SOLID WASTE BURIAL GROUND/ CENTRAL WASTE COMPLEX HAZARDS ASSESSMENT

R. E. Broz

DISCLAIMER

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Order 5500.3A, Emergency Planning and Preparedness for Operational Emergencies, mandates the requirements to complete facility specific hazards assessments in support of Emergency Planning Activities, specifically demonstrating the technical basis for the Emergency Action Levels (EALs) and the Emergency Planning Zone (EPZ). Emergency Planning activities are provided under contract to DOE through the Westinghouse Hanford Company (WHC). [Note: The scope of this effort is limited by DOE Order 5500.3A exclusively.]

The purpose of this document is to summarize the applicable information from the Solid Waste Burial Ground (SWBG), Central Waste Complex (CWC), and Transuranic Waste Storage Facility (TRUSAF) Safety Analysis Reports (SARs), the TRUSAF Hazard Identification and Evaluation Report (HEIR), chemical inventory list and radionuclides inventory list. The hazardous material is identified and screened. Potential SAR accidental release scenarios are reviewed to determine the appropriate emergency classification of the scenarios, and the results are documented in this hazards assessment for the subject facility.

2.0 FACILITY DESCRIPTION

Detailed descriptions of the SWBG, CWC, and TRUSAF in the 200 Areas of the Hanford Site are found in chapter 3.0 of the facility's SAR. The following brief summary is derived from the SAR description.

The active SWBG consists of two areas in the 200 East area and six in the 200 West area. The use of the word "active" is used to distinguish those burial grounds currently in service (plus future purposes) from those that are considered "inactive" or retired. The retired burial grounds are not within the scope of this hazards assessment. Disposal of radioactive waste in both the retired and active burial grounds have taken place since the first radioactive material was produced at the Hanford Site in the 1940's. Radioactive wastes have been provided by both onsite and offsite waste generators. Transuranic (TRU) wastes have been packaged in sealed containers and segregated from low-level waste (LLW) in retrievable storage trenches since May 1, 1970. Before then, the TRU wastes were commingled and buried with the LLW. The creation in 1970 of the TRU waste category designated 370 Becquerel (Bq)/gram (g) (10 nano curie/g (nCi/g)) as the lower limit for TRU radionuclide content, and waste with TRU content greater than that limit was stored as TRU waste in the Hanford Site burial grounds. In 1982, the limit was revised upward to the present value of 3700 Bq/g.

Radioactive wastes at the Hanford Site are divided into general types listed below as defined by DOE Order 5820.2A, Radioactive Waste Management.

- Low-level waste (LLW)-- Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or by product material as defined in DOE Order 5820.2A. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less than 3700 Bq/g.

- High-level waste-- Highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentration requiring permanent isolation.

- Spent nuclear fuel-- Fuel that has been withdrawn from a nuclear reactor following irradiation but has not been reprocessed to remove its constituent elements.

- Transuranic waste (TRU)-- Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 3700 Bq/g at the time of assay. Heads of Field Elements can determine that other alpha contaminated wastes, peculiar to a specific site, must be managed as transuranic waste. At the Hanford Site, transuranic waste also includes uranium-233 and radium sources.

- Mixed Waste-- Waste which contains both radioactive and hazardous material.

2.1 Facility Mission

The Hanford Site covers approximately 1478 km^2 (570 square miles) of semiarid land that is owned by the U.S. Government and managed by the U.S. DOE. In early 1943, the U.S. Army Corps of Engineers selected the Hanford Site as the location for reactors, chemical separation, and related facilities and activities for the production and purification of plutonium. Radioactive wastes became a by-product of these efforts. Disposal of radioactive wastes at the Hanford Site first took place in 1944. Wastes were placed in burial grounds regardless of radionuclide content, and covered with earth to prevent release of contamination.

Since May 1970, DOE has required that radioactive solid wastes be segregated by categorizing as either transuranic and placed in retrievable storage or non-transuranic and placed in non-retrievable disposal sites. Mixed waste tracking was started in November 1987 and until then, mixed waste packages were placed in the active SWBG.

Figure 2.2-1 Location of the Hanford Site in Washington State

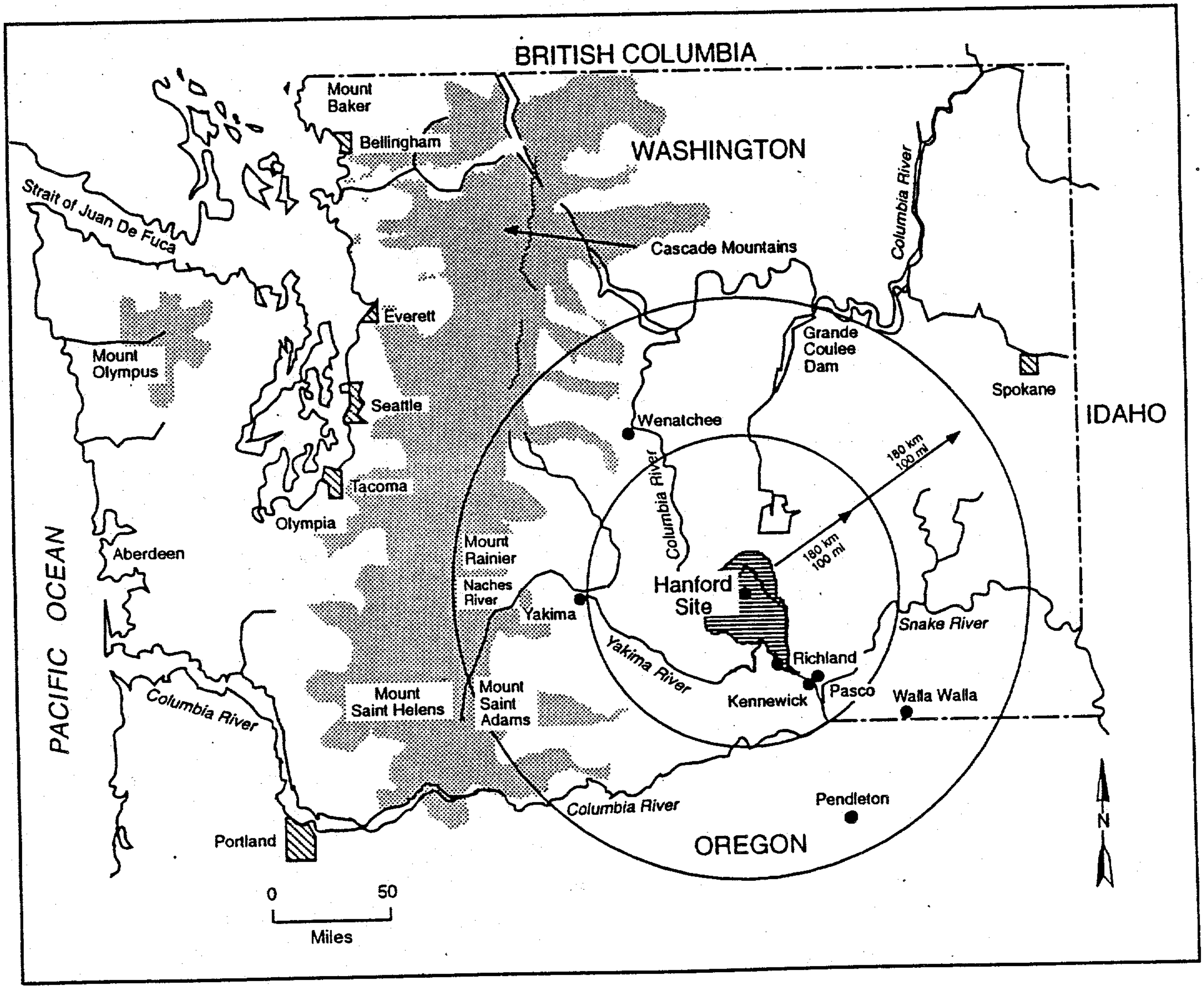
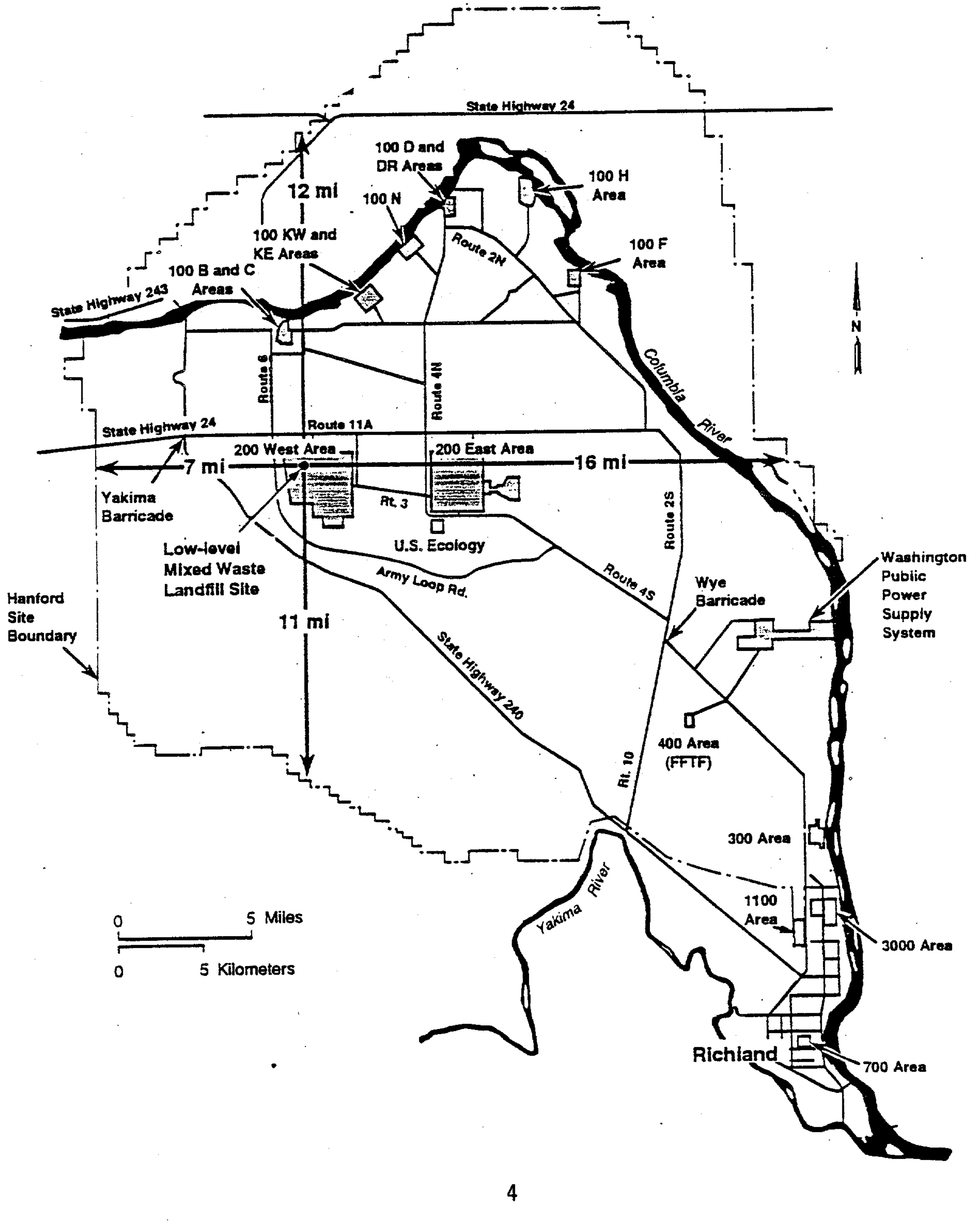


Figure 2.2-2 Location of the Facilities on the Hanford Site



Burial of the waste reduces the dose rate to the workers and because of the semiarid climate reduces the loss of material to the environment.

The 224-T Purification process facility was built during the canyon project in 1944 with the original function of purifying the plutonium nitrate product from the canyon, by a lanthanum fluoride process. In the early 1970's the building was modified for storage of plutonium scrap in liquid and solid forms. In 1985, the 224-T Building was designated as the Transuranic Waste Storage and Assay Facility (TRUSAF).

2.2 Location

The sites selected for the SWBG/CWC are located in southcentral Washington State, Figure 2.2-1. The 200 East and West Area Plateau, near the center of the Hanford Site, shown in Figure 2.2-2. The 200 East Area is about 40.2 km (25 miles) northwest of Richland, Washington, the nearest populated urban area. The nearest site boundary and nearest resident are 12.6 kilometers west of the facilities. The active burial grounds in the 200 East and West are shown in Figures 2.2-3 and 2.2-4.

2.3 Facility Description

2.3.1 218-E-10

This burial ground has been in service since 1960 and is used for the receipt of remote-handled (RH) waste. There are 17 trenches running from north to south, which contain RH-TRU and LLW waste. Trenches 9 and 12 contain some mixed waste. The waste has been received from PUREX, B-Plant, and 100 N Area. The waste was received in large concrete and wooden boxes. The boxes contained failed equipment and filters. Trench 9 was used prior to November 1987, and still has room for a few RH mixed LLW boxes.

2.3.2 218-E-12B

This burial ground has been in service since 1967 and has been used primarily for LLW, but does contain two trenches of TRU waste (Trenches 17 and 27). The burial ground has 94 trenches. There are 38 trenches filled, two partially filled and 56 trenches have not been used. The one low level mixed waste trench (Trench 38) has been filled. Trench 94 is used for the disposal of Navy reactor compartments. The Navy reactor compartment is composed of various types of steel and contains 3.6E+5 kg of lead shielding. Most of the waste received in this burial ground has been generated by facilities in 200 East with the exception of Naval waste.

Figure 2.2-3 Location of the 200 East Burial Grounds

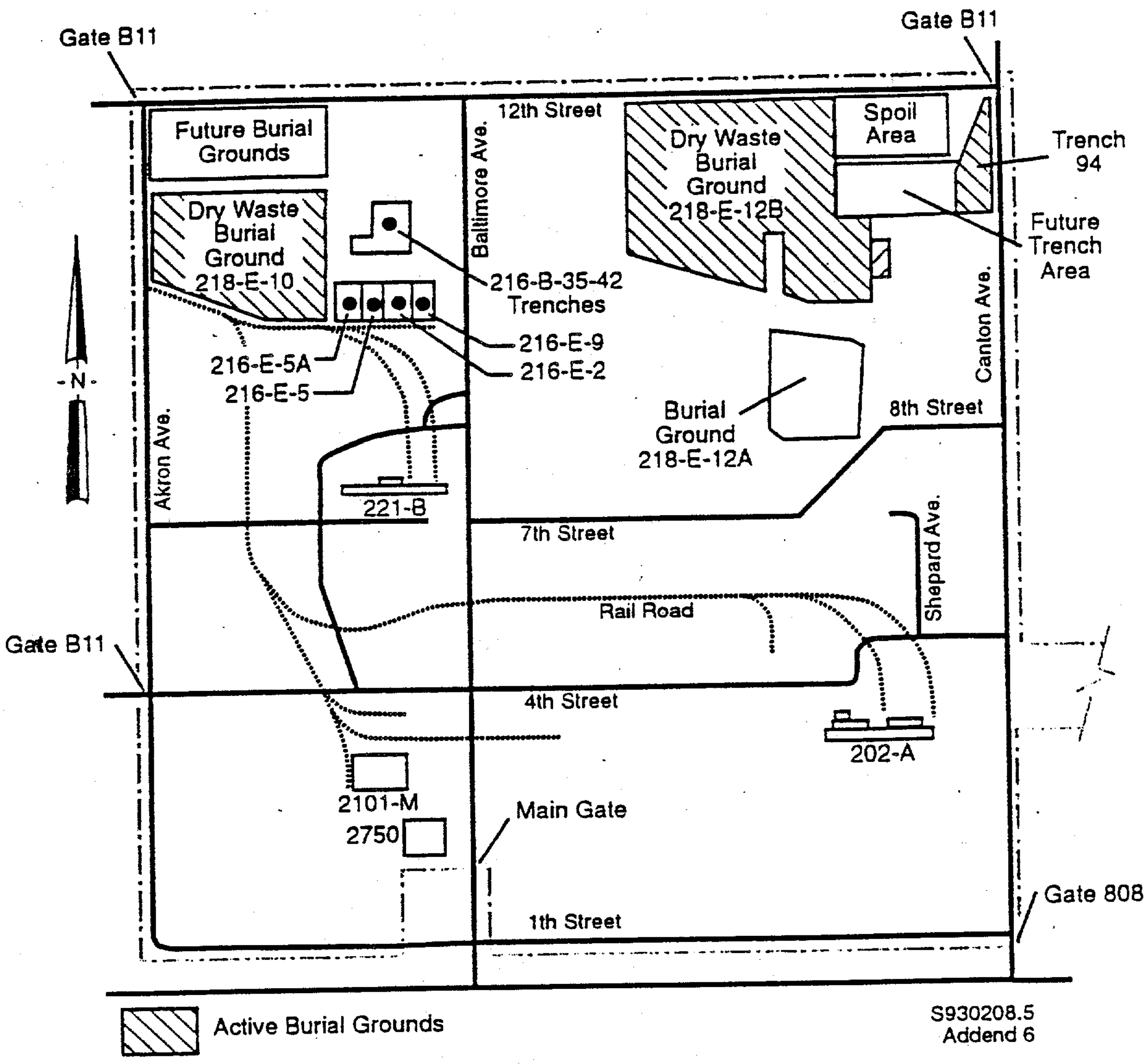
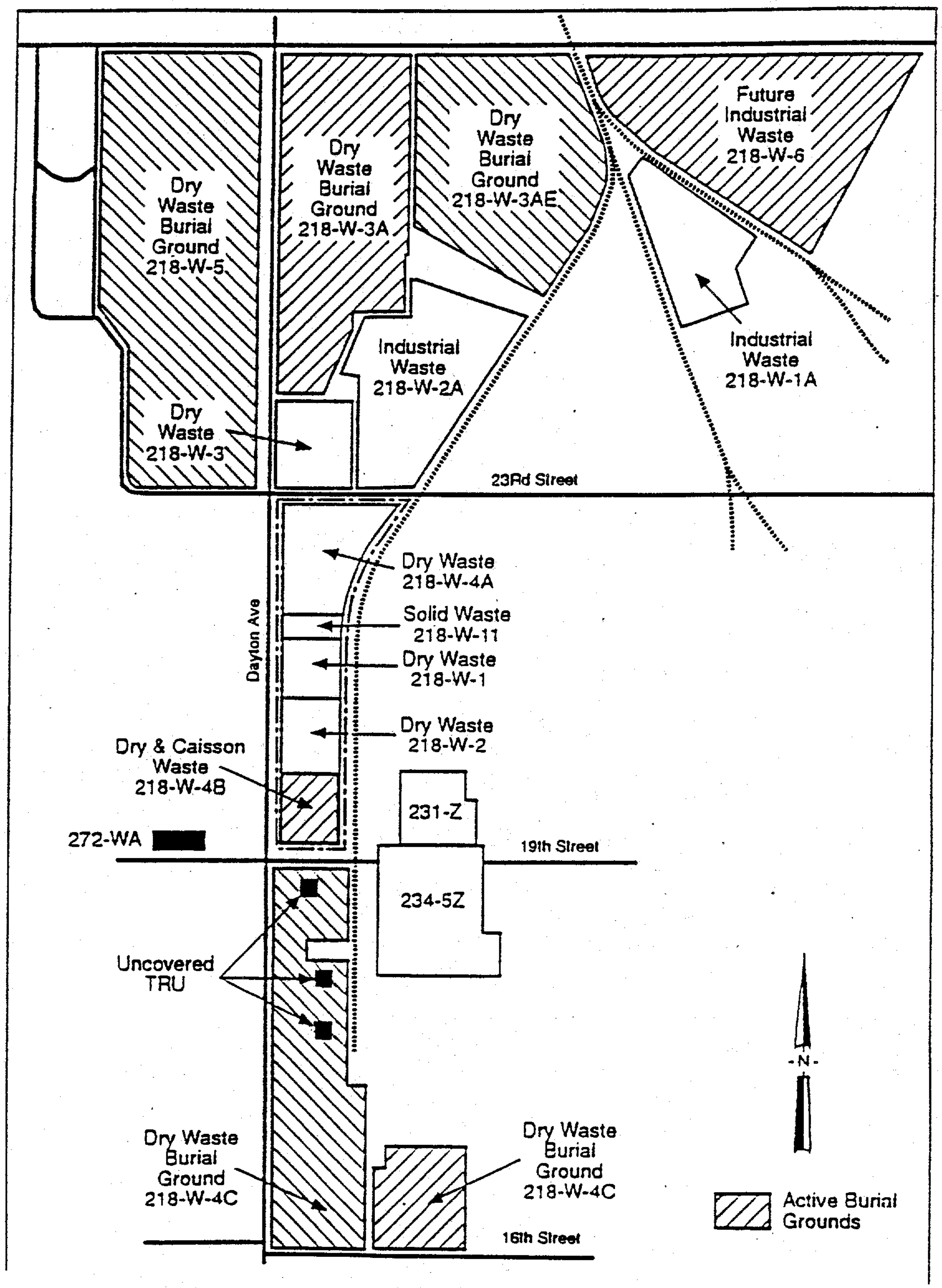


Figure 2.2-4 Location of the 200 West Burial Grounds



2.3.3 218-W-3A

This burial ground has been in service since 1970 and contains TRU, LLW, TRU mixed waste, and low level mixed waste. Trenches 9S, 1, 4, 5, 6, 8, 10, 15, and 17 contain LLW and TRU waste. There is low level mixed waste buried in Trenches 6S and 3S. Trench 14 has ten large concrete boxes of low level radioactive soil from a Tank Farm cleanup in 1973. Trench 17 contains TRU fiberglass reinforced polyester (FRP) plywood boxes related to the decommissioning of the weapons programs. Trench 7S contains waste from the cleanup effort at the Three Mile Island Nuclear Plant. In Trench 8, there are some buried irradiated fuel elements. Trenches 40 and 49 were dug with wide bottoms to allow for the disposal of contact handled LLW equipment, large boxes, and drums; the waste containers are stacked which has increased the volume per trench ratio. This burial ground has 61 trenches, three trenches have not been used, and one is partially filled. This burial ground has been used by onsite and offsite DOE contractors.

2.3.4 218-W-3AE

This burial ground was placed in service in 1981. It was to be used as RH-LLW waste, in support of the 100 Areas and 200 West. Trenches 2 and 3 have received RH-LLW. Trench 16 is prepared to receive RH-LLW. Trenches 5 and 10 are wide bottom stacking trenches; these trenches contain some mixed waste. Trench 26 was dug with a wide bottom to dispose of LLW railroad cars and large tanks. The trenches are dug from east to west.

2.3.5 218-W-4B

This burial ground was placed in service in 1968, and received unsegregated TRU, TRU, and TRU mixed waste. Trenches 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, and 12 contain unsegregated TRU/TRU mixed waste. Trench 7 contains TRU on an asphalt pad; the containers are mostly 208 liter (l) (55 gallon) drums with a few boxes. This trench is contact handled waste. The TRU waste in Trench 11 can contain either RH or contact handled waste; there is no asphalt pad in this trench. Trench 14 has 12 caissons which are vaults or tanks underground for the disposal of 1 to 5 gallon cans of RH waste. There are five alpha caissons but only four have been used; they were used from 1970 to 1979. There are six beta/gamma caissons which are filled, and one United Nuclear Corporation (UNC) caisson which is plugged; these were used from 1968 to 1979.

Trench 7 will be the site of excavations to recover a number of TRU drums for the Contact-Handled, Transuranic Waste Drum In Situ Inspection and Vented Drum Retrieval Project. WHC-SD-WM-SAR-058, is the Safety Analysis Report which describes this project.

2.3.6 218-W-4C

This burial ground was placed in service in 1978. The most northern trench or Trench NC, contains Naval Core Barrels. This waste comes from Naval Bases. Trench 1 contains mostly noncombustible TRU waste, including the 216-Z-9 Crib drums containing plutonium contaminated soil. Trench 4 contains mostly combustible TRU and little noncombustible TRU waste. Trench 7 contains TRU boxes, organic waste in drums, and drums of Training, Research, and Isotope production reactor-General Atomics (TRIGA) fuel. Additional TRU waste in boxes and drums are located in Trenches 19, 20, and 29. LLW waste is located in Trenches 19, 23, and 28. Low level mixed waste is in Trenches 14, 48, 53, and 58. These trenches are filled with waste and back filled. There are several trenches remaining in this burial ground to be used when needed. This burial ground has received waste from onsite and offsite DOE contractors.

Trenches 1, 4, and 20 will be the sites of excavations to recover a number of TRU drums for the Contact-Handled, Transuranic Waste Drum In Situ Inspection and Vented Drum Retrieval Project. WHC-SD-WM-SAR-058, is the Safety Analysis Report which describes this project.

2.3.7 218-W-5

This burial ground became operational in 1986 and was designed for disposal of LLW and low level Mixed Waste Lined Landfill (Project W-025). Trenches 3, 9, 13, 14, 21, and 24 have been filled. Trenches 9, 13, 21, and 22 contain low level mixed waste. Construction is proposed to start on Trench 31, the Mixed Waste Lined Landfill (Project W-025) in February of 1994. Presently Trenches 22 and 27 are used as wide bottom stacking trenches; Trench 22 for drums; and Trench 27 for boxes. Trenches 29 and 33 are dug as wide bottom to be used when Trenches 22 and 27 are filled. The trenches in W-5 are dug from east to west. This burial ground receives waste from onsite and offsite DOE contractors.

2.3.8 218-W-6

This burial ground has been prepared for use as low level mixed waste trenches. Monitoring wells have been installed and testing of the wells has commenced. This burial ground could have lined trenches as they are needed.

2.3.9 224-T Transuranic Waste Storage & Assay Facility (TRUSAF)

This is a three story, reinforced concrete building which was modified in the early 1970's to conform with the then current seismic and tornado standards for plutonium storage facilities. 224-T was designated in 1985 as the Transuranic Storage and Assay Facility (TRUSAF).

The TRUSAF operations consist of nondestructive examination (NDE) and storage of contact-handled transuranic (CH-TRU) waste, destined for the off site Waste Isolation Pilot Plant (WIPP). Nondestructive examination is used to verify general compliance with WIPP waste acceptance criteria. The WIPP will eventually dispose of the CH-TRU waste.

In the 224-T TRUSAF, the deactivated, contaminated processing cells are located in the east (or back third) of the building, and have been completely sealed and isolated from the operating gallery and service areas (three floors). This portion of the building has been stripped of all unnecessary control equipment, panel boards, and partitions to provide approximately 1.1E+3 m^2 of storage space on three floors.

2.3.10 2727-W

The 2727-W building is located in the 200 West Area, west of the UO_3 Plant and east of Camden Avenue. 2727-W is used for storage of the five ~7.6E+4 l Hallam sodium tanks.

2.3.11 2727-WA

2727-WA building is located in the 200 West Area, west of the UO_3 Plant and east of Camden Avenue, and north of the 2727-W building. 2727-WA is used for storage of sodium in 158, 208 l drums.

Table 2.3 provides a list of the active burial facilities as well as the volume and waste type.

Table 2.3 Status and Characteristics of Solid Waste Facilities on the Hanford Site

Burial Ground	Quantity of Waste, m^3	Location, Area	Status	Waste Type
218-E-10	21,764	200-E	Active	LLW**
218-E-12B	78,740	200-E	Active	LLW/TRU*
218-W-3A	100,100	200-W	Active	TRU/LLW
218-W-3AE	21,900	200-W	Active	LLW
218-W-4B	10,466	200-W	Active	TRU/LLW
218-W-4C	15,666	200-W	Active	TRU/LLW
218-W-5	36,310	200-W	Active	LLW
218-W-6	0	200-W	New	LLW

* TRU- Transuranic waste
** LLW- Low level waste (non-transuranic)

3.0 IDENTIFICATION AND SCREENING OF HAZARDS

The Guidance Document on Hazards Assessments contains directions to indicate that 40 CFR 355 Appendix A and 10 CFR 30.72 Schedule C provide Threshold Planning Quantity (TPQ) for extremely hazardous substances and radioactive materials for which emergency planning will be implemented. These lists are not entirely inclusive. Other hazardous materials may exist in sufficient quantity which when released to the environment may pose public health hazards to Hanford workers and the general public.

Non transuranic isotopes exist in the burial grounds at quantities that are greater than the TPQ but are stacked then buried under an earthen cap. This cap effectively seals the waste from the potential accidents postulated in section 5. Transuranics are stored in trenches without an earthen cap and are considered vulnerable to the accidents postulated.

Table 3.1 Inventory of Radioactive Material at Solid Waste Burial Grounds Used to Calculate Effective Dose Equivalent

Location	Radionuclides	PE-Ci	Pu grams	PE-Ci/g(b)	Threshold (Ci)(a)
218-W-4C Trench 1 Module 13	6% TRU 12% TRU	211.6 419.8	1961	8.8E-02 1.76E-01	2
218-W-4C Trench 1 Module 14	6% TRU 12% TRU	170.9 339	1744	8.8E-02 1.76E-01	2
218-W-4C Trench 20 Module 5	6% TRU 12% TRU	96.5 191.6	530	8.8E-02 1.76E-01	2
218-W-4C Trench 20	Misc. TRU		22	1.76E-01	2
218-W-4C Trench 29 Module 6	6% TRU 12% TRU	1434.6 2846.3	13321	8.8E-02 1.76E-01	2
218-W-4C Trench 29 Module 7	6% TRU 12% TRU	977.3 1939.1	8154	8.8E-02 1.76E-01	2
218-W-4C Trench 29 Module 8	6% TRU 12% TRU	30.6 60.8	252	8.8E-02 1.76E-01	2
218-W-4C Trench 29	Misc. TRU		1474	1.76E-01	2

Notes for Table 3.1

(a) Screening threshold established on basis of 10 Code of Federal Regulations (CFR) 30.72 Schedule C value for ^{239}Pu, ^{241}Am, ^{137}Cs, ^{60}Co, and ^{90}Sr

(b) Plutonium Equivalent per gram (PE-Ci/g)- a method to equate other transuranic isotopes to ^{239} plutonium. Curies of ^{239}Pu are determined by multiplying PE-Ci/g by grams.

Table 3.2 Central Waste Complex Extremely Hazardous Chemicals

Facility	Material	Quantity(kg)	Threshold*(kg)
Sodium Modules	Sodium	816	4536
2727-W	Sodium	139,310	4536
2727-WA	Sodium	25,285	4536

* Verification and Threshold Report of Tier II Reported Chemicals for 1992, (Summary of HMI-R042-R)

TRUSAF contains solid TRU waste in 208 l. drums which are handled as part of waste processing and storage operations. The drums contain plutonium contaminated trash and materials (such as papers, rags, hood waste, tools, and failed equipment), with little or no dispersible material. The drums are stored in modules with drums stacked no more than two high. The contaminated processing cells in 224-T have been completely sealed and isolated from the operating gallery and three service areas. Transuranic limits for drums of waste are shown in Table 3.3. Inventory of transuranic material in an average drum is listed in Table 3.4.

Table 3.3 Activity Content Limits and TRU Waste Criteria for a Single Drum

Waste Type	Limit
TRU waste	> 3700 Bq/g of TRU (considered TRU waste possibly to be sent to WIPP)
Low-level (CH-TRU)	≤ 3700 Bq/g of TRU waste (stored on first floor of TRUSAF, to be buried as low-level waste at Hanford)
The transuranic waste assay (TWA) contains 3.7E+11Bq of H-3.	

Table 3.4 Inventory of Radioactive Material in an average 224-T Waste Drum

Location	Radionuclides	Quantity(g)	Bq/drum(b)	Threshold(Bq)(a)
224-T	TRU	70 g/drum	4.5E+11	7.4E+10

Notes for Table 3.4

(a) Screening threshold established on basis of 10 Code of Federal Regulations (CFR) 30.72 Schedule C value for ^{239}Pu, ^{241}Am, ^{137}Cs, ^{60}Co, and ^{90}Sr

(b) Plutonium Equivalent per gram (PE-Ci/g)- a method to equate other transuranic isotopes to ^{239} plutonium. Curies of ^{239}Pu are determined by multiplying PE-Ci/g by grams.

4.0 HAZARD CHARACTERIZATION

The screening process described in the preceding section identified radioactive and/or hazardous materials in the SWBG and CWC facilities that exceed the screening thresholds. Radioactive materials in the form of solid TRU in the burial grounds, 224-T, and non-radioactive hazardous material sodium metal stored in the Alkali Metal Waste Storage Modules are the sources of the hazard. A description of the materials, their hazards, and conditions of storage and use are summarized below.

4.1 Plutonium

Hazards Assessment of the SWBG and 224-T is based on potential release of the residual plutonium and americium oxide in boxes and drums. Descriptions of scenarios which are postulated to release the plutonium are given in section 5.0.

4.1.1 Inventory

There is a large quantity of plutonium and americium held up in all the uncovered TRU waste drums and boxes. Calculations determined that 4.5E+11 Bq of plutonium were an average amount in a drum stored in 224-T.

4.1.2 Properties

Based on the types of material accumulated in the drums and boxes and the results of the non destructive assay (NDA), the material is assumed to be plutonium and americium oxide with the weight percentages and specific activity shown in Table 4.1. Weight percentages were referenced in WHC-EP-0063-4. The corrected specific activity is the weight percentage X isotopic specific activity.

A release fraction of 0.0005 for the plutonium oxide in the vehicle accident with fire and 0.00001 for the plutonium oxide in the vehicle accident without a fire was used for analyses except where specifically stated.

Table 4.1 Isotopic Quantification and Identification[1]

Isotope	Weight Percent	Specific Activity (Ci/g)	Specific Activity for 13% ^{240}Pu PE-Ci Matrix (Ci/g)
^{238}Pu	0.0008	1.71E+1	1.37E-2
^{239}Pu	0.8395	6.20E-2	5.20E-2
^{240}Pu	0.1297	2.27E-1	2.94E-2
^{241}Pu	0.011	1.03E+2	1.13
^{242}Pu	0.0003	3.93E-3	1.18E-6
^{241}Am	0.0175	3.42	5.99E-2

1 Table information is taken from WHC-EP-0063-4, UC-721.

4.1.3 Conditions of Storage

The waste package includes the waste, internal packaging, waste container, and any disposable overpacks intended to be disposed. All low-level mixed waste packages accepted for disposal are to meet the criteria listed in WHC-EP-0063-4 such as waste containers, containment, surface dose rate, surface contamination, thermal power, gas generation, interior void spaces and nuclear criticality. Waste drums and boxes with TRU are stacked in uncovered trenches for eventual retrieval. Non-TRU waste drums and boxes are stacked and covered with soil which makes the inventory not vulnerable to accidents and releases.

4.2 Sodium

4.2.1 Inventory

There are 816 kg of sodium stored in the Alkali Metal Waste Storage Modules at the Central Waste Complex. The 2727-W building has 139,284 kg and 2727-WA has 25,280 kg.

4.2.2 Properties

Sodium is a soft, low density metal easily cut with a knife. In an inert atmosphere freshly cut sodium has a pinkish, bright metallic luster. In air, the cut surface quickly forms a white or light grey coating of sodium oxide, hydroxide, and carbonate. Nitrogen, argon, and helium are inert to sodium and can be used as a cover gas in processes utilizing sodium. Simple hydrocarbons such as mineral oil, kerosene, xylene, and toluene neither dissolve sodium nor react with it, and are used as media for sodium dispersions. Sodium can be stored in high boiling hydrocarbons such as mineral oil or kerosene to retard oxidation. Sodium is a good conductor of heat and electricity. It is thermally stable in dry, inert atmospheres such as nitrogen or argon and will not explode or detonate from heat or shock.

Sodium melts to a silvery white, low-viscosity liquid resembling mercury. Liquid sodium burns in air with a yellow flame, giving off dense acrid white smoke that is predominately sodium monoxide (Na_2O). Some sodium peroxide (Na_2O_2) also forms, especially at higher temperatures and in the presence of excess oxygen. If moisture is present, the oxides are converted to sodium hydroxide (NaOH). Carbon dioxide (CO_2) gas shows little tendency to react with sodium at room temperature. At somewhat higher temperatures, sodium carbonate or, under controlled conditions, sodium oxalate is formed. Carbon dioxide powered fire extinguisher should be used on sodium fires. Solid CO_2 (dry ice) can react explosively with sodium on contact.

Sodium is a powerful reducing agent. It reacts vigorously with water forming sodium hydroxide and hydrogen gas with release of considerable heat. Since the hydrogen usually ignites with explosive violence in the presence of air or oxygen, it is essential to avoid all water contact in sodium storage and handling. Sodium will auto-ignite in air temperatures of approximately 120-125 °C and above. Contact between sodium and halogenated hydrocarbons may cause an explosive reaction. Sodium has the following physical properties and sodium hydroxide has the following exposure limits.

Table 4.2 Physical Properties of Sodium

Atomic Weight	22.99
Melting Point	97.8 °C (208°F)
Boiling Point	881.4 °C
Density	0.968 @ 20 °C

Table 4.3 Exposure Limits for Sodium Hydroxide

TWA	2 mg/m^3
IDLH	250 mg/m^3
ERPG 1	2 mg/m^3
ERPG 2	40 mg/m^3
ERPG 3	100 mg/m^3

4.2.3 Conditions of Storage and Use

All of the sodium is stored in steel vessels, either 208 l drums or steel vessels up to 7.6E+4 l, at ambient temperatures, with slightly pressurized nitrogen cover gas or kerosene to prevent reaction with air and possible generation of explosive hydrogen mixtures. The nitrogen gas pressure is monitored routinely (currently once each eight hour shift) to assure the inert gas cover.

5.0 EVENT SCENARIOS

This section briefly describes several scenarios from the SARs and other safety documents that are applicable to the current status of the facilities. The projected consequences from these events are used to establish the size of the emergency planning zone and to provide guidance for establishing EALs.

5.1 Facility Emergency Events

5.1.1 Vehicle Crash into TRU Containers with Fire

5.1.1.1 Failure of Primary Barrier and Range of Possible Releases

The scenario begins with a vehicle driven into the uncovered TRU drum trench where it makes contact with and breaches 30 drums. The ensuing crash penetrates the primary barrier, the drum, and starts the vehicle fuel on fire. The truck releases 100% of the drum's contents and with the fire a total of 4090 grams are released. The fire release fraction is 5.0 E-4 which equals 2.04 grams Pu in a respirable state. The specific activity of the plutonium and americium is shown in Table 4.1. The number of grams released is multiplied by the weight percent, multiplied by the specific activity (Corrected Specific Activity) to equal the curies released for each isotope. For calculating the HUDU dose equivalent, the various isotopic curies are listed in Table 5.1. The activity released for a single drum is 6.0 E-4.

Table 5.1 Activity Released for the Vehicle Crash into TRU Containers with Fire

Isotope	Activity Released (Bq)
^{238}Pu	1.0 E+9
^{239}Pu	4.1 E+9
^{240}Pu	2.2 E+9
^{241}Pu	8.5 E+10
^{242}Pu	8.9 E+4
^{241}Am	4.4 E+9

5.1.1.2 Effects of Other Barriers

The vehicle fuel tank is an engineered barrier which exists to prevent the fuel from burning. Administrative barriers which exist to prevent this accident include procedures to not allow vehicles in the vicinity of the drums.

5.1.2 Vehicle Crash into TRU Containers Without a Fire

5.1.2.1 Failure of Primary Barrier

The scenario begins with a vehicle driven into the uncovered TRU drum trench where it makes contact with and breaches 30 drums. The ensuing crash mechanically releases 100% of the drum's contents. This accident is described in more detail in WHC-SD-WM-ISB-002, Rev. 0. The accident releases 4092 grams Pu. A release fraction is 1.0 E-5 which equates to 4.09 E-2 grams in a respirable form. The specific activity and the weight percentage of the plutonium and americium isotopes in the waste is shown in Table 4.1. The number of curies released is 0.0409 g X Corrected specific activity. For calculating the HUDU dose equivalent the curies released are shown in Table 5.2.

Table 5.2 Activity Released for the Vehicle Crash into TRU Containers without Fire

Isotope	Activity Released (Ci)
^{238}Pu	2.2 E+7
^{239}Pu	7.8 E+7
^{240}Pu	4.4 E+7
^{241}Pu	1.7 E+9
^{242}Pu	1.8 E+3
^{241}Am	9.2 E+7

5.1.2.2 Effects of Other Barriers

Administrative barriers which exist to prevent this accident include procedures to not allow vehicles in the vicinity of the drums.

5.1.3 TRU Drum Drop Release

5.1.3.1 Failure of Primary Barrier

The steel drums which contain the radioactive material are considered the primary barrier. It is assumed that the material within the TRU Waste drums is PuO_2 in dispersible form and that an impact from a drum falling from a fork lift outside the building while being moved into the facility results in a spill, and lofting of 0.05% of the PuO_2. This results in a 0.1 gram puff release of plutonium and americium. The TRUSAF Hazard Identification and Evaluation document (Pines 1987) does not give an isotopic distribution for plutonium. The specific activity of the plutonium and americium shown in Table 4.1 (WHC-SD-WM-SAR-053) was used to determine the isotopic source term for a release scenario. The radioactivity escapes the container at ground level, a building wake factor of 4645 m^2, F stability as well as a wind speed of 1 meter/second was used. The various isotopes of TRU released in this accident are shown in Table 5.3.

Table 5.3 Activity Released as a Consequence of the Drum Drop Scenario

Radionuclide	Activity in Bq
^{238}Pu	5.2 E+7
^{239}Pu	1.9 E+8
^{240}Pu	1.1 E+8
^{241}Pu	4.1 E+9
^{242}Pu	4.4 E+3
^{241}Am	2.2 E+8

5.1.3.2 Effects of Other Barriers

Other barriers to limit or prevent the release of radioactive material include the facility ventilation and filters as well as administrative barriers such as procedures which limit the stacking height of drums.

5.1.4 TRU Drum Explosion

5.1.4.1 Failure of Primary Barrier

The primary barrier is the steel drum and the vent clip which allows any buildup of flammable gases to escape. The postulated accident occurs because of vent clip failure or improper placment, allowing a buildup of hydrogen gas to an explosive concentration in a single drum. With drum excavation and movement, a spark causes the drum gases to explode accompanied with a fire.

The curies released are shown in Table 5.4 and are determined by using the maximum grams (146) for a single drum. The respirable fraction is assumed to be 1.5 E-3. Assuming that 10% of waste volume is directly released because of the explosion, 10% of dispersed material is made airborne, 10% of airborne material is of respirable size, 100% of material released but not made airborne burns, of the waste that burns, 5.0 E-4 of the TRU in the fire is released as respirable. Table 5.4 shows the quantity released if 0.219 grams (released material) is multiplied by the various Table 4.1 isotopic corrected specific activities.

Table 5.4 Activity Released as a Consequence of the Drum Explosion Scenario

Radionuclide	Activity in Bq
^{238}Pu	1.3 E+8
^{239}Pu	4.8 E+8
^{240}Pu	2.8 E+8
^{241}Pu	1.1 E+10
^{242}Pu	1.1 E+4
^{241}Am	5.6 E+8

5.1.4.2 Effects of Other Barriers

Administrative controls such as no bulging drums or drums without clips will be processed for this project to reduce the likelihood of this event occurring.

5.1.5 Loss of Service Systems

No scenarios are discussed and calculated in the SWBG and CWC SARs. Service Systems are not required for operation of any safety systems in the burial ground or CWC facilities, and loss of these systems will not result in any dose to the onsite or offsite individuals. This event cannot require the facility to declare an emergency.

5.1.6 Loss of Confinement

5.1.6.1 Failure of Primary Barrier

A loss of confinement occurs when the drum or box containing the waste material is breached. This scenario is similar to the Vehicle Crash Without Fire, described in section 5.1.2, above.

5.1.6.2 Effects of Other Barriers

Administrative barriers which exist to prevent this accident include procedures to not allow vehicles in the vicinity of the drums.

5.1.7 Stack Release

The SWBG facility does not have a stack and hence no accident scenarios were postulated. 224-T has a stack but any releases internal to the facility will go through the HEPA filters and the effective dose equivalents will be minimized. No emergencies can be declared.

5.1.8 Hazardous Material Release

5.1.8.1 Failure of Primary Barrier

Central Waste Complex has 888.4 kg of sodium stored in the sodium module facility. A truck crash into the building housing the sodium stored in 208 l drums, with an ensuing fire. Each drum contains 160 kg. A 208 l drum is approximately 0.6 m in diameter. A truck has a width of approximately 2.4 m. Conservatively a truck crashing into the drums would destroy a minimum of four drums. The ensuing fire could consume 4 X 160 kg or 640 kgs of sodium. It is assumed that 35% of the sodium is converted to aerosolized NaOH. The release is a total of 224 kg of NaOH. The 2727-WA facility has 158, 208 l drums of sodium. Each drum has an average of 160 kg of sodium. Another potential accident with sodium is the inadvertent addition of water to the exposed sodium and an ensuing explosion of the hydrogen. Sodium has a density of 970 kg/m^3 making this amount of sodium equivalent to a volume of 0.165 m^3. The void space in each drum is (208 l - 165 l = 43 l (0.0432 m^3). To determine the amount of H_2 gas in each drum [0.0432 m^3 X 1000 liters/m^3 = 43.2 l. At Standard Temperature and Pressure, there are 22.4 l/mole of gas. 43.2 l/22.4 l/mole = 1.9286 moles H_2 gas. If there was 12% H_2, there would be 0.23 moles of H_2. For a stoichiometric mixture, the H_2 % must be twice that of O_2 or 29.6%. 29.6% X 1.9286 moles = 0.571 moles H_2.

The reaction of sodium with water forms hydrogen gas and sodium hydroxide.

$$2Na + 2H_2O = 2NaOH + H_2$$

Thus, for each mole of hydrogen gas (H_2) that is formed, two moles of sodium hydroxide is formed. It is postulated that all of this sodium hydroxide is released in the hydrogen explosion.

Moles of NaOH per drum = 2 X 0.571 = 1.14

Mass of NaOH = 40 X 1.14 = 45.67 grams/drum

The source is an instantaneous release of 4 drums or 183 grams of sodium hydroxide.

5.1.8.2 Effects of Other Barriers

Administrative barriers which exist to prevent this accident include procedures to not allow vehicles in the vicinity of the drums.

5.2 Natural Emergencies

5.2.1 Seismic Event (Earthquake)

The scenario starts with operators observing facility or ground movement. Facility damage is evident with drum and box breached containment. The stacked, uncovered drums of TRU waste are shaken apart and 100% of the drums contents that are breached are released. The specifics and assumptions of this accident are described in more detail in the Solid Waste Burial Grounds Interim Safety Basis, WHC-SD-WM-ISB-002, Rev. 0, May, 1994. The seismic event calculates a respirable quantity of activity for trench 1 and 29 to be 4.52 E-2 g. Table 5.5 shows the curies released for the HUDU calculation which is a multiplication of Table 4.1 corrected specific activity X the above grams released.

Table 5.5 Activity Released for the TRU Container Seismic Event

Radionuclide	Activity in Bq
^{238}Pu	2.2 E+7
^{239}Pu	8.9 E+7
^{240}Pu	4.8 E+7
^{241}Pu	1.9 E+9
^{242}Pu	2.0 E+3
^{241}Am	1.0 E+8

5.2.2 High Winds/Tornado

The consequence of this event was not calculated in the SWBG SAR. The consequence of an event with these initiators is considered to be less severe than the Design Basis Earthquake described in section 5.2.1. The GENII as well as the HUDU computer code was used to calculate the EDE to onsite and offsite individuals as a result of the seismic event. The high winds/tornado scenario is initiated by the facility operators observing the occurrence of higher than normal winds or a funnel cloud in the vicinity of the active Solid Waste Burial trenches. Confirmation of the winds above 4.02E+1 m/s are by calling the Hanford Weather Station. The SWBG SAR describes a high wind generated missile breaching three drums with a mechanical release.

5.2.3 Range Fire

The range fire scenario is not discussed in the SWBG SAR. The consequence of this event cannot be greater than the Vehicle Crash with Fire scenario discussed in section 5.1.1, above. The source material is located inside of noncombustible drums or boxes. Burial grounds are excavated and the act of earthmoving removes the combustible materials from the proximity of the active trench. The drums and boxes are within a trench which is devoid of combustible material. Range fires have been experienced and there is adequate warning time. The source material is not released except after breach of the waste matrix's containment boundary. This event cannot require the facility to declare an emergency.

5.3 Security Contingencies

The following events have not been analyzed but are discussed and given a consequence.

5.3.1 Explosive Device

The consequence of this event was not discussed or calculated in the SWBG SAR. The consequence of an event with this initiator is considered to be no more severe than the Truck Crash without Fire scenario described in section 5.1.2. The Explosive Device scenario is initiated by the facility operators hearing or feeling the detonation of an explosive device in the active Solid Waste Burial Ground trenches. Confirmation of the explosion and resultant release would be by the Health Physics survey of the SWBG. The SAR describes the truck accident as breaching 30 drums.

5.3.2 Sabotage

This scenario is not discussed or calculated in the SWBG SAR. This event could be considered similar to the Vehicle Crash with Fire described in section 5.1.1, above.

5.3.3 Hostage Situation

This scenario is not discussed or calculated in the SWBG SAR but is assumed to be similar to the Vehicle Crash without Fire described in section 5.1.2 above since the hostage could be made to damage drums of waste.

5.3.4 Armed Intruder

This scenario is not discussed or calculated in the SWBG SAR but is assumed to be similar to the Truck Crash without Fire scenario discussed in section 5.1.2 above, since the intruder(s) could do damage to the drums of waste.

5.3.5 Aircraft Crash

An accident involving an aircraft crash was not calculated but is assumed to be no more severe than the truck accident with fire.

6.0 EVENT CONSEQUENCES

6.1 Calculational Models

The SWBG SAR calculations for the effective dose equivalents due to the various accidents are performed using GENII. Environmental radiological releases shown in the various facility safety documents were confirmed by modeling with the Hanford Unified Dose Utility computer code (HUDU). This code is the primary emergency response tool for radiological releases on the Hanford Site and in the Unified Dose Assessment Center (UDAC). It employs a straight line Gaussian plume model, Pasquill-Gifford stability classes, and ICRP 26 and 30 Aerodynamic Mean Activity Diameter (AMAD). Release source terms considered only the respirable fraction, nominally 0.1 percent (DOE-STD-0013-93).

Release of radionuclides into the environment occurs by loss of facility containment integrity. By convention, release heights less than 10 m default to ground level releases. In these analysis plume rise is not considered, producing conservative dose estimates.

Environmental non-radiological hazardous material releases shown in the various facility safety documents were confirmed by modeling with the Emergency Prediction Information (EPI) code.

6.1.1 Radiological Releases

For calculating releases from the SWBG SAR, the GENII, Version 1.485, computer code was used to calculate maximum Effective Dose Equivalents (EDE) for an onsite receptor, 140 m north of the 218-W-4C TRU burial ground, and the nearest offsite receptor, 12.6 kilometers to the north-northwest. The very conservative assumptions about the radioactive inventory at the time of an accident yield projected doses well below Early Severe Health Effects, section 7.1 limits.

6.1.2 Plutonium Release

6.1.2.1 Vehicle Crash into TRU Containers with Fire

The scenario is described in section 5.1.1.1 and has meteorological conditions of F stability and a wind speed of 1 meter per second. The release occurs at ground level. The HUDU calculated EDE with Table 5.1 input is shown in Table 6.1 below.

Table 6.1 HUDU Calculated Doses for TRU Trench Accident with Fire (30 Drums)

Receptor		EDE * Sv	Limiting Organ Dose (Sv)
Onsite (100 m)	Inhalation	1.2E+01	1.7E+02 (Bone Surface)
Offsite (12.6 km	Inhalation	7.2E-03	1.5E-02 (Bone Surface)

* Effective Dose Equivalent

This committed dose equivalent consequence equates to a SITE AREA Emergency due to the greater than 0.01 Sv at the facility boundary.

Table 6.2 HUDU Calculated Doses for TRU Trench Accident with Fire (1 Drum)

Receptor		EDE * Sv	Limiting Organ Dose (Sv)
Onsite (100 m)	Inhalation	1.6E+00	2.2E+01 (Bone Surface)
Offsite (12.6 km)	Inhalation	9.0E-04	1.3E-02 (Bone Surface)

* Effective Dose Equivalent

A SITE AREA Emergency declaration is warranted for this accident when one or more drums are involved.

6.1.2.2 Vehicle Crash into TRU Containers Without a Fire

This scenario assumes that there is a ground level release with F stability and a 1 meter per second wind speed. The HUDU results using Table 5.2 data are shown in Table 6.3. This committed dose equivalent consequence equates to a SITE AREA Emergency due to the greater than 0.01 Sv at the facility boundary.

Table 6.3 HUDU Calculated Doses for TRU Trench Accident without Fire

Receptor		EDE * Sv	Limiting Organ Dose (Sv)
Onsite (100 m)	Inhalation	2.5E-01	3.6E+00 (Bone Surface)
Offsite (12.6 km)	Inhalation	1.5E-04	2.1E-03 (Bone Surface)

* Effective Dose Equivalent

6.1.2.3 TRU Drum Drop

A TRU drum is dropped outside the 224-T facility, its contents are exposed, and Table 5.3 contents are released. Table 6.4 shows the HUDU calculated results for this accident.

Table 6.4 HUDU Calculated Results of a Postulated Single Drum Drop

Receptor		EDE * Sv	Limiting Organ Dose (Sv)
Onsite (100 meters)	Inhalation	6.5E-03	9.1E-02 (Bone Surface)
Offsite (13.1 km)	Inhalation	2.2E-04	3.2E-03 (Bone Surface)

* Effective Dose Equivalent

This event requires declaration of an ALERT LEVEL Emergency since the EDE at the facility boundary is greater than 0.001 Sv.

6.1.3 TRU Drum Explosion

The HUDU results using Table 5.4 data are shown in Table 6.5. This effective dose equivalent consequence equates to a SITE AREA Emergency due to the $\geq$0.01 Sv at the facility boundary.

Table 6.5 HUDU Calculated Results of a Postulated TRU Drum Explosion

Receptor		EDE * Sv	Limiting Organ Dose (Sv)
Onsite (140 meters)	Inhalation	8.7E-01	1.2E+01 (Bone Surface)
Offsite (12.6 km)	Inhalation	8.9E-04	1.3E-02 (Bone Surface)

* Effective Dose Equivalent

6.1.4 Loss of Confinement

This event is not discussed or EDE calculated in the SWBG SAR. This scenario is similar to the Vehicle Crash Without Fire, described in section 5.1.2, above. The HUDU result using Table 5.2 data is shown in Table 6.3. This committed dose equivalent consequence equates to a SITE AREA Emergency due to the greater than 0.01 Sv at the facility boundary.

6.1.5 Hazardous Material Release

6.1.5.1 Sodium Release From A Fire

The EPI computer code was used to calculate the downwind concentration from a four drum, 224 kg NaOH, 20 minute, term release, 5 meter radius, ground level release of sodium hydroxide. The meteorology condition was "F" stability and a 1 meter per second wind speed. Results are shown in Table 6.6.

Table 6.6 EPI Calculated Concentrations CWC Sodium Accident with Fire

Receptor Location/Distance	SAR Concern.	EPI Concern.
Facility boundary (142 m)	15 mg/m^3	1.5 mg/m^3
Site boundary (12.2 km)	0.00245 mg/m^3	0.000044 mg/m^3

These values compare with an ERPG 1 value of 2 mg/m^3 and an ERPG 2 value of 40 mg/m^3. This event would not require declaration of an event.

6.1.5.2 Sodium Release From An Explosion

An accident where the four sodium drums are breached and a fire is fought or rain water is added to the sodium which creates hydrogen gas. A spark causes an explosion giving the following results. A total of 183 grams are instantaneously released, meteorology conditions are F stability, and a 1 meter per second wind speed. Table 6.7 shows the calculated results for this scenario.

Table 6.7 EPI Calculated Concentrations CWC Sodium Accident with Explosion

Receptor Location/Distance	EPI Concentration
Facility boundary (142 m)	694 mg/m^3
Site boundary (12.2 km)	0.000024 mg/m^3

These values compare with an ERPG 1 value of 2 mg/m^3 and an ERPG 2 value of 40 mg/m^3. This event would be a SITE AREA Emergency.

6.1.6 Natural Emergencies

6.1.6.1 Seismic Event (Earthquake)

Approximately 576 drums are stacked and stored in each burial trench. The SAR assumes that two trenches are affected and a fire is initiated. The grams released from trench 29 are calculated to be (116 drums)(31 g)/drum X 5.0 E-4 (release fraction) = 1.8 E+02 grams, and from trench 1, (208 drums)(4.4 g/drum) X 5.0 E-4 (release fraction) = 4.6 E-1 g, which assumes that of the drums that are ruptured, 100% of the nuclear material is released. The HUDU EDE input data is from Table 5.5 and the results are shown in Table 6.8. This committed dose equivalent consequence equates to a SITE AREA Emergency due to the greater than 0.001 Sv at the facility boundary but less than 0.01 Sv at the site boundary.

Table 6.8 HUDU Calculated Doses for TRU Trench Seismic Event

Receptor		EDE * Sv	Limiting Organ Dose (Sv)
Onsite (100 m)	Inhalation	2.7E-01	3.9E+00 (Bone Surface)
Offsite (12.6 km)	Inhalation	1.6E-04	3.3E-03 (Bone Surface)

* Effective Dose Equivalent

6.1.6.2 High Winds/Tornado

The consequence of this event was not calculated but assumed to be less severe than the Design Basis Earthquake. The SAR describes the high wind event has having enough energy to breach three drums with a missile. The nearest onsite individual is calculated to receive 0.04 Sv EDE for the seismic event when approximately 128 drums are breached. A nearest offsite individual is calculated to receive 0.0012 mrem EDE from the seismic event. Calculation of the high winds/tornado emergency includes dividing the 0.04 Sv EDE by the 128 drums to determine the EDE per drum (0.003 Sv/drum). The high winds/tornado accident would be approximately 0.0084 Sv EDE to the onsite worker and less than 0.0001 Sv to the nearest offsite individual and would be an ALERT LEVEL Emergency since the EDE at the facility boundary is approximately 0.001 mrem.

6.1.7 Security Contingencies

The following events have not been analyzed but are discussed and given a consequence.

6.1.7.1 Explosive Device

The consequence of this event was not calculated but the consequence of an event with this initiator is considered to be similar to the drum explosion scenario described in section 5.1.4. The Explosive Device scenario results in a SITE AREA Emergency since consequences described in section 6.1.3 show an effective dose equivalent at the facility boundary of $\geq$0.01 Sv.

6.1.7.2 Sabotage

This scenario is not calculated but is assumed to be similar to the Vehicle Crash with Fire described in section 5.1.1, above. The EDE for the onsite worker is 0.033 Sv and 0.0034 Sv to the nearest offsite individual. This committed dose equivalent consequence equates to a SITE AREA Emergency due to the greater than 0.01 Sv at the facility boundary.

6.1.7.3 Hostage Situation

This scenario is not calculated but is assumed to be an ALERT LEVEL Emergency if a confirmed hostage situation is occurring within the CWC or burial grounds due to events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility with an increased potential for a release.

6.1.7.4 Armed Intruder

This scenario is not analyzed but is assumed to be an ALERT LEVEL Emergency if confirmed armed intruder(s) are located within any of the CWC or burial grounds since events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility with an increased potential for a release.

6.1.7.5 Aircraft Crash

A SITE AREA Emergency shall be declared if an aircraft crash has occurred at or near one of the CWC or burial grounds and which has or is likely to have an adverse affect on the facility's safety, or has or is likely to release radioactive/hazardous material to the environment. This event is similar to the Truck Crash with Fire scenario described in section 5.1.1.

6.2 Receptor Locations

Facility Boundary Receptors The nearest receptors outside of the facility are considered to be 140 meters north.

Site Boundary Receptors The nearest receptors outside of the site boundaries are considered to be 12.6 km west-northwest of the 218-W-04C burial ground.

7.0 THE EMERGENCY PLANNING ZONE

The Emergency Planning Zone (EPZ) is an area within which special planning and preparedness efforts are warranted since the consequences of a severe accident could result in Early Severe Health Effects (ESHE). DOE Order 5500.3A endorses the EPZ concept and requires that the choice of an EPZ for each facility be based on an objective analyses of the hazards associated with the facility. The Emergency Management Guide on Hazards Assessment provides several pages of guidance on establishing the size of the EPZ. The suggested approach is to determine the emergency classification of the events analyzed in the Hazards Assessment and then base the EPZ size on the larger of a default size for each emergency class or the maximum distance that an ESHE Threshold is exceeded. A final step is to make adjustments to the area, if necessary, based on reasonableness tests in the guidance document. For example, the selected EPZ should conform to natural and jurisdictional boundaries where reasonable. The selection of the EPZ for the SWBG and Central Waste Complex facilities, based on this review of the SAR accident scenarios, is described below.

7.1 The Minimum EPZ Radius

The highest emergency classification for the scenarios described above is a Site Area Emergency. The minimum EPZ size is the larger of 2 km (the default size for a Site Area Emergency) or the maximum radius for ESHE which is calculated. The Emergency Management Guide Hazards Assessment document provides the following criteria for ESHE's.

Radiological

External or uniformly distributed internal emitters	1 Sv
Thyroid	30 Sv
Skin	12 Sv
Ovary	1.7 Sv
Bone Marrow	1.65 Sv
Testes	4.4 Sv
Other Organs	5.5 Sv

Non-Radiological

A peak concentration of the substance in air that equals or exceeds the ERPG-3 value, or equivalent.

Conclusion

All of the analyzed radiological releases give consequences less than the ESHE criteria, defined above, at the facility boundary. This distance is less than the default EPZ radius of 2 km. Therefore, the EPZ for the SWBG and CWC facilities is a circle with a 2 km radius around the facility.

7.2 Tests of Reasonableness

1. Are the maximum distances to PAG/ERPG-level impacts (Hanford PAG is 1 rem) for most of the analyzed accident scenarios equal to or less than the EPZ radius selected?

   Most of the analyzed accident scenarios give consequences less than the ESHE criteria at the default EPZ radius of 2 km.

2. Is the selected EPZ radius large enough to provide for extending response activities outside the EPZ if conditions warrant?

   The SWBG/CWC EPZ is within the 1.61 E+4 km EPZ for the 200 Area facilities. Therefore, emergency plans are already in place to extend the Hanford emergency response well beyond the SWBG/CWC EPZ.

3. Is the EPZ radius large enough to support an effective response at and near the scene of the emergency?

   The 2 km radius encompasses the entire SWBG/CWC, the nearest other occupied Hanford facilities, and the Hanford Site roads leading past the facility. Access control can readily be established on these roads.

4. Does the proposed EPZ conform to natural and jurisdictional boundaries where reasonable, and are other expectations and needs of the offsite agencies likely to be met by the selected EPZ?

   There are no natural boundaries with which it makes sense to align any of the EPZ boundary lines. The SWBG/CWC EPZ falls within the 200 Area 1.61 E+4 km EPZ. Therefore, all the jurisdictional boundary questions and offsite agency needs are included in the emergency planning for this larger zone.

5. What enhancement of the facility and site preparedness stature would be achieved by increasing the selected EPZ radius?

   The proposed EPZ radius is within the 200 Area 1.61E+4 km EPZ. This larger EPZ ensures the involvement of all local agencies and governments in the planning process for Hanford emergencies.

The radiological and non-radiological hazards at the SWBG and CWC require that low probability accidents occur to reach alert and site area emergencies based on projected dose criteria. The facility and the emergency preparedness organizations are in the process of establishing event recognition and classification procedures.

8.0 EMERGENCY CLASSES, PROTECTIVE ACTIONS, AND EMERGENCY ACTION LEVELS

8.1 Emergency Classes

A goal of the DOE emergency preparedness system is to quickly classify the severity of an accident. Preplanned actions are then implemented for each emergency class. The emergency classification is based, in part, on projected dose and concentration values at the facility and Hanford site boundaries for pre analyzed accident scenarios. The emergency classification criteria are shown in Table 8.1 and 8.2 below.

Table 8.1 Radiological Release Criteria

Emerg. Category	Criteria*
Alert	> 0.001 Sv committed dose equivalent at facility boundary > 0.005 Sv thyroid (worker) dose at facility boundary > 0.05 Sv skin dose at facility boundary
Site Area	≥ 0.01 Sv committed dose equivalent at facility boundary > 0.05 Sv thyroid (worker) dose at facility boundary > 0.5 Sv skin dose at facility boundary
General	≥ 0.01 Sv committed dose equivalent at site boundary > 0.05 Sv thyroid (infant) dose at site boundary > 0.5 Sv skin dose at site boundary

Table 8.2 Non-Radiological Release Criteria

Emerg. Category	Criteria*
Alert	> ERPG 1 at facility boundary
Site Area	≥ ERPG 2 at facility boundary
General	≥ ERPG 2 at site boundary

*The criteria apply to a peak concentration of the substance in air. If ERPG values have not been established for a substance, alternative criteria specified in the Emergency Management Guide for Hazards Assessments shall be used.

There are also general criteria for emergency classification in addition to the numerical values in the tables above. The threshold between reportable occurrences and the Alert classification is difficult to establish based solely on a numerical value. The following general criteria apply in addition to the airborne release concentration values specified in the tables above.

ALERT

An Alert Level Emergency shall be declared when events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility with an increased potential for a release.

In general, the ALERT classification is appropriate when the severity and/or complexity of an event may exceed the capabilities of the normal operating organization to adequately manage the event and its consequences.

SITE AREA

A SITE AREA emergency shall be declared when events are in progress or have occurred which involve actual or likely major failures of facility functions needed for protection of workers and the public.

GENERAL

A GENERAL EMERGENCY shall be declared when events are in progress or have occurred that involve actual or imminent catastrophic failure of facility safety systems with a potential for loss of confinement or containment integrity.

There is additional emergency classification guidance in the Emergency Management Guide on Event Classification and Emergency Action Levels. The Hazards Assessment in the following sections is based primarily on a comparison of calculated consequences with the numerical criteria in the tables above. However, some recommendations are provided based on the more general emergency classification criteria.

8.2 Emergency Action Levels

The facility accidents, trigger events, and recommended emergency action levels are provided in Appendix A.

9.0 MAINTENANCE AND REVIEW OF THIS HAZARDS ASSESSMENT

The manager of Hanford Hazards Assessment is responsible for ensuring that this Hazards Assessment is revised and submitted as an engineering document. The review will be performed as required.

10.0 REFERENCES

Code of Federal Regulations, Title 10, Part 30.72, Schedule C.

Code of Federal Regulations, Title 40, Part 355, Appendix A.

DOE Order 5500.3A, Emergency Planning and Preparedness for Operational Emergencies, 04/30/91.

DOE Order 5820.2A, Radioactive Waste Management, 1988.

DOE, DOE-STD-0013-93, Recommended Values and Technical Bases for Airborne Release Fractions (ARFs), Airborne Release Rates (ARRs), and Respirable Fractions (RFs) at DOE Non-Reactor Nuclear Facilities, 7/93.

Emergency Predictive Information Code, Homann Associates, INC., Fremont, CA, 1993.

Napier, B. A., et al., GENII - The Hanford Environmental Radiation Dosimetry Software System, PNL-6584, Battelle Pacific Northwest Laboratory, Richland, WA.

Pines, A. G., 1987, TRUSAF Hazards Identification and Evaluation. SD-WM-SAR-025, Rev. 0., Rockwell Hanford Operations, Richland, Washington.

Scherplez, R. I., Hanford Unified Dose Utility computer code, 9/91.

WHC, 1992, Central Waste Complex Safety Analysis Report, WHC-SD-SAR-049, Rev. 0A.

WHC, 1993, 200 Areas Solid Waste Burial Ground Final Safety Analysis Report, WHC-SD-SAR-053, Draft.

WHC, June 1993, CH-Handled Transuranic Waste Drum In Situ Inspection and Vented Drum Retrieval Safety Analysis Report, WHC-SD-WM-SAR-058, Rev. 0, Westinghouse Hanford Company, Richland, WA.

WHC, 1993, Hanford Site Solid Waste Acceptance Criteria, WHC-EP-0063-4, UC-721, Westinghouse Hanford Company, Richland, Wa.

WHC, 1994, Solid Waste Burial Grounds Interim Safety Basis, WHC-SD-WM-ISB-002, Rev. 0, Westinghouse Hanford Company, Richland, WA.

APPENDIX A SOLID WASTE BURIAL GROUNDS/CENTRAL WASTE COMPLEX INDEX OF EMERGENCY CONDITIONS

No. 1A
FACILITIES EMERGENCY EVENTS
(sheet 1 of 1)

RADIATION RELEASE

Initiating Condition	Emergency Action Level	Event Classification
Vehicle crashes into Uncovered TRU drums, with drum rupture.	Vehicle crash into TRU drums verified	**ALERT LEVEL EMERGENCY**
Vehicle crashes into uncovered drums, with drum rupture.	Vehicle crash into TRU drums verified AND Container breach visible.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 1B
FACILITIES EMERGENCY EVENTS
(sheet 1 of 1)

RADIATION RELEASE

Initiating Condition	Emergency Action Level	Event Classification
A TRU Drum failure at the 224-T facility	A confirmed or indication that one TRU Drum has failed at the 224-T facility.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency class identified.

No. 1C
FACILITIES EMERGENCY EVENTS
(sheet 1 of 1)

FIRE AND/OR EXPLOSION

Initiating Condition	Emergency Action Level	Event Classification
Vehicle crashes into uncovered TRU drums with Fire.	Vehicle crash into TRU drums verified	**ALERT LEVEL EMERGENCY**
Vehicle crashes into uncovered drums with Fire.	Vehicle crash into TRU drums verified AND $\geq$1Waste drums breached.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 1D
FACILITIES EMERGENCY EVENTS
(sheet 1 of 1)

HAZARDOUS MATERIAL RELEASE

Initiating Condition	Emergency Action Level	Event Classification
Vehicle crashes into 2727-W or 272-WA, facilities storing sodium, with resulting drum rupture and fire.	Vehicle crash into sodium storage facility verified AND sodium drum breach visible	**ALERT LEVEL EMERGENCY**
Vehicle crashes into 2727-W or 272-WA, facilities storing sodium, with resulting drum rupture and fire.	Vehicle crash into sodium storage facility verified AND sodium drum breach visible AND explosion occurs.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 2A
NATURAL EMERGENCIES
(sheet 1 of 1)

SEISMIC EVENT

Initiating Condition	Emergency Action Level	Event Classification
A seismic event occurs.	A seismic event is felt by personnel, AND Confirmed by the Hanford Meteorological Station AND Disturbance at an Uncovered TRU SWBG	**ALERT LEVEL EMERGENCY**
A seismic event occurs.	A seismic event is felt by personnel, AND Confirmed by the Hanford Meteorological Station AND Disturbance at an Uncovered TRU SWBG AND Waste drum breach visible.	**SITE AREA EMERGENCY**

Note: No General Emergency classes identified.

No. 2B
NATURAL EMERGENCIES
(sheet 1 of 1)

HIGH WINDS/TORNADO

Initiating Condition	Emergency Action Level	Event Classification
High wind or tornado occurs in the 200 Areas.	Sustained high winds (>90 mph) or tornado causes damage to windows and structures at a SWBG AND Waste drum breach visible	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 3A
SECURITY CONTINGENCIES
(sheet 1 of 1)

EXPLOSIVE DEVICE

Initiating Condition	Emergency Action Level	Event Classification
Explosive device.	A confirmed explosive device is located within a SWBG or 2727-WA	**ALERT LEVEL EMERGENCY**
Explosive device.	A confirmed explosive device is located within a SWBG or 2727-WA AND Waste drum breach visible	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 3B
SECURITY CONTINGENCIES
(sheet 1 of 1)

SABOTAGE

Initiating Condition	Emergency Action Level	Event Classification
Confirmed sabotage.	Confirmed damage to a SWBG	**ALERT LEVEL EMERGENCY**
Confirmed sabotage.	Confirmed damage to a SWBG AND $\geq$1Waste drums breached.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 3C
SECURITY CONTINGENCIES
(sheet 1 of 1)

HOSTAGE SITUATION

Initiating Condition	Emergency Action Level	Event Classification
Hostage situation.	A confirmed hostage situation is occurring within a SWBG or CWC facility.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 3D
SECURITY CONTINGENCIES
(sheet 1 of 1)

ARMED INTRUDER

Initiating Condition	Emergency Action Level	Event Classification
Armed intruder(s).	A confirmed armed intruder(s) is within a SWBG or CWC facility.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 3E
SECURITY CONTINGENCIES
(sheet 1 of 1)

AIRCRAFT CRASH

Initiating Condition	Emergency Action Level	Event Classification
An aircraft crash has occurred at or near one of the burial grounds or CWC.	An aircraft crash has occurred AND has or is likely to have an adverse affect on the facility's safety, or has or is likely to release radioactive/hazardous material to the environment.	**ALERT LEVEL EMERGENCY**
An aircraft crash has occurred at or near one of the burial grounds or CWC.	An aircraft crash has occurred AND $\geq$1Waste drums breached.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.