquid organics must be labeled and must have flash point range listed on label.		Liquid organics must be labeled and must have flash point range listed on label.	
must be labeled.			Animal waste must be labeled.	
* label imper quired if s 1 or rums nium nium is posted lid.	Fissile material label required if contents include 1 or more grams. Plutonium quantity must be labeled if 1 or more grams of plutonium is in the container.		Fissile material label required if contents include 1 or more grams. Plutonium quantity must be labeled if 1 or more grams of plutonium is in the container.	

and do not affect the packaging, storage, or disposal requirements of TRU unstable or reactive wastes specifically. The 2063, Rev. 0 (Willis and Triner 1991).

5.0 CHARACTERIZATION OF RETRIEVABLY STORED SOLID WASTE GENERATED BY 231-Z

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 of at the Hanford Site. TRU solid waste packages have been tracked since 1970; however, there was an effort made to identify TRU wastes that were disposed of in the years immediately preceding 1970. This is the reason that the graphs and tables in this section begin with 1969. 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 contained 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 231-Z; however, some general information on the non-TRU waste is included for completeness. The term non-TRU waste is used instead of LLW because a small percentage of the unsegregated waste is designated only as not TRU. Tables 5-1 and 5-2 present TRU and non-TRU waste generation summaries by container type and year. Since the 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. The term "drum" refers to 55-gal drums only, unless specified otherwise.

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 231-Z 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 drums made from carbon sheet steel with minimum thicknesses of 0.134 cm (0.053 in.) and 0.109 cm (0.043 in.), respectively. Before 1982 most of the drums were painted, so these drums have approximately 0.013 cm (0.005 in.) of paint on both the exterior and interior of the drums. In 1982 galvanized drums replaced painted drums. Recycled 55-gal drums were also permitted for the storage of TRU waste between 1973 and 1978.

The AEC 1970 stipulated that TRU wastes be packaged and stored as contamination-free packages for at least 20 years. The 20-year interim period 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 is being 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-EP-0225, Rev. 1 (Anderson et al. 1991) and WHC-SA-1450-FP (Duncan et al. 1992).

Table 5-3 contains waste summary data for 55-gal drums of radioactive waste generated at 231-Z between 1969 and 1988. The upper portion of this table presents the number, total weight, and total volume of TRU waste drums. The number of TRU MW drums are also 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 5-6 present this information graphically.

5.1.1.1 Number of Drums. Between 1969 and 1988 1,978 55-gal drums of radioactive waste were generated at 231-Z. This total includes 618 drums of non-TRU and 1,360 drums of TRU waste. The total number of radioactive MW drums is 73, which includes 55 non-TRU MW drums and 18 TRU MW drums. Figure 5-1 provides a graph of the number of 55-gal drums of TRU and LLW generated at 231-Z by year. The major features of this graph are directly related to historical events that took place at 231-Z.

The large amounts of waste generated from 1973 through 1975 are likely due to the remodeling of the Process Development Laboratory. Also contributing to waste generation in 1975 was the phase-out of the weapons/device fabrication operation and the attendant glovebox cleanout.

From 1976 to 1977 a major effort to refurbish the 231-Z Building and clean and tear out gloveboxes was undertaken. This cleanout generated substantial amounts of waste, particularly in 1977. Since this was largely a maintenance activity, the waste was able to be disposed of in 55-gal drums.

The Advanced Decontamination and Decommissioning Technology Program was conducted from 1978 through at least 1982. This program accounts for a portion of the drum waste generated during these years. The 231-Z facility also went through the second, third, and fourth cleanout campaigns in 1982, 1985, and 1986, respectively. In addition, waste stored in 231-Z vaults was packaged for disposal in this period, further contributing to the quantities of waste generated for onsite storage.

A secondary trend shown in Figure 5-1 is the change in the ratio of TRU to non-TRU waste drums in 1979. This is depicted more clearly in Figure 5-2, which shows the relative percentages of TRU and non-TRU waste drums by year. The reason for this change was the ability to assay waste before shipment. All waste from 231-Z was considered at packaging to be TRU waste unless it could be demonstrated to be non-TRU. In 1979 a SGSAS became operational for the assay of 231-Z waste. With this new capability, all waste was no longer disposed of as TRU.

5.1.1.2 Weight. In the period between 1969 and 1988 approximately 93,857 kg (206,915.78 lb) of TRU waste and 91,814 kg (202,411.81 lb) of non-TRU waste generated at 231-Z were stored in 55-gal drums. These numbers are estimates since container weights were not required for individual containers before 1977. During the R-SWIMS data re-entry program in the mid-1980's, all pre-1977 containers were assigned

standard weights. All 55-gal drums, for instance, were assigned a value of 68 kg (150 lb). Since 1979, however, the average weight of all 231-Z drums has been 72 kg (158.7 lb). However, while the average weight of TRU drums from that period was 69 kg (152.1 lb), the average weight of non-TRU drums was 149 kg (328.48 lb), making these drums more than twice as heavily loaded as the TRU drums.

The probable explanation for the average weight difference is the Decontamination Program, which began in 1978. Since there was no other contaminated research or development work underway at this time, there was no LLW pool, or any provisions for storing low-level contaminated equipment onsite external to the gloveboxes. Because of this, any contaminated equipment that was changed out of the low-level gloveboxes, for whatever reason, was packaged for disposal as LLW. These process pieces would typically be fairly heavy, and their load-out would contribute to a heavily weighted drum.

Figure 5-3 presents the total weight of both TRU and non-TRU radioactive wastes stored annually in 55-gal drums. The relative weight percentages for TRU and non-TRU drums generated annually at 231-Z are shown in Figure 5-4. These figures show, once again, the reduction in the amount of waste designated as TRU after waste assay began.

5.1.1.3 Volume. The total volume of waste generated at 231-Z and stored in 55-gal drums is 417 m³ (14,726.14 ft³), of which 286 m³ (10,099.94 ft³) is TRU and 131 m³ (4,626.2 ft³) is non-TRU. Annual waste generation information is shown in Figure 5-5; the volume percentages of radioactive waste stored in 55-gal drums are provided in Figure 5-6. Since all 55-gal drums have a volume of 0.21 m³ (7.42 ft³), the patterns shown in Figures 5-5 and 5-6 are the same as those described for Figures 5-1 and 5-2 (drum number), respectively. They are included here so that comparisons with later figures can be made.

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. Other container types used for solid waste generated at 231-Z include the following:

- Burlap, cloth, paper, or plastic bags
- Concrete boxes
- Fiberboard/plastic boxes, cartons, or cases
- Metal drums, barrels, or kegs (other than 55-gal drums)
- Metal boxes, cartons, and cases
- FRP boxes
- Wooden boxes, cartons, and cases.

Some items were disposed of or stored without additional packaging, such as dump trucks; gloveboxes; HEPA filters; miscellaneous scrap; trucks, flatbeds, compactors, loadluggers; and self-contained equipment. These items are also included in the "other container" category.

Table 5-4 summarizes the waste data for containers of radioactive waste, other than 55-gal drums, that were generated at 231-Z between 1969 and 1988. 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 MW is also 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 5-7 through 5-12 present these data graphically.

5.1.2.1 Number of Other Containers. Between 1969 and 1988 1,993 other containers of radioactive waste were generated at 231-Z. Of these containers, 861 hold TRU waste, while 1,132 contain non-TRU waste. For reference, during the same period of time a total of 1,978 55-gal drums of radioactive solid waste were generated at 231-Z. Figure 5-7 is a graph of the number of other containers of TRU and non-TRU waste generated at 231-Z by year. The largest number of other containers containing TRU waste (715) was generated in 1969. This is the result of an inordinately large number of fiberboard/plastic boxes, cartons, and cases. It is possible that this is related to the cleanup effort that was required as 231-Z prepared to assume device fabrication work from Rocky Flats following the fire there in 1969. Other than 1969 and 1970, the vast majority of other containers contain non-TRU waste. In the years 1979 to 1988 over 95% of the waste is non-TRU, with fiberboard/plastic boxes, cartons, and cases accounting for over 80% of the non-TRU total.

Figure 5-8 presents the relative percentages of TRU and non-TRU containers other than 55-gal drums. Two things are apparent from this figure: no waste was packaged in other containers from 1974 to 1976, and after 1977 almost all of the waste in other containers was non-TRU. The AEC directive establishing a basis for distinction between TRU and non-TRU waste was announced in 1973. In the absence of positive evidence to the contrary, all waste was considered to be TRU at 231-Z. For this reason, there was no waste characterized as non-TRU during the mid-1970's. Since it was also the practice to store retrievable TRU waste in 55-gal drums, there were no other containers generated during this period. Once the definition of TRU changed again in 1978, and 231-Z considered some waste to be non-TRU, virtually all of the 231-Z waste packaged in other containers became non-TRU.

5.1.2.2 Weight. In the period between 1969 and 1988 approximately 526,053 kg (1,159,728.8 lb) of radioactive solid waste was generated at 231-Z and placed in containers other than 55-gal drums. This total includes approximately 231,386 kg (510,110.22 lb) of TRU and 294,667 kg (649,618.5 lb) of non-TRU contaminated material. These weights are approximations because individual container weights were not required to be recorded for individual containers before 1977. During an update of the R-SWIMS database in the mid-1980's, all waste containers without recorded weights were assigned standard values. For example, all 2-ft³ boxes were given a standard weight of 5.5 kg (12 lb) and 5-gal lard cans were assigned a standard weight of 22.7 kg (50 lb).

Figure 5-9 depicts the weight of TRU and non-TRU waste stored in containers other than 55-gal drums on an annual basis. The most notable feature of this graph is the TRU waste peak in 1980, with a secondary peak in 1981. The large weight of waste disposed of in these 2 years is due to the shipment of 19 extremely large FRPs to burial. These boxes contain approximately 56 gloveboxes and 9 pieces of other equipment that were

removed from 231-Z during the cleanout effort in 1976 and 1977. After waiting in internal storage for several years, these FRPs were loaded out and shipped to Burial Ground 218-W-4C in the 200 West Area. Table 5-5 contains a listing of the burial boxes removed during this campaign, their weight and volume, and the amount of TRU in each.

Also evident in Figure 5-9 are waste generation peaks associated with the various cleanup campaigns of the 1980's. With the exception of the large FRPs containing gloveboxes (which were loaded in 1976 and 1977), all waste disposed in other containers after 1979 is non-TRU.

Figure 5-10 shows the percent contribution of TRU and non-TRU waste to the total annual weight of waste packaged in other containers. Because of the practice of storing TRU waste in drums when possible, and storing non-TRU waste in other containers, proportionately less of the other container waste is TRU.

5.1.2.3 Volume. The volume of waste generated at 231-Z and packaged in containers other than 55-gal drums during the period from 1969 through 1988 is 2,053 m³ (72,500.62 ft³). TRU wastes account for 1,160 m³ (40,964.79 ft³) of the total volume; non-TRU wastes account for 893 m³ (31,535.83 ft³). Figure 5-11 shows annual volumes of TRU and non-TRU wastes generated by 231-Z and packaged in containers other than 55-gal drums, the 19 FRP containers disposed of in 1980 and 1981, and the volume of waste generated in 1969. Figure 5-12 shows the relative contribution of TRU and non-TRU wastes to the total volume of waste in other containers for each year.

5.1.3 Summary of Waste Generation Rates at 231-Z Between 1969 and 1988

5.1.3.1 Number of Waste Containers. Between 1969 and 1988 there were 3,971 containers of radioactive solid waste generated at 231-Z. 55-gal drums account for 50% of the total number of containers. Containers of TRU compose 56% of the total container numbers.

Figure 5-13 shows the total numbers of both TRU and non-TRU waste containers generated on an annual basis during this period. The difference in the amount of waste characterized as TRU and non-TRU from 1969 to 1988 is most evident in this graph. Changes in the DOE (formerly AEC) regulations and 231-Z disposal practices directly affected the proportion of the waste determined to be TRU and non-TRU. A significant portion of the waste stored as TRU before 1979 may be redesignated as LLW upon characterization at WRAP.

5.1.3.2 Total Weight. Approximately 711,724 kg (1,569,056.4 lb) of radioactive solid waste was generated at 231-Z between 1969 and 1988. Waste packaged in 55-gal drums accounts for about 26% of the total weight of waste from 231-Z, with 74% of the total weight composed of waste packaged in some other type of waste container.

Waste designated as TRU makes up 46% of the total weight, while waste designated as non-TRU makes up the remainder. Figure 5-14 provides a graph of the total weight of TRU and non-TRU waste generated at 231-Z on a yearly basis between 1969 and 1988. This graph shows that while the numbers of containers declined in later years, the weight of waste actually increased. This is because fewer containers and containers of larger size were being used to store the waste.

5.1.3.3 Total Volume. In the period between 1969 and 1988 2,469 m³ (87,191.44 ft³) of radioactive solid wastes were generated at 231-Z. Only 17% of this volume is composed of 55-gal drums; the remaining 83% of the volume is made up of other container types. TRU wastes account for 59% of the waste volume, while non-TRU wastes make up the remaining 41%. Figure 5-15 shows the total volume of TRU and non-TRU waste generated at 231-Z on a yearly basis. The very large size of the 19 glovebox FRPs disposed of in 1980 and 1981 is evident here; in fact they account for over 38% of the total TRU waste volume from 231-Z.

5.2 WASTE CONTAINERS

5.2.1 TRU Waste Containers

Table 5-1 provides a summary of the TRU waste generated annually by 231-Z from 1969 to 1988 sorted by container type. The greatest number of containers are 55-gal drums, 61% by count; however, there are also significant numbers of fiberboard/plastic boxes, cartons, and cases in 1969 and 1970. The majority of the weight of TRU waste is contained in FRPs, 52% by weight, with an additional 29% in 55-gal drums. The FRPs are all from 1980 and 1981, and contain the previously mentioned gloveboxes. The percentages for all container types and the weight and volume of these containers are shown for each year in this table.

5.2.2 Non-TRU Waste Containers

Table 5-2 provides a summary of the non-TRU waste generated by 231-Z from 1969 to 1988 by container type. Fiberboard/plastic boxes, cartons, and cases were the most common containers used, in many years accounting for more than 54% of the total non-TRU waste count. Significant numbers of metal drums, barrels, and kegs; self-contained equipment; miscellaneous scrap; and HEPA filters were also generated. The greatest weight of non-TRU waste, 46%, is composed of waste in trucks, flatbeds, compactors, loadluggers, and dump trucks, although there are also large amounts of waste stored in 55-gal drums and metal boxes, cartons, and cases.

5.3 TRU WASTE STORAGE LOCATIONS

Table 5-6 provides the storage locations for TRU waste packaged in 55-gal drums by year. In general, the bulk of the drums generated in 1 year are stored primarily in one facility. Storage locations for TRU waste packaged in other containers are shown in Table 5-7. A summary of 231-Z waste by storage location follows:

- **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. Drums and other containers from 231-Z were disposed of here only in 1970 and 1971. None of this waste is listed as containing hazardous constituents.
- **218-W-4B** — Burial Ground 218-W-4B, consisting of 14 trenches, accepted retrievable waste through September of 1978. Drum and other container waste from 231-Z was buried here from 1969 to 1978. Drums from 231-Z containing beryllium and oil from 1972 through 1976 are recorded as being stored at this site.
- **218-W-4C** — Burial Ground 218-W-4C consists of six trenches, with the first waste emplaced in March 1978. 231-Z drum waste was sent to this area from 1978 to 1983, with other containers emplaced in 1980 and 1981. One 55-gal drum of MW, containing sodium, was buried here in 1982. This is the only recorded MW container at this site.

5.4 PHYSICAL CONTENTS OF TRU WASTE CONTAINERS

The physical contents of 55-gal drums are shown in Tables 5-8 through 5-10. There is a separate table for each storage location. The top portion of each table indicates the number of drums for which a given component is listed; the bottom part of the table indicates the percentage of the total drums from 231-Z in that burial location that contain the listed constituent. The physical contents for TRU waste containers, other than 55-gal drums, can be found in Tables 5-11 through 5-13.

It should be noted that before 1978 physical contents were not required to be listed on the burial records. A great many of the contents on early records are listed only as "miscellaneous". Also important to realize are the limitations of the SWITS database. The database was searched for information on physical contents of TRU drums and other containers, by storage facility and year. In some cases, the number of waste containers listed for a storage facility in the search is substantially less than the number of drums or other containers known to be stored there. This is true to varying degrees for all storage sites, from 1971 through 1979. A further search was done for waste containers with no listing in the physical constituents field; this search did not reveal any further waste containers.

5.5 RADIOLOGICAL DESCRIPTION OF 231-Z SOLID WASTE

Table 5-14 shows the number of grams of TRU contained in waste stored in 55-gal drums each year by storage location; Table 5-15 provides the same information for containers other than 55-gal drums. Figure 5-16 combines the information on these tables in a graph that shows the total amount of TRU present in waste packages from 231-Z by year. It should be noted that not all SWITS records for TRU waste containers (particularly those from the early 1970's) list the number of grams of TRU.

The four notable peaks in Figure 5-16, all above 900 g (31.75 oz) of TRU, are associated with previously discussed operations at 231-Z. The peak in 1973 corresponds to process updates and the tearing out of old equipment. Weapon's program cleanout and disposal from gloveboxes resulted in the peak in 1974. In 1977 the cleaning of gloveboxes in preparation for changeout resulted in disposal of a large amount of TRU. Finally, the peak in 1980 corresponds to the disposal of FRPs containing gloveboxes.

5.6 RADIOACTIVE ISOTOPES PRESENT IN 231-Z SOLID WASTE

Information on radioactive isotopes was obtained from the SWITS database and from the 231-Z Safety Analysis Report (SAR) Supplement (BNWL 1970). While the information from SWITS is taken from burial records, and therefore represents isotopes known to be in the waste stream, the data from the SAR represents isotopes used in 231-Z processes and laboratories, which may or may not be in the solid waste stream. Listed below are isotopes known or suspected to be in the 231-Z solid waste stream:

- **Plutonium** — Isotopes ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu , and ^{242}Pu are all referred to specifically in the SAR (BNWL 1970). Work with plutonium oxide was conducted, including 20 wt% $^{238}\text{PuO}_2$ mixed with sugar and a small amount of water, which was then heated and poured into containers for the Critical Mass Physics Department. The Critical Mass Laboratory also used 2-in. square cubes of plutonium oxide-polystyrene in some experiments. Personnel interviews indicated that a substantial quantity of scrap from the cube fabrication process were disposed of to the burial grounds. It was reported that internal heating sometimes caused these cubes to bubble and deform. Plutonium turnings or other pyrophoric scrap were routinely burned to a safe oxide and then stored for eventual return to recovery operations.

The following plutonium isotopic breakdowns were obtained from the period 1970 to 1972. This isotopic breakdown is considered to be representative of the later years of 231-Z operation as well.

- **Uranium** — Natural, depleted, and enriched uranium are all listed as waste forms in the SWITS database. The SAR refers to small quantities of ^{233}U and ^{235}U being handled in 231-Z.

	²³⁸ Pu	²³⁹ Pu	²⁴⁰ Pu	²⁴¹ Pu	²⁴² Pu
(1)	0.04	93.03	6.30	0.60	0.03
*	0.01	91.26	8.11	0.58	0.04
*	0.088	85.67	11.53	2.32	0.28
*	0.28	75.22	18.35	5.05	1.14
(2)	0.09	72.35	22.35	4.21	0.00
*	0.35	68.50	23.10	5.61	2.38

- (1) Normal stream
 (2) Special AEC lease
 * Plutonium oxide for cubes.

- **Neptunium** — The SAR refers to small quantities of ²³⁷Np being handled in the plant. The SWITS database also contains one reference to ²³⁷Np in the solid waste. This solid waste is in two drums from 1977 which are stored in Burial Ground 218-W-4B.
- **Thorium** — The SWITS database contains one entry of ²³²Th, stored in one drum from 1971 located in Burial Ground 218-W-3A.

5.7 HAZARDOUS CONSTITUENTS OF SOLID WASTE GENERATED BY 231-Z

This section provides a review of the data on the hazardous components known or suspected to be in the solid waste stream from 231-Z. Information was gathered from several sources, including: 231-Z Building SAR (BNWL 1970), SWITS, *Solid Waste Stream Hazardous and Dangerous Components Study* (WHC 1992), SWBRs, personnel interviews, and *Unstable and Reactive Chemicals in Transuranic Retrievable Waste at the Hanford Site* (Reddinger 1992). The hazardous contents of the MW containers in each burial ground are shown in Tables 5-16 through 5-18.

Table 5-19 provides a list of all known or suspected hazardous constituents in the 231-Z solid waste stream. The reference source for each specific chemical is also included. Because of the inherent health and safety risks of chemicals and chemical combinations, wherever data suggested the possible existence of a hazardous material in the solid waste stream, that chemical or compound was included in the table.

Until at least 1970 the segregation of potentially incompatible hazardous wastes was based solely on the knowledge of the personnel packaging the waste. Since 231-Z was never connected to the tank farms, liquid waste would normally have been sent to cribs and ponds. Up until the early 1970's, however, free liquids were disposed of in the solid waste stream.

The final two columns in Table 5-19 contain information on the toxicity and hazards associated with each of the chemicals listed. The first of these columns lists the EPA

toxicity category, if designated, which was determined using the EPA "Spill Table" (40 CFR 302.4). Category X marks the most toxic chemicals, followed by Categories A, B, C, and D, listed in order of decreasing toxicity. The EPA "Spill Table" (40 CFR 302.4) is incorporated by reference into the (WAC 173-303), "Dangerous Waste Regulations". The final column lists the DOT designation found in the DOT *Hazardous Materials Table* (49 CFR 172.101) and comments.

Tables 5-20 and 5-21 provide a summary of the information taken from the SWBRs and the SWSDRs regarding the hazardous contents of TRU and non-TRU waste containers. These data were compiled by a complete review of all 231-Z burial records.

Listed below are the chemicals known, or suspected, to be in the 231-Z solid waste stream. Information on use, forms, disposal practices, and retrieval hazards is included wherever possible.

- **Acetone** — This is commonly used in processing. Some residual liquid may have been present in discarded containers.
- **Aerosol Cans** — Unvented cans, including Krylon*, lubricants, window cleaner, and solvent sprays are reported to be present in the solid waste.
- **Alcohol** — This is used to etch specimens during metallography. Some residual liquid may have been present in discarded containers.
- **Asbestos** — This is present in torn out floor tiles, lagging, and other insulation.
- **Benzene** — This is used conservatively in some glovebox operations.
- **Beryllium** — Metallurgical research for fuels development. A large quantity of beryllium was disposed of from 1960 to 1978, primarily in the form of beryllium chips in cardboard boxes. Site personnel noted no special packaging procedures to isolate these waste chips. It is likely that some of the waste was double-bagged and mixed with glovebox waste. Typical amounts per waste container were 200 to 300 g (7.05 to 10.58 oz) with the most beryllium in one container estimated at 1 kg (2.2 lb).
- **Cadmium** — Laboratory personnel disposed of some cadmium metal in waste boxes.
- **Carbon Tetrachloride** — This is used as a fluid for measuring the density of plutonium specimens.
- **Cellulose Acetate** — Replication tape was used in structure and impurity analyses.

*Krylon is a trademark of Borden, Incorporated.

- **Cyanide Salts** — Large quantities were used in the electroplating baths. The solution from these baths typically would have been sent to the 231-Z cribs.
- **Freon-113** — This is used in ultrasonic cleaning of plutonium parts. It is also used as a fluid for measuring the density of plutonium specimens.
- **Graphite** — Suitably protected graphite crucibles were used to hold plutonium metal during melting for casting processes.
- **Hydraulic Fluid with Polychlorinated Biphenyls (PCB)** — This may be present as a contaminant in gloveboxes and other equipment that were disposed of to solid waste.
- **Hydrochloric Acid** — This is used to clean the replicas in structure and impurity analyses.
- **Hydrogen Peroxide** — Small volumes in pint bottles were stored in boxes in the laboratory.
- **Lard Oil** — No attempt was made to rinse or stabilize solvents. Before the ban on free liquids, solvents were bagged and went out with no kitty litter or other absorbent.
- **Lead** — In the form of sheets and pigs, lead was entered on burial records from 231-Z. It is certain to be present in the solid waste in significant quantities.
- **Magnesium Oxide** — This is used as a fire extinguishing agent in gloveboxes. Because of the serious consequences of a glovebox fire, fire extinguishing drills were conducted frequently.
- **Mercury** — This is used to check the void volume of casting molds. Mercury lost in spills and from broken instruments was reported to have been disposed in the solid waste from 231-Z.
- **Methylene Chloride** — At least 37.85 to 75.7 L (10 to 20 gal) of methylene chloride paint strippers were disposed of in 55-gal drums.
- **Molybdenum** — Personnel indicated that molybdenum may be present in the 231-Z solid waste stream.
- **Nitric Acid** — Large amounts were used in the cleaning and decontamination of molybdenum. In the mid-1980's nitric acid was pumped out of the vaults and transported to the 200 East Area liquid waste tanks. It is estimated that there are small amounts in solid waste burial.
- **Oil** — Many oils were used in the processes and experiments at 231-Z. Oils were used as lubricants, in cutting operations, etc. Most of the gloveboxes had oil or hydraulic lines or containers.

- **Phosphoric Acid** — Contaminated rags were disposed of to the waste stream without further processing. Plutonium contaminated phosphoric acid reportedly was also disposed of.
- **Plutonium Nitrate** — This was concentrated and shipped by the 231-Z Facility before the Plutonium Finishing Plant began operating.
- **Polypropylene** — Large numbers of polypropylene wound filters were used to keep the phosphoric acid baths clean. When the filters were changed out they were disposed of with plenty of kitty litter or absorbent. There is reported to be a thick, gooey sludge and syrup in the filters which will make retrieval and cleanup efforts especially difficult.
- **Polystyrene** — Scraps of plutonium oxide - polystyrene from the cube fabrication process were disposed of in substantial quantities. Hydrogen buildup and bubbling of the surface were reported in these cubes.
- **Portland Cement** — This was used to solidify nitric acid, phosphoric acid, and sodium hydroxide in the bottom of the evaporator. The flash dried acid was reported to be very crumbly and not a solid monolith which will make cleanup efforts more difficult.
- **Propane** — Some small cylinders from the maintenance or shop areas may be in the solid waste stream.
- **Salts of Copper, Nickel, and Sulfate** — These were used in the electroplating baths before 1970. Salt baths were also used in the heat treating of plutonium metal specimens. Salts were disposed of without any special packaging.
- **Sodium** — Extremely small quantities were stored in boxes.
- **Sodium Hydroxide** — This was used in the vibratory finisher project, resulting in a ceramic which was put into a sodium hydroxide tank. The waste form was a clay-like sludge in the bottom of the tank. This was then packed with absorbents and disposed of in 55-gal drums. It is estimated that a large amount of this waste form was routed to solid waste. Sodium hydroxide was also used as a neutralizing agent. It was made by dissolving small pellets in 1-gal or smaller bottles.
- **Sodium Phosphate** — This is listed as a contaminant in the 231-Z burial records.
- **Solvents** — Many different solvents were used routinely at 231-Z. No attempt was made to rinse or stabilize solvents. Before the ban on free liquids, solvents were bagged and went out with no kitty litter or other absorbent. Organic solvents may found be in reagent bottles which were disposed of in 55-gal drums.

- **Sulfamic Acid** — A very large quantity was used during processing. Sulfamic acid was also used in the dissolution of plutonium-clad metal parts. The acid was received as a powder, and was mixed with water before it was used. While sulfamic acid was normally routed to the 231-Z cribs, it is possible that some was disposed of in solid waste.
- **Tantalum** — Oxidized tantalum crucibles were used to hold plutonium metal during melting for casting processes.
- **Teflon*** — Teflon tubes were used to contain specimens during spallation testing.
- **Trichloroethane** — No attempt was made to rinse or stabilize solvents. Before the ban on free liquids, solvents were bagged and went out without kitty litter or any other absorbent.
- **Trichloroethylene** — No attempt was made to rinse or stabilize solvents. Before the ban on free liquids, solvents were bagged and went out without kitty litter or any other absorbent.
- **Tungsten** — This is indicated as a component of the solid waste stream by interviewed personnel.
- **Uranyl Nitrate** — A small amount may have been made accidentally. This would have been disposed of in small beakers after being solidified in kitty litter.
- **Uranyl Nitrate Hexahydrate** — Very small amounts were stored in boxes at 231-Z.
- **Vacuum Pump Oil** — May be present as a contaminant in gloveboxes that were disposed of to solid waste.
- **Zirconium** — Metallurgical research generated large amounts of zirconium chips. Typically, these chips were either burned to an oxide outside of the 231-Z Building or were disposed of in cardboard boxes. Personnel did not recall any special precautions taken in the disposal of the zirconium chips.

5.8 CLASSIFIED WASTE

The vast majority of the work, which was performed during PNL's tenure at 231-Z, was classified. There is the possibility that some classified material or drawings may be contained in this waste, however, none of this waste has been officially designated as "classified".

*Teflon is a trademark of E.I. duPont de Nemours and Company.

Figure 5-1. 55-Gallon Drum Waste Count Generated by 231-Z Annually.

Figure 5-2. Percentage of 231-Z TRU/Non-TRU 55-Gallon Drums.

Figure 5-3. Weight of 55-Gallon Drum Waste Generated by 231-Z Annually.

Figure 5-4. Weight Percentage of 231-Z 55-Gallon Drums.

Figure 5-5. Volume of 55-Gallon Drum Waste Generated by 231-Z Annually.

Figure 5-6. Volume Percentage of 231-Z 55-Gallon Drums.

Figure 5-7. Other Container Waste Count Generated by 231-Z Annually.

Figure 5-8. Percentage of 231-Z TRU/Non-TRU Other Containers.

Figure 5-9. Weight of Other Containers Generated by 231-Z Annually.

Figure 5-10. Weight Percentage of Other Containers
Generated by 231-Z Annually.

Figure 5-11. Volume of Other Containers Generated by 231-Z Annually.

Figure 5-12. Volume Percentage of Other Containers Generated by 231-Z Annually.

Figure 5-13. Total Number of Waste Containers Generated by 231-Z Annually.

Figure 5-14. Total Weight of Waste Generated by 231-Z Annually.

Figure 5-15. Total Volume of Waste Generated by 231-Z Annually.

Figure 5-16. Grams of TRU Waste Generated by 231-Z Annually.

Table 5-1. TRU Waste Generated at 231-Z by Container Type and Year. (3 sheets)

Container type	Container size	Container number	Percent of total	Total container weight (kg)	Percent weight	Volume (m ³)	Percent volume
1969							
Fiberboard/plastic boxes, cartons, and gases	2 ft ³	3	0.4%	16	<0.1%	0.1	0.1%
	unknown	688	96.2%	8738	20.2%	87.2	53.1%
Trucks, flatbeds, compactor, loadlugger	unknown	20	2.8%	32537	75.1%	72.5	44.1%
Wooden boxes, cartons, and cases	2x4x8 ft	1	0.1%	610	1.4%	1.4	0.8%
	3x5x5 ft	1	0.1%	8676	2.0%	1.9	1.1%
	unknown	2	0.3%	521	1.2%	1.2	0.7%
Total		715		43298		164.3	
1970							
Fiberboard/plastic boxes, cartons, and cases	2 ft ³	2	1.6%	24	0.5%	0.1	0.5%
	unknown	99	76.7%	1257	28.7%	12.6	59.7%
Metal drums, barrels, or kegs	30 gal	4	3.1%	163	3.7%	0.5	2.4%
	55 gal	23	17.8%	1565	35.7%	4.8	22.7%
Trucks, flatbeds, compactors, loadluggers	unknown	1	0.8%	1372	31.3%	3.1	14.7%
Total		129		4381		21.1	
1971							
Gloveboxes	unknown	1	1.1%	11430	63.3%	25.5	56.2%
Metal drums, barrels, or kegs	55 gal	86	96.6%	5851	32.4%	18.1	39.9%
Miscellaneous scrap	unknown	1	1.1%	356	2.0%	0.9	2.0%
Self-contained equipment	unknown	1	1.1%	408	2.3%	0.9	2.0%
Total		89		18045		45.4	
1972							
Metal boxes, carton, and cases	2x2x3 ft	11	8.9%	1677	14.1%	3.7	11.6%
	3.5x6x8 ft	1	0.8%	2136	17.9%	4.8	15.0%
Metal drums, barrels, or kegs	55 gal	10	8.1%	706	5.9%	2.1	6.6%
	55 gal	102	82.3%	7405	62.1%	21.4	66.9%
Total		124		11924		32.0	

Table 5-1. TRU Waste Generated at 231-Z by Container Type and Year. (3 sheets)

Container type	Container size	Container number	Percent of total	Total container weight (kg)	Percent weight	Volume (m ³)	Percent volume
1973							
Metal boxes, cartons, and cases	2x2x3 ft	5	2.9%	762	6.3%	1.7	4.7%
Metal drums, barrels, or kegs	55 gal ^a	4	2.3%	272	2.6%	0.8	2.2%
	55 gal	162	94.7%	11022	91.4%	34.0	93.2%
Total		<u>171</u>		<u>12056</u>		<u>36.5</u>	
1974							
Metal drums, barrels, or kegs	55 gal ^a	185	100.0%	12587	100.0%	38.9	100.0%
Total		<u>185</u>		<u>12587</u>		<u>38.9</u>	
1975							
Metal drums, barrels, or kegs	55 gal ^a	2	1.1%	136	1.1%	0.4	1.1%
	55 gal	179	98.9%	12179	98.9%	37.6	98.9%
Total		<u>181</u>		<u>12315</u>		<u>38.0</u>	
1976							
Metal drums, barrels, or kegs	55 gal	1	1.1%	68	1.1%	0.2	1.0%
	55 gal	94	98.9%	6396	98.9%	19.7	99.0%
Total		<u>95</u>		<u>6464</u>		<u>19.9</u>	
1977							
Metal drums, barrels, or kegs	55 gal	228	100.0%	15513	100.0%	47.9	100.0%
Total		<u>228</u>		<u>15513</u>		<u>47.9</u>	
1978							
Metal boxes, cartons, and cases	2x2x3 ft	1	1.4%	175	3.6%	0.4	2.7%
Metal drums, barrels, or kegs	55 gal	68	98.6%	4027	96.4%	14.3	97.3%
Total		<u>69</u>		<u>4802</u>		<u>14.7</u>	
1979							
Metal drums, barrels, or kegs	55 gal	129	100.0%	8773	100.0%	27.1	100.0%
Total		<u>129</u>		<u>8773</u>		<u>27.1</u>	

Table 5-1. TRU Waste Generated at 231-Z by Container Type and Year. (3 sheets)

Container type	Container size	Container number	Percent of total	Total container weight (kg)	Percent weight	Volume (m ³)	Percent volume
1980							
Fiberglass reinforced polyester boxes	10.5x10.7x12 ft	4	9.1%	22725	14.5%	152.2	17.7%
	8.3x10.6x19.6 ft	1	2.3%	37648	24.0%	48.1	5.6%
	9x10.7x16 ft	3	6.8%	19731	12.6%	130.6	15.2%
	9x10.7x12 ft	1	2.3%	5556	3.5%	32.6	3.8%
	9x12x12.7 ft	1	2.3%	3629	2.3%	38.7	4.5%
	9x12.7x20 ft	7	15.9%	65771	41.9%	452.1	52.6%
Metal drums, barrels, or kegs	55 gal	27	61.4%	1837	1.2%	5.7	0.7%
Total		44		156897		860.0	
1981							
Fiberglass reinforced polyester boxes	9x10.7x16 ft	2	6.7%	13268	87.4%	87.1	93.7%
Metal drums, barrels, and kegs	55 gal	28	93.3%	1905	12.6%	5.9	6.3%
Total		30		15173		93.0	
1982							
Metal drums, barrels, or kegs	55 gal*	1	5.3%	118	7.0%	0.2	5.0%
	55 gal	18	94.7%	1574	93.0%	3.8	95.0%
Total		19		1692		4.0	
1983							
Metal drums, barrels, or kegs	55 gal	13	100.0%	1321	100.0%	2.7	100.0%
Total		13		1321		2.7	

*These containers hold mixed waste.

Table 5-2. Non-TRU Waste Generated at 231-Z by Container Type and Year. (4 sheets)

Container type	Container size	Container number	Percent of total	Total container weight (kg)	Percent weight	Volume (m ³)	Percent volume
1970							
Fiberboard/plastic boxes, cartons, and cases	unknown	178	89.4%	2402	25.9%	22.7	59.7%
HEPA filters	unknown	7	3.5%	711	7.7%	1.6	4.2%
Metal drums, barrels, or kegs	55 gal	2	1.0%	45	0.5%	0.1	0.3%
Self-contained equipment	unknown	8	4.0%	1765	19.0%	3.9	10.3%
Trucks, flatbeds, compactor, loadlifter	unknown	3	1.5%	4120	44.4%	9.2	24.2%
Wooden boxes, cartons, and cases	2x3x4 ft	1	0.5%	229	2.5%	0.5	1.3%
Total		<u>199</u>		<u>9272</u>		<u>38.0</u>	
1971							
HEPA filters	unknown	7	77.8%	711	59.9%	1.6	59.3%
Self-contained equipment	unknown	2	22.2%	476	40.1%	1.1	40.7%
Total		<u>9</u>		<u>1187</u>		<u>2.7</u>	
1972							
Concrete boxes	unknown	1	100.0%	19305	100.0%	43.0	100.0%
Total		<u>1</u>		<u>19305</u>		<u>43.0</u>	
1973							
Concrete boxes	unknown	1	11.1%	23496	98.0%	52.4	93.6%
Self-contained equipment	unknown	8	88.9%	483	2.0%	3.6	6.4%
Total		<u>9</u>		<u>23979</u>		<u>56.0</u>	
1974							
Total		0		0		0	
1975							
Total		0		0		0	
1976							
Total		0		0		0	
1977							
Metal drums, barrels, or kegs	30 gal	1	100.0%	41	100.0%	0.1	100.0%
Total		<u>1</u>		<u>41</u>		<u>0.1</u>	

Table 5-2. Non-TRU Waste Generated at 231-Z by Container Type and Year. (4 sheets)

Container type	Container size	Container number	Percent of total	Total container weight (kg)	Percent weight	Volume (m ³)	Percent volume
1978							
Concrete boxes	unknown	1	100.0%	10433	100.0%	7.3	100.0%
Total		1		10433		7.3	
1979							
Fiberboard/plastic boxes, cartons, and cases	unknown	85	37.6%	1035	1.8%	10.3	13.0%
	unknown	55	24.3%	699	1.2%	7.0	8.8%
Metal drums, barrels, or kegs	30 gal	2	0.9%	82	0.1%	0.2	0.3%
	55 gal*	28	12.4%	9207	16.5%	5.9	7.5%
	55 gal	50	22.1%	7031	12.6%	10.6	13.4%
Trucks, flatbeds, compactor, loadluggers	unknown	5	2.2%	37772	67.5%	44.7	56.5%
Wooden boxes, cartons, and cases	unknown	1	0.4%	125	0.2%	0.4	0.5%
Total		226		55951		79.1	
1980							
Fiberboard/plastic boxes, cartons, and cases	unknown*	10	3.2%	127	0.3%	1.3	1.0%
	unknown	135	43.8%	1794	4.0%	17.2	13.8%
Metal drums, barrels, and kegs	55 gal*	14	4.5%	2378	5.3%	3.0	2.4%
	55 gal	93	30.2%	17751	39.8%	19.7	15.8%
Miscellaneous scrap	unknown	7	2.3%	397	0.9%	0.6	0.5%
Self-contained equipment	unknown	34	11.0%	2249	5.0%	2.6	2.1%
Trucks, flatbeds, compactor, loadluggers	unknown	8	2.6%	18189	40.8%	74.7	59.9%
Wooden boxes, cartons, and cases	unknown*	3	1.0%	544	1.2%	3.1	2.5%
	unknown	4	1.3%	1156	2.6%	2.6	2.1%
Total		308		44585		124.8	
1981							
Dump truck	unknown	1	0.3%	1996	5.0%	9.2	8.7%
Fiberboard/plastic boxes, cartons, and cases	unknown*	33	10.0%	419	1.0%	4.2	4.0%
	unknown	148	44.8%	2049	5.1%	18.9	17.9%
Metal drums, barrels, or kegs	30 gal	1	0.3%	41	0.1%	0.1	0.1%
	55 gal*	13	3.9%	3119	7.8%	2.7	2.6%
	55 gal	126	38.2%	23515	58.8%	26.7	25.3%
Miscellaneous scrap	unknown	6	1.8%	2948	7.4%	25.5	24.1%

Table 5-2. Non-TRU Waste Generated at 231-Z by Container Type and Year. (4 sheets)

Container type	Container size	Container number	Percent of total	Total container weight (kg)	Percent weight	Volume (m ³)	Percent volume
Trucks, flatbeds, compactor, loadluggers	unknown*	1	0.3%	4536	11.3%	10.9	10.3%
	unknown	1	0.3%	1361	3.4%	7.4	7.0%
Total		330		39984		105.6	
1982							
Fiberboard/plastic boxes, cartons, and cases	unknown	64	48.1%	813	4.1%	8.2	12.2%
Metal drums, barrels, or kegs	55 gal	61	45.9%	8083	40.8%	12.8	19.1%
Self-contained equipment	unknown	2	1.5%	384	1.9%	2.8	4.2%
Trucks, flatbeds, compactor, loadluggers	unknown	6	4.5%	10523	53.1%	43.3	64.5%
Total		133		19803		67.1	
1983							
Burlap, cloth, paper or plastic bags	unknown	3	3.0%	420	0.8%	0.3	0.2%
Fiberboard/plastic boxes, cartons, and cases	unknown	45	45.0%	561	1.1%	5.7	4.4%
Metal drums, barrels, or kegs	30 gal	3	3.0%	1225	2.5%	0.4	0.3%
	55 gal	27	27.0%	3742	7.6%	5.7	4.4%
Self-contained equipment	unknown	11	11.0%	1286	2.6%	4.5	3.5%
Trucks, flatbeds, compactor, loadluggers	unknown	11	11.0%	42184	85.4%	113.1	87.2%
Total		100		49418		129.7	
1984							
Fiberboard/plastic boxes, cartons, and cases	unknown	44	34.6%	533	6.8%	5.6	23.7%
Metal drums, barrels, or kegs	55 gal	71	55.9%	2166	27.5%	14.9	63.1%
Miscellaneous scrap	unknown	12	9.4%	5185	65.8%	3.1	13.1%
Total		127		7884		23.6	
1985							
Fiberboard/plastic boxes, cartons, and cases	unknown	110	48.0%	2141	4.1%	14.0	7.0%
Fiberglass reinforced polyester boxes	unknown*	1	0.4%	9616	18.3%	38.7	19.4%
	unknown	1	0.4%	5806	11.1%	38.7	19.4%
Metal boxes, cartons, and cases	unknown	2	0.9%	21319	40.6%	72.6	36.4%

Table 5-2. Non-TRU Waste Generated at 231-Z by Container Type and Year. (4 sheets)

Container type	Container size	Container number	Percent of total	Total container weight (kg)	Percent weight	Volume (m ³)	Percent volume
Metal drums, barrels, or kegs	55 gal	114	49.8%	12016	22.9%	24.3	12.2%
Trucks, flatbeds, compactor, loadligger	unknown	1	0.4%	1588	3.0%	10.9	5.5%
Total		229		52486		199.2	
1986							
Dump truck	unknown	2	4.1%	21818	49.4%	19.9	19.0%
Fiberboard/plastic boxes, cartons, and cases	unknown	16	32.7%	145	0.3%	2.0	1.9%
Metal drums, barrels, or kegs	55 gal	20	40.8	2678	6.1%	4.2	4.0%
Miscellaneous scrap	unknown	1	2.0%	1100	2.5%	2.4	2.3%
Trucks, flatbeds, compactor, loadligger	unknown	5	10.2%	14167	32.1%	58.0	55.4%
Wooden boxes, cartons, and cases	4x4x8 ft	5	10.2%	4252	9.6%	18.1	17.3%
Total		49		44160		104.6	
1987							
Fiberboard/plastic boxes, cartons, and cases	unknown	3	27.3%	41	0.7%	0.4	1.2%
Wooden boxes, cartons, and cases	4x4x8 ft	8	72.7%	5693	99.3%	32.4	98.8%
Total		11		5734		32.8	
1988							
Fiberboard/plastic boxes, cartons, and cases	unknown	14	82.4%	317	14.0%	1.8	17.8%
Metal drums, barrels, or kegs	55 gal	1	5.9%	128	5.7%	0.2	2.0%
Wooden boxes, cartons, and cases	4x4x10 ft	2	11.8%	1814	80.3%	8.1	80.2%
Total		17		2259		10.1	

HEPA = High-efficiency particulate air.

*These containers hold mixed waste.

Table 5-3. 231-Z Waste Summary Data for 55-Gallon Drums.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
TRU count	0	23	86	112	166	185	181	95	228	68	129	27	28	19	13	0	0	0	0	0
TRU wt (kg)	0	1565	5851	8111	11294	12587	12315	6464	15513	4629	8773	1837	1905	1692	1321	0	0	0	0	0
TRU vol (m ³)	0	4.8	18.1	23.5	34.8	38.9	38	19.9	47.9	14.3	27.1	5.7	5.9	4	2.7	0	0	0	0	0
TRU MW count	0	0	0	10	4	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0
Non-TRU count	0	0	0	0	0	0	0	0	0	0	78	107	139	61	27	71	114	20	0	1
Non-TRU wt (kg)	0	0	0	0	0	0	0	0	0	0	16238	20129	26634	8083	3742	2166	12016	2678	0	128
Non-TRU vol (m ³)	0	0	0	0	0	0	0	0	0	0	16.5	22.7	29.4	12.8	5.7	14.9	24.3	4.2	0	0.2
Non-TRU MW count	0	0	0	0	0	0	0	0	0	0	28	14	13	0	0	0	0	0	0	0
% TRU by count	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	62%	20%	17%	24%	33%	0%	0%	0%	0%	0%
% non-TRU by count	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	38%	80%	83%	76%	68%	100%	100%	100%	100%	100%
Wt% TRU	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	35%	8%	7%	17%	26%	0%	0%	0%	0%	0%
Wt% non-TRU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	65%	92%	93%	83%	74%	100%	100%	100%	100%	100%
Vol% TRU	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	62%	20%	17%	24%	32%	0%	0%	0%	0%	0%
Vol% non-TRU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	38%	80%	83%	76%	68%	100%	100%	100%	100%	100%
% of TRU drums that are TRU MW	0%	0%	0%	9%	2%	0%	1%	1%	0%	0%	0%	0%	0%	5%	0%					
% of non-TRU drums that are MW											36%	13%	9%	0%	0%	0%	0%	0%	0%	0%

MW = Mixed waste.
TRU = Transuranic.

Table 5-4. 231-Z Waste Summary Data for Containers Other Than 55-Gallon Drums.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
TRU count	715	106	3	12	5	0	0	0	0	1	0	17	2	0	0	0	0	0	0	0
TRU wt (kg)	43298	2816	12194	3813	762	0	0	0	0	175	0	155060	13268	0	0	0	0	0	0	0
TRU vol (m ³)	164.3	16.3	27.3	8.5	1.7	0	0	0	0	0.4	0	854.3	87.1	0	0	0	0	0	0	0
TRU MW count	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-TRU count	0	199	9	1	9	0	0	0	1	1	148	201	191	72	73	56	115	29	11	16
Non-TRU wt (kg)	0	9272	1187	19305	23979	0	0	0	41	10433	39713	24456	13350	11720	45676	5718	40470	41482	5734	2131
Non-TRU vol (m ³)	0	38	2.7	43	56	0	0	0	0.1	7.3	62.6	102.1	76.2	54.3	124	8.7	174.9	100.4	32.8	9.9
Non-TRU MW count	0	0	0	0	0	0	0	0	0	0	85	13	34	0	0	0	1	0	0	0
% TRU by count	100%	35%	25%	92%	36%				0%	50%	0%	8%	1%	0%	0%	0%	0%	0%	0%	0%
% non-TRU by count	0%	65%	75%	8%	64%				100%	50%	100%	92%	99%	100%	100%	100%	100%	100%	100%	100%
Wt% TRU	100%	23%	91%	16%	3%				0%	2%	0%	86%	50%	0%	0%	0%	0%	0%	0%	0%
Wt% non-TRU	0%	77%	9%	84%	97%				100%	98%	100%	14%	50%	100%	100%	100%	100%	100%	100%	100%
Vol% TRU	100%	30%	91%	17%	3%				0%	5%	0%	89%	53%	0%	0%	0%	0%	0%	0%	0%
Vol% non-TRU	0%	70%	9%	83%	97%				100%	95%	100%	11%	47%	100%	100%	100%	100%	100%	100%	100%
% of TRU containers that are TRU MW	0%	0%	0%	0%	0%				0%	0%	0%	0%	0%							
% of non-TRU containers that are MW	0%	0%	0%	0%	0%				0%	0%	57%	6%	18%	0%	0%	0%	1%	0%	0%	0%

MW = Mixed waste.
TRU = Transuranic.

Table 5-5. 231-Z Burial Boxes From 1980 and 1981.

Container number	Date accepted	Storage location	Container weight (lb)	Container volume (ft ³)	Grams of TRU (Pu)
231-Z-DR-1	11/18/80	218-W-4C	22,000	2,281	53.0 g
231-Z-DR-2	11/19/80	218-W-4C	13,000	1,344	0.0 g
231-Z-DR-3	11/18/80	218-W-4C	20,000	2,281	200.0 g
231-Z-DR-4	2/9/81	218-W-4C	13,000	1,537	39.0 g
231-Z-DR-5	11/20/80	218-W-4C	22,500	2,281	30.0 g
231-Z-DR-6	11/19/80	218-W-4C	18,000	2,281	<0.01 g
231-Z-DR-7	2/9/81	218-W-4C	12,000	1,537	5.0 g
231-Z-DR-8	11/19/80	218-W-4C	13,000	1,344	157.0 g
231-Z-DR-9	11/20/80	218-W-4C	11,600	1,344	8.0 g
231-Z-DR-10	11/19/80	218-W-4C	12,500	1,344	<0.01 g
231-Z-DR-11	11/17/80	218-W-4C	83,000	1,710	108.0 g
231-Z-DR-12	2/9/81	218-W-4C	15,500	1,537	30.0 g
231-Z-DR-13	12/2/80	218-W-4C	16,000	1,537	184.0 g
231-Z-DR-14	2/9/81	218-W-4C	13,250	1,537	74.0 g
231-Z-DR-15	11/20/80	218-W-4C	16,500	2,281	108.0 g
231-Z-DR-16	11/19/80	218-W-4C	12,250	1,152	<0.01 g
231-Z-DR-17	11/20/80	218-W-4C	23,000	2,281	1.0 g
231-Z-DR-19	11/19/80	218-W-4C	23,000	2,281	17.0 g
231-Z-DR-20	11/18/80	218-W-4C	8,000	1,368	14.0 g

TRU = Transuranic.

Table 5-6. 231-Z TRU Waste in 55-Gallon Drums — Drum Count by Storage Location.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
218-W-3A		23	35																	
218-W-4B			51	112	166	185	181	95	228											
218-W-4C										68	129	27	28	19	13					

Table 5-7. 231-Z TRU Waste in Containers Other Than 55-Gallon Drums — Container Count by Storage Location.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
218-W-3A		4																		
218-W-4B		715	102	3	12	5				1										
218-W-4C												17	2							

Table 5-8. Distribution and Percentage of TRU 55-Gallon Drum Physical Contents by Storage Location — 218-W-3A.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Misc/unknown/ other			23	35																
Percentage																				
Misc/unknown/ other			100%	100%																

Table 5-9. Distribution and Percentage of TRU 55-Gallon Drum Physical Contents by Storage Location — 218-W-4B.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Misc/unknown/ other			51	110	162	185	181	95	228											
Oils				5	4															
Percentage																				
Misc/unknown/ other			100%	98%	98%	100%	100%	100%	100%	100%										
Oils				4%	2%															

Table 5-10. Distribution and Percentage of TRU 55-Gallon Drum Physical Contents
by Storage Location — 218-W-4C.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Absorbent/kitty litter/vermiculite													6	8						
Brick/firebrick														8						
Cloth/rags/nylon												3	1							
Metal/iron/galvanized/sheet												9	27	19	9					
Misc/unknown/other							68	125	7											
Paper/cardboard								4	11	28	11	4								
Plastic/polyurethane							4	11	28	19	4									
Rubber							4	8	16	11	4									
Wood/lumber/plywood									3	1	11	4								
Percentage																				
Absorbent/kitty litter/vermiculite													21%	42%						
Brick/firebrick														42%						
Cloth/rags/nylon									11%	4%										
Metal/iron/galvanized/sheet									33%	96%	100%	69%								
Misc/unknown/other							100%	97%	26%											
Paper/cardboard								3%	41%	100%	58%	31%								
Plastic/polyurethane								3%	41%	100%	100%	31%								
Rubber								3%	30%	57%	58%	31%								
Wood/lumber/plywood									11%	4%	58%	31%								

Table 5-11. Distribution and Percentage of TRU Containers Other Than 55-Gallon Drums Physical Contents
by Storage Location — 218-W-3A.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1978	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Misc/unknown/other																				
Percentage																				
Misc/unknown/other																				

Table 5-12. Distribution and Percentage of TRU Containers Other Than 55-Gallon Drums Physical Contents
by Storage Location — 218-W-4B.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1978	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Misc/unknown/other																				
Percentage																				
Misc/unknown/other																				

Table 5-13. Distribution and Percentage of TRU Containers Other Than 55-Gallon Drums Physical Contents
by Storage Location — 218-W-4C.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Concrete													1	1						
Metal/iron/ galvanized/sheet												17	2							
Percentage																				
Concrete													6%	50%						
Metal/iron/ galvanized/sheet													100%	100%						

Table 5-14. 231-Z TRU Waste in 55-Gallon Drums — Total Grams TRU by Storage Location.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
218-W-3A	9.5	97.0																		
218-W-4B		114.0	154.6	1221.2	299.4	1407.6	213.4	1223.7												
218-W-4C										11.6	243.3	41.1	20.5	7.9	1.9					
Total TRU in drums	9.5	211.0	154.6	1221.2	299.4	1407.6	213.4	1223.7		11.6	243.3	41.1	20.5	7.9	1.9					

TRU = Transuranic.

Table 5-15. 231-Z TRU Waste in Containers Other Than 55-Gallon Drums — Total Grams TRU by Storage Location.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
218-W-3A																				
218-W-4B	137.5	19.3	100.0	55.0	0.2					0.01		920.0	113.0							
218-W-4C																				
Total TRU in other containers	137.5	19.3	100.0	55.0	0.2					0.01		920.0	113.0							

TRU = Transuranic.

Table 5-16. 231-Z TRU Mixed Waste in 55-Gallon Drums — Drum Count by Storage Location.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
218-W-3A																				
218-W-4B				10	4		2	1												
218-W-4C																				1

Table 5-17. Number and Percentage of 231-Z TRU 55-Gallon Drums Containing Hazardous Constituents
by Storage Location — 218-W-4B.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Beryllium				1																
Oil				10	4		2	1												
Percentage																				
Beryllium				1%																
Oil				8%	2.4%		1%	1%												

Table 5-18. Number and Percentage of 231-Z TRU 55-Gallon Drums Containing Hazardous Constituents
by Storage Location — 218-W-4C.

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Distribution																				
Sodium																				
Percentage																				
Sodium																				

Table 5-19. Hazardous Substances Known or Suspected to be in the 231-Z Solid Waste System. (3 sheets)

Compound name	Chemical formula	Information source ^a	EPA toxicity category	DOT classification
Acetone	CH ₃ COCH ₃	5,6	D	Flammable liquid
Alcohol	C ₂ H ₅ OH	1,5		Flammable liquid
Asbestos	Fibrous mineral silicates	5	X	ORM-C
Benzene	C ₆ H ₆	1	A	Flammable liquid
Berkelium ^b	Bk	4		
Beryllium	Be	2,3,4,5,6	X	Poison B
Cadmium	Cd	3	A	
Carbon tetrachloride	CCl ₄	1	A	ORM-A
Cellulose acetate	Partially acetylated cellulose	1		
Copper salts		5	D	
Cyanide salts	CN	5,6	A	Poison B
Freon-113	CCl ₂ FCClF ₂	1	B	
Graphite	C	1		
Hydraulic fluid	Various hydrocarbons	1	B	
Hydrochloric acid	HCl	1	D	Nonflammable gas, corrosive
Hydrogen peroxide	H ₂ O ₂	3	B	Oxidizer
Lard oil		5		
Lead	Pb	4	X	
Magnesium oxide	MgO	1,5		
Mercury	Hg	4,5	X	ORM-B
Methylene chloride	CH ₂ Cl ₂	5	C	ORM-A
Molybdenum	Mo	5		
Nickel salts		5	B	
Nitric acid	HNO ₃	5	C	Oxidizer, corrosive
Oil	Various hydrocarbons	1,2		
Oil, vacuum pump	Various hydrocarbons	1,4		
PCBs	Polychlorinated biphenyls	5	X	

**Table 5-19. Hazardous Substances Known or Suspected to be in the 231-Z
Solid Waste System. (3 sheets)**

Compound name	Chemical formula	Information source*	EPA toxicity category	DOT classification
Phosphoric acid	H ₃ PO ₄	4,5	D	Corrosive
Plutonium nitrite		5		
Plutonium oxide — sugar mixture	PuO ₂ — sugar	1		
Polypropylene	C ₃ H ₆	5		
Polystyrene	C ₈ H ₈	1,5		
Portland cement		5		
Propane	CH ₃ CH ₂ CH ₃	3,5	X	Flammable gas
Sodium phosphate	H _x Na _x O ₄ P	4	D	
Sodium	Na	2,3	A	Flammable solid, dangerous when wet
Sodium hydroxide	NaOH	3,4,5	C	Corrosive
Sulfamic acid	H ₃ NO ₃ S	1	D	
Sulfate salts		1,5		
Tantalum	Ta	1,5		
Teflon*	CF ₂ chains	1		
Trichloroethane	C ₂ H ₃ Cl ₃	5	B	ORM-A
Trichloroethylene	C ₂ H Cl ₃	5	B	ORM-A
Tungsten	W	5		
Uranyl nitrate	N ₂ O ₆ U	5	B	Radioactive material

Table 5-19. Hazardous Substances Known or Suspected to be in the 231-Z Solid Waste System. (3 sheets)

Compound name	Chemical formula	Information source ^a	EPA toxicity category	DOT classification
Uranyl nitrate hexahydrate	$N_2O_{10}U \cdot 6H_2O$	3	B	Radioactive material
Zirconium	Zr	5,6		Flammable solid, flammable liquid

^aSource number refers to the following:

1. BNWL-CC-1924, *Safety Analysis Report, 231-Z Building* (BNWL 1970)
2. Solid Waste Information Tracking System (SWITS)
3. WHC-SD-WM-RPT-056, *Solid Waste Stream Hazardous and Dangerous Components Study* (WHC 1992)
4. Solid Waste Burial Records (SWBR)
5. Personnel interviews
6. WHC-EP-0603, *Reactive and Unstable Chemicals in Transuranic Retrievable Waste at the Hanford Site* (Reddinger 1992).

^bBerkelium has been determined to have been entered on the Solid Waste Burial Record in error.

^cTeflon is a trademark of duPont de Nemours and Company.

DOT = U.S. Department of Transportation.

EPA = U.S. Environmental Protection Agency.

ORM = Other radioactive material.

Table 5-20. Summary of Information from Solid Waste Storage Disposal Records for TRU Wastes with Hazardous Contents from PNL 231-Z.

Date accepted	PIN	Burial record number	Hazardous constituents	Waste codes	Weight (kg)	Volume (%)
04/28/72		231-Z-BR-28-72-018	Beryllium mercury			
06/02/72		231-Z-BR-6-2-72-024	Beryllium			
12/01/72	11-72#6	BNW-231-Z-72-076	Beryllium			
02/27/73	2-73-14	231-Z-BNW-73-031	Sodium hydroxide			
03/23/79	231-Z-14	231-Z-PNL-79-3	Phosphoric acid			
05/18/79	4-78-26	231-Z-PNL-79-40	Phosphoric acid			
05/18/79	4-78-27	231-Z-PNL-79-41	Phosphoric acid			
05/18/79	4-78-28	231-Z-PNL-79-42	Phosphoric acid			
05/18/79	4-78-29	231-Z-PNL-79-43	Phosphoric acid			
05/18/79	4-78-30	231-Z-PNL-79-44	Phosphoric acid			
05/18/79	4-78-31	231-Z-PNL-79-45	Phosphoric acid			
05/18/79	4-78-32	231-Z-PNL-79-46	Phosphoric acid			
06/01/79	231-Z-17	231-Z-PNL-79-6	Phosphoric acid			
02/18/81	PNL-2-18-81	231-Z-PNL-81-6	Lead (pigs)	D008		11
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
04/16/82	231-Z-81-2	231-Z-PNL-82-1	Sodium phosphate			3*
07/31/85	PNL-85-161	231-Z-PNL-85-2	Lead (sheet)	D008	455	2

PIN = Personal identification number.

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

**Table 5-21. Summary of Information from Solid Waste Storage Disposal Records
for Low-Level Waste with Hazardous Contents from PNL 231-Z.**

Date accepted	PIN	Burial record number	Hazardous constituents	Waste codes	Weight (kg)	Volume (%)
10/05/79	231-Z-28	231-Z-PNL-79-14	Phosphoric acid			95
11/27/79	231-Z-35	231-Z-PNL-79-17	Phosphoric acid			
03/04/80	231-Z-46	231-Z-PNL-80-8	Phosphoric acid			80
05/21/81	231-Z-78	231-Z-PNL-81-14	Sodium phosphate			100
06/30/81	231-Z-79	231-Z-PNL-81-15	Sodium hydroxide			50

PIN = Personal identification number.

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6.0 REFERENCES

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WAC 173-303, 1989, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WHC, 1992, *Solid Waste Stream Hazardous and Dangerous Components Study*, WHC-SP-WM-RPT-056, Westinghouse Hanford Company, Richland, Washington.

Willis, N. P. and G. C. Triner, 1991. *Hanford Site Radioactive Solid Waste Acceptance Criteria*, WHC-EP-0063-3, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

**DATA ON 231-Z WASTE GENERATION FROM THE SOLID WASTE
INFORMATION TRACKING SYSTEM**

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**DATA ON 231-Z 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 System (R-SWIMS) database and is used to track information on radioactive and other wastes stored or disposed of 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 is also included.

The bulk of the data provided is limited to information about transuranic (TRU) waste generated at Plutonium Metallurgy Laboratory (231-Z); however, some general information on 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. Since initial retrieval efforts and the Waste Retrieval and Processing Plant (WRAP) 1 will focus on 55-gal drums, these container types are considered separately.

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

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.

SWIR401

Solid Waste Information and Tracking System

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Primary Waste Type Code Table

Primary Waste Type Code	Primary Waste Type Description	Ship Time	Rad
AH	HAZ, ADMIN HOLD	89	N
CM	MORATORIUM CONTROLLED	89	N
H	HAZARDOUS	89	N
HP	HAZARDOUS WASTE PCB	29	N
M	MIXED	89	Y
MP	MIXED PCB	29	Y
N	NON-REGULATED		N
P	PCB	29	N
R	RADIOACTIVE		Y
RP	RADIOACTIVE PCB	29	Y
U	UNKNOWN		N

SWIR402

Solid Waste Information and Tracking System

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Secondary Waste Type Code Table

Secondary Waste Type Code	Secondary Waste Group	Secondary Waste Type Description
1A	TRU	TRANSURANIC (NOT PROCESSED THROUGH TRUSAF)
1B	TRU	TRANSURANIC CLASSIFIED
1C	TRU	TRANSURANIC WIPP CERTIFIED
1D	TRU	TRANSURANIC WIPP UNCERTIFIED
1E	TRU	TRANSURANIC SPECIAL CASE
1F	TRU	TRANSURANIC CAISSONS
2A	LLW	LOW-LEVEL NON-INDUSTRIAL
2B	LLW	LOW-LEVEL NON-INDUSTRIAL CLASSIFIED
2F	LLW	LOW-LEVEL CAISSONS
2L	LLW	LOW-LEVEL NON-INDUSTRIAL (ASSAYED FROM TRU)
3A	LLW	LOW-LEVEL INDUSTRIAL
3L	LLW	LOW-LEVEL INDUSTRIAL (ASSAYED FROM TRU)
4A	HLW	HIGH LEVEL WASTE (SPENT FUEL)
UA	USG	UNSEGREGATED NON-TRANSURANIC DRY WASTE
UB	USG	UNSEGREGATED NON-TRANSURANIC INDUSTRIAL
UC	USG	UNSEGREGATED CAISSONS (REMOTE HANDLED)
UF	USG	UNSEGREGATED TRANSURANIC/LOW-LEVEL (TUNNELS PUREX)
UG	USG	UNSEGREGATED TRANSURANIC DRY WASTE
UJ	USG	UNSEGREGATED TRANSURANIC INDUSTRIAL

APPENDIX A.1

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

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**CONTAINER NUMBER AND WEIGHT OF TRU 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 kilograms) of the radioactive wastes generated at Plutonium Metallurgy Laboratory (231-Z) 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 value represents.

From 1970 until 1978 individual container weights were not required for TRU waste 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 (149.9 lb). This is why the average weight per drum for TRU is so consistent during this period.

```

set linesize 170
set pagesize 45
set newpage 0
spool pot2.srep
tttitle center '231-Z' -
right 'Page:' format 999 sql.pno skip 1
break on dt skip 1
compute sum of sum(con_gross_wgt) on dt
compute sum of sum(rdet_rswims_count) on dt
compute sum of sum(con_cntr_vol) on dt
col dt                                format a4          heading "Date"
col con_pwtyp_cd                      format a4          heading "Pri|Wast|Type"
col rdet_swtyp_cd                     format a4          heading "Sec|Wast|Type"
col sum(rdet_rswims_count)            format 999999       heading "Count"
col avg(con_gross_wgt)                format 99999.99     heading "Avg|Weight"
col sum(con_gross_wgt)                format 9999999.99    heading "Sum|Weight"
col sum(con_cntr_vol)                 format 99999.99     heading "Sum|Vol"
col avg(con_cntr_vol)                 format 99999.99     heading "Avg|Vol"
col cntyp_descr                       format a30         heading "Container Description"
col con_size_descr                    format a25         heading "Container Size"
select substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       rdet_swtyp_cd,
       sum(rdet_rswims_count),
       sum(con_gross_wgt),
       avg(con_gross_wgt),
       sum(con_cntr_vol),
       avg(con_cntr_vol)
from radwaste, cntype
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z'
and con_size_descr = '55 GALLON' and con_cntyp_cd = cntyp_cd
group by cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4),
       rdet_swtyp_cd
;
spool off

```


231-2

Date	Container Description	Container Size	Pri	Sec	Wast	Type	Count	Sum	Avg	Sum	Avg	Sum	Vol
1972	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	M	10	706.25	70.63	2.10	.21			

SUM						10	706.25		2.10				
1973	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	M	4	272.16	68.04	.84	.21			

SUM						4	272.16		.84				
1975	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	M	2	136.08	68.04	.42	.21			

SUM						2	136.08		.42				
1976	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	M	1	68.04	68.04	.21	.21			

SUM						1	68.04		.21				
1979	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	2A	M	28	9206.96	1534.49	5.93	.99			

SUM						28	9206.96		5.93				
1980	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	2A	M	14	2377.72	1188.86	2.97	1.49			

SUM						14	2377.72		2.97				
1981	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	2A	M	2	411.86	411.86	.43	.43			

SUM						11	2707.03	2707.03	2.31	2.31			
1982	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	M	1	117.93	117.93	.21	.21			

SUM						1	117.93		.21				
1970	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	R	23	1564.92	68.04	4.83	.21			

SUM						23	1564.92		4.83				
1971	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	R	86	5851.44	68.04	18.06	.21			

SUM						86	5851.44		18.06				

231-Z

Date	Container Description	Container Size	Pri	Sec	Uast	Type	Count	Sum Weight	Avg Weight	Sum Vol	Avg Vol
1972	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			102	7405.38	72.60	21.42	.21

SUM							102	7405.38		21.42	
1973	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			162	11022.48	68.04	34.02	.21

SUM							162	11022.48		34.02	
1974	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			185	12587.40	68.04	38.85	.21

SUM							185	12587.40		38.85	
1975	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			179	12179.16	68.04	37.59	.21

SUM							179	12179.16		37.59	
1976	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			94	6395.76	68.04	19.74	.21

SUM							94	6395.76		19.74	
1977	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			228	15513.12	68.04	47.88	.21

SUM							228	15513.12		47.88	
1978	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			68	4626.72	68.04	14.28	.21

SUM							68	4626.72		14.28	
1979	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			129	8772.62	68.00	27.09	.21

SUM							50	7030.66	1004.38	10.55	1.51
1980	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			27	1837.08	68.04	5.67	.21

SUM							93	17750.80	1183.39	19.68	1.31
1981	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A			28	1905.12	68.04	5.93	.21

SUM							120	19587.88		25.35	

231-Z

Date	Container Description	Container Size	Pri	Sec	Wast	Type	Count	Sum Weight	Avg Weight	Sum Vol	Avg Vol
1981	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	2A		R	90	12327.67	1027.31	19.16	1.60
	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	3A		R	36	11187.34	5593.67	7.55	3.77

SUM							154	25420.13		32.64	
1982	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A		R	18	1573.95	87.44	3.82	.21
	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	2A		R	61	8082.53	1154.65	12.84	1.83

SUM							79	9656.48		16.65	
1983	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A		R	13	1321.29	101.64	2.73	.21
	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	2A		R	27	3742.12	935.53	5.67	1.42

SUM							40	5063.41		8.40	
1984	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	2A		R	71	2165.89	433.18	14.89	2.98

SUM							71	2165.89		14.89	
1985	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	2A		R	114	12015.60	2002.60	24.32	3.47

SUM							114	12015.60		24.32	
1986	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	2A		R	20	2678.45	1339.23	4.19	2.10

SUM							20	2678.45		4.19	
1988	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	3A		R	1	128.37	128.37	.21	.21

SUM							1	128.37		.21	

33 rows selected.

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APPENDIX A.2

**231-Z TRU WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION,
SIZE, YEAR, AND PRIMARY WASTE TYPE**

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**231-Z TRU WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION,
SIZE, YEAR, AND PRIMARY WASTE TYPE**

This subappendix provides information on the Plutonium Metallurgy Laboratory (231-Z) TRU waste containers' weight and volume, and the primary waste type stored at various TRU waste storage facilities on the Hanford Site. The data provide the TRU waste generation from the 231-Z Facility by year.

```

set linesize 170
set pagesize 44
set newpage 0
spool pot3.srep
tttitle center 'TRU WASTE - 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on dt skip 1
compute sum of sum(con_gross_wgt) on dt
compute sum of sum(rdet_rswims_count) on dt
col dt                                format a4          heading "Date"
col con_pwtyp_cd                     format a4          heading "Pri|Wast|Type"
col rdet_swtyp_de                    format a4          heading "Sec|Wast|Type"
col sum(con_gross_wgt)               format 999999.99      heading "Weight"
col sum(rdet_rswims_count)           format 99999          heading "Count"
col avg(con_gross_wgt)               format 999999.99      heading "Avg|Weight"
col sum(con_cntr_vol)                format 99999.99       heading "Volume"
col avg(con_cntr_vol)                format 99999.99       heading "Avg|Volume"
col cntyp_descr                      format a55         heading "Container Discription"
col con_size_descr                   format a45         heading "Container Size"
col con_locn_facil_id                format a8          heading "Facility"
select
    cntyp_descr,
    con_size_descr,
    substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
    con_pwtyp_cd,
    con_locn_facil_id,
    sum(rdet_rswims_count),
    sum(con_gross_wgt),
    avg(con_gross_wgt),
    sum(con_cntr_vol),
    avg(con_cntr_vol)
from radwaste, contype
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd
group by cntyp_descr,
    con_size_descr,
    substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) ,
    con_pwtyp_cd,
    con_locn_facil_id
;
spool off

```


TRU WASTE - 2312

Container Description	Container Size	Date	Type	Facility	Count	Weight	Avg	
							Weight	Volume
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	2 CU FT	1969 R	218W48	3	16.32	5.44	.11	.04

		SUM		3	16.32		.11	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	2 CU FT	1970 R	218W48	2	24.04	12.02	.09	.04

		SUM		2	24.04		.09	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1969 R	218W48	688	8737.79	87.38	87.20	.87

		SUM		688	8737.79		87.20	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1970 R	218W48	99	1257.31	78.58	12.62	.79

		SUM		99	1257.31		12.62	
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	10.5*10.7*12	1980 R	218W4C	4	22724.86	5681.22	152.23	38.06
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	8.3*10.6*19.6	R	218W4C	1	37647.97	37647.97	48.14	48.14
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	R	218W4C	3	19731.17	6577.06	130.57	43.52

		SUM		8	80104.00		330.94	
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	1981 R	218W4C	2	13267.51	6633.76	87.05	43.52

		SUM		2	13267.51		87.05	
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.7*12	1980 R	218W4C	1	5556.48	5556.48	32.62	32.62
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*12*12.7	R	218W4C	1	3628.72	3628.72	38.74	38.74
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*12.7*20	R	218W4C	7	65770.56	9395.79	452.14	64.59

		SUM		9	74955.76		523.50	
GLOVE BOXES	UNKNOWN	1971 R	218W48	1	11430.47	11430.47	25.49	25.49

		SUM		1	11430.47		25.49	
METAL BOXES, CARTONS, CASES	2*2*3	1972 R	218W48	11	1676.51	152.41	3.74	.34

		SUM		11	1676.51		3.74	

TRU WASTE - 2312

Container Description	Container Size	Date	Type	Facility	Count	Weight	Pri		Avg	Volume
							Wast	Wt		
METAL BOXES, CARTONS, CASES	2*2*3	1973 R		218W48	5	762.05			152.41	1.70

		SUM			5	762.05				1.70
METAL BOXES, CARTONS, CASES	2*2*3	1978 R		218W48	1	174.63			174.63	.39

		SUM			1	174.63				.39
METAL BOXES, CARTONS, CASES	3.5*6*8	1972 R		218W48	1	2135.50			2135.50	4.76

		SUM			1	2135.50				4.76
METAL DRUMS, BARRELS, KEGS	30 GALLON	1970 R		218U3A	4	163.28			40.82	.46
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218U3A	23	1564.92			68.04	4.83

		SUM			27	1728.20				5.29
METAL DRUMS, BARRELS, KEGS	55 GALLON	1971 R		218U3A	35	2381.40			68.04	7.35
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218W48	51	3470.04			68.04	10.71

		SUM			86	5851.44				18.06
METAL DRUMS, BARRELS, KEGS	55 GALLON	1972 M		218W48	10	706.25			70.63	2.10
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218W48	102	7405.38			72.60	21.42

		SUM			112	8111.63				23.52
METAL DRUMS, BARRELS, KEGS	55 GALLON	1973 M		218W48	4	272.16			68.04	.84
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218W48	162	11022.48			68.04	34.02

		SUM			166	11294.64				34.86
METAL DRUMS, BARRELS, KEGS	55 GALLON	1974 R		218W48	185	12587.40			68.04	38.85

		SUM			185	12587.40				38.85
METAL DRUMS, BARRELS, KEGS	55 GALLON	1975 M		218W48	2	136.08			68.04	.42
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218W48	179	12179.16			68.04	37.59

TRU WASTE - 2312

Container Discription	Container Size	Date	Type	Facility	Count	Weight	Avg Weight	Volume	Avg Volume

		sum			181	12315.24		38.01	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1976 M		218W4B	1	68.04	68.04	.21	.21
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218W4B	94	6395.76	68.04	19.74	.21

		sum			95	6463.80		19.95	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1977 R		218W4B	228	15513.12	68.04	47.88	.21

		sum			228	15513.12		47.88	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1978 R		218W4C	68	4626.72	68.04	14.28	.21

		sum			68	4626.72		14.28	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1979 R		218W4C	129	8772.62	68.00	27.09	.21

		sum			129	8772.62		27.09	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1980 R		218W4C	27	1837.08	68.04	5.67	.21

		sum			27	1837.08		5.67	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1981 R		218W4C	28	1905.12	68.04	5.93	.21

		sum			28	1905.12		5.93	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1982 M		218W4C	1	117.93	117.93	.21	.21
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218W4C	18	1573.95	87.44	3.82	.21

		sum			19	1691.88		4.03	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1983 R		218W4C	13	1321.29	101.64	2.73	.21

		sum			13	1321.29		2.73	
MISCELLANEOUS SCRAP	UNKNOWN	1971 R		218W4B	1	355.61	355.61	.89	.89
SELF CONTAINED, EQUIPMENT	UNKNOWN	R		218W4B	1	407.78	407.78	.91	.91

TRU WASTE - 231Z Page: 4

Container Description	Container Size	Pri	Date	Type	Facility	Count	Weight	Avg Height	Volume	Avg Volume

Sum						2	763.39		1.80	
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN		1969	R	218W48	20	32536.98	1626.85	72.54	3.63

Sum						20	32536.98		72.54	
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN		1970	R	218W48	1	1371.66	1371.66	3.06	3.06

Sum						1	1371.66		3.06	
WOODEN BOXES, CARTONS, CASES	2*4*8		1969	R	218W48	1	609.62	609.62	1.36	1.36
WOODEN BOXES, CARTONS, CASES	3*5*5			R	218W48	1	876.34	876.34	1.91	1.91
WOODEN BOXES, CARTONS, CASES	UNKNOWN			R	218W48	2	520.72	260.36	1.15	.57

Sum						4	2006.68		4.42	

44 rows selected.

APPENDIX A.3

**231-Z NON-TRU WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION,
SIZE, YEAR, AND PRIMARY WASTE TYPE**

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**231-Z Non-TRU WASTE CONTAINERS SORTED BY CONTAINER DESCRIPTION,
SIZE, YEAR, AND PRIMARY WASTE TYPE**

This subappendix provides information on the Plutonium Metallurgy Laboratory (231-Z) non-TRU waste containers' weight and volume, and the primary waste type stored at various waste storage facilities on the Hanford Site. The data provide the non-TRU waste generation from the 231-Z Facility by year.

```

set linesize 175
set pagesize 45
set newpage 0
spool pot3a.srep
title center 'NON-TRU WASTE- 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on dt skip 1
compute sum of sum(con_gross_wgt) on dt
compute sum of sum(rdet_rswims_count) on dt
col dt                                format a4          heading "Date"
col con_pwtyp_cd                      format a4          heading "Pri|Wast|Type"
col rdet_swtyp_cd                     format a4          heading "Sec|Wast|Type"
col sum(con_gross_wgt)                format 999999.99      heading "Weight"
col sum(rdet_rswims_count)            format 99999          heading "Count"
col avg(con_gross_wgt)                format 999999.99      heading "Avg|Weight"
col sum(con_cntr_vol)                 format 99999.99      heading "Volume"
col avg(con_cntr_vol)                 format 99999.99      heading "Avg|Volume"
col cntyp_descr                       format a55         heading "Container Discription"
col con_size_descr                    format a45          heading "Container Size"
col con_locn_facil_id                 format a8          heading "Facility"
col rdet_swtyp_cd                     format a4          heading "Sec|Wast|Code"
select
    cntyp_descr,
    con_size_descr,
    substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
    con_pwtyp_cd,
    rdet_swtyp_cd,
    con_locn_facil_id,
    sum(rdet_rswims_count),
    sum(con_gross_wgt),
    avg(con_gross_wgt),
    sum(con_cntr_vol),
    avg(con_cntr_vol)
from radwaste, contype
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z'
and rdet_swtyp_cd in ('2A','2B','2L','3A','3L','UA','UB') and
con_cntyp_cd = cntyp_cd
group by cntyp_descr,
    con_size_descr,
    substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) ,
    con_pwtyp_cd,
    rdet_swtyp_cd,
    con_locn_facil_id
;
spool off

```


NON-TRU WASTE- 2312

Container Discription	Container Size	Date	Type	Code	Facility	Count	Weight	Avg Weight	Volume	Avg Volume
BURLAP, CLOTH, PAPER OR PLASTIC BAGS	UNKNOWN	1983 R	2A	218U3A	3	420.48	420.48	420.48	.32	.32

		SUM			3	420.48			.32	
CONCRETE BOXES	UNKNOWN	1972 R	3A	218U2A	1	19304.79	19304.79	19304.79	43.04	43.04

		SUM			1	19304.79			43.04	
CONCRETE BOXES	UNKNOWN	1973 R	3A	218U2A	1	23495.96	23495.96	23495.96	52.39	52.39

		SUM			1	23495.96			52.39	
CONCRETE BOXES	UNKNOWN	1978 R	2A	218U3A	1	10432.57	10432.57	10432.57	7.25	7.25

		SUM			1	10432.57			7.25	
DUMP TRUCK	UNKNOWN	1981 R	2A	218U3A	1	1995.80	1995.80	1995.80	9.18	9.18

		SUM			1	1995.80			9.18	
DUMP TRUCK	UNKNOWN	1986 R	2A	218U3A	2	21817.68	21817.68	21817.68	19.94	19.94

		SUM			2	21817.68			19.94	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1970 R	UA	218U3A	178	2402.19	2402.19	2402.19	22.68	22.68

		SUM			178	2402.19			22.68	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1979 R	2A	218U3A	85	1035.08	1035.08	1035.08	10.32	10.32

		SUM			85	1035.08			10.32	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1980 R	2A	218U3A	135	1794.40	1794.40	1794.40	17.20	17.20

		SUM			135	1794.40			17.20	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1981 M	2A	218U3A	14	177.81	177.81	177.81	1.78	1.78

		SUM			14	177.81			1.78	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1981 M	3A	218U3A	19	241.31	241.31	241.31	2.42	2.42

		SUM			19	241.31			2.42	

NON-TRU WASTE- 2312

Container Description	Container Size	Date	Type	Sec	Facility	Count	Weight	Avg Weight	Volume	Avg Volume
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1981	R	2A	218U3A	61	944.35	118.04	7.77	.97
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN		R	2A	218U4C	75	952.54	190.51	9.56	1.91
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN		R	3A	218U3A	12	152.40	76.20	1.53	.76

		SUM				181	2668.41		23.06	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1982	R	2A	218U3A	52	660.43	132.09	6.63	1.33
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN		R	2A	218U4C	12	152.41	152.41	1.53	1.53

		SUM				64	812.84		8.16	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1983	R	2A	218U3A	45	561.10	112.22	5.73	1.15

		SUM				45	561.10		5.73	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1984	R	2A	218U3A	44	532.98	177.66	5.61	1.87

		SUM				44	532.98		5.61	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1985	R	2A	218U3A	110	2140.94	356.82	14.02	2.34

		SUM				110	2140.94		14.02	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1986	R	2A	218U3A	16	145.15	145.15	2.04	2.04

		SUM				16	145.15		2.04	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1987	R	2A	218U5	3	40.82	40.82	.38	.38

		SUM				3	40.82		.38	
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1988	R	2A	218U5	14	316.61	316.61	1.78	1.78

		SUM				14	316.61		1.78	
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	UNKNOWN	1985	M	3A	218U3AE	1	9616.11	9616.11	38.74	38.74
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	UNKNOWN		R	3A	218U3AE	1	5805.95	5805.95	38.74	38.74

		SUM				2	15422.06		77.48	

NON-TRU WASTE- 2312

Container Discription	Container Size	Pri Sec		Date	Type	Code	Facility	Count	Weight	Avg Weight	Volume	Avg Volume
		Wast	Sec									
HEPA FILTERS	UNKNOWN	1970 R	2A	218A3A	7	711.23	711.23	1.59	1.59	1.59	1.59	1.59

		SUM			7	711.23					1.59	
HEPA FILTERS	UNKNOWN	1971 R	2A	218A3A	7	711.23	711.23	1.59	1.59	1.59	1.59	1.59

		SUM			7	711.23					1.59	
METAL BOXES, CARTONS, CASES	UNKNOWN	1985 R	3A	218A3AE	2	21318.73	10659.37	72.55	72.55	72.55	72.55	36.27

		SUM			2	21318.73					72.55	
METAL DRUMS, BARRELS, KEGS	30 GALLON	1977 R	2A	218A3A	1	40.82	40.82	.12	.12	.12	.12	.12

		SUM			1	40.82					.12	
METAL DRUMS, BARRELS, KEGS	30 GALLON	1979 R	2A	218A3A	2	81.65	81.65	.23	.23	.23	.23	.23

		SUM			2	81.65					.23	
METAL DRUMS, BARRELS, KEGS	30 GALLON	1981 R	2A	218A3A	1	40.82	40.82	.12	.12	.12	.12	.12

		SUM			1	40.82					.12	
METAL DRUMS, BARRELS, KEGS	30 GALLON	1983 R	2A	218A3A	3	1224.70	612.35	.39	.39	.39	.39	.19

		SUM			3	1224.70					.39	
METAL DRUMS, BARRELS, KEGS	5 GALLON	1970 R	UA	218A3A	2	45.36	45.36	.06	.06	.06	.06	.06

		SUM			2	45.36					.06	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1979 M	2A	218A3A	28	9206.96	1534.49	5.93	5.93	5.93	5.93	.99
		R	2A	218A3A	50	7030.66	1004.38	10.55	10.55	10.55	10.55	1.51

METAL DRUMS, BARRELS, KEGS	55 GALLON	1980 M	2A	218A3A	14	2377.72	188.86	2.97	2.97	2.97	2.97	1.49
		R	2A	218A3A	93	17750.80	1183.39	19.68	19.68	19.68	19.68	1.31

MON-TRU WASTE- 2312

Container Description	Container Size	Pri Sec		Date	Wast Code	Facility	Count	Weight	Avg Weight	Volume	Avg Volume
		Wast	Sec								
							107	20128.52		22.65	
		SUM									
METAL DRUMS, BARRELS, KEGS	55 GALLON	1981	M	2A	218U3A		2	411.86	411.86	.43	.43
METAL DRUMS, BARRELS, KEGS	55 GALLON		M	3A	218U3A		11	2707.03	2707.03	2.31	2.31
METAL DRUMS, BARRELS, KEGS	55 GALLON		R	2A	218U3A		51	7625.75	1089.39	10.91	1.56
METAL DRUMS, BARRELS, KEGS	55 GALLON		R	2A	218U4C		39	4701.92	940.38	8.25	1.65
METAL DRUMS, BARRELS, KEGS	55 GALLON		R	3A	218U3A		36	11187.34	5593.67	7.55	3.77

		SUM					139	26633.90		29.44	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1982	R	2A	218U3A		53	7331.38	1221.90	11.16	1.86
METAL DRUMS, BARRELS, KEGS	55 GALLON		R	2A	218U4C		8	751.15	751.15	1.68	1.68

		SUM					61	8082.53		12.84	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1983	R	2A	218U3A		27	3742.12	935.53	5.67	1.42

		SUM					27	3742.12		5.67	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1984	R	2A	218U3A		71	2165.89	433.18	14.89	2.98

		SUM					71	2165.89		14.89	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1985	R	2A	218U3A		114	12015.60	2002.60	24.32	3.47

		SUM					114	12015.60		24.32	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1986	R	2A	218U3A		19	2585.46	2585.46	3.98	3.98
METAL DRUMS, BARRELS, KEGS	55 GALLON		R	2A	218U5		1	92.99	92.99	.21	.21

		SUM					20	2678.45		4.19	
METAL DRUMS, BARRELS, KEGS	55 GALLON	1988	R	3A	218U5		1	128.37	128.37	.21	.21

		SUM					1	128.37		.21	
MISCELLANEOUS SCRAP	UNKNOW	1988	R	2A	218U3A		7	396.89	396.89	.55	.55

		SUM					7	396.89		.55	

NON-TRU WASTE- 2312

Page: 5

Container Discription	Container Size	Pri Sec		Date	Type	Code	Facility	Count	Weight	Avg Weight	Volume	Avg Volume
		Wast	Sec									
MISCELLANEOUS SCRAP	UNKNOWN	1981	R	2A	218W4C	6	2948.34	2948.34	25.49	25.49	25.49	25.49

		SUM				6	2948.34				25.49	
MISCELLANEOUS SCRAP	UNKNOWN	1984	R	2A	218W3A	12	5184.53	5184.53	3.14	3.14	3.14	3.14

		SUM				12	5184.53				3.14	
MISCELLANEOUS SCRAP	UNKNOWN	1986	R	2A	218W5	1	1099.96	1099.96	2.35	2.35	2.35	2.35

		SUM				1	1099.96				2.35	
SELF CONTAINED, EQUIPMENT	UNKNOWN	1970	R	2A	218W3A	5	1587.57	1587.57	3.54	3.54	3.54	3.54
		R	UA	218W3A	3	177.81	177.81				.40	.40

SELF CONTAINED, EQUIPMENT	UNKNOWN	1971	R	2A	218W3A	2	476.27	476.27	1.08	1.08	1.08	1.08

		SUM				2	476.27				1.08	
SELF CONTAINED, EQUIPMENT	UNKNOWN	1973	R	2A	218W3A	8	482.62	482.62	3.63	3.63	3.63	3.63

		SUM				8	482.62				3.63	
SELF CONTAINED, EQUIPMENT	UNKNOWN	1980	R	2A	218W3A	34	2248.90	2248.90	2.58	2.58	2.58	2.58

		SUM				34	2248.90				2.58	
SELF CONTAINED, EQUIPMENT	UNKNOWN	1982	R	2A	218W3A	1	239.04	239.04	1.02	1.02	1.02	1.02
		R	2A	218W4C	1	145.15	145.15				1.81	1.81

SELF CONTAINED, EQUIPMENT	UNKNOWN	1983	R	2A	218W3A	11	1285.92	1285.92	4.47	4.47	4.47	4.47

		SUM				11	1285.92				4.47	
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1970	R	UP	218W3A	3	4119.51	1373.17	9.17	9.17	9.17	9.17

		SUM				3	4119.51				9.17	

NON-TRU WASTE- 2312

Container Discription	Container Size	Pri Sec		Date	Type	Code	Facility	Count	Weight	Avg	
		Wast	Wast							Weight	Volume
		Sum						3	4119.51		9.17
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1979 R	2A	218U3A				5	37771.81	7554.36	44.70

		Sum						5	37771.81		44.70
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1980 R	2A	218U3A				8	18188.96	2273.62	74.70

		Sum						8	18188.96		74.70
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1981 M	2A	218U3A				1	4535.90	4535.90	10.87
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	R	2A	218U3A				1	1360.77	1360.77	7.36

		Sum						2	5896.67		18.24
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1982 R	2A	218U3A				6	10523.30	1753.88	43.33

		Sum						6	10523.30		43.33
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1983 R	2A	218U3A				11	42183.88	3834.90	113.07

		Sum						11	42183.88		113.07
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1985 R	2A	218U3A				1	1587.57	1587.57	10.87

		Sum						1	1587.57		10.87
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1986 R	2A	218U3A				4	12353.06	3088.27	43.50
TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	R	2A	218U5				1	1814.36	1814.36	14.50

		Sum						5	14167.42		57.99
WOODEN BOXES, CARTONS, CASES	2*3*4	1970 R	UA	218U3A				1	228.61	228.61	.51

		Sum						1	228.61		.51
WOODEN BOXES, CARTONS, CASES	4*4*10	1988 R	3A	218U5				2	1814.36	1814.36	8.10

		Sum						2	1814.36		8.10

NON-TRU WASTE- 231Z

Container Description	Container Size	Date	Type	Code	Facility	Count	Weight	Avg Weight	Volume	Avg Volume
WOODEN BOXES, CARTONS, CASES	4*4*8	1986 R	3A	218U3AE	5	4252.41	4252.41	18.12	18.12	18.12

		sum			5	4252.41			18.12	
WOODEN BOXES, CARTONS, CASES	4*4*8	1987 R	3A	218U5	8	5692.55	2846.28	32.39	16.20	

		sum			8	5692.55		32.39		
WOODEN BOXES, CARTONS, CASES	UNKNOWN	1979 R	2A	218U3A	1	125.19	125.19	.40	.40	.40

		sum			1	125.19			.40	
WOODEN BOXES, CARTONS, CASES	UNKNOWN	1980 M	2A	218U3A	3	544.31	544.31	3.12	3.12	3.12
		R	2A	218U3A	4	1155.75	577.88	2.58	1.29	

		sum			7	1700.06		5.69		

80 rows selected.

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APPENDIX A.4

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

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

This subappendix summarizes the radiological data for all TRU waste containers generated at Plutonium Metallurgy Laboratory (231-Z). 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 of alpha radiation was included on the Solid Waste Burial Records (SWBRs). Since the 231-Z waste generation data are all from 1969 to 1988, these columns contain blank entries. The "Max Dose" column contains the highest value recorded for a given container in a given year, in mrem/h.

Additional information about the isotopes present in 231-Z waste containers can be found in subappendixes A.9 and A.10.

```

set linesize 170
set pagesize 44
set newpage 0
spool pot4.srep
tttitle center 'TRU Waste 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on dt skip 1
compute sum of sum(rdet_rswims_count) on dt
compute sum of sum(rdet_rswims_count) on report
compute sum of sum(rad_qty) on dt
compute sum of avg(rad_qty) on dt
compute sum of sum(rad_alpha_ci) on dt
compute sum of avg(rad_alpha_ci) on dt
compute sum of max(rdet_bg_dose_rate) on dt
col dt                format a4                heading "Date"
col cntyp_descr        format a45                heading "Container Description"
col con_size_descr     format a20                heading "Container Size"
col con_pwtyp_cd       format a4                heading "Pri|Wast|Type"
col con_locn_facil_id  format a8                heading "Location"
col sum(rdet_rswims_count) format 999999          heading "Count"
col sum(rad_qty)        format 999999.99          heading "Total|TRU (g)"
col avg(rad_qty)        format 99999.99           heading "Avg|TRU (g)"
col sum(rad_alpha_ci)   format 999999.99          heading "Total|Alpha (ci)"
col avg(rad_alpha_ci)   format 999999.99          heading "Avg|Alpha (ci)"
col max(rdet_bg_dose_rate) format 999999.99       heading "Max|Alpha (ci)"
select cntyp_descr,
       con_size_descr,
       substr(to_char(con_tsd_accept_dt, 'YYYY'),1, 4)dt,
       con_pwtyp_cd,
       con_locn_facil_id,
       sum(rdet_rswims_count),
       sum(rad_qty),
       avg(rad_qty),
       sum(rad_alpha_ci),
       avg(rad_alpha_ci),
       max(rdet_bg_dose_rate)
from radwaste, contype, isoqty
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z' and
rad_iso_num in (1,21,22,26,41,52,87,97,98,100,104,105,111,146,147) and
rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UF','UG','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = rad_pkg_id
group by cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       substr(to_char(con_tsd_accept_dt, 'YYYY'), 1, 4),
       con_locn_facil_id
;
spool off
tttitle off

```

TRU Waste 2312

Container Description	Container Size	Date	Type	Location	Count	Pri			
						Total	Avg	Total	Max
						TRU (g)	TRU (g) Alpha (ci)	Alpha (ci)	Alpha (ci)
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	2 CU FT	1969 R		218W48	3	.18	.06		

		SUM			3	.18	.06	.00	.00
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	2 CU FT	1970 R		218W48	2	.07	.03		

		SUM			2	.07	.03	.00	.00
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1969 R		218W48	679	136.19	1.38		10.00

		SUM			679	136.19	1.38	.00	10.00
FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1970 R		218W48	99	18.63	1.16		

		SUM			99	18.63	1.16	.00	.00
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	10.5*10.7*12	1980 R		218W4C	4	170.01	42.50		2.20
		R		218W4C	1	108.00	108.00		.10
		R		218W4C	3	219.00	73.00		4.50

		SUM			8	497.01	223.50	.00	6.80
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	1981 R		218W4C	2	113.00	56.50		2.00

		SUM			2	113.00	56.50	.00	2.00
FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.7*12	1980 R		218W4C	1	.01	.01		1.00
		R		218W4C	1	14.00	14.00		1.00
		R		218W4C	7	409.01	58.43		5.00

		SUM			9	423.02	72.44	.00	7.00
GLOVE BOXES	UNKNOWN	1971 R		218W48	1	100.00	100.00		1.00

		SUM			1	100.00	100.00	.00	1.00
METAL BOXES, CARTONS, CASES	2*2*3	1972 R		218W48	11	5.00	.45		1.00

		SUM			11	5.00	.45	.00	1.00

TRU Waste 2312

Container Description	Container Size	Date	Waste	Location	Count	Total		Avg		Total		Avg		Max
						TRU (g)	Alpha (ci)	TRU (g)	Alpha (ci)	TRU (g)	Alpha (ci)	TRU (g)	Alpha (ci)	
METAL BOXES, CARTONS, CASES	2*2*3	1973 R	218W48		5	.21	.04							1.00

		SUM			5	.21	.04			.00		.00		1.00
METAL BOXES, CARTONS, CASES	2*2*3	1978 R	218W48		1	.01	.01							1.00

		SUM			1	.01	.01			.00		.00		1.00
METAL BOXES, CARTONS, CASES	3.5*6*8	1972 R	218W48		1	50.00	50.00							1.00

		SUM			1	50.00	50.00			.00		.00		1.00
METAL DRUMS, BARRELS, KEGS	30 GALLON	1970 R	218W3A		4	.60	.15							1.00

		SUM			4	.60	.15			.00		.00		1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1972 H	218W48		10	34.00	3.40							6.00

		SUM			10	34.00	3.40			.00		.00		6.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1973 H	218W48		4	3.30	.83							1.00

		SUM			4	3.30	.83			.00		.00		1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1975 H	218W48		2	.25	.13							1.00

		SUM			2	.25	.13			.00		.00		1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1976 H	218W48		1	44.00	44.00							17.00

		SUM			1	44.00	44.00			.00		.00		17.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1982 H	218W4C		1	2.00	2.00							1.00

		SUM			1	2.00	2.00			.00		.00		1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1970 R	218W3A		23	9.50	.41							2.00

TRU Waste 2312										
Container Description	Container Size	Date	Type	Location	Count	Total TRU (g)	Avg TRU (g)	Total Alpha (ci)	Avg Alpha (ci)	Max Alpha (ci)
		SUM			23	9.50	.41	.00	.00	2.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1971 R		218J3A	35	97.00	2.77			6.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	R		218J48	51	114.00	2.24			6.00

		SUM			86	211.00	5.01	.00	.00	12.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1972 R		218J48	102	120.60	1.18			2.00

		SUM			102	120.60	1.18	.00	.00	2.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1973 R		218J48	162	1217.90	7.52			45.00

		SUM			162	1217.90	7.52	.00	.00	45.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1974 R		218J48	185	299.35	1.62			3.00

		SUM			185	299.35	1.62	.00	.00	3.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1975 R		218J48	179	1407.35	7.86			9.00

		SUM			179	1407.35	7.86	.00	.00	9.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1976 R		218J48	94	169.37	1.80			17.00

		SUM			94	169.37	1.80	.00	.00	17.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1977 R		218J48	230	1223.65	5.32			1.00

		SUM			230	1223.65	5.32	.00	.00	1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1978 R		218J4C	68	11.57	.17			1.00

		SUM			68	11.57	.17	.00	.00	1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1979 R		218J4C	129	243.34	1.89			1.00

		SUM			129	243.34	1.89	.00	.00	1.00

TRU Waste 2312

Container Description	Container Size	Date	Type	Location	Count	Total TRU (g)	Avg TRU (g)	Total Alpha (ci)	Avg Alpha (ci)	Max Alpha (ci)
METAL DRUMS, BARRELS, KEGS	55 GALLON	1980 R		218U4C	27	41.09	1.52			1.00

		SUM			27	41.09	1.52	.00	.00	1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1981 R		218U4C	28	20.50	.73			1.00

		SUM			28	20.50	.73	.00	.00	1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1982 R		218U4C	18	5.90	.33			1.00

		SUM			18	5.90	.33	.00	.00	1.00
METAL DRUMS, BARRELS, KEGS	55 GALLON	1983 R		218U4C	13	1.90	.15			1.00

		SUM			13	1.90	.15	.00	.00	1.00
MISCELLANEOUS SCRAP SELF CONTAINED, EQUIPMENT	UNKNOWN UNKNOWN	1971 R		218U48	1	.00	.00			1.00
		R		218U48	1	.00	.00			1.00

		SUM			2	.00	.00	.00	.00	2.00
WOODEN BOXES, CARTONS, CASES	UNKNOWN	1969 R		218U48	2	1.13	.56			

		SUM			2	1.13	.56	.00	.00	.00

40 rows selected.

APPENDIX A.5

**PHYSICAL CONTENTS DESCRIPTION FOR 231-Z
55-GALLON DRUMS CONTAINING TRU WASTE
SORTED BY DATE, PRIMARY WASTE TYPE,
AND STORAGE FACILITY**

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**PHYSICAL CONTENTS DESCRIPTION FOR 231-Z
55-GALLON DRUMS CONTAINING TRU WASTE
SORTED BY DATE, PRIMARY WASTE TYPE,
AND STORAGE FACILITY**

This subappendix describes the physical contents of the 55-gal drums of TRU waste generated by Plutonium Metallurgy Laboratory (231-Z). 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.

```

set linesize 170
set pagesize 45
set newpage 0
spool pot5.srep
tttitle center 'TRU WASTE - 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on con_locn_facil_id skip 1
col phys_comp_descr          format a40          heading "Physical Description"
col cntyp_descr              format a55           heading "Container Discription"
col con_size_descr           format a45           heading "Container Size"
col dt                       format a4           heading "Date"
col con_pwtyp_cd              format a4           heading "Pri|Wast|Type"
col con_locn_facil_id        format a8           heading "Facility"
col sum(rdet_rswims_count)    format 999999      heading "Count"
compute sum of sum(rdet_rswims_count) on con_locn_facil_id
select phys_comp_descr,
       cntyp_descr,
       con_size_descr,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       con_pwtyp_cd,
       con_locn_facil_id,
       sum(rdet_rswims_count)
from radwaste, contype, physcomp
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z'
and con_size_descr = '55 GALLON'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = phys_pkg_id(+)
group by con_locn_facil_id,
phys_comp_descr,
con_pwtyp_cd,
substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4),
cntyp_descr,
con_size_descr
;
spool off

```

Physical Description	Container Description	Container Size	Date	Type	Facility	Count	Pri	Last
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1970	R	218J3A	23		
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1971	R		6		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1971	R		29		

					SUM	58		
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1972	M	218J48	8		
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1971	R		51		
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1972	R		87		
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1977	R		1		
OILS	METAL DRUMS, BARRELS, KEGS	55 GALLON	1972	M		5		
OILS	METAL DRUMS, BARRELS, KEGS	55 GALLON	1973	M		4		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1975	M		2		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1976	M		1		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1972	R		15		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1973	R		162		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1974	R		185		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1975	R		179		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1976	R		94		
	METAL DRUMS, BARRELS, KEGS	55 GALLON	1977	R		227		

					SUM	1021		
ABSORBANT/KITY LTR/VERMICULITE	METAL DRUMS, BARRELS, KEGS	55 GALLON	1982	M	218J4C	1		
ABSORBANT/KITY LTR/VERMICULITE	METAL DRUMS, BARRELS, KEGS	55 GALLON	1981	R		6		
ABSORBANT/KITY LTR/VERMICULITE	METAL DRUMS, BARRELS, KEGS	55 GALLON	1982	R		7		
BRICK/FIREBRICK	METAL DRUMS, BARRELS, KEGS	55 GALLON	1982	M		1		
BRICK/FIREBRICK	METAL DRUMS, BARRELS, KEGS	55 GALLON	1982	R		7		
CLOTH/RAGS/NYLON	METAL DRUMS, BARRELS, KEGS	55 GALLON	1980	R		3		
CLOTH/RAGS/NYLON	METAL DRUMS, BARRELS, KEGS	55 GALLON	1981	R		1		
METAL/IRON/GALVANIZED/SHEET	METAL DRUMS, BARRELS, KEGS	55 GALLON	1982	M		1		
METAL/IRON/GALVANIZED/SHEET	METAL DRUMS, BARRELS, KEGS	55 GALLON	1980	R		9		
METAL/IRON/GALVANIZED/SHEET	METAL DRUMS, BARRELS, KEGS	55 GALLON	1981	R		27		
METAL/IRON/GALVANIZED/SHEET	METAL DRUMS, BARRELS, KEGS	55 GALLON	1982	R		18		
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1983	R		9		
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	55 GALLON	1979	R		1		
PAPER/CARDBOARD	METAL DRUMS, BARRELS, KEGS	55 GALLON	1980	R		7		
PAPER/CARDBOARD	METAL DRUMS, BARRELS, KEGS	55 GALLON	1979	R		4		
PAPER/CARDBOARD	METAL DRUMS, BARRELS, KEGS	55 GALLON	1980	R		11		
PAPER/CARDBOARD	METAL DRUMS, BARRELS, KEGS	55 GALLON	1981	R		28		

TRU WASTE - 2312

Physical Description	Container Discription	Container Size	Waste	Date	Type	Facility	Count
PAPER/CARDBOARD	METAL DRUMS, BARRELS, KEGS	55 GALLON		1982	R	218W4C	11
PAPER/CARDBOARD	METAL DRUMS, BARRELS, KEGS	55 GALLON		1983	R		4
PLASTIC/POLYURATHANE	METAL DRUMS, BARRELS, KEGS	55 GALLON		1982	M		1
PLASTIC/POLYURATHANE	METAL DRUMS, BARRELS, KEGS	55 GALLON		1979	R		4
PLASTIC/POLYURATHANE	METAL DRUMS, BARRELS, KEGS	55 GALLON		1980	R		11
PLASTIC/POLYURATHANE	METAL DRUMS, BARRELS, KEGS	55 GALLON		1981	R		28
PLASTIC/POLYURATHANE	METAL DRUMS, BARRELS, KEGS	55 GALLON		1982	R		18
PLASTIC/POLYURATHANE	METAL DRUMS, BARRELS, KEGS	55 GALLON		1983	R		4
RUBBER	METAL DRUMS, BARRELS, KEGS	55 GALLON		1979	R		4
RUBBER	METAL DRUMS, BARRELS, KEGS	55 GALLON		1980	R		8
RUBBER	METAL DRUMS, BARRELS, KEGS	55 GALLON		1981	R		16
RUBBER	METAL DRUMS, BARRELS, KEGS	55 GALLON		1982	R		11
RUBBER	METAL DRUMS, BARRELS, KEGS	55 GALLON		1983	R		4
WOOD/LUMBER/PLYWOOD	METAL DRUMS, BARRELS, KEGS	55 GALLON		1980	R		3
WOOD/LUMBER/PLYWOOD	METAL DRUMS, BARRELS, KEGS	55 GALLON		1981	R		1
WOOD/LUMBER/PLYWOOD	METAL DRUMS, BARRELS, KEGS	55 GALLON		1982	R		11
WOOD/LUMBER/PLYWOOD	METAL DRUMS, BARRELS, KEGS	55 GALLON		1983	R		4
	METAL DRUMS, BARRELS, KEGS	55 GALLON		1978	R		68
	METAL DRUMS, BARRELS, KEGS	55 GALLON		1979	R		124
*****							-----
SUM							476

53 rows selected.

APPENDIX A.6

**PHYSICAL CONTENTS DESCRIPTION FOR 231-Z TRU WASTE
CONTAINERS OTHER THAN 55-GALLON DRUMS
SORTED BY DATE, PRIMARY WASTE TYPE,
AND STORAGE FACILITY**

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**PHYSICAL CONTENTS DESCRIPTION FOR 231-Z TRU WASTE
CONTAINERS OTHER THAN 55-GALLON DRUMS
SORTED BY DATE, PRIMARY WASTE TYPE,
AND STORAGE FACILITY**

This subappendix describes the physical contents of the TRU waste containers other than 55-gal drums generated at Plutonium Metallurgy Laboratory (231-Z). 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.

```

set linesize 170
set pagesize 45
set newpage 0
spool pot6.srep
title center 'TRU WASTE - 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on con_locn_facil_id skip 1
col phys_comp_descr          format a40          heading "Physical Description"
col con_size_descr          format a47          heading "Container Description"
col cntyp_descr             format a45          heading "Container Size"
col dt                      format a4           heading "Date"
col con_pwtyp_cd            format a4           heading "Pri|Wast|Type"
col con_locn_facil_id       format a8           heading "Facility"
col sum(rdet_rswims_count)   format 999999      heading "Count"
col rdet_swtyp_cd           format a4           heading "Sec|Wast|Type"
compute sum of sum(rdet_rswims_count) on con_locn_facil_id
select phys_comp_descr,
       cntyp_descr,
       con_size_descr,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       con_pwtyp_cd,
       rdet_swtyp_cd,
       con_locn_facil_id,
       sum(rdet_rswims_count)
from radwaste, contype, physcomp
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
      con_srce_facil_id = '231Z'
and con_size_descr <> '55 GALLON'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = phys_pkg_id(+)
group by con_locn_facil_id,
phys_comp_descr,
con_pwtyp_cd,
rdet_swtyp_cd,
substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4),
cntyp_descr,
con_size_descr
;
spool off

```

Physical Description	Container Size	Container Description	Date	Type	Facility	Count	Pri Sec	
							Wast	Wast
MISCELLANEOUS/UNKNOWN/OTHER	METAL DRUMS, BARRELS, KEGS	30 GALLON	1970 R	1A	218J3A	4		

					SUM	4		
MISCELLANEOUS/UNKNOWN/OTHER	GLOVE BOXES	UNKNOWN	1971 R	1A	218J48	1		
MISCELLANEOUS/UNKNOWN/OTHER	MISCELLANEOUS SCRAP	UNKNOWN	1971 R	1A		1		
MISCELLANEOUS/UNKNOWN/OTHER	SELF CONTAINED, EQUIPMENT	UNKNOWN	1971 R	1A		1		
MISCELLANEOUS/UNKNOWN/OTHER	METAL BOXES, CARTONS, CASES	2*2*3	1972 R	1A		11		
MISCELLANEOUS/UNKNOWN/OTHER	METAL BOXES, CARTONS, CASES	3.5*6*8	1972 R	1A		1		
MISCELLANEOUS/UNKNOWN/OTHER	METAL BOXES, CARTONS, CASES	2*2*3	1973 R	1A		5		
MISCELLANEOUS/UNKNOWN/OTHER	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	2 CU FT	1969 R	UG		3		
MISCELLANEOUS/UNKNOWN/OTHER	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1969 R	UG		688		
MISCELLANEOUS/UNKNOWN/OTHER	TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1969 R	UG		20		
MISCELLANEOUS/UNKNOWN/OTHER	WOODEN BOXES, CARTONS, CASES	2*4*8	1969 R	UG		1		
MISCELLANEOUS/UNKNOWN/OTHER	WOODEN BOXES, CARTONS, CASES	3*5*5	1969 R	UG		1		
MISCELLANEOUS/UNKNOWN/OTHER	WOODEN BOXES, CARTONS, CASES	UNKNOWN	1969 R	UG		2		
MISCELLANEOUS/UNKNOWN/OTHER	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1970 R	UG		14		
MISCELLANEOUS/UNKNOWN/OTHER	METAL BOXES, CARTONS, CASES	2*2*3	1978 R	1A		1		
MISCELLANEOUS/UNKNOWN/OTHER	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	2 CU FT	1970 R	UG		2		
MISCELLANEOUS/UNKNOWN/OTHER	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	1970 R	UG		85		
MISCELLANEOUS/UNKNOWN/OTHER	TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	1970 R	UG		1		

					SUM	838		
CONCRETE	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	8.3*10.6*19.6	1980 R	1A	218J4C	1		
CONCRETE	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	1981 R	1A		1		
METAL/IRON/GALVANIZED/SHEET	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	10.5*10.7*12	1980 R	1A		4		
METAL/IRON/GALVANIZED/SHEET	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	8.3*10.6*19.6	1980 R	1A		1		
METAL/IRON/GALVANIZED/SHEET	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	1980 R	1A		3		
METAL/IRON/GALVANIZED/SHEET	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.7*12	1980 R	1A		1		
METAL/IRON/GALVANIZED/SHEET	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*12*12.7	1980 R	1A		1		
METAL/IRON/GALVANIZED/SHEET	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*12.7*20	1980 R	1A		7		
METAL/IRON/GALVANIZED/SHEET	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	1981 R	1A		2		

					SUM	21		

27 rows selected.

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APPENDIX A.7

**HAZARDOUS CONSTITUENTS OF 55-GALLON
DRUMS CONTAINING TRU WASTE**

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**HAZARDOUS CONSTITUENTS OF 55-GALLON
DRUMS CONTAINING TRU WASTE**

The presence of hazardous constituents in a radioactive waste drum designates the waste as "Mixed" (primary waste code "M"). In this subappendix the hazardous contents of 55-gal drums generated at Plutonium Metallurgy Laboratory (231-Z) 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.

```

set linesize 170
set pagesize 45
set newpage 0
spool pot7.srep
title center 'TRU Waste - 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on con_locn_facil_id skip 1
col haz_comp_text          format a40          heading "Hazardous"
col con_size_descr         format a45          heading "Container Description"
col cntyp_descr            format a40          heading "Container Size"
col dt                     format a4           heading "Date"
col con_pwtyp_cd           format a4           heading "Pri|Wast|Type"
col con_locn_facil_id      format a8           heading "Facility"
col sum(rdet_rswims_count) format 999999      heading "Count"
compute sum of sum(rdet_rswims_count) on con_locn_facil_id
select haz_comp_text,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       con_locn_facil_id,
       sum(rdet_rswims_count)
from radwaste, contype, chemcomp
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z'
and con_size_descr = '55 GALLON'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = haz_pkg_id
group by con_locn_facil_id,
haz_comp_text,
con_pwtyp_cd,
substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4),
cntyp_descr,
con_size_descr
;
spool off

```


Page: 1

TRU Waste - 2312

Hazardous	Date	Container Size	Container Description	Pri		Type	Facility	Count
				Waste	Waste			
BERYLLIUM OIL	1972	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	218448			1
	1972	METAL DRUMS, BARRELS, KEGS	55 GALLON	M				10
	1973	METAL DRUMS, BARRELS, KEGS	55 GALLON	M				4
	1975	METAL DRUMS, BARRELS, KEGS	55 GALLON	M				2
	1976	METAL DRUMS, BARRELS, KEGS	55 GALLON	M				1

					SUM			18
SODIUM	1982	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	21844C			1

					SUM			1

6 rows selected.

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APPENDIX A.8

**HAZARDOUS CONSTITUENTS OF TRU WASTE CONTAINERS
OTHER THAN 55-GALLON DRUMS**

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**HAZARDOUS CONSTITUENTS OF TRU 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 Plutonium Metallurgy Laboratory (231-Z); therefore this run did not reveal any hazardous information.

```

set linesize 170
set pagesize 45
set newpage 0
spool pot8.srep
tttitle center 'TRU Waste - 231Z WHC' -
right 'Page:' format 999 sql.pno skip 1
break on con_locn_facil_id skip 1
col haz_comp_text          format a40          heading "Hazardous"
col con_size_descr        format a45          heading "Container Description"
col cntyp_descr           format a40          heading "Container Size"
col dt                    format a4           heading "Date"
col con_pwtyp_cd          format a4           heading "Pri|Wast|Type"
col con_locn_facil_id     format a8           heading "Facility"
col sum(rdet_rswims_count) format 999999     heading "Count"
select haz_comp_text,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       con_locn_facil_id,
       rdet_rswims_count
from radwaste, contype, chemcomp
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_cmpny_id = 'WHC' and
con_srce_facil_id = '231Z'
and con_size_descr <> '55 GALLON'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = haz_pkg_id
group by con_locn_facil_id,
haz_comp_text,
con_pwtyp_cd,
       cntyp_descr,
substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4),
       con_size_descr,
       rdet_rswims_count
;
spool off

```

```

col con_pwtyp_cd          format a4          heading "Pri|Wast|Type"
col con_locn_facil_id     format a8          heading "Facility"
col sum(rdet_rswims_count) format 999999     heading "Count"
select haz_comp_text,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       con_locn_facil_id,
       rdet_rswims_count
from radwaste, contype, chemcomp
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_cmpny_id = 'WHC' and
con_srce_facil_id = '231Z'
and con_size_descr <> '55 GALLON'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = haz_pkg_id
"pot8.sql" 37 lines, 1184 characters

```

SQL> @pot8

no rows selected

SQL>

°VT100° 80 COL° °7 BIT MODE°

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APPENDIX A.9

**ISOTOPES LISTED IN 55-GALLON DRUMS
CONTAINING TRU WASTES**

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**ISOTOPES LISTED IN 55-GALLON DRUMS
CONTAINING TRU WASTES**

This subappendix contains a listing of the SWITS isotope information for TRU waste from Plutonium Metallurgy Laboratory (231-Z) stored in 55-gal drums. The isotope field in SWITS contains several types of information including the following:

- Specific isotope (e.g., ^{241}Am , ^{237}Np , ^{233}U , and ^{238}Pu)
- Generic isotope listings (e.g., plutonium, uranium-enriched, and uranium-depleted)
- ^{239}Pu fissile gram equivalents (^{239}Pu FSL GR equivalent).
- 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.

```

set linesize 170
set pagesize 45
set newpage 0
spool pot9.srep
tttitle center 'TRU Waste - 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on dt skip 1
compute sum of sum(rad_qty) on con_locn_facil_id
compute sum of sum(rdet_rswims_count) on con_locn_facil_id
col iso_name          format a30          heading "Isotope"
col sum(rad_qty)      format 999999.999999 heading "Rad Qty"
col iso_unit          heading a4          heading "Unit"
col dt                format a4           heading "Date"
col cntyp_descr       format a40          heading "Container Size"
col con_size_descr    format a45          heading "Container Description"
col con_pwtyp_cd      format a4           heading "Pri|Wast|Type"
col con_locn_facil_id format a8           heading "Facility"
col sum(rdet_rswims_count) format 999999 heading "Count"
select iso_name,
       sum(rad_qty),
       iso_unit,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       rdet_swtyp_cd,
       con_locn_facil_id,
       sum(rdet_rswims_count)
from radwaste, contype, isotope, isoqty
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z'
and con_size_descr = '55 GALLON'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = rad_pkg_id and rad_iso_num = iso_num
group by iso_name,
       iso_unit,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4),
       con_pwtyp_cd,
       rdet_swtyp_cd,
       con_locn_facil_id,
       cntyp_descr,
       con_size_descr,
       rdet_rswims_count
;
spool off

```

Isotope	Rad Qty Un Date Container Size			Container Description	Pri Sec			Count
	Wast	Type	Facility					
NP-237	73.000000	GM	1977 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	2
	-----	-----	-----	-----	-----	-----	-----	-----
	73.000000	SUM						2
PU	9.500000	GM	1970 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A3A	23
	-----	-----	-----	-----	-----	-----	-----	-----
	9.500000	SUM						23
PU	97.000100	GM	1971 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A3A	35
	-----	-----	-----	-----	-----	-----	-----	-----
	114.003300	GM	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	51
PU	211.003400	SUM						86
	-----	-----	-----	-----	-----	-----	-----	-----
	34.000000	GM	1972 METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218A48	10
PU	120.600100	GM	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	102
	-----	-----	-----	-----	-----	-----	-----	-----
	154.600100	SUM						112
PU	3.300000	GM	1973 METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218A48	4
	-----	-----	-----	-----	-----	-----	-----	-----
	1217.900100	GM	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	162
PU	1221.200100	SUM						166
	-----	-----	-----	-----	-----	-----	-----	-----
	299.350000	GM	1974 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	185
PU	299.350000	SUM						185
	-----	-----	-----	-----	-----	-----	-----	-----
	.250000	GM	1975 METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218A48	2
PU	1407.350100	GM	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	179
	-----	-----	-----	-----	-----	-----	-----	-----
	1407.600100	SUM						181
PU	44.003000	GM	1976 METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218A48	1
	-----	-----	-----	-----	-----	-----	-----	-----
	169.370100	GM	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	94
PU	213.370100	SUM						95
	-----	-----	-----	-----	-----	-----	-----	-----
	1150.649000	GM	1977 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218A48	228
PU	1150.649000	SUM						228
	-----	-----	-----	-----	-----	-----	-----	-----

Isotope	Rad Qty	Un Date	Container Size	Container Description	Pri Sec		Count
					Wast	Type	
PU	11.565100	GM	1978 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218UAC	68
	11.565100	SUM					68
PU	243.342400	GM	1979 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218UAC	129
	243.342400	SUM					129
PU	41.090200	GM	1980 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218UAC	27
	41.090200	SUM					27
PU	20.500900	GM	1981 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218UAC	28
	20.500900	SUM					28
PU	2.000000	GM	1982 METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A 218UAC	1
	5.900100	GM	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218UAC	18
	7.900100	SUM					19
PU	1.900000	GM	1983 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218UAC	13
	1.900000	SUM					13
TH-232	776.800000	GM	1971 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218U3A	1
	776.800000	SUM					1
TOTAL BETA/GAMMA	.023001	CI	1970 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218U3A	23
	.023001	SUM					23
TOTAL BETA/GAMMA	.051000	CI	1971 METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218U3A	35
	.059000	CI	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A 218U4B	48
	.110000	SUM					83
TOTAL BETA/GAMMA	.015000	CI	1972 METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A 218U4B	10

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Isotope	Rad Qty Un Date		Container Size	Container Description	Pri Sec		Wast Wast	Type Type	Facility	Count
TOTAL BETA/GAMMA	.103000	CI 1972	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48			102
	-----	****								-----
	.118000	sum								112
TOTAL BETA/GAMMA	.004000	CI 1973	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218W48			4
TOTAL BETA/GAMMA	.420000	CI	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48			162
	-----	****								-----
	.424000	sum								166
TOTAL BETA/GAMMA	.204000	CI 1974	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48			185
	-----	****								-----
	.204000	sum								185
TOTAL BETA/GAMMA	.002000	CI 1975	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218W48			2
TOTAL BETA/GAMMA	.727000	CI	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48			176
	-----	****								-----
	.729000	sum								178
TOTAL BETA/GAMMA	.017000	CI 1976	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218W48			1
TOTAL BETA/GAMMA	.328000	CI	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48			94
	-----	****								-----
	.345000	sum								95
TOTAL BETA/GAMMA	.241011	CI 1977	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48			215
	-----	****								-----
	.241011	sum								215
TOTAL BETA/GAMMA	.067001	CI 1978	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C			68
	-----	****								-----
	.067001	sum								68
TOTAL BETA/GAMMA	.145002	CI 1979	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C			129
	-----	****								-----
	.145002	sum								129
TOTAL BETA/GAMMA	.027000	CI 1980	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C			27
	-----	****								-----
	.027000	sum								27
TOTAL BETA/GAMMA	1.280000	CI 1981	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C			28

TRU Waste - 2312

Isotope	Rad Qty	Un Date	Container Size	Container Description	Pri Sec		Type	Facility	Count
					Waste	Waste			
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	1.280000	CI 1982	METAL DRUMS, BARRELS, KEGS	55 GALLON	M	1A	218W4C		28
TOTAL BETA/GAMMA									
	.010000	CI 1982	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C		1
TOTAL BETA/GAMMA									
	.125000	CI 1982	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C		18
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	.135000	SUM							19
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.090000	CI 1983	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C		13
TOTAL BETA/GAMMA									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2.090000	SUM							13
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	9891.000000	GM 1971	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W3A		1
URANIUM-DEPLETED									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	9891.000000	SUM							1
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	236.800000	GM 1972	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4B		5
URANIUM-DEPLETED									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	236.800000	SUM							5
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	72000.000000	GM 1975	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4B		1
URANIUM-DEPLETED									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	72000.000000	SUM							1
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	67000.000000	GM 1976	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4B		1
URANIUM-DEPLETED									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	67000.000000	SUM							1
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	108000.000000	GM 1977	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4B		1
URANIUM-DEPLETED									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	108000.000000	SUM							1
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	3000.000000	GM 1979	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C		1
URANIUM-DEPLETED									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	3000.000000	SUM							1
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	10.000000	GM 1971	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W3A		2
URANIUM-ENRICHED									
	-----	-----	-----	-----	-----	-----	-----	-----	-----
	10.000000	SUM							2

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TRU Waste - 231Z

Isotope	Rad Qty	Un Date	Container Size	Container Description	Pri	Sec	Waste Type	Facility	Count
URANIUM-ENRICHED	100.000000	GM 1975	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48		1
	100.000000	sum							1
URANIUM-ENRICHED	293.000000	GM 1982	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W4C		1
	293.000000	sum							1
URANIUM-NATURAL	5.000000	GM 1971	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W3A		1
	5.000000	sum							1
URANIUM-NATURAL	1016.000000	GM 1972	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48		1
	1016.000000	sum							1
URANIUM-NATURAL	218.000000	GM 1976	METAL DRUMS, BARRELS, KEGS	55 GALLON	R	1A	218W48		1
	218.000000	sum							1

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APPENDIX A.10

**ISOTOPES LISTED IN TRU CONTAINERS
OTHER THAN 55-GALLON DRUMS**

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ISOTOPES LISTED IN TRU CONTAINERS OTHER THAN 55-GALLON DRUMS

This subappendix contains a listing of the SWITS isotope information for TRU waste from Plutonium Metallurgy Laboratory (231-Z) stored in containers other than 55-gal drums. The isotope field in SWITS contains several types of information including the following:

- Specific isotope (e.g., ^{241}Am , ^{237}Np , ^{233}U , and ^{238}Pu)
- Generic isotope listings (e.g., plutonium, uranium-enriched, uranium-depleted)
- ^{239}Pu equivalent curies (PE-CI)
- Total alpha radionuclide content
- Total beta/gamma radionuclide content
- Plutonium equivalent curies (PE-Ci).

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.

```

set linesize 170
set pagesize 45
set newpage 0
spool pot10.srep
tttitle center 'TRU Waste - 231Z' -
right 'Page:' format 999 sql.pno skip 1
break on dt skip 1
compute sum of sum(rad_qty) on con_locn_facil_id
compute sum of sum(rdet_rswims_count) on con_locn_facil_id
col iso_name          format a30          heading "Isotope"
col sum(rad_qty)       format 999999.999999 heading "Rad Qty"
col iso_unit           heading a4          heading "Unit"
col dt                format a4           heading "Date"
col cntyp_descr        format a45         heading "Container Size"
col con_size_descr     format a45         heading "Container Description"
col con_pwtyp_cd       format a4          heading "Pri|Wast|Type"
col con_locn_facil_id  format a8          heading "Facility"
col sum(rdet_rswims_count) format 999999 heading "Count"
select iso_name,
       sum(rad_qty),
       iso_unit,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4) dt,
       cntyp_descr,
       con_size_descr,
       con_pwtyp_cd,
       con_locn_facil_id,
       sum(rdet_rswims_count)
from radwaste, contype, isotope, isoqty
where con_tsd_accept_dt between '01-jan-69' and '31-dec-92' and
con_srce_facil_id = '231Z'
and con_size_descr <> '55 GALLON'
and rdet_swtyp_cd in ('1A','1B','1C','1D','1E','1F','UG','UF','UJ') and
con_cntyp_cd = cntyp_cd and con_pkg_id = rad_pkg_id and rad_iso_num = iso_num
group by iso_name,
       iso_unit,
       con_pwtyp_cd,
       con_locn_facil_id,
       substr (to_char(con_tsd_accept_dt, 'YYYY'),1, 4),
       cntyp_descr,
       con_size_descr
;
spool off

```

Isotope	Rad Qty	Un Date	Container Size	Container Description	Pri		Waste	Type	Facility	Count
PU	.600000	GM	1970	METAL DRUMS, BARRELS, KEGS			R	218U3A		4
	-----	-----	-----	-----	-----	-----				-----
	.600000		SUM							4
PU	.179790	GM	1969	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES			R	218U48		3
PU	136.193810	GM		FIBERBOARD/PLASTIC BOXES, CARTONS, CASES			R	218U48		679
PU	1.126480	GM		WOODEN BOXES, CARTONS, CASES			R	218U48		2
	-----	-----	-----	-----	-----	-----				-----
	137.500080		SUM							684
PU	.069695	GM	1970	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES			R	218U48		2
PU	18.630320	GM		FIBERBOARD/PLASTIC BOXES, CARTONS, CASES			R	218U48		99
	-----	-----	-----	-----	-----	-----				-----
	18.700015		SUM							101
PU	100.000000	GM	1971	GLOVE BOXES			R	218U48		1
PU	.000100	GM		MISCELLANEOUS SCRAP			R	218U48		1
PU	.000100	GM		SELF CONTAINED, EQUIPMENT			R	218U48		1
	-----	-----	-----	-----	-----	-----				-----
	100.000200		SUM							3
PU	5.000000	GM	1972	METAL BOXES, CARTONS, CASES			R	218U48		11
PU	50.000000	GM		METAL BOXES, CARTONS, CASES			R	218U48		1
	-----	-----	-----	-----	-----	-----				-----
	55.000000		SUM							12
PU	.205000	GM	1973	METAL BOXES, CARTONS, CASES			R	218U48		5
	-----	-----	-----	-----	-----	-----				-----
	.205000		SUM							5
PU	.010000	GM	1978	METAL BOXES, CARTONS, CASES			R	218U48		1
	-----	-----	-----	-----	-----	-----				-----
	.010000		SUM							1
PU	170.010000	GM	1980	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES			R	218U4C		4
PU	108.000000	GM		FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES			R	218U4C		1
PU	219.000000	GM		FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES			R	218U4C		3
PU	.010000	GM		FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES			R	218U4C		1
PU	14.000000	GM		FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES			R	218U4C		1
PU	409.010000	GM		FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES			R	218U4C		7

Isotope	Rad Qty	Un Date	Container Size	Container Description	Pri		Count
					Waste	Facility	
PU	-----	-----	-----	-----	-----	-----	-----
	920.030000	sum	-----	-----	-----	-----	17
	113.000000	GM 1981	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	R	218J4C	2
	113.000000	sum	-----	-----	-----	-----	2
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.004000	CI 1970	METAL DRUMS, BARRELS, KEGS	30 GALLON	R	218J3A	4
	.004000	sum	-----	-----	-----	-----	4
	-----	-----	-----	-----	-----	-----	-----
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.008000	CI 1969	FIBERBOARD/PLASTIC BOXES, CARTONS, CASES	UNKNOWN	R	218J48	5
	.001000	CI	TRUCKS, FLATBEDS, COMPACTOR, LOADLUGGER	UNKNOWN	R	218J48	1
	-----	-----	-----	-----	-----	-----	-----
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.009000	sum	-----	-----	-----	-----	6
	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.001000	CI 1971	GLOVE BOXES	UNKNOWN	R	218J48	1
	.001000	CI	MISCELLANEOUS SCRAP	UNKNOWN	R	218J48	1
	.001000	CI	SELF CONTAINED, EQUIPMENT	UNKNOWN	R	218J48	1
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.003000	sum	-----	-----	-----	-----	3
	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.011000	CI 1972	METAL BOXES, CARTONS, CASES	2*2*3	R	218J48	11
	.023000	CI	METAL BOXES, CARTONS, CASES	3.5*6*8	R	218J48	1
	-----	-----	-----	-----	-----	-----	-----
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.034000	sum	-----	-----	-----	-----	12
	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.005000	CI 1973	METAL BOXES, CARTONS, CASES	2*2*3	R	218J48	5
	-----	-----	-----	-----	-----	-----	-----
	.005000	sum	-----	-----	-----	-----	5
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.001000	CI 1978	METAL BOXES, CARTONS, CASES	2*2*3	R	218J48	1
	-----	-----	-----	-----	-----	-----	-----
	.001000	sum	-----	-----	-----	-----	1
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.005200	CI 1980	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	10.5*10.7*12	R	218J4C	4
	.001000	CI	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	8.3*10.6*19.6	R	218J4C	1
	.007000	CI	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	R	218J4C	3
TOTAL BETA/GAMMA	-----	-----	-----	-----	-----	-----	-----
	.001000	CI	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.7*12	R	218J4C	1
	.001000	CI	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*12*12.7	R	218J4C	1
	-----	-----	-----	-----	-----	-----	-----

TRU Waste - 2312

IsG: de	Rad Qty	Un Date	Container Size	Container Description	Waste Type	Facility	Count
TOTAL BETA/GAMMA	.061000	CI 1980	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*12.7*20	R	218W4C	7
	.076200	SUM					17
TOTAL BETA/GAMMA	.003000	CI 1981	FIBERGLASS REINFORCED PLYWOOD (FRP) BOXES	9*10.67*16	R	218W4C	2
	.003000	SUM					2

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