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Waste Receiving and Processing Facility Module 1 Auditable Safety Analysis

R. J. Bottenus

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Abstract: The Waste Receiving and Processing Facility Module 1 Auditable Safety Analysis analyzes postulated accidents and determines controls to prevent the accidents or mitigate the consequences.

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EXECUTIVE SUMMARY

E.1 FACILITY BACKGROUND AND MISSION

The Waste Receiving and Processing Facility Module 1 (WRAP 1), Building 2336W, at the Hanford Site is designed to receive, examine, process, certify and ship contact-handled transuranic and low-level radioactive waste from past and present U.S. Department of Energy activities. WRAP 1 provides safer, more efficient methods of handling the waste than currently exist at the Hanford Site and contributes to achievement of as low as reasonably achievable (ALARA) goals for Hanford Site waste management.

E.2 FACILITY OVERVIEW

The Hanford Site in Southeastern Washington has been exhaustively studied and characterized in connection with siting and operation of various U.S. Department of Energy facilities. This Auditable Safety Analysis (ASA) provides a summary description of the WRAP 1 facility, focusing on significant safety-related characteristics of the location and facility operation during phase 1. The hazards associated with operation of WRAP 1 during phase 1 are comparable to any public warehouse facility that stores and moves drums except for potential radiological consequences, which are extensively analyzed in this ASA.

E.2.1 Facility Location

A prescribed site selection procedure was followed to select the safest, most cost-effective location for WRAP 1. The location selected is in the 200 West Area of the Hanford Site, in an area of other installations with functions and characteristics broadly similar to those of WRAP 1.

The 200 West Area is 213.4 m (700 ft) above mean sea level and 97.5 m (320 ft) above the level of the Columbia River. The Columbia River at its nearest point is approximately 9.7 km (6 mi) from WRAP 1. State Highway 240 passes approximately 4.3 km (2.7 mi) from the facility. This location is relatively remote from population centers and commercial activities; offers

protection from flooding; and is not historically subject to extreme impacts of natural phenomena or weather.

E.2.2 Physical and Institutional Boundaries

The WRAP 1 site lies within the boundary of the 1,450 km² (560 mi²) Hanford Site and is 12.6 km (7.8 mi) away from the nearest point of that boundary. WRAP 1 is bounded on the north by 23rd Street; on the east by Dayton Avenue; and on the remaining sides by unoccupied land. Dimensions of the WRAP 1 site are 305 m (1000 ft) in the east-west direction and 125 m (450 ft) in the north-south direction.

E.2.3 Relationships and Interfaces with Nearby Facilities

WRAP 1 is located at least 13 km (8 mi) from the nearest non-Hanford facility and 0.8 km (0.5 mi) from the nearest major Hanford facility. Following are the nearest facilities to WRAP 1, identified by function:

Industrial facilities. There are no major commercial or industrial facilities within 32 km (20 mi) of WRAP 1. The nearest natural gas transmission pipeline is about 48 km (30 mi) away. A vehicle refueling station is about 13 km (8 mi) away.

Government installations. The southeastern boundary of the U.S. Army's Yakima Firing Center, used for military maneuvers and weapons training, is located 13 km (8 mi) from WRAP 1.

Nuclear reactors. A commercial nuclear power plant operated by Washington Public Power Supply System is located 26 km (16 mi) southeast of WRAP 1.

Nonreactor nuclear facilities. The nearest nuclear facility that poses a significant potential hazard to WRAP 1 from radioactive material releases is the Plutonium Finishing Plant (PFP) complex, which is 0.8 km (0.5 mi) to the southeast.

Safety analyses indicate that none of these installations pose significant hazards to WRAP 1 personnel or operations, and no credible accidents at WRAP 1 during phase 1 operations would affect neighboring facilities. The worst case operational accident at PFP might require orderly evacuation of WRAP 1 under some meteorological conditions.

The only routine operational relationships or interfaces between WRAP 1 and other Hanford Site facilities are those associated with receiving waste from the facilities by truck. This will include scheduling waste deliveries and conveying other information by telephone and fax. In addition, WRAP 1 shares criticality protection, radiological protection, industrial safety, and hazardous waste management expertise with other waste management facilities at Hanford.

E.2.4 Facility Layout

Although three buildings are part of WRAP 1, the only building of concern to this ASA is the main building where waste is received, handled and verified.

WRAP 1 is a 4800 m³ (51300 ft³) pre-engineered metal building with a ground floor and partial second floor. The building layout accommodates seven functional areas: the secured building entry; waste shipping and receiving; nondestructive examination/nondestructive assay (NDE/NDA); waste processing; control and computers; heating/ventilation/air conditioning and electrical/mechanical; and personnel support (change rooms). All areas are covered by this ASA except the waste processing area, which will not be operational in Phase I.

E.2.5 Significant External Interfaces

Like other Hanford Site facilities, WRAP 1 relies on local providers, both on and off the Hanford Site, for utilities, medical support, fire protection, and security. While all of these interfaces are important to WRAP 1 operation, their unavailability would not affect any of the accident scenarios evaluated in this safety analysis.

E.3 FACILITY HAZARD CLASSIFICATION

The hazard categorization for WRAP 1 is based on the hazardous material available for release from accidents considered in the hazard and accident analyses presented in Chapter 3. The hazard categorization process used, as required by DOE Order 5480.23 and implemented according to DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, results in classification of WRAP 1 as a radiological facility.

E.4 SAFETY ANALYSIS OVERVIEW

The graded approach recommended in DOE-STD-3009-94 was used to identify potential hazards from WRAP 1 operations and evaluate the risks associated with operating conditions and accidents. Results indicated that WRAP 1 design, operation, and administrative procedures/controls incorporate adequate mitigative and preventive features to protect the public, workers, and the environment from unacceptable consequences of credible accident scenarios.

The Safety analysis described herein is more rigorous than is required for a radiological facility. The WRAP 1 hazard and accident analysis was originally performed for the facility and operations in totality, including future operations. Future operations will involve additional processing activities and higher radiological material inventory. Because this safety analysis information for WRAP 1 has been generated, it is included in this ASA for completeness (information relating solely to future operation is not included).

E.4.1 Facility Operations

The following operations and processes performed in WRAP 1 during Phase I are analyzed in this document:

- Shipping and receiving, which includes handling, storage, and movement of drums and boxes of waste within WRAP 1*

- *NDE/NDA of waste drums and boxes.*

Generally, the WRAP 1 process flow is as follows. Incoming waste containers are received, examined, and stored in the shipping and receiving area to await NDE/NDA. After examination and/or assay, containers that meet waste acceptance criteria are shipped directly to long-term storage or disposal facilities.

E.4.2 Hazards Associated with Facility Processes

The hazards associated with WRAP 1 operations and process are those normally associated with the physical activities involved in handling waste containers and with the risks presented by contact-handled waste, i.e., transuranic (TRU) waste, low-level radioactive waste (LLW), "dangerous" waste as defined by the Washington Administrative Code, and mixtures of these (mixed waste). The amounts of these materials present in WRAP 1 are administratively controlled to eliminate potential for many radiological accidents and consequences.

E.4.3 Main Preventive and Mitigative Features

Engineered design features of WRAP 1, administrative controls, and institutional controls provide the primary level of industrial safety protection and protection from exposure to hazardous and radioactive materials. The activity level of the waste and its configuration eliminate the potential for a criticality. Administrative procedures and controls minimize accidents and facilitate ALARA levels of exposure to all hazardous materials during normal operations, maintenance, and off-normal occurrences.

E.5 ORGANIZATIONS

WRAP 1 is owned by the U.S. Department of Energy and operated and maintained by Rust Federal Services of Hanford, the waste management subcontractor to Project Hanford Management Contractor Fluor Daniel Hanford, Inc. The WRAP 1 facility was designed and constructed by United Engineers and

Constructors with project oversight by ICF Kaiser. This ASA was developed by Rust Federal Services of Hanford, Inc.

E.6 SAFETY ANALYSIS CONCLUSIONS

The hazard and accident analysis concludes that all risks associated with phase 1 operation of WRAP 1 are well within evaluation guidelines. Unmitigated effects of releases in all bounding accidents are below safety class criteria, eliminating the need for safety-class designation of any structures, systems or components. The WRAP 1, Phase I, operations include mostly industrial-type hazards that are generally accepted by the public. These industrial hazards and the small radiological inventory that may be present are routinely managed by the workforce.

E.7 REFERENCES

DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, U.S. Department of Energy, Washington, D.C., 1992.

DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, U.S. Department of Energy, Washington, D.C., 1994.

DOE Order 5480.23, Nuclear Safety Analysis Reports, paragraphs 4.f.(3)(a), U.S. Department of Energy, Washington, D.C., 1992.

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**WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
AUDITABLE SAFETY ANALYSIS
Revision 0**

**CHAPTER 1.0
Site Characteristics**

February 1997

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LIST OF TERMS

ASA	Auditable Safety Analysis
DBE	design basis earthquake
DOE-RL	U.S. Department of Energy, Richland Operations Office
EIS	Environmental Impact Statement
HEPA	high efficiency particulate air (filter)
HMS	Hanford Meteorological Station
NRC	U.S. Nuclear Regulatory Commission
PFP	Plutonium Finishing Plant
SAR	safety analysis report
SSC	structures, systems, and components
Supply System	Washington Public Power Supply System
WNP	Washington Nuclear Plant
WRAP 1	Waste Receiving and Processing Facility Module 1

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1.0 SITE CHARACTERISTICS

1.1 INTRODUCTION

Waste Receiving and Processing Facility Module 1 (WRAP 1) is a waste management facility located at the DOE Hanford Site. The Hanford Site was selected in 1943 by the U.S. Army Corps of Engineers for the production of nuclear weapons material. Current activities at Hanford focus on environmental restoration, waste management, and technology research. WRAP 1 will receive, process, verify and ship containers of waste resulting from these activities.

This chapter summarizes information about:

- The location of WRAP 1 and its proximity to other Hanford Site facilities and to the public
- Environmental characteristics that influence the safety of the operations planned for WRAP 1
- Population sheltering, location, and density, as well as other aspects that affect the WRAP 1 area
- Onsite workers and site boundaries.

1.2 SITE DESCRIPTION

WRAP 1 is located in the 200 West Area (Figure 1-1). The location was chosen based on the results of a site selection process described in WHC-SD-W026-SE-001, *The Hanford Central Waste Complex Site Evaluation Report*.

The following paragraphs describe the WRAP 1 site and facility area boundaries and present demographic information for the area based on 1990 census data. All figures referenced are from WHC-SD-W112-RPT-001.

1.2.1 Geography

The Hanford Site is a 1,450-km² (560-mi²) tract of semiarid land located in southeastern Washington State (Figure 1-2). The Site, which lies primarily within Grant, Benton, and Franklin Counties, is bounded on the north by the Saddle Mountains, on the east by the Columbia River, on the south by the Yakima River, and on the west by the Rattlesnake Hills.

Facilities and activities at the Hanford Site are consolidated in operating areas that occupy approximately 6% of the total Site area (Figure 1-3). WRAP 1 is located within the 200 West Area, approximately 70 m (230 ft) south of 23rd Street and 180 m (590 ft) west of Dayton Avenue (Figure 1-1). The 200 West Area, 213 m (700 ft) above mean sea level, is 97 m (320 ft) above the level of the Columbia River, which at its nearest point is approximately 9.7 km (6 mi) from the WRAP 1 facility. Highway 240, which runs through the Site, passes approximately 4.3 km (2.7 mi) from WRAP 1.

The distances from WRAP 1 to the Hanford Site boundary for 16 compass sectors is presented in Table 1-1. Distances range from a minimum of 12.6 km (7.8 mi) to a maximum of 33.0 km (20.5 mi), the average being 22.0 km (13.7 mi). Although the public may travel on the Columbia River and Highway 240, both of which pass WRAP 1 within the Site boundary, such travel could be controlled.

1.2.2 Demography

Population size and distribution are important criteria for assessing the magnitude of risk to the public from radiological exposure, whether from accidents or normal operations. This section summarizes data on current population, projected population, and transient or seasonal population. A more detailed demographic description is contained in WHC-SD-W112-RPT-001.

1.2.2.1 Current Population. Census data for the 1990 population within a 80-km (50-mi) radius of the Hanford Meteorological Station (HMS), located approximately 4.8 km (3 mi) east of WRAP 1, are shown in Figure 1-4. Communities nearest WRAP 1 include Richland, Kennewick, Pasco, West Richland, Benton City, Prosser, Sunnyside, Grandview, and Mesa. The 1990 census data for these communities are presented in Table 1-2.

Onsite personnel are industrial employees working in areas predominately under DOE access control. They are employed by such organizations as the DOE-RL, DOE contractors, or the Washington Public Power Supply System (Supply System). A recent survey of the employee population located within the Hanford Site boundaries shows approximately 9,000 people.

1.3 ENVIRONMENTAL DESCRIPTION

This section summarizes the meteorological, hydrological, and geological characteristics of the area where WRAP 1 is located.

1.3.1 Meteorology

The meteorological measurement program at the Hanford Site is described in WHC-SD-W112-RPT-001. The following information is taken from that report.

1.3.1.1 Regional Climatology. The regional climate is considered to be semiarid. The summers are warm and dry, and the winters are cool with occasional precipitation. The Cascade mountain range to the west and the Rocky Mountains to the east and north influence the climate of the region. The relatively low annual average rainfall (16 cm [6.3 in.]) at the Hanford Site is caused by the rain shadow created by the Cascade range.

1.3.1.2 Local Meteorology. Information about local winds and diffusion estimates are based on measurements at HMS, about 4.8 km (3 mi) east of WRAP 1. Meteorological parameters have been measured in the area of the Hanford Site since 1912 and are summarized below from PNLL-11107-UC-603, *Climatological Data Summary, 1995 with Historical Data*. In December 1944, the

HMS and its 125-m (410-ft) instrumented tower became operational. In 1982, the instruments on the HMS tower were replaced with equipment that met applicable U.S. Nuclear Regulatory commission (NRC) requirements. Temperature, relative humidity, precipitation, atmospheric pressure, solar radiation, cloud cover, and visibility are measured or observed at regular intervals at the HMS.

Wind data are also collected at the HMS. In addition to surface wind (2.1-m [7-ft] level), wind data are collected at the 9-, 15.2-, 30.5-, 61-, 91.4-, and 122-m (30-, 50-, 100-, 200-, 300-, and 400-ft) levels of a 125-m (410-ft) tower at the station. More than 20 telemetry stations distributed on and around the Hanford Site supplement the surface (9.1-m [30-ft] level) wind data for defining wind patterns. The prevailing near-surface wind at the HMS has a strong northwest and west-northwest component throughout the year. June has the highest average monthly wind speed, 17.2 km/h (10.7 mi/h). In December, average wind speeds fall to 9.5 km/h (5.9 mi/h).

The mean surface temperature average is 11.7 °C (53 °F) at the HMS. July is the warmest month, with temperatures averaging 24.4 °C (76 °F). The average daily minimum and maximum temperatures in July are 16.1 °C (61 °F) and 33.3 °C (92 °F), respectively. January is the coldest month of the year with temperatures averaging -2.8 °C (30.5 °F). The average daily minimum and maximum temperatures in January are -4.4 °C (24 °F) and 3.5 °C (38.4 °F), respectively.

The mean annual precipitation at the HMS is 16 cm (6.3 in.). Historical data indicate that over a period of roughly 80 years, the annual precipitation has varied from a low of 7.6 cm (3.0 in.) to a high of 31.2 cm (12.3 in.). Precipitation in excess of 1.3 cm (0.5 in.) during a 24-hour period occurs on an average of twice a year. The Hanford Site design basis storm, expected to occur at least once in 25 years, is considered to produce 3.96 cm (1.56 in.) of precipitation in a 24-hour period. The maximum precipitation for a 24-hour period expected to occur once in 1,000 years, is 6.8 cm (2.68 in.). The maximum historical precipitation at the HMS in 24 hours is 4.85 cm (1.91 in.).

July is the driest month, with an average of 11 hours of precipitation producing 0.56 cm (0.22 in.) of water. January is the wettest month with an average of 100 hours of precipitation producing 2.5 cm (1.0 in.) of water. The average annual snowfall is 38.1 cm (15.0 in.). Total annual snowfall has varied from a low of 0.79 cm (0.31 in.) to a high of more than 142.5 cm (56.1 in.). The largest recorded depth of snow on the ground at any one time was 62.2 cm (24.5 in.) in February 1916.

1.3.2 Hydrology

A comprehensive and detailed analysis of the surface and subsurface hydrology of the Hanford Site is presented in WHC-SD-W112-RPT-001. Major characteristics relevant to the WRAP 1 location are summarized in the following paragraphs.

1.3.2.1 Surface Hydrology. The Hanford Site is situated within the Columbia River drainage basin. Two major rivers within the drainage basin, the Columbia and the Yakima, border the Hanford Site. Columbia River flow near

the Hanford Site has been measured since 1917. These data show an average discharge of 3,400 m³/s (120,000 ft³/s). Data gathered from the mouth of the Yakima River show an average discharge of 99 m³/s (3,500 ft³/s).

The flow of the Columbia River adjacent to the Hanford Site is regulated by operation of the Priest Rapids Dam. The maximum historical flood recorded on the unregulated Columbia River occurred in 1894. The peak discharge at the Hanford Site was 21,011 m³/s (742,000 ft³/s). Under regulated conditions, the peak discharge below the Priest Rapids Dam for the 100-year flood is calculated to be 12,459 m³/s (440,000 ft³/s).

Dam failures provide the most severe Columbia River flooding potential in terms of downstream damage. The worst-case hypothetical flood of the Columbia River results from an assumed 50% breach of the Grand Coulee Dam. Calculations indicate such a breach would create a maximum flow of 226,536 m³/s (8,000,000 ft³/s) at the Hanford Site according to RL0-76-4, *Evaluation of Impact of Potential Flooding Criteria on the Hanford Project*. The resultant flood plain is shown in Figure 1-5. The 226,536 m³/s (8,000,000 ft³/s) maximum flow corresponds to a flood elevation of 148 m (486 ft) above mean sea level. Because of its location 213 m (700 ft) above mean sea level, WRAP 1 it would not be affected by such a flood.

The most severe flood of the Yakima River was recorded in 1933 and had a peak discharge of 1,900 m³/s (67,000 ft³/s). Floods of this size are expected about once every 170 years. Figure 1-6 shows the 100-year flood plain for the Yakima River and indicates that flood waters reach only the very southern portions of the Hanford Site.

1.3.2.2 Subsurface Hydrology. The subsurface geohydrology system at the Hanford Site consists of unconfined and confined aquifers that flow down-gradient to discharge areas along the Columbia River. The unconfined aquifer consists of saturated sands and gravels lying between the water table and the first impermeable bed below the water table. The confined aquifer consists of sedimentary interbeds or interflow zones that occur between dense basalt flows.

The water table (representing the upper limit of the unconfined aquifer) in the vicinity of WRAP 1 is 71 m (235 ft) below surface level. Lying between the surface and the water table is the unsaturated, or vadose, zone. Moisture movement and contaminant transport within the unsaturated zone has been modeled by as described in WHC-EP-0645, *Performance Assessment for the Disposal of Low-Level Waste in the 200 West Area Burial Grounds*. The results of this modeling effort indicate that the discharge rate would be 0.5 cm/yr to 5 cm/yr. Given the proximity of WRAP 1 to the 200 West Area Burial Grounds, these results are judged applicable to WRAP 1. While transport times can be calculated, the potential for contaminants from WRAP 1 to reach the groundwater does not exist because there are no routine liquid effluent releases (with the exception of sanitary sewage), and liquid spills, should they occur, would be limited in volume and cleanup would be required in accordance with state and federal regulations.

1.3.3 Geology

A detailed assessment of the geological seismology of the Hanford Site is provided in WHC-SD-W112-RPT-001. The following summary description is taken from this source.

1.3.3.1 Geological Characteristics. The Hanford Site lies within the Columbia Intermontane Province, which is bordered on the north and east by the Rocky Mountains, on the west by the Cascade Range, and on the south by the Basin and Range Province (Figure 1-7). The dominant geological characteristics of the Columbia Intermontane Province result from flood, basalt volcanism, and deformation processes.

The Columbia Plateau is the portion of the Columbia Intermontane Province that is covered or partly covered by the Columbia River Basalt Group. Large-scale tectonic deformation within the Columbia Plateau resulted in several basins. The Hanford Site is located on one of these, the Pasco Basin, which is bounded by anticlinal structures on the north, west, and south and a broad monoclinic structure on the east. The Pasco Basin is composed of thick layers of basalt interspersed with layers of sedimentary material. Above the uppermost basalt layer of the Columbia River Basalt Group lies the unconsolidated sand and gravel of the Ringold Formation. The Ringold Formation was deposited some 8.5 to 3.9 million years ago and was primarily the result of fluvial processes. The sediments forming the Hanford Formation were deposited by floods some 15,300 to 12,700 years ago.

1.3.3.2 Seismic Hazards. The seismic hazard curves for non-reactor facilities on the Hanford Site are based on a probabilistic seismic hazard assessment completed for the 100-N, 200 East, 200 West, and 300 and 400 Areas and documented in WHC-MR-0023, *Evaluation of Seismic Hazard for Non-Reactor Facilities, Hanford Reservation, Hanford Washington*. The methodology and database used are generally the same as those used in the *Final Safety Analysis Report, WPPSS Nuclear Project No. 2, Amendment 18*. A revised earthquake recurrence rate was used, and the ground motions included contributions from magnitude 5.0 and greater earthquakes. Earthquakes of magnitude <5.0 contain a narrow, generally high, frequency band and are of short duration. Because of the short duration, they are not damaging to engineered structures and are not included in the hazard assessment. The potential earthquake sources considered in the seismic hazard study are shown in Figure 1-8.

Seismic hazards for the various locations on the Hanford Site are illustrated in Figure 1-9. Seismic design criteria for Hanford Site facilities are specified in SDC 4.1, *Hanford Plant Standards, Standard Architectural-Civil Design Criteria Design Load for Facilities*, and UCRL-15910. For the high-hazard facility use category, the design basis earthquake (DBE) is specified in the DOE seismic guidelines as the maximum horizontal ground surface acceleration with an annual probability of exceedance of 2×10^{-4} (return period of 5,000 years). This corresponds to a peak horizontal acceleration of 0.20 g. For the moderate and low-hazard facility use categories, the DOE seismic guidelines specify the DBE loading as the maximum horizontal ground surface acceleration with an annual probability of exceedance of 1×10^{-3} (return period of 1,000 years). This corresponds to

a peak horizontal acceleration of 0.12 g for the 200 West Area. The WRAP 1 facility is designed to withstand 0.12 g horizontal acceleration.

1.4 NATURAL PHENOMENA THREATS

This section identifies the natural phenomena with potential for adverse impacts on the safe operation of WRAP 1. For each natural phenomenon, information is presented on frequency of occurrence, magnitude, and WRAP 1 design considerations to reduce impacts. The natural phenomena presented in this section are severe weather, floods, earthquakes, snow, rain, volcanic activity, and range fires.

1.4.1 Severe Weather

Severe weather phenomena include dust storms, thunderstorms, lightning strikes, and tornados.

1.4.1.1 Dust Storms. The most frequent severe weather phenomenon at the Hanford Site and the one with the greatest impact on normal operations is the dust storm. Dust storms occur when winds greater than 29 km/h (18 mi/h) resuspend dust from various sources into the air. The HMS reports that dust storms occur at the Hanford Site with an average frequency of eight times a year. During these times, visibility is reduced to 9.7 km (6.2 mi) or less. Restricted visibility, blowing dust, and the potential to clog high efficiency particulate air (HEPA) and other filters are the main hazards associated with these storms.

Extreme winds and the associated wind pressures on WRAP 1 constitute the major severe weather hazard to the facility. The maximum recorded peak wind gust at 15.2 m (50 ft) above ground level is 129 km/h (80 mi/h), which occurred in January 1972. The HMS is about 6.4 km (4 mi) east of the WRAP 1 site.

1.4.1.2 Thunderstorms. The HMS reports the average year has 10 thunderstorm days. Thunderstorms are considered severe weather when accompanied with wind gusts greater than 90 km/h (56 mi/h) and/or hail with diameter equal to or greater than 1.9 cm (0.75 in.). Although very rare, severe weather thunderstorms have occurred at the Hanford Site. Other than the impact of rain, high wind speeds have the potential to adversely impact WRAP 1. As discussed previously, the design of WRAP 1 for normal wind load is based on a minimum of 113 km/h (70 mi/h) wind speed, hence the effect of thunderstorms is not expected to hinder the safe operation of WRAP 1.

1.4.1.3 Lightning Strikes. Of the lightning discharges reported at the Hanford Site, only 20% have been cloud-to-ground discharges the remainder being cloud-to-cloud discharges. For WRAP 1, lightning protection systems are designed and installed in accordance with National Fire Protection Association 780 recommendations and requirements. Module trim, structure, siding, etc., made of conducting materials are continuous and are bonded to the facility ground grid. Therefore, the only impact for lightning strikes considered to affect WRAP 1 is resulting range fires during the summer months. Range fires are discussed later in this section.

1.4.1.4 Tornados. Tornados are very rare in the vicinity of the Hanford Site. The DOE no longer requires design criteria to be established for tornados for nonreactor facilities at the Hanford Site.

1.4.2 Floods

Three scenarios for possible flooding on the Hanford Site are dam failure, river blockage, and intense precipitation.

The maximum postulated flood scenario results from a hypothetical 50% breach of Grand Coulee Dam on the Columbia River, upstream from the Hanford Site. This scenario is calculated to result in an inundation of the site with flood waters to an elevation of about 140 m (460 ft) above mean sea level. Because the WRAP 1 site is at an elevation of about 213 m (700 ft) above mean sea level, it would remain about 73 m (240 ft) above flood level for this scenario. The potential for massive landslides along the Columbia River is judged to be bounded by the 50% breach of Grand Coulee Dam case.

The location of WRAP 1 near the top of the 200 Area plateau, in addition to the grading and drainage features that are provided for the facility, ensures that precipitation, even from a downpour as severe as 30 cm (11 in.) in 24 hours, would infiltrate the ground or drain off toward the Columbia River without significant flooding. Controls preclude adverse impacts from less severe local precipitation run-on and run-off. WRAP 1 is not sited in a wetlands or coastal high-hazard area.

1.4.3 Earthquakes

The Columbia Plateau has experienced seismic activities that have been relatively shallow in nature and of low to moderate intensities. A seismic network installed on the Hanford Site in 1969 shows that the majority of seismic events have magnitudes of <3.5 and occur at depths of <4.8 km (3 mi). These are considered to be shallow micro-earthquakes and can consist of as many as 100 events lasting a few days to several months.

The largest known earthquake in the region occurred in 1936 near Milton-Freewater, Oregon. A subsequent study suggests that the epicenter was closer to Waitsburg, Washington, which is 137 km (85 mi) east of WRAP 1. The estimated surface-wave magnitude of this quake was 5.7 to 5.8. Other events occurred near Umatilla, Oregon, in 1893; near the Saddle Mountains in 1918; near Corfu, Washington, in 1973; and near College Place, Washington, in 1979. Each of these events measured <4.5 in intensity.

A seismic event is the most safety-significant natural phenomenon because it has the greatest potential for resulting in common-cause failures. For most facilities, the primary seismic hazard is earthquake ground motion. Because earthquake ground motion is unavoidable, it is a potential hazard to the WRAP 1 facility. Other potentially adverse impacts of earthquakes stem from fault displacement, liquefaction, and seismic-induced slope instability and ground settlement; however, ground conditions favorable to these hazards are not present at the WRAP 1 facility.

The seismic design of WRAP 1 is governed by Hanford Plant Standards (DOE-RL 1993). The UCRL-15910 seismic hazard evaluation process was used as input to the development of DOE-RL (1993), and UCRL-15910 supplements the requirements of DOE-RL (1993). The design is consistent with the requirements of DOE Order 6430.1A, *General Design Criteria*, Division 1, Section 0111-2.7. The guidelines presented in UCRL-15910 control the level of conservatism introduced in the seismic design process to that appropriate for the DOE facility. The guidelines specify use of probabilistic methods, expressed as the annual probability of exceedance of some level of facility damage from an earthquake, to establish performance goals.

The probability of exceeding specified earthquake ground acceleration at the WRAP 1 site is determined by a seismic exposure assessment that considers known potential earthquake generators within the proper zone of influence. The result of the assessment is a seismic hazard curve that correlates the peak free-fixed ground acceleration at WRAP 1 with the annual probability of exceedance.

1.4.4 Snow, Rain, and Volcanic Activity

Aboveground structures, systems, and components (SSC) of WRAP 1 are designed to withstand snow loading in accordance with Section 7 of American National Standards Institute 158.1-1982, *Structures*, using the following criteria:

- Ground snow load - 73 kg/m^2 (17 lb/ft^2)
- Minimum roof load - 98 kg/m^2 (22 lb/ft^2).

WRAP 1 is located in a semiarid region, hence the rain loading is bounded by the snow loading.

Volcanic ash loading is applicable only to the design of safety-class SSC in accordance with DOE-RL (1993). There are no safety-class or safety significant SSC items in WRAP 1.

1.4.5 Range Fires

When the vegetation becomes extremely dry in the summer, range or grass fires are possible occurrences at the Hanford Site. Vegetation is removed from facility sites and fire breaks are established along roadways as a precaution. Nevertheless, range fires can burn out of control if they are driven by strong winds.

The major factors that protect WRAP 1 from hazards associated with range fire are (1) grading, maintenance, and continuous housekeeping on the WRAP 1 site to minimize combustible material; (2) fire breaks by the roadways in the vicinity of WRAP 1; and (3) location of WRAP 1 close to the 200 Area fire station (the fire station can respond to WRAP 1 calls within 10 minutes). The Hanford Fire Department has firefighting equipment on hand to deal with range fires and has experience protecting Hanford Site facilities from fire damage. For these reasons, potential range fires are considered to be possible, but adverse impacts on WRAP 1 in excess of the bounding accident scenarios are not

anticipated. The most severe range fire documented in the vicinity of the Hanford Site occurred in 1984. The fire covered a considerable area and threatened some Hanford Site facilities. The Hanford Fire Department was on standby to protect the facilities and there was no significant damage, project economic loss, or programmatic impact.

1.4.6 Other Natural Phenomena

Hazards from other natural phenomena (e.g., surge and seiche flooding, tsunami flooding, and ice flooding) were considered not credible or were determined to have no potential for impact on WRAP 1.

1.5 NEARBY FACILITIES

1.5.1 Industrial Facilities

There are no industrial refineries, oil storage facilities, or other major commercial facilities within 32 km (20 mi) of WRAP 1. A vehicle refueling station is located in the 200 East area approximately 13 km (8 mi) from WRAP 1. The nearest natural gas transmission pipeline is about 48 km (30 mi) away. The distance of these facilities from WRAP 1 makes the hazard from explosions or fire at these installations almost nonexistent.

1.5.2 Nonreactor Nuclear Facilities

The SARs for nonreactor nuclear facilities located in the 200 West Area (such as the Central Waste Complex) and the 200 East Area were reviewed to identify those facilities with potential for impacts to WRAP 1 operations. The accident analyses in each SAR were reviewed to identify hazards such as radiological dose from direct radiation, airborne releases of radioactive or nonradioactive hazardous materials, and accident-generated missiles or blast effects. Based on this review, there are no credible accidents at nearby facilities that would result in physical damage to WRAP 1. An NRC-licensed commercial low-level waste burial ground (operated by US Ecology) is located 7.3 km (4.5 mi) south-southeast of WRAP 1, and poses no hazard to WRAP 1.

The PFP is the nearest nonreactor nuclear facility that poses a significant potential hazard to WRAP 1 from radioactive material releases. If an accident occurred, an immediate but orderly evacuation (including the safe shutdown of WRAP 1 systems) could be required to maintain exposures as low as reasonably achievable. There are no significant health, safety, or environmental considerations that would require personnel to remain at WRAP 1.

1.5.3 Commercial Nuclear Power Reactors

There is one operating commercial nuclear power reactor on the Hanford Site. WNP-2, a boiling water reactor steam supply system with a design power level of 3,323 MW. It is located 26 km (16 mi) southeast of WRAP 1. Analyses

of hypothetical worst-case accidents at this reactors show no significant risk to operations personnel at WRAP 1.

1.5.4 Military Facilities

The southeastern boundary of the U.S. Army Yakima Firing Center, used for military maneuvers and weapons training, is located 12.9 km (8 mi) from WRAP 1. Live firing of weapons with explosive warheads is directed into a centrally located impact area within the center boundary. Therefore, the U.S. Army contends that no safety threat exists for people living adjacent to the Yakima Firing Center or for those living on the east bank of the Columbia River (DOA 1989). Accordingly, the firing center poses no threat to WRAP 1 operations or personnel.

DOE-RL has requested from the U.S. Army additional information regarding potential risk to the Hanford Site associated with planned increases in training activities at the Yakima Firing Center. The DOE-RL is also interested in determining the extent to which proposed expansion of Yakima Firing Center boundaries could impact the safety of Hanford Site personnel and facilities.

1.6 VALIDITY OF EXISTING ENVIRONMENTAL ANALYSES

Two existing environmental analyses apply to WRAP 1. DOE/EIS-0113, *Final Environmental Impact Statement (EIS) - Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes*, specifically considered WRAP-1, although the scope of WRAP 1 considered in this ASA is reduced from that considered in the EIS. However, there are no significant discrepancies between the ASA and the EIS nor an indication that revisions to the EIS are needed. A second environmental analysis, DOE/EIS-0200-0, *Draft Waste Management Programmatic Environmental Impact Statement For Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, considers the treatment, storage, and disposal of radioactive and hazardous waste at DOE Sites in general. There are no significant discrepancies between this ASA and the Draft Programmatic EIS, and no indication that revisions to the Draft Programmatic EIS are needed.

1.7 REFERENCES

- ANSI 158.1-1982, *Structures*, American National Standards Institute, New York, New York.
- DOA, 1989, *Yakima Firing Center Proposed Land Acquisition*, Department of the Army, I Corps and Ft. Lewis, Washington, 1989.
- DOE/EIS-0113, *Final Environmental Impact Statement (EIS) - Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes*, U.S. Department of Energy, Washington, D.C., 1987.

DOE/EIS-0200-0, *Draft Waste Management Programmatic Environmental Impact Statement For Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, U.S. Department of Energy, Washington, D.C., 1995.

DOE Order 6430.1A, *General Design Criteria*, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1993, *Hanford Plant Standards, Standard Architectural-Civil Design Criteria Design Load for Facilities*, SDC 4.1, Rev. 12, U.S. Department of Energy Richland Field Office, Richland, Washington.

Final Safety Analysis Report, WPPSS Nuclear Project No. 2, Amendment 18, Washington Public Power Supply System, Richland, Washington, 1991.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, National Fire Protection Association, Quincy, Massachusetts, 1992.

Nuclear Projects Numbers 1 and 4, Emergency Preparedness Plan, Rev. 7, Washington Public Power Supply System, Richland, Washington, 1988.

PNNL-11107-UC-603, *Climatological Data Summary, 1995 with Historical Data*, D. J. Hoytink and K. W. Burk, Pacific Northwest National Laboratory, Richland, Washington, 1996.

RL0-76-4, *Evaluation of Impact of Potential Flooding Criteria on the Hanford Project*, U.S. Energy Research and Development Administration - Richland Operations Office, Richland, Washington, 1976.

UCRL-15910, *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards*, Lawrence Livermore National Laboratory, Livermore, California, 1990.

WHC-EP-0645, *Performance Assessment for the Disposal of Low-Level Waste in the 200 West Area Burial Grounds*, Westinghouse Hanford Company, Richland, Washington, 1995.

WHC-MR-0023, *Evaluation of Seismic Hazard for Non-Reactor Facilities, Hanford Reservation, Hanford Washington*, prepared for Westinghouse Hanford Company by Woodward-Clyde Consultants, Oakland, California, 1989.

WHC-SD-W026-SE-001, *The Hanford Central Waste Complex Site Evaluation Report*, Westinghouse Hanford Company, Richland, Washington, 1988.

WHC-SD-W112-RPT-001, *Solid Waste Operations Complex Site Characteristics Description*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1993.

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Figure 3-1. Location of Waste Receiving and Processing Facility in the Hanford Site 200 West Area.

Figure 1-2. The Hanford Site in Washington State
(from WHC-SD-W112-RPT-001).

Figure 1-3. Location of Waste Receiving and Processing Facility in the 200 West Area of the Hanford Site (from WHC-SD-W112-RP1-001).

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H2 WRAP

Figure 1-4. 1990 Residential Population Within an 50-mi (80-km)
Radius of the Hanford Meteorological Station
(from WMC-SD-W112-RP1-001).

Ring km (mi)	0-16 (0-10)	16-32 (10-20)	32-48 (20-30)	48-64 (30-40)	64-80 (40-50)	Total 0-80 (0-50)
Population	0	15,519	98,748	115,061	146,531	375,860

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Figure 1-5. Flooded Area Expected to Result from a 50% Breach of Grand Coulee Dam (from WNC-SD-W112-RPT-001).

Figure 1-6. Expected Flooded Area from a 100-Year Flood of the Yakima River in the Vicinity of the Hanford Site (from WHC-SD-W112-RPT-001).

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Figure 1-7. Divisions of the Columbia Intermontane Province and Adjacent Provinces (from WHC-SD-W112-RPT-001).

Figure 1-8. Map of Potential Seismic Sources in and Around the Hanford Site (from WHC-SD-W112-RPT-001).

Figure 1-9. Hanford Site Seismic Hazard Curves
(from WHC-SD-W112-RPT-001).

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Table 1-1. Distances from Waste Receiving and Processing Facility to the Hanford Site Boundary.

Direction	Distance	
	Miles	Kilometers
N	14.1	22.7
NNE	19.4	31.3
NE	19.3	31.0
ENE	17.2	27.7
E	18.3	29.4
ESE	20.5	33.0
SE	16.7	26.8
SSE	14.4	23.2
S	9.8	15.8
SSW	10.0	16.1
SW	11.4	18.3
WSW	8.6	13.8
W	7.8	12.6
WNW	9.9	15.9
NW	10.4	16.7
NNW	11.1	17.8

Table 1-2. 1990 Census Data for Communities Nearest the Waste Receiving and Processing Facility.

Municipality	Population
Richland	32,315
Kennewick	42,155
Pasco	20,377
West Richland	3,962
Benton City	1,806
Prosser	4,476
Sunnyside	11,238
Grandview	7,169
Mesa	252

WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
AUDITABLE SAFETY ANALYSIS
Revision 0

CHAPTER 2.0
Facility Description

February 1997

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LIST OF TERMS

ACI	American Concrete Institute
AGV	automated guided vehicle
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ASA	Auditable Safety Analysis
ASME	American Society of Mechanical Engineers
AS/RS	Automated Stacker/Retrieval System
ASTM	American Society for Testing and Material
CIN	container identification number
DMS	Data Management System
GEA	gamma energy assay
HEPA	high-efficiency particulate air
HVAC	heating, ventilating, and air conditioning
I&C	instrumentation and control
LLW	low-level waste
NACE	National Association of Corrosion Engineers
NDA	nondestructive assay
NDE	nondestructive examination
OSHA	Occupational Safety and Health Administration
PAN	passive/active neutron
PCS	Plant Control System
PIN	packaging identification number
S/RID	standards/requirements identification document
SSC	structures, systems, and components
TRU	transuranic
TRUPACT	transuranic package transporter
UBC	Uniform Building Code
WAC	Washington Administrative Code

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2.0 FACILITY DESCRIPTION

2.1 INTRODUCTION

This chapter describes the WRAP 1 facility, systems, features, equipment, and processes in sufficient detail to support the assumptions used in the Hazard and Accident Analysis (Chapter 3.0) for Phase I operations. Specifically, this chapter includes a brief overview of the mission of WRAP 1, including its inputs and outputs, and descriptions of the following:

- WRAP 1 structure and design basis
- WRAP 1 process systems and their constituent components, instrumentation, controls, and operating parameters
- WRAP 1 safety support systems
- Utilities
- Auxiliary systems and support facilities.

In keeping with the application of a graded approach, the level of detail provided in this chapter is appropriate for the preparation of a safety analysis report for the Phase I operation of WRAP 1.

2.2 REQUIREMENTS

The information contained in this chapter satisfies the requirements of DOE Order 5481.1B, *Safety Analysis and Review System*.

The Hazard and Accident Analysis (Chapter 3.0) takes no credit for accident mitigation by any structure or system in WRAP 1.

WRAP 1 is designed to comply with all applicable codes and standards including DOE Orders, control manuals, and state and federal regulations. Applicable codes and standards in effect at the time of WRAP 1 design are identified in Appendix 2A. Acceptance and operation of WRAP 1 are based on requirements delineated in WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Document (S/RID)*, published in 1995. Structural and mechanical safety criteria used to establish design loads and acceptance values were derived from SDC 4.1, *Standard Architectural-Civil Design Criteria, Design Loads for Facilities*.

2.3 FACILITY OVERVIEW

This section includes a brief overview of the uses, configuration, and processes of WRAP 1.

2.3.1 Near Term Uses of WRAP 1

During Phase I operation, WRAP 1 will receive containers of contact-handled waste (surface radioactivity <200 mrem/h) from Hanford Site generators, the Hanford Central Waste Complex, stored waste retrieval operations, and offsite generators. WRAP 1 will examine, assay, process, and certify the waste containers for shipment to an appropriate treatment, storage, or disposal facility. Waste drums determined by nondestructive evaluation/nondestructive assay (NDE/NDA) to meet appropriate disposal criteria will be certified and shipped to a disposal facility.

2.3.2 Facility Configuration

WRAP 1 consists of three structures housing process and process support systems and various support and utility systems. The main facility consists of the following areas:

- Waste shipping and receiving
- NDE/NDA
- Waste processing (not operational during Phase I and not covered in this Auditable Safety Analysis [ASA])
- Control and computer
- Electrical and mechanical equipment, including heating, ventilating, and air conditioning (HVAC)
- Personnel support.

Adjacent buildings house maintenance and administrative support functions. Figure 2-1 shows the WRAP 1 site plan and its location on the Hanford Site. A more detailed description of the WRAP 1 facility is contained in Section 2.4.

2.3.3 General Process Description

WRAP 1 processes low-level waste (LLW) and transuranic (TRU) waste that can be handled without radiation shielding (i.e., contact-handled wastes with radioactive dose rates <200 mrem/h at any point on the waste container).

New 208-L (55-gal) drums and retrieved drums in 322-L (85-gal) overpacks are, typically, received, transferred to a containment pallet and stored. Before entering the NDE/NDA area, each drum is removed from the pallet and weighed and its bar code is read. The weight label is confirmed or corrected.

Information about the received waste containers is entered into the WRAP 1 Data Management System (DMS). Weight information is used to calculate specific TRU activity and to identify containers that exceed weight limits established in the waste acceptance criteria.

Waste drums received at WRAP 1 are typically subjected to NDE/NDA to verify compliance with waste certification requirements and (in the case of drums) determine the appropriate method for processing any restricted waste present. For example, LLW for verification purposes may require only NDE.

If an incoming waste container has completed NDE/NDA assessment and is certified for disposal, it is returned to the shipping and receiving area and prepared for shipment.

2.4 FACILITY STRUCTURE

This section provides an overview of the WRAP 1 buildings and structures. It is intended to supply information to support an overall understanding of the facility layout, structural specifications, and general arrangements relevant to accident analysis.

2.4.1 Facility Layout and Description

The main WRAP 1 building where all waste handling and processing occurs is a pre-engineered metal building with a ground floor and a partial second floor. The structure is a beam and column type typically supplied by pre-engineered metal building manufacturers. The building houses all waste processing and process support systems and various services and utility systems. The facility design provides access control for areas containing hazardous materials and operations as well as segregation of administrative and other support personnel from the process areas.

The WRAP 1 structure contains about 4,766 m² (51,300 ft²) of total floor space. Figure 2-2 depicts the building exterior elevations and floor plans. The following subsections describe each area in the building that will be operational during Phase I.

2.4.1.1 Entrance Control Area. The entrance control area is located at the front door of the building. The area includes offices, a conference room and a dining area. Facility personnel control access beyond the entrance control area.

2.4.1.2 Personnel Support Area. The personnel support area consists of storage rooms and change room facilities located off the main traffic path to the operational areas. Change rooms are sized to accommodate 60 operations personnel per shift.

2.4.1.3 Shipping and Receiving Area. The shipping and receiving area occupies the southeast corner of the facility and is entered from the main traffic corridor. The finished floor elevation of the area is ~121.9 cm (48 in.) above the adjacent exterior grade to accommodate two dock-height waste unloading stations and a depressed drive-through bay for transuranic package transporter- (TRUPACT) II container loading. Trucks back up to the two dock-height waste unloading stations to load and unload waste containers. An automated stacker/retrieval system (AS/RS) for drum storage is located in the shipping and receiving area.

In the shipping and receiving area, personnel use fork trucks, drum handling equipment, conveyers, an overhead bridge crane, and jib cranes to unload and move waste drums and boxes. An automated guided vehicle (AGV) is generally used to transport drums between the shipping and receiving area and the NDE/NDA area. Processed LLW containers are loaded onto trucks at the loading dock for storage or burial at the Hanford Site.

2.4.1.4 NDE/NDA Area. The NDE/NDA area is located in the southwest corner of the facility and is typically entered from the shipping and receiving area. In addition to the NDE and NDA stations, the area is equipped for the storage of up to 12 drums going to or coming from the process area or shipping and receiving area.

Waste drums are examined and assayed in the NDE/NDA area. Drums are transported by the AGV or manually from the shipping and receiving area to the NDE/NDA equipment. The NDE/NDA equipment consists of the following:

- NDE stations for drums (2)
- Passive/active neutron (PAN) stations for drums (2)
- Gamma energy assay (GEA) stations for drums (2).

2.4.1.5 Control and Computer Area. The control and computer area contains operator consoles for NDE/NDA transport, dispatcher functions, facility alarm annunciator, printers, central processing units, and miscellaneous supporting elements.

The control and computer areas are located on the upper level of the facility. This location permits direct observation of the shipping and receiving, NDE/NDA, and process areas.

2.4.1.6 Storage Facilities. WRAP 1 does not have external storage facilities, process tanks, holding ponds, or storage vessels, with the exception of a sand receptor downstream of the truck wash drain. This stream drains to a permitted gravel basin outside of the facility. Generation, handling, and storage of hazardous wastes in WRAP 1 are discussed in Chapter 9.0. Storage areas for accumulation of wastes meet all regulatory requirements as delineated in WHC-CM-5-34, *Solid Waste Disposal Operations Administration Manual*.

2.4.2 Structural Specifications

The design bases and associated safety-class designation for buildings and structures depend on the design basis accidents or other events that the building must withstand. Natural phenomena design basis accidents and human-generated events are important elements that determine structural specifications. The bases for design of WRAP 1 also include consideration of the following items:

- Principal hazards and risks that can be encountered in facility operation
- Principal design, construction, and operating features selected for preventing accidents or reducing risks to acceptable levels

- Operation, maintenance, repair, and replacement requirements
- Restricted area requirements.

The structural elements of WRAP 1 include the floor, roof, wall framing members, slabs on grade, footing equipment foundations, platforms, ladders, and stairs. These members are proportioned on the basis of stress, strength, and deflection requirements.

Nationally recognized codes, standards, and specifications applicable to the design of WRAP 1 are listed in Appendix 2A. The codes, standards, and specifications listed are met by the design, with the exception of items transmitted to DOE-RL for resolution in accordance with the WRAP 1 Title II 100% Design, DOE Order 6430.1A Compliance Review, and/or as specified by the deviation request by the Architect-Engineer. DOE's assessment of the exceptions as proposed by the Architect-Engineer, and as noted to be noncompliant and nonapplicable in the compliance review and the preliminary safety analysis report, has been completed and approved. Appropriate concurrence memos are attached (Appendixes 2B and 2C).

The following subsections summarize the design requirements utilized for construction of WRAP 1.

2.4.2.1 Wind Loadings. WRAP 1 is designed to comply with ASCE 7-88, *Minimum Design Loads for Buildings and Other Structures*, Section 6; DOE Order 6430.1A, *General Design Criteria*, Section 011-99.0.2; UCRL-53526, including conclusions from Lytherm, a computer simulation model for extreme wind conditions; and the non-safety class wind velocity parameters shown in Table 2-1.

Facility design to withstand wind loadings is based on an importance factor estimate, the exposure category, and the occupancy category. The importance factor conservatively accounts for the hazard to human life and damage to property. The exposure category reflects the characteristics of ground surface irregularities at the Hanford Site, and the occupancy category reflects the classification of the facility. The importance factor and the exposure and occupancy categories are described more fully in ASCE 7-88.

The design wind velocity selection is based on SDC 4.1. Wind histories and supporting data are presented in UCRL-53526 and UCRL-15910. The design wind loads for WRAP 1 are based on an equivalent wind velocity (fastest mile wind) specified in Table 2-1, which is representative of open, flat terrain.

The WRAP 1 stack design complies with the *Uniform Building Code* (UBC), Chapter 37, International Conference of Building Officials.

Shielding effects of nearby structures or terrain features are not accounted for; however, any increases in pressure or suction on buildings and structures resulting from these features are accounted for in the facility design.

2.4.2.2 Tornado Loadings. The design-basis tornado is not a design requirement for Hanford Site facilities according to SDC 4.1.

2.4.2.3 Water Level (Flood) Design. Based on the surface hydrologic characteristics of the Hanford Site described in Chapter 1.0, there is no possibility of floodwater approaching the WRAP 1 site from flooding of the Columbia River, even with a 50% breach in Grand Coulee Dam. Also, the possibility of flooding from local rain is extremely low because of the porous nature of the soil, the distance to groundwater, and the relatively low precipitation rate. The maximum rainfall in a 24-h period, expected once every 1,000 years, is 6.8 cm (2.68 in.).

The only other potential flood source is runoff from a large precipitation event in the Cold Creek watershed, via flooding of the ephemeral Cold Creek (RHO-BWI-C-120). The probable maximum flood using conservative values of precipitation, infiltration, surface roughness, and topographic features would not affect WRAP 1. The 100-year flood would be less than the probable maximum flood.

The WRAP 1 site stormwater management system is designed for the 25-year, 6-h storm. The potential effect of larger storms (up to the 100-year, 6-h storm) was considered according to DOE Order 6430.1A.

Structures, systems, and components in WRAP 1 are mounted above floor level for protection from the effects of internal flooding from piping leakage and fire suppression water accumulation. A 39-cm (6-in.) curb and epoxy-coated floors help prevent leakage into or out of the facility.

2.4.2.4 Missile Protection. According to applicable requirements of DOE Order 6430.1A, Section 0111-99, the postulated sources of missiles are:

- Wind-transported objects (external)
- Vehicle impact (external)
- Aircraft impact (external)
- Objects ejected from equipment due to operational failures (internal).

Consideration of wind-borne missiles generated by the 113 km/h (70 mi/h) design wind is not applicable to WRAP 1 design based on the original low hazard classification.

The WRAP 1 shipping and receiving area is elevated. Therefore, a truck or vehicle impact sufficient to cause a radiological release from this area is not credible.

A previous safety analysis (WHC-SD-HWV-RA-001, *Aircraft Impact on the Hanford Waste Vitrification Plant*) demonstrated that the probability of an aircraft crashing into a facility on the Hanford Site is negligible and therefore presents an acceptable risk. Thus, potential aircraft crashes are not considered to be among the spectrum of human-generated missiles that confinement structures should be designed to withstand.

The effects of internal missiles created by equipment failure, system ruptures, dropped loads, or forklift truck accidents were analyzed to

determine their potential for impacts to the environment and health and safety of the public. More information on this analysis is included in Chapter 3.0.

2.4.2.5 Seismic Design. In accordance with SDC 4.1, all structures, systems, and components (SSC) at the Hanford Site are required to withstand certain postulated earthquake events. The criteria for seismic design are based on the preliminary safety analysis report safety classification of the SSC.

A detailed seismic analysis approach and detailed design criteria were used for all SSC. The criteria include input definition, response determination, performance requirements, and seismic design considerations, and are based primarily on the guidelines of UCRL-15910, TM 5-809-10-1, and the UBC.

Input Criteria. Seismic loading is based on the provisions of Section 2312 of the UBC for seismic Zone 2B as modified according to UCRL-15910. When the UBC loading exceeded the loading as modified by UCRL-15910, the UBC loading was used. For the WRAP 1 site, a UBC soil coefficient of 1.2 (Type S_2) was applied.

WRAP 1 SSC, including nonstructural elements, are designed to resist a total lateral seismic force, F_p , as given in Section 2312(g) of the UBC.

The seismic design criteria used for non-building equipment and furnishings are documented in *Structural/Mechanical of the Waste Receiving and Processing Facility Project Design Criteria*, Appendix C.

As required by the UBC and referred to by UCRL-15910, WRAP 1 SSC are designed for one horizontal earthquake input. The input is applied nonconcurrently with other earthquake directional inputs. Horizontal input is oriented so that each item is designed for the worst-case (maximum) seismic response.

WRAP 1 SSC are designed to resist 100% of the prescribed seismic forces in the north-south horizontal direction plus 30% of the prescribed seismic forces in the east-west horizontal direction. The combination requiring the greatest component strength is used for design. Alternatively, the effects of the two horizontal directions may be combined on a square root of the sum of the squares basis. Except for horizontal cantilevers, the contribution of the vertical component is not combined with the response from other horizontal components.

Seismic System Analysis. WRAP 1 SSC are designed for the UBC-level earthquake, E_u , using the static force procedure in accordance with UBC Section 2312 (e)2 as modified by UCRL-15910.

Load combinations and allowable stresses for the seismic design of WRAP 1 SSC are as specified in Section 2.4.2.9.

Applied earthquake forces, including base shear, distribution of forces over the height of the structure, and forces on individual structural and nonstructural items, conform to the standards specified above. For irregular structures, as defined in UBC Sections 2312 (d)5.C and 2312 (d)8, distribution of applied forces is determined by dynamic analysis procedures, except that

all forces are scaled so that total base shear is equal to the UBC established base shear.

Analysis to determine internal forces and system deflections for applied seismic loading on structures is based on established structural analysis procedures. Mathematical models for manual or computer analysis are consistent with the complexity of the physical structure represented.

The equivalent static force method of seismic analysis is used for the seismic analysis of WRAP 1 SSC. The basic requirements of the static force method of seismic design and analysis are summarized in UCRL-15910.

Seismic Subsystem Analysis. The seismic analysis criteria applicable to WRAP 1 subsystems, such as equipment and piping, are obtained from UCRL-15910.

Because WRAP 1 contains hazardous operations and materials, the seismic adequacy of equipment and piping is as important as that of the structure. Therefore, practical guidelines in UCRL-15910 for the support and anchorage of equipment items are used for the seismic subsystem analyses.

The procedures for piping and subsystem analyses are similar to those described for simplified dynamic analysis in UCRL-15910. Locations of all field supports and restraints are based on the assumptions made in the seismic analysis.

To prevent dislodging during a seismic event, overhead cranes have restraints that anchor the crane to the rail in the event of vertical or horizontal movement.

2.4.2.6 Snow Loadings. Snow loadings on roofs or other exposed surfaces were evaluated according to ASCE 7-88. Ground snow load (p_g) is equal to 73 kg/m^2 (15 lb/ft^2) for ASCE 7-88, Table 1, Occupancy Category III, but roofs are designed for 98 kg/m^2 ($>20 \text{ lb/ft}^2$) snow load. Effects of snow drifts are considered.

2.4.2.7 Roof Loadings. WRAP 1 roof loads are specified as follows:

- Roof live loads are in accordance with ASCE 7-88, Section 4.
- Snow loads are in accordance with the criteria in Section 2.4.2.6.

Roof and ceiling loadings are in accordance with the requirements of DOE Order 6430.1A, Section 0111-99-0-1.

2.4.2.8 Ashfall Loadings. Volcanic ashfall is considered an extreme natural phenomena; therefore, in accordance with SDC 4.1, the volcanic ashfall loading is not applicable to the design of WRAP 1.

2.4.2.9 Total Loadings. A summary of specific loads applicable to WRAP 1 SSC is presented in Table 2-2. The WRAP 1 structure and components are designed to resist all applicable loads. Load combinations and allowable stresses are consistent with Section H of SDC 4.1 and are determined as described in Sections 2.4.2.5, 2.4.2.6, and 2.4.2.7. In addition to the environmental loads described previously, process and equipment-derived loads are considered as follows.

Dead loads include the gravitational load of structures; permanent equipment; piping; static liquid; soil; long-term stored materials; permanent partitions; and any other permanent, static load.

Live loads are loads superimposed on structures or components by the use and occupancy of the facility. Live loads include the weight of moveable objects such as personnel, temporarily stored materials, moveable partitions, maintenance equipment, forklifts, hoists, and cranes. Live loads are considered as directed in ASCE 7-88.

Self-straining forces and their effects arise from restraint of expansion or contraction resulting from temperature change, shrinkage, creep, or differential settlement. These forces are considered in the facility design, as are fluid pressure loads caused by containment of gases and liquids within piping, equipment, or structures and lateral earth pressures acting on foundations, buried walls, or retaining walls.

2.4.2.10 Mechanical Design Criteria. Design stress limits for equipment that contains fluids at gauge pressures of 1.1 kg/cm^2 (15 lb/in^2) and greater are in accordance with ASME Section VIII, *Boiler and Pressure Vessel Code*. This code is also used as a guideline for the design and fabrication of other tanks and equipment.

The maximum allowable compressive stress used to design cylindrical shells subjected to loadings that produce longitudinal compressive stress satisfies the stress limits of paragraph UG-23 (B), Section VIII, *Boiler and Pressure Vessel Code*.

WRAP 1 embedded and exposed pipe lines are designed and installed in accordance with ANSI/ASME B31.3, *Chemical Plant and Petroleum Refining Piping*. Piping and piping components are made of materials compatible with operating conditions.

Piping for sprinkler systems is in accordance with applicable National Fire Protection Association requirements. Other piping, such as for instrument air, is designed and installed in accordance with appropriate American National Standards Institute and American Society of Mechanical Engineers standards. Piping identification meets OSHA requirements. The separation of potable water supplies from other water supplies and the use of cross-contamination control devices complies with the Uniform Plumbing Code and DOE Order 6430.1A.

2.4.2.11 Combined Load Criteria. The criteria for load combinations are provided in DOE Order 6430.1A, *General Design Criteria*. Specific Hanford Site criteria for combination of loads are provided in SDC 4.1 and discussed in this section.

All concrete is designed to comply with American Concrete Institute Standard (ACI) 318-89 and ACI 349-89 strength design method. All structural steel is designed to comply with the American Institute of Steel Construction allowable stress design method or plastic yield strength (K) design method. Loads are considered to act in the combination that produces the highest load in the building, foundation, or structural member being considered.

Unfavorable effects are accounted for when one or more of the contributing loads is not acting.

When load combinations include earthquake motions, the live loads are limited to operational loads. When loads are included with the dead load for the purpose of computing seismic inertial forces, uniformly distributed floor live loads are included at 25%. Unloaded cranes and movable equipment expected to be in place are included at 50%. The snow load is not combined with the earthquake load. Roof live load is not combined with severe or extreme environmental loads. Earthquake and wind loads do not act simultaneously. Directional effects are included.

For load combinations in which any load reduces the effects of other loads, the corresponding coefficient for that load is conservatively taken as 0.85 for allowable stress design and 0.9 for concrete ultimate strength design, if it can be demonstrated that the load is always present or occurs simultaneously with the other loads. If this cannot be demonstrated, the coefficient for the load is taken as zero.

2.4.2.12 Subsurface Hydrostatic Loading. Subsurface hydrostatic loading is not applicable to the design of WRAP 1 because the groundwater table is at least 61 m (200 ft) below the lowest point of the foundation of the facility.

2.5 PROCESS DESCRIPTION

This section describes the normal operating parameters for WRAP 1 that establish the requirements for the safety management program.

This section begins with a description of the waste feedstreams processed in WRAP 1 and an overview of the process flow. The remaining sections provide more detail for the shipping and receiving and NDE/NTA areas. Flow diagrams illustrate the flow of waste through these processes.

2.5.1 Feed Material Characteristics

WRAP 1 will receive drums of waste from DOE operations at the Hanford Site and other locations. The facility is expected to process waste on a single-shift-per-day basis. This rate may increase if processing needs increase.

2.5.1.1 Waste Definitions. During Phase I, WRAP 1 will receive waste with the following characteristics:

- **Contact-handled waste.** Packaged waste with an external surface radiation dose rate not exceeding 200 mrem/h (WHC-EP-0063-04).
- **TRU waste.** Waste contaminated with alpha-emitting radionuclides with half-lives >20 years and concentrations >100 nCi/g at the time of assay, as defined in WHC-EP-0063-04, *Hanford Site Solid Waste Acceptance Criteria*.

- **LLW.** Waste that contains radioactivity and is not classified as high-level waste, TRU waste, or spent nuclear fuel or byproduct material as defined by DOE Order 5820.2A. A test specimen or fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as LLW provided the concentration for transuranic materials is less than 100 nCi/g (WHC-EP-0063-4)
- **Mixed Waste.** Waste that contains radioactive contaminants and hazardous constituents or characteristics (DOE Order 5820.2A).
- **Dangerous Waste.** Waste defined by Washington Administrative Code (WAC) 173-303.

Waste received at WRAP 1 may fall into more than one of the categories described above. For example, mixed waste may also be restricted waste, and all waste is contact-handled. All waste accepted during Phase I will have known radiological contents, certified as to its content characterization by an onsite generating unit or an offsite generator.

2.5.1.2 Characteristics of the Waste Feedstream. Newly generated waste is defined as waste that has been certified as to the content by onsite generating units or an offsite generator. Newly generated waste to be processed in WRAP 1 results from current environmental restoration and remediation activities as well as retrieved waste that has been characterized.

Radiological Contents. Newly generated waste will meet the radiological limits of the WRAP 1 waste acceptance criteria as follows:

- Less than the category three threshold quantity (the sum of the fractions for all isotopes is maintained less than one)
- 200 mrem/h non-removable surface contact radiation dose for drums.

Hazardous Material Contents. Because Hanford Site waste generators are required to comply with the *Hanford Site Solid Waste Acceptance Criteria*, hazardous and dangerous materials should pose little, if any, threat to WRAP 1 operations. The hazardous constituent quantities for newly generated waste are not anticipated to exceed those quantities found in retrieved waste. The following wastes are prohibited based upon the *Hanford Site Solid Waste Acceptance Criteria*:

- Waste capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.
- Gaseous waste packaged at a pressure in excess of 1.5 atmospheres.
- Pyrophoric waste.
- Mixed waste packages that do not provide at least two containment barriers or equivalent.

- Packages containing materials of two or more incompatible hazard classes, the mixture of which would be liable to cause a dangerous evolution of heat or gas, or produce corrosive materials.

In addition, the following restrictions are imposed:

- Secondary containment for liquid containing mixed waste shall be a 90-mil high density polyethylene rigid liner if the liquid exceeds 1% of the waste.
- All liquids must be packaged in approved absorbent materials having twice the volume capacity of the liquid, or the liquids are limited to a maximum volume of 56.8 L (15 gal) packaged in inner packages and nested in absorbent material.
- Where the potential for hydrogen gas generation is present, hydrogen-oxygen recombiners will be added to maintain hydrogen gas at safe concentrations and to prevent the package from reaching a flammable concentration. In addition, the package may use NRC and DOT approved filter-vents to allow hydrogen gas to escape as well as to prevent over-pressurization.
- If asbestos is included because of previous contamination of the asbestos, the material shall be prepackaged in accordance with the *Hanford Site Solid Waste Acceptance Criteria* (e.g., same packaging requirements as for tritiated waste). Note: When properly handled and packaged, asbestos is not a "dangerous" waste according to WAC 173-303.

Noncertifiable materials, if found by WRAP 1 NDE/NDA, will be handled in the same manner as retrieved hazardous materials or returned to the generator.

2.5.2 Process Flow

The following sections describe each process flow step, by area, and safety features for each area. One 8-h operating shift per day is planned, although the processing time may be extended if waste volumes warrant.

2.5.2.1 Shipping and Receiving. The shipping and receiving area accepts incoming shipments of drums, drums overpacked in salvage drums; provides incoming and outgoing storage for drums; and prepares 208- and 322-L (55- and 85-gal) drums for transport to onsite LLW disposal and various other storage facilities. Waste drums (208- and 322-L [55- and 85-gal]) are typically shipped in flatbed trucks or enclosed vans to and from the loading docks.

Detailed Process Description. Waste drums delivered to the loading dock are surveyed for external radiological contamination before removal from the transport vehicles. The drums are unloaded using a forklift, inspected for damage, and re-surveyed for radiological contamination. If contamination is detected, the vehicle, pallets, and drums are decontaminated and/or the contamination is fixed to avoid spreading. Inspection and survey data are recorded manually. Drums that do not meet the acceptance criteria of

WHC-EP-0063-04 are not accepted into the facility. The decision whether to accept specific containers into WRAP 1 will be made before the containers are shipped.

Every drum received should be labeled with a bar code designating its package identification number/container identification number (PIN/CIN). The bar code is used to identify and track drums through the facility. If a bar code is missing or damaged upon receipt, a new one is placed on the drum. At this point, specific data on the waste that will be confirmed or used to assist process operations is downloaded from the Solid Waste Information Tracking System to the WRAP 1 DMS.

A pallet of drums is moved to the pallet stand at the entrance of the AS/RS using a forklift. At this location, the drums are scanned again with a bar code reader to allow the AS/RS to maintain individual drum location. When ready, a coded command is sent to store the pallet containing the drums. The AS/RS selects an empty location and automatically stores the waste. Drum location information is recorded in the AS/RS computer system and the DMS. Container location information throughout WRAP 1 is also recorded in the Plant Control System (PCS).

A pick list is then generated to identify drums that require assaying, examination, and processing. This list represents a batch or lot and is developed by selecting the appropriate PIN/CIN on drums in the AS/RS.

A coded signal is sent to the AS/RS to retrieve the pallet of drums. The pallet is moved to the pallet stand and logged out of the AS/RS. Drum location information is updated in the AS/RS computer system and the DMS.

The pallet of drums is moved to a weigh conveyor using a forklift. The drums are then placed on the in-feed conveyor using a jib crane. Any remaining drums on the pallet that will not be processed at this time are returned and logged back into the AS/RS. Empty pallets are moved to the side and stored until needed.

When all drum positions on the in-feed conveyor are full or when ready, the drums are advanced onto the weigh conveyor. The drum bar code is scanned with the drum location and weight (confirmation) information recorded automatically in the DMS. If the weight label is missing or damaged, a new label is printed and attached to the drum.

After weighing is completed, the drum is transferred to an AGV for transport into the NDE/NDA area.

Drums may also be transferred directly to the in-feed conveyor for NDE/NDA processing and return to the shipping and receiving area, bypassing the AS/RS.

Instrumentation and Control (I&C) System. The following lists the major components of the I&C system and their functions in support of waste container receiving, storage, and shipping operations.

- Information obtained from visual inspection, radiological survey, and accompanying documentation of incoming waste containers is

manually entered into the DMS by an operator. Documentation can also be received electronically by the Hanford Local Area Network.

- Bar-coded information is automatically entered into the DMS from hand-held readers and permanently installed bar-code readers.
- Weight information from the drum scale/conveyor is automatically entered into the DMS.
- Two terminals are located in the shipping and receiving office. One connects to the DMS system and the other controls the AS/RS.
- A bar-code generator is used for incoming waste containers that are received with adequate identification but with no label.
- The PCS uses bar-code readers and software logic to track the locations of waste drums in the receiving and storage area.
- The AGV computer, located in the computer room, controls (through a radio transmitter) the operation of the all AGVs in the facility. The AGV computer is under the supervisory control of the transport controller consoles and the dispatcher's console, which are located in the central control room and are connected to the AGV computer through the WRAP 1 Local Area Network.
- Two transport/NDA controller consoles, located in the central control room, provide process status information to the central control room operators and are used by the operators to supervise waste container material handling operations throughout the facility using the PCS data highway. The transport/NDA controller consoles are also used to send information (by the WRAP 1 Local Area Network) to the DMS computer.
- The shipping and receiving input/output cabinet provides a signal interface between the shipping and receiving area equipment and the shipping and receiving and NDE/NDA controller.
- The drum discharge conveyor that receives waste drums from the AGV is automatically operated using software control logic. This control logic starts and stops the drum conveyor based on input from a position sensor, which signals when the AGV is in position to transfer a waste drum to the conveyor. The conveyor can also be operated manually.
- Local operators in the shipping and receiving area control the operation of the drum conveyors, and drum jib crane using local controls. The transport/NDA controller consoles located in the central control room are used to send supervisory and emergency control signals to the local controllers and to receive status and alarm signals.

Worker Protection Features. The following worker protection features are provided in the design and operation of the mechanical process equipment used for waste container receiving, storage, and shipping.

- A shield wall of average density concrete surrounds the waste drum lag storage area to reduce radiation exposure of personnel in the shipping and receiving area in accordance with as low as reasonably achievable (ALARA) requirements.
- Radiological control monitoring is provided in the shipping and receiving area by counting equipment for the evaluation of air, swipe and other samples, and routine dose rate surveys.
- The number of waste drums normally present in the shipping and receiving area is limited by the available space and operational constraints required for movement between stations.
- The forklift and AGV are battery powered, eliminating the possibility of a diesel fuel fire.
- The shipping and receiving area is surrounded by a containment curb poured integrally with the floor slab to prevent ingress or egress of water.
- The laser-guidance system for the AGV is designed to be safe to operating and maintenance personnel.
- The drum jib cranes are designed to retain their loads in case of loss of power. Other material handling equipment (e.g., AGV and forklift) does not raise the waste containers more than 1.22 m (4 ft) above floor level.
- The AGV is equipped with sensors to detect the presence of any object or person in its path and tactile bumpers to stop the AGV upon contact with an object.
- Every conveyor is equipped with an emergency feature that stops the rollers when activated.

In case emergency evacuation of the facility is required, worker protection features prevent drum stackup. If no action is taken by operators before evacuating the facility, the internal transport system continues to transfer drums for approximately 30 minutes before becoming blocked by occupied NDE units and conveyors. At that time, all material transport operations will automatically cease. The resulting configuration of drums and accumulation of material will be within the design limits of the facility, and unsafe conditions will not result.

The following safety features are provided in the design and operation of the I&C system for the waste container receiving, storage, and shipping operations.

- Safety alarms and emergency shutdown controls.
- Lockout capability in the local control panels for AS/RS and the drum in-feed conveyors for use during maintenance.

2.5.2.2 Nondestructive Examination/Nondestructive Assay. Incoming and outgoing waste containers undergo NDE/NDA to ensure compliance with waste certification requirements. The feed to the NDE/NDA area consists of certified (but unverified) and uncertified newly generated drums from lag storage in the shipping and receiving area.

Detailed Process Description. A waste container entering NDE/NDA is identified by a bar code reader. The container is then examined and assayed. The following NDE/NDA technologies are provided for examining and assaying waste drums (208- and 322-L [55- and 85-gal]) weighing up to 450 kg (1,000 lb):

- Real-time radiography, consisting of X-ray fluoroscopy with image intensification and video recording to identify noncompliant waste in sealed drums and boxes and to certify the waste containers in accordance with storage and shipping criteria
- PAN interrogation of drums and boxes, to detect and measure isotopes for determination of TRU activity; GEA of drums to identify and quantify principal gamma ray emitters; and equipment to interface these measurement systems with the facility DMS and calculate the best estimate of radionuclide contents of each drum.

Real-time radiography is typically performed on incoming waste containers and on a percentage of the outgoing processed waste drums. PAN counting and GEA may be performed on incoming waste containers and, as required, on outgoing processed waste drums. These measurement techniques do not alter the physical and chemical properties of the waste and do not present a risk in terms of initiating credible accident scenarios. Separate stations are provided for waste drums and boxes.

Because of radiation normally emitted from the NDE/NDA equipment, shielding is provided to limit personnel exposure to an initial design target of 0.2 mR/h for areas occupied full-time and 2.0 mR/h for areas of part-time occupancy.

There are two NDE stations for drums. All NDE stations are equipped with real-time radiography. To ensure a complete scan, the drum units are capable of rotating, raising, and lowering the drum. The X-ray generator system is under direct control of the NDE operators in the central control room. The operator increases or decreases the power to evaluate different waste items within the waste containers. Information on dense or noncompliant waste items is entered into the DMS by the NDE operators.

The NDA stations include two PAN counting units for drums and two GEA units for drums. The NDA stations use weight, density, and radionuclide distribution data and algorithms to calculate the radionuclide contents of each container. NDA results are used to determine whether the incoming waste drum is processed as LLW or TRU waste and to meet certification and shipping requirements.

The assays are performed automatically or manually, with waste drum movement control and computational algorithms provided by the local controller for each NDA station.

The possibility of NDE/NDA equipment failure, resulting in false assay/examination results, is minimized by rigorous verification and calibration requirements. Drums containing known waste matrices and radionuclide contents are used as standards for periodic verification of all NDE/NDA equipment.

A drum storage carousel is provided in the NDE/NDA area for the temporary storage of drums in transit between stations.

After NDE/NDA assessment is completed on an incoming waste container and the container is found to contain certified waste, it is returned to the shipping and receiving area and prepared for shipment. Incoming waste drums found during NDE/NDA to contain restricted waste are returned to the generator.

I&C System. The NDE/NDA stations are designed to operate with minimal personnel involvement. All normal NDE/NDA operations are automatically generated by local controllers using process control sequencing logic. Supervisory and emergency shutdown actions are accomplished by the PCS under the direction of operators in the central control room. The operators supervise each NDE/NDA station by directly viewing operations through glass windows and/or by observing the appropriate consoles. Transport/NDA controller consoles and NDE operator consoles located in the central control room receive status and alarm signals sent from the local controller for each NDE/NDA station. The local controller and consoles are manually operated during system maintenance and reconfiguration. Normal movement of the waste drums between stations is automatically controlled and tracked by the PCS. The major components of the NDE/NDA I&C system are as follows:

- Two NDE operator consoles are located in the central control room. Each console consists of a terminal connected to the WRAP 1 local area network and a monitor for viewing X-ray images on a closed-circuit television system.
- Two NDA controllers provide supervisory control to the NDA drum accumulation conveyor local controller.
- The input/output cabinet provides signal interface between the NDE/NDA local controller/control consoles and the shipping and receiving and NDE/NDA controller. In addition, the NDE/NDA area drum storage carousel is controlled through this input/output cabinet.
- Field devices consist of position sensors at drum transfer conveyors, switches for manually operating drum transfer conveyors during maintenance, box weight sensors, and recorder/transmitters and closed-circuit television located at each NDE station.
- A bar-code reader mounted on the drum carousel automatically sends bar-code information to the DMS.
- The AGV signals its presence to each NDE/NDA station using a transmitter/receiver. The process control software ensures safe and reliable transfer of waste drums to and from the NDE/NDA stations from the AGV.

Worker Protection Features. The following worker protection features are provided in the design and operation of the NDE/NDA equipment.

- The NDE equipment is designed to meet the following federal and state statutory requirements:
 - Fail-safe X-ray warning lamps
 - Redundant safety circuits for the cubicle (vault) door interlocks to prevent operation of the X-ray machine when the vault door is open
 - Fail-safe door locking contact
 - Continuous internal diagnostics with automatic shutdown and fault display
 - Radiation leakage from the vault is <0.5 mrem/h.
- The NDA equipment contains neutron generators in the PANs and transmission sources in the GEAs. Shielding of and access to these devices are designed to meet federal, state, and Hanford Site requirements.
- Standard safety design and operating features are provided for the AGV battery charging station located in the NDE/NDA area.
- The AGV is equipped with tactile bumpers to stop the vehicle upon contact.
- A concrete shield wall partially surrounds the drum storage carousel to reduce radiation exposure to personnel in the NDE/NDA area, in accordance with ALARA requirements.
- An emergency building exit door (with airlock) is provided for the NDE/NDA area. This door has no external entry hardware.
- Normal HVAC system covers the NDE/NDA area.
- Radiological control is provided for the NDE/NDA area.
- Appropriate protection is provided for personnel handling liquid nitrogen for GEA units.
- The NDE/NDA area is surrounded by a high containment curb poured integrally with the floor slab to contain water released from fire protection sprinklers.
- Material handling equipment (AGV, forklift, manual drum handling equipment) and NDE/NDA platforms for drums are <0.9 m (3 ft) above the floor. Standard lifts and transfers do not require lifting waste containers higher than 1.2 m (4 ft) above the floor.

- Diagnostic hardware and software are provided to detect and announce NDE/NDA equipment failures to the control room operators.

The following worker protection features are provided in the design and operation of the I&C system for NDE/NDA operations.

- The drum carousel in the NDE/NDA area has local emergency shutdown features.
- The local control consoles and control panels for the NDE/NDA stations are provided with local lockout capabilities for use during maintenance.

2.6 CONFINEMENT SYSTEMS

The confinement system provided in the WRAP 1 facility design consists of the building structure and the containers themselves, including any required liners.

The building structure, while not sealed or provided with high efficiency particulate air (HEPA) filtration, provides some obstruction to the release of hazardous materials. No credit for the structure is taken in the hazard/accident analysis, however, as its effectiveness is not easily determined or quantified.

2.7 ENHANCED WORKER PROTECTION SYSTEMS

The following sections describe the principal systems that perform protective functions but which are not a specific part of WRAP 1 processes.

2.7.1 Miscellaneous Systems

The following systems contribute to worker protection in the WRAP 1 facility:

- Radiation levels are low enough that monitoring needs can be met with the use of portable instruments and/or the readout of functioning building radiation monitoring systems.
- Radiation monitoring systems display locally and/or remotely.
- Safety alarms, such as fire and radiation, are monitored and displayed in the control room on a hard-wired annunciator panel and on the plant control system. Failure of one alarm system does not prevent the alarm from being displayed at the other. Fire alarms are also monitored in the 200 Area fire station.

- Some emergency shut-down systems that rely on hard-wired interlocks are backed up by software interlocks. Local pushbuttons and rope switches are provided throughout the plant to shut down equipment to prevent personnel injury or equipment damage.
- Radiation monitoring instrumentation is on an uninterruptible power supply and independently returns to normal operation following switching transients.
- The PCS is on an uninterruptible power supply to ensure maintenance of data integrity and a safe shutdown and orderly restart of equipment in case of a loss of power.
- Industry practices are employed to prevent control system signal degradation due to electromagnetic or radio frequency interference. Proper grounding techniques are employed.
- The HVAC dampers and valves are designed to fail in their safe state on loss of power. The safe state is the state in which contamination is contained within its enclosure(s).

2.7.2 Criticality Safety

Appropriate safety margins are provided to ensure that a subcritical situation exists at all times. WRAP 1 inventory control will maintain total inventory less than 1/3 of a critical mass at all times. However, from a criticality safety standpoint, WRAP 1 is authorized as a "limited control" facility.

2.7.3 Radiological Protection

Engineered design features of WRAP 1 processes and equipment minimize hazards to personnel from exposure to external and internal sources of ionizing radiation and provide the primary level of protection. The design of the facility maintains ALARA levels of radiation exposure to personnel during normal operations, maintenance activities, and for accidents or off-normal occurrences that are anticipated during the life of the facility. Movement of personnel into and within the operating areas is performed according to well-defined traffic patterns. Restricted access into radiologically controlled areas is ensured by facility design, including provisions for locked doors; by controlled flow through radiological control points; and by posted signs.

2.7.4 Fire Safety

WRAP 1 is divided into fire zones, each with its own fire detection, alarm, and suppression system. These systems are required during operations and anticipated operational occurrences for protection of personnel, equipment, and building functions. A supervised automatic fire detection and alarm system warns of smoke, overheating, and/or a tripped fire suppression

system at the facility and at the Hanford Fire Department. The alarm system is augmented by manual pull stations at exits and other locations. Response of mobile fire units is within 10 minutes. Four hose stations are located inside the facility and two fire hydrants are located outside the facility.

To help contain potential fires, 2-h rated fire barriers provide the shipping and receiving area and the NDE/NDA area, with occupancy separation from the administrative and utility areas of the facility and with loss limitation separation from each other. One-h rated fire barriers isolate the stairwells and egress paths from the surrounding facility. NDE/NDA, shipping and receiving and receiving support are each serviced by a dedicated HVAC system. Automatic sprinkler systems protect all areas of the building. Hand-held fire extinguishers are placed throughout the facility in accordance with NFPA 10-1990, *Standards for Portable Fire Extinguisher*.

2.7.4.1 Fire Suppression. Automatic wet-pipe and/or dry-pipe overhead sprinkler systems, installed in accordance with NFPA 13-1989, are provided in all building areas. Additionally, wet stand-pipe hose connections and hand extinguishers are provided throughout the building. A pumper truck connection is located outside the building. The fire water supply is provided by a sanitary water line.

Two reliable, independent water sources, each with a maximum demand capacity of 3,085 L/min (815 gal/min) at 446 kPa (52 lb/in²) (gauge) minimum, are required for fire fighting. The requirement for WRAP 1 to have a secondary water source has been waived as described in Appendix 2B.

2.7.4.2 Inspection and Testing. An operational underground water system including flushing of all lines and placement of hydrants in service was provided during construction of WRAP 1. A housekeeping plan for construction materials and an inspection program were in place during construction. All fire protection systems were flushed, tested, and placed in service before WRAP 1 was occupied. Testing of the fire protection systems is performed in accordance with National Fire Protection Association codes and standards, as modified by a permanent exemption approved by DOE (Appendix 2C).

2.7.4.3 Personnel Qualifications and Training. Qualifications and training of all fire protection personnel are dictated by PHMC administration manuals. Fire protection is provided to WRAP 1 by the Hanford Fire Department. The training for personnel in this department is based on International Fire Service Training Association Standards and conforms to National Fire Codes. In addition, facility-specific training is provided by WRAP 1 for special hazards associated with WRAP operations.

2.8 UTILITY DISTRIBUTION SYSTEM

This section provides an overview of the WRAP 1 utility distribution systems in sufficient detail to describe the role of utility distribution in safe operation of the facility.

2.8.1 Electrical Power System

The design bases for the electrical systems are dependent on the safety or process-related function of the load. The electrical systems are installed in accordance with NFPA 70-1990. The following subsections describe the major electrical components and operating characteristics as well as the safety considerations and controls for the electrical distribution system.

2.8.1.1 Major Electrical Components and Operating Characteristics. Normal power for WRAP 1 is derived from an outdoor substation located at the northwest corner of the building.

The transformers feed two 480-V switchgear assemblies. Both transformers feed a common bus with a normally open manual tie breaker for load separation and/or reduced load sharing. All transformer feeds are to the main switchgear assembly and all electrical equipment in WRAP 1 derives its power from this switchgear.

There is no provision for emergency or standby power but an uninterruptible power supply is available for selected loads, as described below.

2.8.1.2 Safety Considerations and Controls. WRAP 1 is not required to operate under all conditions. All plant equipment and valves are designed to fail safe. An uninterruptible power supply system provides power to air monitoring systems and alarms and backup power for the time needed to shut down the facility in a safe, controlled manner.

In the event of a total loss of power, the uninterruptible power supply system supplies battery power for approximately 55 minutes to operate alarms until personnel are evacuated; provide emergency instructions over the plant communication system; preserve PCS information; and radiation monitors. Written emergency procedures detail the actions required. The uninterruptible power supply can accept a plug-in portable generator to maintain selected loads indefinitely.

Requirements of operability, surveillance, testing, and response to off-normal conditions for this system are covered in the operating and maintenance procedures.

2.8.2 Water Supply System

A single water supply system provides water to WRAP 1 for drinking, cooling, and fire protection. Water for all of the 200 West Area is drawn from the Columbia River and two clean water wells. It is pumped through a piping system known as the exporter water system to the reservoir at the 282-W Building. At the 282-W Building, it is converted to sanitary water by chlorination and filtration, then pumped to WRAP 1 for all potable uses, including fire protection. The following subsections describe major components, operating characteristics, and safety considerations and controls for the water supply system.

2.8.2.1 Potable Water. Up to 1,514 L/min (400 gal/min) of potable water are supplied to the facility through a 10-cm (4-in.) pipe branched off the 30-cm (12-in.) sanitary water line. The potable water system is sized to supply the maximum peak flow requirement of 852 L/min (225 gal/min) with a minimum of 207 kPa (30 lb/in²) residual pressure. The potable water system services the utility stations, the emergency decon shower, the HVAC equipment, drinking water fountains, and all personal sanitation facilities throughout the building.

2.8.2.2 Fire Water. The main water line supplies the four building fire areas and three fire hose stations. Two 15-cm (6-in.) lines are branched off the 30-cm (12-in.) sanitary water line to supply fire water to the building's two fire hydrants. The fire water supply lines have a static pressure of ≈ 827 kPa (120 lb/in²).

2.8.2.3 Cooling Water. Air-cooled, reciprocating water chiller, with shell and tube heat exchangers supply water/glycol at ≈ 7 °C (44 °F). Chilled water/glycol loop circulation to the HVAC air supply cooling coils is provided by two variable-speed pumps, each capable of approximately 1,026 L/min (271 gal/min).

A closed-loop water/glycol system is provided between supply and exhaust systems for heat recovery. Water treatment systems are provided for the chilled glycol and heat recovery glycol circuits to prevent corrosion. The chilled water system equipment is located outside the building northeast of the mechanical room.

2.8.2.4 Safety Considerations and Controls. Reduced pressure vacuum breakers and isolation valves separate potable water lines from process and HVAC lines. Total power failure at WRAP 1 has no effect on the water supply.

2.8.3 Sewage Treatment

Normal sanitary wastes are disposed to a conventional septic tank/leach field sewage system. This system serves WRAP 1 only.

2.9 AUXILIARY SYSTEMS AND SUPPORT FACILITIES

This section provides information on the portions of the facility that are not covered in the preceding sections. System capabilities are based on

loads required for confinement and emergency operation as well as normal operation.

2.9.1 Compressed Air

Compressed air is used for equipment and control of operations. The compressed air and breathing air systems are designed in accordance with ASME Section VIII, ASTM A312, NFPA 70-1990, NACE RP-01-69, and 29 CFR 1910.

2.9.1.1 Major Components and Operating Characteristics. Compressed air is provided by reciprocating compressors located in the mechanical equipment room. The compressors discharge to air receivers. Overpressure protection is provided by relief valves. Each compressor is capable of providing the total amount of air required for the facility.

2.9.1.2 Safety Considerations and Controls. Each compressor provides separate air capacity, ensuring constant availability of compressed air.

2.9.2 Safety Communications and Alarms

The safety-related function of the WRAP 1 communication system is to alert personnel to hazards and provide instructions in emergency situations. Safety alarms provide warning of potential fire, radiation, and other threats.

2.9.2.1 Major Components and Operating Characteristics. The onsite communications system includes telephones, radios, a public address system, closed-circuit television monitoring, and alarm systems. The telephone and radio systems provide intraplant and external communications.

Immediate emergency instruction to personnel is provided by a public address system, which is coupled to the building telephone system to provide telephone-accessed voice paging. The general plant phone system is linked to the Hanford Site Integrated Voice Data Telecommunications System.

2.9.2.2 Safety Consideration and Controls. The emergency evacuation, essential communications, and safety alarm systems are all connected to the uninterruptible power supply system. All are designed and maintained for high reliability and equipped with malfunction alarms. Administrative procedures govern the response to a malfunction as well as maintenance/repair operations. All alarms are audible and/or visible.

Requirements of operability, surveillance, testing, and response to off-normal conditions for these systems are incorporated into the operating and maintenance procedures.

2.9.3 Cold Chemical Systems

The WRAP 1 uses and stores only small quantities of chemicals in its operation. Chemicals are separated from one another as much as practical to eliminate the possibility of mixing incompatibles. Any accidental spill is cleaned up following approved procedures.

2.10 REFERENCES

- 29 CFR 1910, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.
- ACI 318-89, *Building Code Requirements for Reinforced Concrete*, American Concrete Institute, Detroit, Michigan, 1989.
- ACI 349-89, *Formwork for Concrete*, American Concrete Institute, Detroit, Michigan, 1985.
- ANSI/ASME B31.3, *Chemical Plant and Petroleum Refining Piping*, American National Standards Institute/American Society of Mechanical Engineers, New York, New York, 1990.
- ASCE 7-88, *Minimum Design Loads for Buildings and Other Structures*, American Society of Civil Engineers, New York, New York, 1988.
- ASME Section VIII, *Boiler and Pressure Vessel Code*, American Society of Mechanical Engineers, New York, New York, 1986.
- ASTM A312, *Standard Specification for Seamless and Welder Austenitic Stainless Steel Pipes*, American Society for Testing and Materials, Philadelphia, Pennsylvania, 1994.
- DOE Order 5481.1B, *Safety Analysis and Review System*, U.S. Department of Energy, Washington, D.C., 1986.
- DOE Order 5820.2A, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C., 1988.
- DOE Order 6430.1A, *General Design Criteria*, U.S. Department of Energy, Washington, D.C., 1989.
- NACE-RP-01-69, *Control of External Corrosion on Underground or Submerged Metallic Piping Systems*, National Association of Corrosion Engineers, Houston, Texas, 1992.
- NFPA 10-1990, *Standards for Portable Fire Extinguisher*, National Fire Protection Association, Quincy, Massachusetts, 1990.
- NFPA 13-1989, *Standards for the Installation of Sprinkler System*, National Fire Protection Associate, Quincy, Massachusetts, 1989.
- NFPA 70-1990, *National Electrical Code*, National Fire Protection Association, Quincy, Massachusetts, 1990.
- RHO-BWI-C-120, *Flood Risk Analysis of Cold Creek Near the Hanford Site*, Rockwell Hanford Operations, Richland, Washington, 1983.
- SDC 4.1, Rev. 12, *Hanford Plant Standards, Standard Architectural-Civil Design Criteria Design Load for Facilities*, U.S. Department of Energy Richland Field Office, Richland, Washington, 1993.

- TM 5-809-10-1, *Structural Design Criteria*, U. S. Army, Change 1, 1986.
- UCRL-15910, *Design and Evaluation Criteria for Department of Energy Facilities, Subjected to Natural Phenomena Hazards*, Lawrence Livermore National Laboratory, Livermore, California, 1990.
- UCRL-53526, *Natural Phenomena Hazards Modeling Project: Extreme Wind/Tornado Hazard Model for Department of Energy Sites*, Rev. 1, Lawrence Livermore National Laboratory, Livermore, California, 1985.
- Structural/Mechanical of the Waste Receiving and Processing Facility Project Design Criteria*, Appendix C, United Engineers and Constructors, Richland, Washington, 1991.
- Uniform Building Code*, International Conference of Building Officials, Whittier, California, 1991.
- Uniform Plumbing Code*, International Conference of Building Officials, Whittier, California, 1991.
- WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.
- WHC-CM-5-34, *Solid Waste Disposal Operations Administration Manual*, Westinghouse Hanford Company, Richland, Washington.
- WHC-EP-0063-04, *Hanford Site Solid Waste Acceptance Criteria*, Rev. 4, Westinghouse Hanford Company, Richland, Washington, 1993.
- WHC-EP-0225, *Contact-Handled Transuranic Waste Characterization Based on Existing Records*, Rev. 1, Westinghouse Hanford Company, Richland, Washington, 1991.
- WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Document (S/RID)*, Rev. 4, Westinghouse Hanford Company, Richland, Washington, 1995.
- WHC-SD-HWV-RA-001, *Aircraft Impact on the Hanford Waste Vitrification Plant*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1990.

Figure 2-2. Waste Receiving and Process Facility
Module 1 Design--First Floor Plan. (Sheet 1 of 5)

First Floor Plan

* Not used in Phase I

Figure 2-2. Waste Receiving and Process Facility
Module 1 Design--Shipping/Receiving Area Detail. (Sheet 2 of 5)

Figure 2-2. Waste Receiving and Process Facility Module 1
Design--NDE/NDA Area Detail. (Sheet 3 of 5)

Figure 2-2. Waste Receiving and Process Facility Module 1
Design--Upper Level Floor Plan. (Sheet 4 of 5)

Figure 2-2. Waste Receiving and Process Facility Module 1
Design--Exterior Elevations. (Sheet 5 of 5)

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Table 2-1. Design Wind Velocity Parameters.

Design parameters	Safety-significant	Non-safety class
Fastest mile wind speed (10.1 m [33 ft] above the ground)	70 (mi/h)	70 (mi/h)
Importance factor	1.07	1
Exposure category	C	C
Occupancy category	III	III

SSC = structure, system, and component.

Table 2-2. Loads Applicable to WRAP 1 Systems, Structures, and Components.

Loads	Symbol	Applicable to WRAP 1
Dead	D	Yes
Live	L	Yes
Live, roof	L	Yes
Self-strain	T	Yes
Pressure	F	Yes
Lateral earth	H	Yes
Severe environmental loads		
Snow	S	Yes
Wind	W	Yes
Earthquake, UBC	E _u	Yes
Extreme environmental loads		
Wind, extreme	W _e	No
Wind, missile	W _m	No
Earthquake, DBE	E _d	No
Volcanic ashfall	V	No

DBE = Design basis earthquake.

UBC = Uniform building code.

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APPENDIX 2A
APPLICABLE CODES AND STANDARDS

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APPENDIX 2A APPLICABLE CODES AND STANDARDS

This appendix provides key codes and standards applicable during the design of WRAP 1. These codes and standards are applicable in part or in whole, depending on the particular design aspect. Future design changes will comply with current requirements of the SWD Standards and Requirements Identification Document WHC-IP-1120, Rev. 4, WHC-CM-5-34, and WHC-CM-5-36.

A.1 SHIPPING AND RECEIVING

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

U.S. Department of Energy Orders

DOE Order 6430.1A, *General Design Criteria*, Section 1460, "Cranes."

Controlled Manuals

Hanford Plant Standards Design Criteria

WHC-CM-6-4, *Hoisting and Rigging Manual*

WHC-CM-4-9, *Radiation Design*

WHC-CM-4-10, *Radiation Protection*

WHC-CM-2-14, *Hazardous Material Packing and Shipping*

WHC-CM-4-29, *Nuclear Criticality Safety*

Codes and Standards

NE, *Hoisting and Rigging of Critical Components*, NE F 8-6T.

NRC, *Single Failure Proof Cranes for Nuclear Power Plants*, NUREG-0554, U.S. Nuclear Regulatory Commission.

ANSI, *Rules for Construction of Overhead and Gantry Cranes*, NOG-1, American National Standards Institute.

ANSI, *Overhead and Gantry Cranes*, ANSI B30.2, American National Standards Institute.

ANSI, *Monorails and Underhung Cranes*, ANSI B30.11, American National Standards Institute.

ANSI, *Overhead Hoists*, ANSI B30.16, American National Standards Institute.

ANSI, *Overhead and Gantry Cranes*, ANSI B30.17, American National Standards Institute.

ANSI, *Stacker Cranes*, ANSI B30.18, American National Standards Institute.

ANSI, *Safety Standard for Powered Industrial Trucks, Low Lift and High Lift Trucks*, ANSI B56.1, American National Standards Institute.

ANSI, *Safety Standard for Electric-Battery Powered Industrial Trucks*, ANSI 583, American National Standards Institute.

ANSI, *Safety Practices for the Use of Industrial and Commercial Steel Storage Racks*, ANSI MH16.2, American National Standards Institute.

AWS, *Specification for Welding of Industrial and Mill Cranes*, AWS D14.1, American Welding Society.

CMAA, *Specification for Electric Overhead Traveling Cranes*, CMAA-70, Crane Manufacturers Association of America.

CMAA, *Specification for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes*, CMAA-74, Crane Manufacturers Association of America.

NFPA, *Powered Industrial Trucks*, NFPA-505, National Fire Protection Association.

RMI, *Industrial Steel Storage Racks*, RMI I-11, Rack Manufacturer's Institute.

RMI, *Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks*, RMI III-3, Rack Manufacturer's Institute.

A.2 NONDESTRUCTIVE ASSAY/NONDESTRUCTIVE EXAMINATION

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

U.S. Department of Energy Orders

DOE Order 6430.1A, *General Design Criteria*, Section 1300-10.3.3, Material Accounting Systems, pages 13-30 to 13-31:

Controlled Manuals

Hanford Plant Standards Design Criteria

WHC-EP-0063-2, *Hanford Site Radioactive Solid Waste Acceptance Criteria*

WHC-CM-4-9, *Radiological Design Criteria*.

A.3 WASTE PROCESSING**APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS****U.S. Department of Energy Orders**

DOE Order 6430.1A, *General Design Criteria*

The principal divisions of DOE Order 6530.1A that are applicable to the waste process area design are:

Division	Section	Title
2. Site and Civil Engineering	0275-99.0.2	Process Wastes
11. Equipment	1100 1161	General Enclosures
13. Special Facilities	1300 1304 1323 1324	General Plutonium Handling Facilities Liquid Waste Solid Waste
14. Conveying Systems	1460	Cranes

Controlled Manuals

Hanford Plant Standards Design Criteria

WHC-CM-4-9, *Radiological Design Criteria*:

Sections: 3.0 Contamination Control
5.0 Selecting Workplaces
6.0 Gloveboxes
8.0 Shielding
10.0 Sampling and Monitoring
11.0 Waste Handling, Storage and Disposal

Appendix A.

Codes and Standards

ASTM, *Standard Specification for Heating-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels*, ASTM A240-89, American Society for Testing and Materials.

ASTM, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, ASTM A269-88A, American Society for Testing and Materials.

ASTM, *Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes*, ASTM 276-89A, American Society for Testing and Materials.

ASTM, *Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plate*, ASTM A283/A283M-88, American Society for Testing and Materials.

ASTM, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe*, ASTM A312/A312M-89A, American Society for Testing and Materials.

ASTM, *Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings*, ASTM A403/A403M-89, American Society for Testing and Materials.

ASTM, *Standard Specification for General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet and Strip*, ASTM A480/A480M-88, American Society for Testing and Materials.

ASTM, *Flammability of Self-Supporting Plastics*, ASTM D635-81, American Society for Testing and Materials.

ASTM, *Standard Specification for Flexible Cellular Materials, Sponge or Expanded Rubber*, ASTM D1056-85, American Society for Testing and Materials.

ASTM, *Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs*, ASTM F593-86, American Society for Testing and Materials.

AWS, *Specification for Covered Corrosion-Resisting Chromium and Chromium Nickel Steel Welding Electrodes*, AWS A5.4-81, American Welding Society.

AWS, *Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Bare and Composite Metal Cored and Stranded Welding Electrodes and Welding Rods*, AWS A5.9-81, American Welding Society.

AWS, *Specifications for Tungsten Arc Welding Electrodes*, AWS A5.12-80, American Welding Society.

AWS, *Structural Welding Code Steel*, AWS D1.1-86, American Welding Society.

AWS, *Structural Welding Code Sheet Steel*, AWS D1.3-89, American Welding Society.

ANSI, *Chemical Plant and Petroleum Refinery Piping*, ANSI-STANDARD B31.3-87, American National Standards Institute.

ASME, 1989, *Boiler and Pressure Vessel Code; Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers and Welding and Brazing Operators; and Section V, Nondestructive Examination*, American Society of Mechanical Engineers.

EPA, EPA-SW-846 40 CFR Part 261, Environmental Protection Agency.

A.4 INTERNAL TRANSPORT/HANDLING

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

U.S. Department of Energy Orders

DOE Order 6430.1A, *General Design Criteria*.

Applicable sections of DOE Order 6430.1A include:

0110-9	Operation, Maintenance, Repair, and Replacement
0110-13.5	Physical Protection; Communications Equipment
0110-99.0	Special Facilities, Nonreactor Nuclear Facilities
0110-99.8	Telecommunications, Alarm and ADP Centers and Radio Repeater Stations
0203	Utilities Within Easements or Corridors
0260	Piped Utility Materials
0266	Water Distribution Systems
0270-1	Sanitary Wastewater Collection Systems
0279	Exterior Communications and Alarms Systems
1161-3	Enclosures; Fire Protection
1300-3	Safety Class Criteria
1300-6.9	Radiation Protection; Breathing Air System
1300-7	Confinement Systems
1300-8	Waste Management
1300-9	Effluent Control and Monitoring
1300-10.2	Physical Protection
1300-11	Decontamination and Decommissioning
1300-12	Human Factors Engineering
1525	Mechanical Insulation
1530	Fire Protection
1540	Plumbing/Service Piping
1550-2	HVAC Systems Selection
1550-2.3	Water Distribution Systems
1550-2.4	Steam Distribution Systems
1550-2.5	Air Handling and Air Distribution Systems
1555-2.4	Steam Generation Units
1595	Controls.

Controlled Manuals

Hanford Plant Standards Design Criteria
 WHC-CM-6-4, *Hoisting and Rigging Manual*.

Codes and Standards

NE, *Hoisting and Rigging of Critical Components*, NE F 8-6T.

NRC, *Single Failure Proof Cranes for Nuclear Power Plants*, NUREG-0554,
 U.S. Nuclear Regulatory Commission.

ANSI, *Rules for Construction of Overhead and Gantry Cranes*, NOG-1,
 American National Standards Institute.

ANSI, *Overhead and Gantry Cranes*, ANSI B30.2, American National Standards Institute.

ANSI, *Monorails and Underhung Cranes*, ANSI B30.11, American National Standards Institute.

ANSI, *Overhead Hoists*, ANSI B30.16, American National Standards Institute.

ANSI, *Overhead and Gantry Cranes*, ANSI B30.17, American National Standards Institute.

ANSI, *Stacker Cranes*, ANSI B30.18, American National Standards Institute.

ASME, *Performance Standard for Electric Chain Hoists*, ASME HST-1M, American Society of Mechanical Engineers.

ASME, *Safety Standard for Conveyors and Related Equipment*, ASME B20.1, American Society of Mechanical Engineers.

AWS, *Specification for Welding of Industrial and Mill Cranes*, AWS D14.1, American Welding Society.

CEMA, *Roller Conveyors-Non Powered*, CEMA Std. 401, Conveyor Equipment Manufacturer's Association.

CEMA, *Chain Driven Live Roller Conveyor*, CEMA Std. 404, Conveyor Equipment Manufacturer's Association.

CMAA, *Specification for Electric Overhead Traveling Cranes*, CMAA-70, Crane Manufacturers Association of America.

CMAA, *Specification for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes*, CMAA-74, Crane Manufacturers Association of America.

MMA, *Underhung Cranes and Monorails*, MMA I-4, Monorail Manufacturers Association.

MMA, *Specifications for Underhung Cranes and Monorail Systems*, MMA III-5, Monorail Manufacturers Association.

A.5 BUILDING SYSTEM

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

The WRAP 1 will be a nonreactor nuclear facility and shall be designed to comply with the requirements for Radioactive Solid Waste Facilities specified in DOE Order 6430.1A.

The building code requirements as defined in the Uniform Building Code (UBC), 1991 Edition, and Life Safety Code, NFPA 101, 1991, shall be met.

- a) Occupancy: Group H-7 Storage of Hazardous Materials

Group B-2 Office (Administrative areas) FPA-Industrial

b) Construction: Type II N

The structures, systems, and components shall be designed in accordance with requirements for a "Low-Hazard Facility"--Westinghouse Hanford Company (WHC) Safety Class 3 ("non-safety" class/DOE Order 6430.1A) in accordance with the Preliminary Safety Evaluation.

U.S. Department of Energy Orders

DOE Order 6430.1A, *General Design Criteria*.

Applicable sections of DOE Order 6430.1A include:

<u>Section Number</u>	<u>Section Title</u>
0110-4	Operational Efficiency
0110-99	General Requirements - Special Facilities
0111	Structural Design Requirements
0111-99	Special Facilities - Non-Reactor
	Nuclear Facilities - General
0201-1	Subsurface Investigations - General
0235	Building Foundations
0301	General Requirements - Concrete
0310	Concrete Foundations
0320	Concrete Reinforcement
0330	Cast-in-Place Concrete
0340	Recast Concrete
0380	Mass Concrete
0401	Masonry Structures - General
0410	Mortar and Grout
0420	Unit Masonry
0512	Structural Steel
0514	Structural Aluminum
0521	Steel Joists
0531	Steel Decks
0532	Metal Fasteners
0750-1	Membrane Roofing Design
0750-3	Roof Mounted Equipment
0751	Bituminous Roofing
0750-4	Walkways
0753	Elastomeric/Plastomeric Sheet Roofing
0760-1	Sheet Metal Roofing
0512-3	Pre-engineered Metal Building
0710-1	Waterproofing - General
0711	Sheet Membrane Waterproofing
0715-1	Dampproofing - General
0719	Vapor and Air Retards
0720-1	Insulation
0721	Building Insulation
0722	Roof and Deck Insulation
0724	Exterior Insulation and Finish Systems
0760	Flashing and Sheet Metal

0790	Sealants and Joints
0800-1	Doors
0810	Metal Doors and Frames
0836	Sectional Overhead Doors
0800-2	Windows
0850-2	Aluminum Windows
0880	Glazing
0870	Door and Window Hardware
0900	Finishes - General
0900-3	Hazardous Materials Contamination
0900-99	Special Facilities
0910-1	Non-load Bearing Wall Framing Systems
0910-2	Ceiling Suspension Systems
0925	Gypsum Board
0930-1	Ceramic Tile
0950-1	Acoustical Treatment - General
0965	Resilient Flooring
0968	Carpet
0980	Special Coatings
0990	Painting
1015	Compartments and Cubicles
1027	Access Flooring
1050	Lockers
1052	Fire Protection Specialties
1065	Operable Partitions
1080	Toilet and Bath Accessories
1201	Furnishings - General
1230	Manufactured Casework
1250	Window Treatment
1260-2	Furniture
1260-99	Special Facilities - Laboratories.

Controlled Manuals

Hanford Plant Standard Design Criteria, SDC 4.1, Standard Architectural-Civil Design Criteria, Design Loads For Facilities, Rev. 12.

WHC-CM-4-3, Industrial Safety Standards.

WHC-CM-7-5, Environmental compliance Manual.

WHC-CM-4-9, Radiological Design Criteria.

WHC-CM-4-41, Fire Protection Program Manual.

Codes and Standards

AAMA, Aluminum Prime Windows and Sliding Glass Doors, AAMA 101, American Architectural Manufacturers Association.

ACI, Building Code Requirements for Reinforced Concrete, ACI 318, American Concrete Institute.

AISC, *Manual of Steel Construction, Ninth Edition*, American Institute of Steel Construction.

ANSI, *Door and Frame Preparation*, ANSI A115, American National Standards Institute.

ANSI, *Hardware*, ANSI A156, American National Standards Institute.

ANSI, *Sectional Overhead Type Doors*, ANSI A216.1, American National Standards Institute.

ANSI, *Protective Coatings (Paint) for the Nuclear Industry*, ANSI N512, American National Standards Institute.

ASTM, *Standard Specification for Metal Suspension Systems for Acoustical Tile and for Lay-in Panels*, ASTM C635, American Society for Testing and Materials.

ASTM, *Standard Recommended Practice for Installation of Metal Ceiling Systems for Acoustical Tile and for Lay-in Panels*, ASTM C636, American Society for Testing and Materials.

ASTM, *Standard Specification for Application and Finishing of Gypsum Board*, ASTM C840, American Society for Testing and Materials.

ASTM, *Specification for Flat Glass*, ASTM C1036, American Society for Testing and Materials.

ASTM, *Test Method for Surface Burning Characteristics of Building Materials*, ASTM E84, American Society for Testing and Materials.

ASTM, *Standard Recommended Practice for Application of Ceiling Suspension Systems for Acoustical Tile and for Lay-in Panels*, ASTM E580, American Society for Testing and Materials.

ASTM, *Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, ASTM E648, American Society for Testing and Materials.

ASTM, *Practice for Sealing Seams of Resilient Sheet Flooring Products by Use of Liquid Seam Sealers*, ASTM F693, American Society for Testing and Materials.

CFR, *Occupational Safety and Health Standards*, 29 CFR 1910.

CFR, *Safety and Health Regulations and Construction*, 29 CFR 1926.

CISCA, *Acoustical Ceilings Handbook*, Ceiling and Interior Systems Contractors Association.

CRI, *Carpet Specifiers Handbook*, Carpet and Rug Institute.

FGMA, *Glazing Manual*, Flat Glass Marketing Association.

FM, *Approval Guide*, Factory Mutual.

ICBO, *Suspended Ceilings*, Rpt. 4071, International Conference of Building Officials.

MBMA, *Metal Building Systems Manual*, Metal Building Manufacturers' Association.

MLSFA, *Steel Framing Systems Manual*, Metal Lath/Steel Framing Association.

NFPA (1990), *Portable Fire Extinguishers*, NFPA 10, National Fire Protection Agency.

NFPA (1991), *Life Safety Code*, NFPA 101, National Fire Protection Agency.

NRCA, *Roofing and Waterproofing Manual*, National Roofing Contractors Association.

PCA, *Clear Coatings for Exposed Architectural Concrete*, Portland Cement Association.

PCA, *Painting Concrete*, Portland Cement Association.

PDCA, *Architectural Painting and Wall Covering Manual*, Painting and Decorating Contractors of America.

RFCI, *Recommended Work Procedures for Resilient Floor Covering*, Resilient Floor Covering Institute.

SDI, *Standard Steel Doors and Frames*, SDI 100, Steel Door Institute.

SMACNA, *Architectural Sheet Metal Manual*, Sheet Metal and Air Conditioning Contractors National Association.

TCA, *Handbook of Ceramic Tile Installation*, Tile Council of America.

UBC, *Classification of all Buildings By Type of Construction and General Requirements*, UBC Chapter 17.

UBC, *General Design Requirements*, UBC Chapter 23.

UBC, *Roof Construction and Covering*, UBC Chapter 32.

UBC, *Metal Suspension System, for Acoustical Tile and for Lay-in Panel Ceilings*, UBC Standard 47-18.

UCRL, *Suspend Ceiling System Survey and Seismic Bracing Recommendations*, UCRL 15714, Section V, University of California Research Laboratory.

UL, *Building Materials Directory*, Underwriters Laboratory.

UL, *Fire Resistance Directory*, Underwriters Laboratory.

UL, *Safety Standard for Electrically Conductive Floorings*, UL 779, Underwriters Laboratory.

UL, *Test Methods for Measuring the Surface Plane Propagation Characteristics of Flooring and Floor Covering Materials*, UL 992, Underwriters Laboratory.

Washington State Department of Transportation Standards

Uniform Plumbing Code, 1991 Edition.

A.6 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES AND STANDARDS REQUIREMENTS

U.S. Department of Energy Orders

DOE ERDA 76-21 (ORNL-NSIC-65-1), *Nuclear Air Cleaning Handbook: The Design, Construction and Testing of High Efficiency Air Cleaning Systems*.

DOE 5400.1, *General Environmental Protection Program Requirements Chapter IV Environmental Monitoring Requirements*.

DOE 5480.11, *Radiation Protection for Occupational Workers*.

DOE Order 6430.1A, *General Design Criteria* (reference only).

0110-12	Energy Conservation
0110-99.0	Special Facilities, Nonreactor Nuclear Facilities-- General
1161	Enclosures
1300-1	Coverage and Objectives
1300-6	Radiation Protection
1300-7	Confinement Systems
1300-8	Waste Management
1300-9	Effluent Control and Monitoring
1300-11	Decontamination and Decommissioning
1300-12	Human Factors Engineering
1324-1	Coverage
1324-6	Confinement Systems
1324-7	Effluent Control and Monitoring
1525	Mechanical Insulation
1530-99.0	Fire Protection, Nonreactor Nuclear Facilities-- General
1550	Heating, Ventilating and Air-Conditioning Systems
1550-1	General Sizing and Design Criteria
1550-2	Heating, Ventilating, and Air-Conditioning Systems
1550-3	Testing, Adjusting, and Balancing
1565-1	Refrigeration, CFC Limitations as a Refrigerant
1589-1	Air Pollution Control, General
1589-2	Improved Risk Concept

1589-99.0 Special Facilities, Nonreactor Nuclear Facilities--
General
1595 Controls (All Sections).

Controlled Manuals

Hanford Plant Standards Design Criteria, SDC 5.1, Standard Design Criteria for Heating, Ventilating and Air Conditioning, Rev. 6.

Hanford Plant Standards, HPS-157-M to HPS-163-M. Standard Specifications for high-efficiency particulate air Filters.

WHC-CM-4-9, *Radiological Design Criteria*, Section 4, Ventilation (to be provided by WHC).

WHC-CM-4-3, *Industrial Safety Manual*.

WHC-CM-4-11, *As low as Reasonably Achievable Program Manual*.

Codes and Standards

AABC, *National Standards for Total System Balance Air Distribution Hydronic Systems-Sound-Vibration-Field Surveys for Energy Audits*, AABC Volume A-82, Associated Air Balance Council.

ACGIH, *Industrial Ventilation Manual of Recommended Practice*, American Conference of Governmental Industrial Hygienists.

AMCA, *Standards Handbook*, Publication 99, Air Movement and Control Association.

AMCA, *Fans and Systems*, Publication 201, Air Movement and Control Association.

AMCA, *Laboratory Methods for Testing Fans for Ratings*, Publication 210, Air Movement and Control Association.

AMCA, *Directory of Products Licensed to Bear the AMCA Certified Rating Seal*, Publication 261, Air Movement and Control Association.

ANSI, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, ANSI N13.1, American National Standards Institute.

ARI, *Forced Circulation Air Cooling and Air Heating Coils*, ARI 410, Air Conditioning and Refrigeration Institute.

ARI, *Central Station Air Handling Units*, ARI 430, Air Conditioning and Refrigeration Institute.

ARI, *Water-Cooled Refrigerant Condensers, Remote Type*, ARI 450, Air Conditioning and Refrigeration Institute.

ARI, *Remote Mechanical-Draft Air-Cooled Refrigerant Compressors*, ARI 460, Air Conditioning and Refrigeration Institute.

ARI, *Positive Displacement Refrigerant Compressors and Condensing Units*, ARI 520, Air Conditioning and Refrigeration Institute.

ARI, *Centrifugal Water Chilling Packages*, ARI 550, Air Conditioning and Refrigeration Institute.

ARI, *Reciprocating Water Chilling Packages*, ARI 590, Air Conditioning and Refrigeration Institute.

ARI, *Commercial and Industrial Air Filter Equipment*, ARI 850, Air Conditioning and Refrigeration Institute.

ASHRAE, *Safety Code for Mechanical Refrigeration*, Standard 15, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Methods of Testing for Rating Remote Mechanical Draft Air Cooled Refrigerant Condenser*, Standard 20, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Methods of Testing for Rating Liquid Coolers*, Standard 24, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Methods of Testing Fans for Rating*, Standard 51, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Thermal Environmental Conditions for Human Occupancy*, Standard 55, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Ventilation for Acceptable Indoor Air Quality*, Standard 62, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Energy Conservation in New Building Design*, Standard 90, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Applications Handbook*, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Equipment Handbook*, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Fundamentals Handbook*, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Refrigeration Handbook*, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Systems Handbook*, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Manual, Design of Smoke Control Systems for Buildings*, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASHRAE, *Cooling and Heating Load Calculation Manual*, Publication GRP 158, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

ASME, *Fittings, Flanges, and Valves*, ASME B16 Series, American Society of Mechanical Engineers.

ASME, *Chemical Plant and Petroleum Refinery Piping*, ASME B31.1, American Society of Mechanical Engineers.

ASME, *Nuclear Power Plant Air Cleaning Units and Components*, ASME N509, American Society of Mechanical Engineers.

ASME, *Testing of Nuclear Air Cleaning Systems*, ASME N510, American Society of Mechanical Engineers.

ASME, *Boiler and Pressure Vessel Code*, Section VIII, American Society of Mechanical Engineers.

ASTM, *Recommended Practice for Examination and Evaluation of Pitting Corrosion*, ASTM G46, American Society for Testing and Materials.

CTI, *Test for Water Cooling Towers*, Bulletin ATC-105, Cooling Tower Institute.

NEMA, *Motors and Generators*, NEMA MG-1, National Electrical Manufacturing Association.

NFPA, *Standard on Automatic Fire Detectors*, NFPA 72E, National Fire Protection Agency.

NFPA, *Air Conditioning and Ventilation Systems*, NFPA 90A, National Fire Protection Agency.

NFPA, *Blower and Exhaust Systems*, NFPA 91, National Fire Protection Agency.

NFPA, *Cooking Equipment, Vapor Removal*, NFPA 96, National Fire Protection Agency.

NFPA, *Life Safety Code*, NFPA 101, National Fire Protection Agency.

NFPA, *Test and Surface Burning Characteristics of Building Materials*, NFPA 255, National Fire Protection Agency.

NRC, *Guidelines for Control Room Design Reviews*, NUREG 0700, U.S. Nuclear Regulatory Commission.

SMACNA, *Heating, Ventilating, and Air Conditioning Air Duct Leakage Test Manual*, Sheet Metal and Air Conditioning Contractors National Association.

SMACNA, *Heating, Ventilating, and Air Conditioning Duct Construction Standards--Metal and Flexible*, Sheet Metal and Air Conditioning Contractors National Association.

SMACNA, *Fibrous Glass Duct Construction Standards*, Sheet Metal and Air Conditioning Contractors National Association.

SMACNA, *Round Industrial Duct Construction Standards Heating, Ventilating, and Air Conditioning Duct Design Manual*, NUREG 0700, Sheet Metal and Air Conditioning Contractors National Association.

SMACNA, *Energy Recovery Equipment and Systems Manual*, Sheet Metal and Air Conditioning Contractors National Association.

TIMA, *Economic Thickness Manual*, Thermal Insulation Manufacturers Association.

UL, *Refrigerant-Containing Components and Accessories, Nonelectrical*, UL 207, Underwriters Laboratory.

UL, *High Efficiency Particulate, Air Filter Units*, UL 586, Underwriters Laboratory.

UL, *Test for Surface Burning Characteristics of Building Materials*, UL 723, Underwriters Laboratory.

UL, *Test Performance of Air Filter Units*, UL 900, Underwriters Laboratory.

UL, *Hermetic Refrigerant Motor--Compressors*, UL 984, Underwriters Laboratory.

A.8 UTILITIES SYSTEM

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS REQUIREMENTS

Code of Federal Regulations

29 CFR 1910, 1991, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.

U.S. Department of Energy Orders

DOE Order 6430.1A, *General Design Criteria*.

Applicable sections of DOE Order 6430.1A include:

0110-9	Operation, Maintenance, Repair, and Replacement
0110-13.5	Physical Protection; communications Equipment
0110-99.0	Special Facilities, Nonreactor Nuclear Facilities
0110-99.8	Telecommunications, Alarm and ADP Centers and Radio Repeater Stations
0203	Utilities Within Easements or Corridors

0260	Piped Utility Materials
0262-3	Cathodic Protection Systems
0266	Water Distribution Systems
0270-1	Sanitary Wastewater Collection Systems
0278	Power and Lighting Exterior Communications and Alarms Systems
0283-7	Physical Protection; Lighting
1161-3	Enclosures; Fire Protection
1300-3	Safety Class Criteria
1300-6.9	Radiation Protection; Breathing Air System
1300-7	Confinement Systems
1300-8	Waste Management
1300-9	Effluent Control and Monitoring
1300-10.2	Physical Protection
1300-11	Decontamination and Decommissioning
1300-12	Human Factors Engineering
1525	Mechanical Insulation
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1685	Space Heating
1694	Energy Conservation.

Controlled Manuals

Hanford Plant Standards Design Criteria.

WHC-CM-6-4, Hoisting and Rigging Manual.

WHC-CM-4-3, Industrial Safety Standards.

WHC-CM-7-5, Environmental Compliance.

Hanford Plant Standards - Electrical.

Codes and Standards

ANSI, *Chemical Plant and Petroleum Refinery Piping*, ANSI B31.3, American National Standards Institute.

ANSI, *Specification for Horizontal End Suction Centrifugal Pumps*, ANSI B73.1, American National Standards Institute.

ANSI, *National Electrical Safety Code*, ANSI C2, American National Standards Institute.

ANSI, *Emergency Eyewash and Shower Equipment*, ANSI Z358.1, American National Standards Institute.

ASME, *Unfired Pressure Vessels*, ASME Section VIII, American Society of Mechanical Engineers.

ASTM, *Specification for Seamless and Austenitic Stainless Steel Pipe*, ASTM A312, American Society for Testing and Materials.

ASTM, *Specification for Hard-Drawn Copper Wire*, ASTM B1, American Society for Testing and Materials.

ASTM, *Recommended Practice for Examination and Evaluation of Pitting Corrosion*, ASTM G46, American Society for Testing and Materials.

AWS, *Structural Welding Code - Steel*, AWS D1.1, American Welding Society.

CFR, *Occupational Safety and Health*, 29 CFR Part 1910.

FM, *Approval Guide*.

HIS, *Standard for Centrifugal, Rotary and Reciprocating Pumps*, Hydraulic Institute Standards.

IAPMO, *Uniform Plumbing Code*, International Association of Plumbing and Mechanical Officials.

NFPA, *Installation of Sprinkler Systems*, NFPA 13, National Fire Protection Association.

NFPA, *Installation of Standpipe and Hose Systems*, NFPA 14, National Fire Protection Association.

NFPA, *National Electrical Code*, NFPA 70, National Fire Protection Association.

NFPA, *Signalling Systems for Control Station Service*, NFPA 71, National Fire Protection Association.

NFPA, *Protective Signalling Systems*, NFPA 72, National Fire Protection Association.

NFPA, *Automatic Fire Detectors*, NFPA 72E, National Fire Protection Association.

NFPA, *Life Safety Code*, NFPA 101, National Fire Protection Association.

NFPA, *Fire Protection for Laboratories Using Chemicals*, NFPA 45, National Fire Protection Association.

NEMA National Electrical Manufacturers Association.

IEEE, *Standards*, Institute of Electrical & Electronic Engineers.

IES, *Lighting Handbook*, Illuminating Engineering Society.

NACE, *Recommended Practice Control of External Corrosion on Underground or Submerged Piping*, NACE RP-01-69, National Association of Corrosion Engineers.

FS, *Plumbing Fixtures*, FS WW-P-541.

WAC-173-303-040, *Dangerous Waste Regulations, Definitions*.

WAC-173-303-640, *Dangerous Waste Regulations, Tank Systems*.

WAC-173-303-810, *Dangerous Waste Regulations, General Permit Conditions*.

A.9 ENVIRONMENTAL PROTECTION/WASTE MANAGEMENT

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS REQUIREMENTS

U.S. Department of Energy Orders

DOE (and DOE-RL) Order 5484.1 and 1A, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*.

DOE Notice 5400.4, *Integration of Environmental Compliance Processes*.

DOE Notice 5480.4, *Preliminary Notification of Environment, Safety and Health Concerns*.

DOE Order 4700.1, *Project Management System*.

DOE Order 5400.1, *General Environmental Protection Program*.

DOE Order 5400.2 and 2A, *Environmental Compliance Issue Coordination*.

DOE Order 5400.3, *Hazardous and Radioactive Mixed Waste Program*.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*.

DOE Order 5440.1C, *Implementation of the National Environmental Policy Act*.

DOE Order 5480.1B, *Environment, Safety and Health Program for Department of Energy Operations*.

DOE Order 5480.2, *Hazardous and Radioactive Mixed Waste Management*.

DOE Order 5480.3, *Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances and Hazardous Wastes.*

DOE Order 5480.4, *Environmental Protection, Safety and Health Protection Standards.*

DOE Order 5820.2A, *Radioactive Waste Management.*

DOE Order 6430.1A, *General Design Criteria.*

Draft DOE Order 5400.xx, *Environment, Safety and Health Directive.*

Draft DOE Order 5400.xy, *Radiological and Effluent Monitoring and Environmental Surveillance.*

Controlled Manuals

WHC-CM-7-5, *Environmental Compliance*, March 1993.

WHC-EP-0063-2, *Hanford Site Radioactive Solid Waste Acceptance Criteria*, September 1990.

WHC-SD-WM-TI-428 as referenced in July 9, 1991 memorandum Lucas to Mani, *Backup Data for Waste Receiving and Processing Facility Module 1 SDRD Revision C Flowsheet.*

Codes and Standards

ANSI, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, ANSI N13.1, American National Standards Institute.

ANSI, *Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents*, ANSI N42.18-1980, American National Standards Institute.

CFR, *Compliance with Floodplains/Wetlands Environmental Review Requirements*, 10 CFR 1022.

USC, *Toxic Substances Control Act*, 15 USC 2601 et. seq.

CFR, Subpart Z, Toxic and Hazardous Substances, 29 CFR 1910.1000.

CFR, Subpart H, Hazardous Materials, 29 CFR 1910.101-.120.

CFR, *Toxic Pollutant Effluent Standards*, 40 CFR 129.

CFR, *Guidelines Establishing Test Procedures for the Analysis of Pollutants*, 40 CFR 136.

CFR, *National Primary Drinking Water Standards*, 40 CFR 141.

CFR, *CEQ Regulations*, 40 CFR 1500, et seq.

CFR, *Environmental Radiation Protection Standards for Nuclear Power Operations*, 40 CFR 190.

CFR, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes*, 40 CFR 191.

CFR, *Designation, Reportable Quantities and Notification*, 40 CFR 302.

CFR, *Emergency Planning and Notification under CERCLA*, 40 CFR 355.

CFR, *CERCLA Reportable Quantities*, 40 CFR 402.

CFR, *Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions*, 40 CFR 761.

CFR, *New Source Performance Standards (NSPS)*, 40 CFR Part 60.

CFR, *National Emission Standards for Hazardous Air Pollutants (NESHAP)*, 40 CFR Part 61.

CFR, *Resource Conservation and Recovery Act (RCRA) Regulations*, 40 CFR Parts 240, 241-247, 256-257, 260-265, 268 and 270.

USC, *National Environmental Policy Act*, 42 USC 4321-4347.

USC, *Resource Conservation and Recovery Act*, 42 USC 6901, et seq.

USC, *Safe Drinking Water Act*, 42 USC 201 et seq.

USC, *Clean Air Act*, 42 USC 7401, et seq.

USC, *Clean Water Restoration Act*, 43 USC 431 et seq., Sections 307, 318, 402 and 405.

EO, *Floodplains/Wetlands Environmental Review*, EO 11988 and 11990.

CFR, *Department of Transportation Regulations for Hazardous Materials*, 49 CFR 171-179.

FR, *DOE Guidelines for NEPA Compliance*, 52 FR 47662, Section D.

FR, September 2, 1988, *Use of Sumps for Secondary Containment*, 53 FR 34079.

EO, *Protection and Enhancement of Environmental Quality*, EO 11514 and 11991.

EO, *Federal Compliance with Pollution Control Standards*, EO 12088.

EO, *Response to Environmental Damage*, EO 12316.

General Regulation 80-7, Benton-Franklin-Walla Walla Counties Air Pollution Control Authority.

NuPac TRUPACT-II SAR, Rev.4, August 1989, Nuclear Packaging, Inc., Federal Way, Washington.

OMB Circular No. A-106, *Reporting Requirements in Connection with the Prevention, Control and Abatement of Environmental Pollution of Existing Federal Facilities of December 31, 1974 as revised.*

PSD-X80-14, *Approval to Application to Construct* (EPA Region X document).

Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs - Effluent Streams and the Environment*, Revision 1, U.S. Nuclear Regulatory Commission, Office of Standards Development, Washington, D.C. 1979.

EPA, 1986, *Test Methods for Evaluating Solid Waste*, SW-846, U.S. Environmental Protection Agency.

UCRL, *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomenon Hazards*, UCRL 15910 (draft), University of California Lawrence Radiation Laboratory.

Washington Air Pollution Control Regulations, Title 173, Chapters 173.400 through 173.490.

Washington Clean Air Act, Title 70, Chapter 94.

Washington Department of Ecology General Regulations, Chapter 173, Chapters 173.03, 173.04, 173.06, 173.08 and 173.12.

Washington Energy Facility Site Evaluation Council General Regulations for Air Pollution Sources, Title 463, Chapter 39.

Washington Environmental Coordination Procedures Act of 1973, Title 90, Chapter 90.62.

Washington Environmental Quality Laws, Title 43, Chapter 43.21A.

Washington Hazardous Waste Cleanup Regulations, Title 173, Chapter 340.

Washington Hazardous Waste Fee Regulations, Title 173, Chapter 305.

Washington Hazardous Waste Management Act, Title 70, Chapter 70.105.

Washington Model Toxics Control Act, Title 70, Chapter 70.105D.

Washington Pollution Control Tax Credit Regulations, Title 173, Chapter 24.

Washington Safe Drinking Water Act, Title 70, Chapter 119A.

Washington Solid Waste Management Law, Title 70, Chapter 70.95.

Washington State Department of Ecology, *Dangerous Waste Regulations*, Title 173 Chapter 303.

Washington State Solid Waste Rules, Title 173, Chapter 304.

Washington Water Pollution Control Laws, Title 90, Chapter 48.

Washington Water Pollution Control Regulations, Title 173, Chapters 10, 216, 220, 221, 222, 225, and 227.

Washington Water Quality Standards, Title 173, Chapter 201.

WIPP-DOE-069, Rev. 2, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*.

WIPP-DOE-069, Revision 3, *Transuranic Waste Acceptance Criteria*, January 1989.

WIPP-DOE-114, Rev. 2, *Transuranic Waste Certification Compliance Requirements for Acceptance of Newly Generated Contact-Handled Wastes to be Shipped to the Waste Isolation Pilot Plant*, January 1989.

WIPP-DOE-120, Rev 1, *Quality Assurance*.

WIPP-DOE-137, Rev. 2, *Transuranic Waste Certification Compliance Requirements for Acceptance of Newly Generated Contact-Handled Waste to be Shipped to the Waste Isolation Pilot Plant*, January 1989.

WIPP-DOE-157, Rev. 1, *Data Package Format for Certified Transuranic Waste for the Waste Isolation Pilot Plant*.

A.10 RADIOLOGICAL PROTECTION

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

U.S. Department of Energy Orders

DOE (and DOE-RL) Order 6430.1A, *General Design Criteria*.

DOE Order 5480.11, *Radiation Protection for Occupational Workers*.

DOE Order 5500.2, *Emergency Planning, Preparedness, and Response for Operations*.

DOE-RL Order 5480.11A, *Requirements for Radiation Protection*.

DOE/EV/1830-T5, *A Guide to Reducing Radiation Exposures to As Low As Reasonably Achievable*, April 1980.

Controlled Manuals

WHC-CM-4-9, *Radiological Design*.

WHC-CM-4-10, *Radiation Protection*.

Codes and Standards

ANSI, *Protective Coatings (Paints) for the Nuclear Industry*, ANSI Standard N512, American National Standards Institute.

ICRP, *Cost-Benefit Analysis in the Optimization of Radiation Protection*, ICRP 37, International Commission on Radiological Protection.

A.11 INDUSTRIAL SAFETY

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

U.S. Department of Energy Orders

DOE Order 6430.1A, *General Design Criteria*, 4-6-89.

Controlled Manuals

Industrial Safety Manual, WHC-CM-4-3; Volumes 1, 2 and 3, December 1987.

Codes and Standards

OSHA, Code of Federal Regulations, 29 CFR 1926 and 29 CFR 1910, Occupational Safety and Health Administration.

OSHA, June 5, 1989, *Permit Required Confined Spaces*, proposed standard 29 CFR 1910.146; Notice of Proposed Rulemaking, Occupational Safety and Health Administration.

ANSI, April 10, 1990, *Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems*, ANSI A1264, American National Standards Institute.

NFPA, *101 Life Safety Code*, 1991 Edition, National Fire Protection Association.

ASHRAE, 1975, *Heating Ventilating and Air Conditioning Guide*, American Society of Heating, Air Conditioning and Refrigerating Engineers.

DOL, OSHA, *Occupational Exposure to Hazardous Chemicals in Laboratories*, 29 CFR 1910.1450, Department of Labor, Occupational Safety and Health Administration.

NIOSH, October 1978, *Development of Performance Criteria for Protective Clothing Used Against Carcinogenic Liquids*, Publication No. 79-106, National Institute for Occupational Safety and Health.

NIOSH, October 1984, *Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide*, Publication No. 84-114, National Institute for Occupational Safety and Health.

ANSI, 1980, *American National Standard Practices for Respiratory Protection*, ANSI Z88.2, American National Standards Institute.

ANSI, 1973, Compressed Gas Association, Inc., *Commodity Specification for Air*, ANSI G-7.1, ANSI Z86.1, American National Standards Institute.

ANSI, 1989, Compressed Gas Association, Inc., *Commodity Specification for Air*, ANSI G-7.1, ANSI Z86.1, American National Standards Institute.

ANSI, 1990, Compressed Gas Association, Inc., *Compressed Air For Human Respiration*, ANSI CGA G-7, American National Standards Institute.

National Safety Council, *Emergency Showers and Eyewash Fountains*, Data Sheet 1-686-Rev.86.

ANSI, 1981, *American National Standard for Emergency Eyewash and Shower Equipment*, ANSI Z386.1, American National Standards Institute.

National Safety Council, 1988, *Accident Prevention Manual for Industrial Operations, Engineering and Technology*.

ANSI, *Scheme for the Identification of Piping Systems*, ANSI A13.1, American National Standards Institute.

A.12 NUCLEAR CRITICALITY SAFETY

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

U.S. Department of Energy Orders

DOE Order 6430.1A, *General Design Criteria*.

DOE Order 5480.5, *Safety of Nuclear Facilities*.

DOE Order 5480.24, *Nuclear Criticality Safety*.

DOE Order 5481.1B, *Safety Analysis and Review System*.

Controlled Manuals

WHC-CM-4-29, *Nuclear Criticality Safety*.

Codes and Standards

ANSI, *Safety Standards for Operations with Fissionable Materials*, ANSI N16.1, American National Standards Institute.

TID, *Nuclear Safety Guide*, TID-7016, Technical Information Division.

NRC, May 1988, *Nuclear Fuel Cycle Facility Accident Analysis Handbook*, NUREG 1320, U.S. Nuclear Regulatory Commission.

A.13 FIRE PROTECTION

APPLICABLE U.S. DEPARTMENT OF ENERGY ORDERS, CODES, AND STANDARDS

U.S. Department of Energy Orders

DOE 6430.1, Section 15, *General Design Criteria Manual*, 04/06/89, Section 0110-6, 110-99.0.6 and 1530 (DOE 1989).

DOE and DOE-RL 5480.7, *Fire Protection*, 11/16/87. DOE 5480.4, Attachment 2, Section 2C. (DOE 1987b).

Controlled Manuals

Industrial Safety Manual, WHC-CM-4-3, Volumes 1 and 2. (WHC 1988b)

Codes and Standards

NFPA, 1990, *Portable Extinguisher*, NFPA-10, National Fire Protection Agency.

NFPA, 1989a, *Fire Sprinkler Systems*, NFPA-13, National Fire Protection Agency.

NFPA, 1989c, *Standpipe & Hose Systems*, NFPA-14, National Fire Protection Agency.

NFPA, 1990d, *Dry Chemical Extinguishing Systems*, NFPA-17, National Fire Protection Agency.

NFPA, 1990a, *National Electric Code*, NFPA-70, National Fire Protection Agency.

NFPA, 1990b, *Installation, Maintenance, and Use of Protective Signaling Systems*, NFPA-72, National Fire Protection Agency.

NFPA, 1990e, *Automatic Fire Detectors*, NFPA-72E, National Fire Protection Agency.

NFPA, 1990f, *Fire Doors and Windows*, National Fire Protection Agency.

NFPA, 1987a, *Exterior Fire Exposures*, NFPA-80A, National Fire Protection Agency.

NFPA, 1991, *Life Safety Code*, NFPA-101, National Fire Protection Agency.

NFPA, 1991a, *Properties of Flammable Liquids, Gases and Solids*, NFPA-325M, National Fire Protection Agency.

NFPA, 1991b, *Facilities Handling Radioactive Materials*, NFPA-801, National Fire Protection Agency.

NFPA, 1988, *Standard for Installation, Maintenance, and Use of Public Fire Service Communication Systems*, NFPA-1221, National Fire Protection Agency.

NFPA, 1991c, *Fire Protection Handbook*, 17th Edition, National Fire Protection Agency.

Factory Mutual System, *Loss Prevention Data Sheets*.

Uniform Building Code, International Conference of Building Officials, Whittier, California, 1991

A.14 STRUCTURAL

APPLICABLE CODES AND STANDARDS

ACI, *Building Code Requirements for Reinforced Concrete*, ACI 318-89, American Concrete Institute.

AISC, *Manual of Steel construction*, 9th edition, American Institute of Steel Construction.

ICBO, *Uniform Building Code*, 1988 edition, International Conference of Building Officials.

UCRL, June 1990, *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards*, UCRL-15910, University of California Lawrence Radiation Laboratory.

ASCE, *Minimum Design Loads for Buildings and Other Structures*, ASCE 7-88, American Society of Civil Engineers.

ASTM, *ASTM Specifications and Standards*, American Society for Testing and Materials.

AWS, *Structural Welding Code*, D1.1-90, American Welding Society.

Hanford Plant Standards, Architectural-Civil Design Criteria, Design Loads for Facilities, SDC 4.1, Rev. 12.

A.15 ELECTRICAL

APPLICABLE CODES AND STANDARDS

IEEE, 1986a, *Recommended Practice for Electrical Power Distribution for Industrial Plants*, IEEE 141-1986, Institute of Electrical and Electronics Engineers.

IEEE, 1986b, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*, IEEE 242-1986, Institute of Electrical and Electronics Engineers.

IEEE, 1980, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems*, IEEE 493-1980, Institute of Electrical and Electronics Engineers.

IEEE, 1987, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications*, IEEE 446-1987, Institute of Electrical and Electronics Engineers.

IEEE, 1982, *Recommended Practice for Grounding of Industrial and Commercial Power Systems*, IEEE 142-1982, Institute of Electrical and Electronics Engineers.

NFPA, 1990a, *National Electrical Code*, NFPA 70, National Fire Protection Agency.

NFPA, 1986b, *Lightning Protection Code*, NFPA 78, National Fire Protection Agency.

NFPA, 1991, *Code for Safety to Life from Fire in Buildings and Structures*, NFPA 101, National Fire Protection Agency.

IES, *Lightning Handbook*, Reference Volume (IES 1984), and Applications Volume (IES 1987), Illumination Engineering Society of North America.

ANSI, 1990, *National Electrical Safety Code*, ANSI C2-1990, American National Standards Institute.

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APPENDIX 2B

**WASTE RECEIVING AND PROCESSING FACILITY MODULE 1 DEVIATION TO
GENERAL DESIGN CRITERIA 6430.1A.**

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Department of Energy

Richland Field Office

P.O. Box 550

Richland, Washington 99352

APR 13 1993

W003437

93-PMD-152

Mr. M. J. Wolters, WRAP Project Manager
United Engineers & Constructors, Inc.
Western Operations Division
5555 Greenwood Plaza Blvd.
Englewood, Colorado 80111

Dear Mr. Wolters:

CONTRACT NO. DE-AC06-91RL11946, WASTE RECEIVING AND PROCESSING MODULE 1,
DEVIATION TO GENERAL DESIGN CRITERIA 6430.1A

Deviation from the Statement of Work paragraph 4.0, as invoked through
DOE Order 6430.1A, Section 1530-99.0, Pages 15-21, requirement for two
independent sources of water for the permanent fire protection system, is
approved. The Project is to provide the point-of-connection and appropriate
back-flow preventers for the second source of water that is being provided by
another project. If there are any questions, please contact the undersigned
or Robert Bley at (509) 376-0172.

Sincerely,

A. W. Kellogg, Contracting Officer
Procurement Division

PMD:REB

cc: D. R. Lucas, WHC ✓

RECEIVED
WFO AD DMC
APR 14 1993

Department of Energy

Richland Field Office
P.O. Box 550
Richland, Washington 99352

FEB 04 1994

94-PMD-033

President
Westinghouse Hanford Company
Richland, Washington

Dear Sir:

DEVIATION REQUEST TO DOE ORDER 6430.1A AND RLIP 5480.7 FOR WASTE RECEIVING AND PROCESSING MODULE 1

In response to the request made by Raytheon Engineers and Constructors, letter UDL0437.007, dated September 7, 1993, RL concurs with approving the deviation request to DOE 6430.1A, Sections 0111-99.0, 1161-2, and 0110-99.0.6.

The deviation request to RLIP 5480.7, paragraph 7.a, is not required since the MPFL limit was redefined in DOE 5480.7A and concurrence to implement that order was given via RL letter 93-PMD-340, dated August 12, 1993.

If you have any questions concerning this direction, please contact Mr. Robert Bley at 376-0172.

Sincerely,

L. C. Williams, Director
Project Management Division

PMD:WSC

cc: D. K. Quigley, WHC
J. A. Swenson, WHC

4.1.A
(E)

FEB 04 1994

94-PMO-033

President
Westinghouse Hanford Company
Richland, Washington

Dear Sir:

DEVIATION REQUEST TO DOE ORDER 5430.1A AND RLIP 5480.7 FOR WASTE RECEIVING AND PROCESSING MODULE 1

In response to the request made by Raytheon Engineers and Constructors, letter UDL0437.007, dated September 7, 1993, RL concurs with approving the deviation request to DOE 5430.1A, Sections 0111-99.0, 1161-2, and 0110-99.0.6.

The deviation request to RLIP 5480.7, paragraph 7.a, is not required since the MPFL limit was redefined in DOE 5480.7A and concurrence to implement that order was given via RL letter 93-PMO-340, dated August 12, 1993.

If you have any questions concerning this direction, please contact Mr. Robert Bley at 376-0172.

Sincerely,

ORIGINAL SIGNED BY
L. C. WILLIAMS

L. C. Williams, Director
Project Management Division

PMO:WSC

cc: D. K. Quigley, WHC
J. A. Swenson, WHC

bcc: PMO Off File
PMO Rdg File
CCC Rdg File
R. E. Bley, PMO

RECORD NOTE: Approval of the deviation request is based on the Preliminary Safety Evaluation consequences, the FHA, and the Safety Class determination all of which supports that there are no safety class greater than 3 in the WRAP-1 facility. This means that there are no Safety Class items within the facility. The deviation may therefore be granted by the DOE field organization. Section 0110-99.0.6 is also waived due to its reference in 1161-2. This incorporates comments from QSH and WMD. *Note the QSH memo dated 2/7/94 which documents QSH position supporting these deviations.*

RECEIVED

FEB 07 1994

DEVIATE

DOE-RL/CCC

CE >	PMO	PMO	QSH	WMD	AMW	PMO
SURNAME >	PREVIOUSLY	PREVIOUSLY	HOLST	HOLST	PUTHUR	WILLIAMS
DATE >	DISCURRED	DISCURRED	2/1/94	2/1/94	2/1/94	2/1/94

(Please Return To Joeli Giles, 6-1011, FED/565 PMO)

DOCUMENT No. 34816

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APPENDIX 2C
FIRE PROTECTION STANDARDS AND EXEMPTION

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OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

United States Government

Department of Energy

Memorandum

OSI FILE

QSH

RECEIVED CONTROL PHONE 6-8577
CONTROL NO. 62-547E
RECORD TO OSI
RECEIVED 1700K HRT CPA

DATE: MAY 27 1993

REPLY TO
ATTN OF: EM-322

SUBJECT: Request for Exemption from Fire Protection Testing and Inspection Standards as Specified in DOE Order 5480.4

TO: Manager, DOE Richland Field Office

Reference is made to a memorandum from the DOE Richland Field Office, dated October 1991, requesting exemptions for 14 signaling devices from fire protection testing and inspection standards or guidelines as specified in the National Fire Codes of the National Fire Protection Association (NFPA), which is directed for use by DOE Order 5480.4, "Environmental, Protection, Safety, and Health Protection Standards." The request has been approved by the Acting Assistant Secretary for Environment, Safety and Health (EH-1) as required in DOE Order 5480.4. The approval grants exemption for fire protection equipment testing and inspection standards, as specified in your request, except for the following:

- The dry sprinkler system low-pressure alarms must be tested quarterly during months in which temperatures are below 40 °F. This is necessary to insure proper air pressure levels during winter months.
- Heat detectors must be tested in accordance with NFPA criteria in structures where no other fire alarm system exists. Failure of the heat detector could result in no alarm if a fire occurs and other sensing equipment is not available.
- Paddle-type water flow switches, which were manufactured prior to 1980, with bronze or stainless steel components, will require testing in accordance with NFPA 72. Paddle-type waterflow switches with bronze or stainless steel components as noted have been known to fail as a result of the paddle breaking and traveling in the water stream and possibly obstructing flow.

We regret the time it has taken to process this exemption request, but technical and procedural problems prevented us from being more responsive. Future exemptions will be handled more expeditiously.

Please contact James Keenan of my staff at (301) 903-7121 if you have any comments on this decision.

R.L. Commitment Control

JUN 02 1993

Richland Operations Office

Paul D. Grima
Paul D. Grima

Acting Assistant Secretary for Environmental
Restoration and Waste Management

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**WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
FINAL SAFETY ANALYSIS REPORT
Revision 0**

**CHAPTER 3.0
Hazard and Accident Analysis**

February 1997

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TERMS

AED	aerodynamic equivalent diameter
AGV	automated guided vehicle
ARF	airborne release fraction
AS/RS	automated stacker/retrieval system
ASA	Auditable Safety Analysis
CAM	continuous air monitor
DBA	design basis accident
DBE	design basis earthquake
DCF	dose conversion factor
DE-Ci	dose equivalent-Curie
DOE	U.S. Department of Energy
EDE	effective dose equivalent
ERPG	emergency response planning guideline
HAZOP	hazard and operability (study)
HEPA	high efficiency particulate air (filter)
HSRCM-1	Hanford Site Radiological Control Manual
HVAC	heating, ventilating, and air conditioning
INEL	Idaho National Engineering Laboratory
JHA	Job Hazards Analysis
LLW	low-level waste
LPF	leakpath factor
MAR	material at risk
MFP	mixed fission products
MLD	master logic diagram
NDA	nondestructive assay
NDE	nondestructive examination
NRC	U.S. Nuclear Regulatory Commission
ORPS	occurrence reporting and processing system
PCB	polychlorinated biphenyl
PE-Ci	plutonium-equivalent curie
PHA	preliminary hazards analysis
PFP	Plutonium Finishing Plant
RF	respirable fraction
RWM	restricted waste management
RWP	radiological work permit
SAR	Safety Analysis Report
SSC	structures, systems, and components
S/RID	Standards and Requirements Identification Document
SWB	standard waste boxes
SWITS	Solid Waste Information and Tracking System
TNT	trinitrotoluene
TRU	transuranic (waste)
TRUPACT	transuranic package transporter
WIPP	Waste Isolation Pilot Plant

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3.0 HAZARD AND ACCIDENT ANALYSIS

3.1 INTRODUCTION

The WRAP 1 facility is designed to receive, prepare, and ship transuranic (TRU) and low-level waste (LLW) in preparation for long term storage or disposal. The analysis presented represents conditions expected during Phase I. Phase I operations include the receipt, storage, x-ray, assay and shipment of LLW, mixed, and TRU waste drums. The facility will not open drums during Phase I. The receipt and handling of this waste in WRAP 1 presents the potential for various hazards, which must be evaluated to ensure that the risk associated with facility operation is acceptable. This chapter provides the results of the hazards and safety evaluation performed for WRAP 1.

WRAP 1 is determined to be a radiological facility based upon the review of the radionuclide inventories expected to be present in the facility during initial Phase I operations. The radiological inventories will be administratively limited to levels below Hazard Category 3 thresholds during Phase I.

3.2 REQUIREMENTS

This safety analysis report complies with WHC-IP-1120, *Standards and Requirements Identification Document (S/RID)* for Solid Waste. DOE Order 5480.23 requires a facility hazard classification (categorization) that complies with DOE-STD-1027-92. In addition to these orders and standards, general guidance is provided by *Guidelines for Hazard Evaluation Procedures*, issued by the Center for Chemical Process Safety of the American Institute of Chemical Engineers.

3.3 HAZARD ANALYSIS

This section describes the hazard identification and evaluation performed for WRAP 1. The evaluation considers potential process-related, natural, and externally initiated hazards to workers, the public, and the environment presented by WRAP 1 operations. A description of the methodology used is presented in Section 3.3.1 and the results are presented in Section 3.3.2, including the hazard categorization analysis. Section 3.4 summarizes the accidents selected for detailed analysis.

The information in this chapter is based on the hazard and accident analysis originally performed for the entire WRAP 1 facility and on the total activities planned for the facility, including those beyond Phase I. The original hazard and accident analysis was performed for a facility hazard Category of 2 or 3 with potential for nuclear criticality events. During Phase I, this potential does not exist due to administrative controls placed on the inventory of radiological material in WRAP 1. During Phase I, WRAP 1 will be categorized as a radiological facility. The hazard and accident analysis required for a radiological facility is far less stringent than for a Category 2 or 3 facility. However, since information had already been developed in excess of what is now required, it is included here for

completeness. The specific activities related to assessing hazards related to nuclear criticality have been eliminated.

3.3.1 Methodology

The hazard analysis methodology is based on the graded approach. The intent of this approach is to define techniques that are commensurate with a given facility's risks and complexity. The methodology consists of two phases: hazard identification (materials, operations, and natural phenomena) and hazard evaluation, leading to determination of the facility's hazard categorization.

3.3.1.1 Hazard Identification. Potential hazards at WRAP 1 come from three sources: (1) the intrinsic nature of the materials in the waste handled, (2) the activities carried out by facility personnel, and (3) influences of natural phenomena involving these materials. The WRAP 1 facility will handle solid waste contained in 208-L (55 gal) drums, and 322-L (85 gal) overpacked drums during Phase I operations. This waste will come from current Hanford operations and offsite generators and waste retrieved from onsite underground storage.

The hazardous material inventory is composed of radioactive and nonradioactive hazardous materials, as discussed in Section 2.5.1.

The radioactive material inventory for WRAP 1 depends on the type and quantity of waste being processed or stored. From a radiological standpoint, two different waste types are present, transuranic (TRU) waste and LLW.

TRU waste is defined as waste contaminated with alpha-emitting transuranic radionuclides with half-lives >20 yrs and concentrations >100 nCi/g at the time of assay. TRU waste retrieved from storage at the Hanford Site was first stored in May 1970. WHC-SD-WM-TI-517 provides TRU gram distributions for material stored during the periods May 1, 1970, through December 31, 1988, and January 1, 1989 through June 30, 1993, which show average TRU contents of 10.7 and 9.8 g per drum, respectively, for these periods.

Approximately $15,432 \text{ m}^3$ ($545,000 \text{ ft}^3$) of "suspect" TRU waste has accumulated in solid waste burial grounds at the Hanford Site. This waste is referred to as suspect TRU due to changes in the definition of TRU waste. From 1970 to 1982, TRU waste was defined as waste with a TRU radionuclide concentration of >10 nCi/g. In 1982, the limit was revised upward to the present value of >100 nCi/g, and the equipment required to assay at the 100 nCi/g limit was installed at the Hanford Site in 1985. Thus, a portion of the waste stored between 1970 and 1985 may no longer be TRU waste. Characterization at WRAP 1 will determine whether such waste is TRU.

There are 3.67×10^4 curies of mixed fission products (MFPs) in 36,232 drums placed in retrievable storage through December 31, 1988, according to WHC-SD-WM-TI-517. WHC-SD-WM-TI-517 further characterized the 118 drums containing more than 200 Ci of MFPs and concluded that for drums containing significant quantities of TRU (>0.0001 g), the average MFP loading would be 0.07 Ci. Therefore, 0.07 Ci MFP are assumed to be present in all TRU

containers. This is justified because in drums with MFP contents in the range from 0.01 to 0.10 Ci, containing the average 0.07 Ci value, constitute 97.64 cumulative percent of the total drums. The (arithmetic) average MFP curie content (0.07 Ci) in this distribution is larger than the 95 percentile so its usage in the calculations is conservative. The isotopic distribution of ^{137}Cs - 24.8%, ^{137m}Ba - 24.8%, ^{90}Sr - 19.4%, ^{90}Y - 19.4%, ^{241}Pu - 10.4%, ^{241}Am - 0.79%, ^{239}Pu - 0.41% is based on the isotopic fractions for waste decayed 25 years as calculated by the ORIGEN code. The ^{137m}Ba and ^{90}Y are assumed to be in equilibrium with the parents, ^{137}Cs and ^{90}Sr .

WHC-SD-WM-RPT-056 contains an annotated list of the hazardous/dangerous chemicals and materials believed to be present in the solid waste stored in the 200 Area burial grounds at the Hanford Site. Table 3-2 of WHC-SD-WM-RPT-056 contains information gathered for the selected group of constituents judged most likely to be present in waste destined for WRAP 1. The chemicals and materials listed were judged to pose the greatest risk to the safety of onsite and offsite persons not directly involved in handling waste containers. This judgement was based primarily on their toxicity and hazard potential. This table was not intended to be inclusive of all hazardous/dangerous chemicals that may be present in solid waste containers at the Hanford Site. The rationale for the choice of these materials is given in Sections 1.4 and 1.5 of WHC-SD-WM-RPT-056. These sections form the basis used to determine the candidate list of hazardous/dangerous waste constituents within the limitations of the data collected.

Table 3-2 of WHC-SD-WM-RPT-056 also lists numbers of containers and the maximum and median concentrations for each of the hazardous/dangerous chemicals as determined from Solid Waste Information and Tracking System (SWITS) data on a per container basis.

This group of chemicals includes gases, liquids, and solids that vary widely in their toxicity and reactivity. Many of these constituents are hazardous/dangerous in a specific physical form, when combined with other chemicals, or under certain physical conditions. In some cases, the chemical and physical form of the constituents was not available.

Based on a review of disposal records, materials in a solid form are not readily dispersable. Waste packaging requirements for liquids have varied with time and have included: solidification and neutralization (for chemicals such as HNO_3 and NaOH), containerization, absorbent material overpack, and adsorption to a suitable media. A common liquid waste container was a 250-ml polyethylene bottle. The limit for fissile material was 1 L of free liquid (surrounded by absorbent material equal to two times the liquid volume).

The radioactive materials that could be present in waste storage drums have been identified along with the chemicals that may be present. These chemicals when released could cause vaporization, fire or explosion that could transport toxic or radioactive materials within or outside the WRAP 1 facility.

To assist in identifying and focusing on potential abnormal and accident scenarios in WRAP 1, a team consisting of an experienced hazards identification leader, project engineers, operations specialists, and safety analysis engineers was assembled to perform a hazards evaluation analysis.

The analysis was conducted in the form of a hybrid Hazard and Operability (HAZOP) study, a What-If Analysis, and a Preliminary Hazard Analysis (PHA), wherein the containers were tracked from arrival at WRAP 1 to departure.

The purpose of a HAZOP study is to carefully review a process or operation in a systematic way to determine whether deviation from prescribed procedures can lead to undesirable consequences. A leader guides a team through the plant design using a fixed set of guide words. These guide words are applied at specific points or nodes in the plant design and are combined with specific process parameters to identify potential deviations from the plant's intended operation. For example, the guide word "No" combined with the process parameter "Flow" results in the deviation "No Flow."

Process flow diagrams developed from the modified HAZOP study (see Appendix 3A) were used to identify operational hazards for WRAP 1. Every stop or transfer to a piece of equipment was considered a node. Instead of applying guide words, which are not applicable to this mechanical process, What-If and PHA processes were used and the questions "What can go wrong?" and "What energy sources are available?" were asked at each node. The process flow diagrams were retraced by the team to identify any hazardous situations that could affect worker safety. Each cognizant area engineer led the task team through the design drawings, identifying inventories, equipment, facility features, primary and secondary process material flow streams, and interfaces. Every potential accident, hazardous scenario, or threat to worker safety identified by the task team was recorded in a PHA-type table. These tables are described in Section 3.3.2.1.

The PHA information was also reviewed in relation to possible challenges to the waste containers' integrity. This process consisted of identifying all equipment that caused the drums to be moved or elevated and determining if errors in that portion of the operating process could cause a loss of confinement. These challenges to material confinement were organized and documented on Equipment Safety Evaluation Forms based on the two WRAP 1 areas analyzed:

- Shipping and receiving
- Nondestructive examination/nondestructive assay (NDE/NDA).

As a final check and an initial step in the hazard evaluation, a master logic diagram (MLD) similar to an event tree but without probabilities (Appendix 3B) was used to organize the PHA information to verify that the most significant accident considerations had been identified in the hazard analysis methodology.

3.3.1.2 Hazard Evaluation. Hazard evaluation for WRAP 1 consisted of a two-step process: creation of a MLD to verify completeness of accident consideration, and development of event trees to describe specific accident progressions, considering mitigative and preventive features. Event trees serve as a guide to accident sequence selection, binning, and frequency. For each area analyzed (shipping and receiving, NDE/NDA) event trees or fault trees were developed for the hazards identified in Section 3.3.2.1. A description of each event tree, along with the tree itself and associated probability, is provided in Appendix 3B.

3.3.2 Hazard Analysis Results

This section describes the results of the hazard identification and evaluation performed for WRAP 1 and the hazard category resulting from these activities.

3.3.2.1 Hazard Identification. Before formally proceeding with the PHA, accidents or hazardous situations, including issues affecting worker safety, that have occurred in a facility's operating history would normally be researched. Since WRAP 1 is new, historical problem areas encountered during operation of facilities with functions similar to those of WRAP 1 were investigated.

This part of Section 3.3.2.1 outlines the historical problem areas of facilities with functions similar to those of WRAP 1. These problem areas have been addressed in Hanford Event Fact Sheets and Occurrence Reports. The Hanford Event Fact Sheets and Occurrence Reports were reviewed for waste handling experience to find characteristics of typical abnormal operations. All data from January 1987 to the present were considered.

This information was further supported by information from the occurrence reporting and processing system (ORPS), that tracks abnormal operations throughout the DOE complex as required by DOE Order 232.1. Abnormal operations are defined by the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 3.26, as events that may be expected to occur during the life of the facility that will not have significant consequences beyond the facility boundary. These data were specifically sorted for waste handling and ruptured container information which could lead to release of hazardous materials with possible consequences to workers and the public. This compilation is representative of the kinds of abnormal operations that could be experienced by WRAP 1.

In addition, since the Plutonium Finishing Plant (PFP) complex has generated a large portion of the waste to be processed at WRAP 1, historical PFP information (such as occurrence reports, incident summaries, and PFP Safety Analysis Report [SAR] analyses) were reviewed for applicability to WRAP 1 facility operations.

The above data were sorted by a safety analyst into 16 categories to represent the types of occurrences most likely to be experienced at a waste processing facility such as WRAP 1. Table 3-1 lists these types of abnormal operations, the number of occurrences at the Hanford Site from 1987 to 1992, and number of occurrences DOE-wide as reported in ORPS from 1990 to 1992 (note the different reporting periods covered by the two sources). The occurrence types listed in Table 3-1 are intended to be representative, but do not represent all possible abnormal operations. The following paragraphs summarize the types of occurrences judged most relevant to WRAP 1 operations and the mitigating steps included in facility design or operating procedures for each type.

Loss of Control of Radioactive Waste (Contamination Spread). Spread of contamination is the waste handling event with the highest frequency. Contamination has been spread by such agents as tumble weeds, rodent feces, and movement of contaminated tools outside of controlled areas. Contaminated

waste has been put into the normal refuse containers (polishing buffs and mops in dumpster and uncontaminated waste collection trucks). Paint chips from contaminated areas have been found outside controlled zones. WRAP 1 design considered these items (in the provision for portal monitors) and in administrative procedures.

Actual process contamination spreads have occurred as a result of (1) seal out of contaminated equipment, (2) failure to detect contamination on internal surfaces of equipment and pipes, (3) discharge of liquids to improper drains. WRAP 1 design and operating procedures considered the need to minimize these concerns.

Loss of Control of Hazardous Material. Experience has shown a number of problems in asbestos and polychlorinated biphenyl (PCB) oil control. These materials should not be problems at WRAP 1 because they are not routinely processed in the facility. Wastes containing these substances that are shipped to WRAP 1 will be identified and controlled. One event cited involved failure of a neutralization attempt, which is a consideration for WRAP 1. Other potential occurrences are receipt of radioactive material within waste identified as hazardous waste, receipt of mercury, and receipt of PCB oil when not expected. WRAP 1 will identify the presence of such material through NDE/NDA of the waste before processing.

Skin Contamination. Personnel skin contamination occurs with high frequency. No containers will be opened during Phase I operations, minimizing opportunities for contamination to be released from containers.

Loss of Administrative Control. Experience shows that waste shipments must be carefully controlled. The following problems in this area have been experienced at DOE facilities:

- Improperly filled out manifests
- Detectable contamination of containers, noted upon receipt of waste (in numerous cases)
- Contamination on transporting vehicles
- Improper shipping of radioactive samples
- Sample vials shipped in plant mail
- Excessed radioactive containers found offsite.

WRAP 1 has taken steps to avoid this concern by automating the process to the extent possible.

Container Break or Rupture. Experience shows that waste containers have been pressurized (at PFP); containers of cesium capsules have broken when dropped; and leaking containers have been shipped. These types of events have been anticipated in the WRAP 1 design and procedures are provided, including remote operation, to minimize the risk of harm to personnel if they occur.

Mishandling of Waste Drums and Forklifts. Abnormal operations involving waste drum handling have included: shipping of wrong drums; detection of free liquids in drums; overfilling of drums; inappropriate TRU waste assay of plutonium (^{240}Pu); and drums leaking in storage. These events support the need for NDA and NDE of drums received at WRAP 1.

The potential exists for a drum to be dropped or broken during handling by forklifts or automated guided vehicles (AGV) and other drum handling equipment, as discussed in Section 3.4.2.1. DOE-wide experience with forklift incidents was determined using the ORPS. The following two significant events have been considered in the design and operation of WRAP 1.

- At the Idaho National Engineering Laboratory (INEL) Radioactive Waste Management Complex, "While sorting drums of waste in the certified and segregated storage building in support of the Waste Isolation Pilot Plant (WIPP) bin test using an approved waste handling procedure, two drums of waste were dislodged from the third tier of the stack. The equipment operator was attempting to remove the plywood separator from the top of the third tier of drums. While engaging the plywood with the forklift drum handlers, the forklift rolled downgrade toward the stack. The outside tines of the handlers engaged the top of the two center drums on the face of the third tier of drums. This action caused the drums to rock and they fell forward off the stack. The drums struck the floor in a horizontal position. The top ring of the drum was deflected inward about $\frac{1}{4}$ in. on each drum. Integrity of the containers was not breached."

If the drums' lids had come off, allowing the contents to spill out, or the forklift tine had penetrated the drum, the event could have required cleanup, with possible interruption to normal operations.

At the Feed Material Production Center, two explosion events are described as follows: "A skid containing four sealed 208-L (55-gal) drums of double melt (MTC-219) spill metal was being transferred from the Plant 5 North Pad to the Plant 9 East Pad. As the forklift was transporting the skid of drums, one drum violently ruptured. This resulted in the drum lid being blown off the drum and into the air, and the drum being deformed (bulging). On December 4, 1989, another drum of MTC-219 material violently ruptured at the Plant 1 Pad. This drum was also sealed and was in the process of being moved when the incident occurred."

The event report indicates the cause was hydrolysis between the uranium and water, which caused free hydrogen to form. It was theorized that a spark from the uranium ignited the hydrogen. The hydrogen then exploded and the lid blew off. All TRU drums coming to WRAP 1 from retrievable storage or current operations are vented, minimizing the potential for hydrogen buildup.

ORPS data for 1990-1992 revealed the following types of events involving forklifts:

- Dropped loads (17 events)

- Loss of hazardous, material control, including breaking of hydraulic lines, loss of antifreeze, etc. (15 events)
- Accidents (of 18 events, 12 involved damaged equipment, 5 involved injury and 1 involved a fatality, but in no event was the presence of hazardous materials a factor)
- Contamination spread (12 events)
- Unsafe work practices, such as working under a load (6 events)
- Loss of administrative/procedural control (2 events)
- Rupture of a drum with a fork tine (2 events)
- Fire from hydraulic leak (1 event).

Fires. One event fact sheet describes a fire in a radioactive material waste box. A fire in a waste drum is also a possibility. Normally, fires will be controlled by fire suppression systems and will not propagate into a potential accident situation. Any significant fire involving hazardous waste could result in contamination spreads and the need for clean up and decontamination. Therefore, the accumulation of combustible material is tightly controlled in WRAP 1, especially accumulations of contaminated/hazardous material.

Many of the events discussed above, such as spread of contamination, unanticipated waste forms, etc. will be handled through operating procedures to ensure appropriate mitigating action is taken. The development of the PHA considered the experience described above in determining the qualitative frequencies of the events, severity levels, and required mitigation features. These experiences cover the major operational risks that can be experienced at WRAP 1. Remaining incident types listed in Table 3-1 are discussed adequately elsewhere in this Auditable Safety Analysis (ASA).

The abnormal operations highlighted in this section also appear to be consistent with a safety note issued by DOE for the years 1989 through 1991. For 36 incidents of interest over a 3-year period, 20 involved release of radioactive material, 7 involved release of a toxic or chemical gas, 5 resulted in fire or increased potential for fire, and 4 involved criticality violations. The double contingency criteria and appropriate operational limits are rigorously applied within WRAP 1 preclude the potential for a criticality.

After reviewing the incidents at other DOE facilities, PHA tables (Tables 3-2 through 3-4) were constructed listing the potential accidents, potential consequences, mitigating features, and a broad estimation of the risk involved with each event. Tables 3-5 and 3-6 give the criteria for determining the probability and severity categories of the tables.

In the PHA tables the potential events are grouped by location in or around WRAP 1. Specific grouping locations are: (1) the shipping and receiving area, (2) the NDE/NDA area, (3) the external area.

In each table, initiating events that could cause unplanned release of waste are identified. These can be broadly categorized as natural phenomena events, external events, and operational events (also referred to as internal events). The safety evaluation of events connected with natural phenomena assesses whether their occurrence could lead to container failure inside WRAP 1.

Natural phenomena include wind, flood, earthquake, and snow. The WRAP 1 structure is designed and constructed in accordance with appropriate codes to withstand anticipated impacts from natural phenomena. Thus, severe impacts of natural phenomena events may induce failure of containers in the building without causing structural damage to the facility. The process for analyzing natural phenomena hazards consists primarily of identifying any mechanism that will cause release modes different from those identified for operating hazards.

External events are caused by human-created factors outside WRAP 1, such as missiles and vehicle and aircraft impacts. The likelihood of a potential aircraft accident has been investigated and is documented in WHC-SD-W236A-ANAL-002, *Additional Analysis Related to the Multi-Function Waste Tank Facility*. The analysis covers all of the 200 Areas including the area of the WRAP facility. The analysis concluded that the frequency of an aircraft crash at the tank farm sites is $<1 \times 10^{-6}$ event/y, putting it into a "beyond extremely unlikely" category. Based on WHC-CM-5-34, scenarios with this frequency do not require a consequence analysis. Missiles were excluded from further analysis, since a missile would have to penetrate the building walls to provide a threat to containers inside, and even if a missile did strike a container, damage would be bounded by the analysis for a fork lift puncture.

Vehicle crashes at the facility are not evaluated since elevated concrete foundations would prevent any vehicle from penetrating the building.

Operational hazard information was organized by reviewing the HAZOP information to group challenges to the waste containers. The process consisted of listing any equipment that causes the drums to be moved or elevated and determining if errors in that portion of the operating process could cause a loss of confinement. These challenges to material confinement were organized and documented by area: shipping and receiving, and NDE/NDAs.

The results of this process are documented on equipment safety evaluation forms for each of these areas (Tables 3-7 and 3-8).

The HAZOP process flow diagram in Appendix 3A indicates that when the truck arrives at the WRAP 1 facility, it is stationed at a loading dock. Pre-operational surveys have indicated that some trucks making deliveries will have trailer heights that are incompatible with the loading docks. Therefore, trucks that cannot use the loading docks will be parked away from the facility and the pallets or individual drums will be offloaded with forklifts and ferried to the loading dock. Hazards associated with this activity will be the same as when offloading drums from trucks backed up to the loading dock, where the pallets are transported directly into the shipping and receiving areas.

3.3.2.2 Hazard Categorization. This section establishes the hazard categorization for WRAP 1. The hazard category is based on the radiological waste inventories expected to be present in the facility during the Phase I operations. Phase I operations include the receipt, storage, x-ray, assay and shipment of low level, mixed, and transuranic waste drums. Phase I operations cover facility activities in the Shipping and Receiving and NDE/NDA areas.

The hazard category is determined by identifying and listing the radionuclide inventories expected to be in WRAP-1 during Phase I, and comparing the inventories with the Hazard Category 3 threshold quantity table in DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports (DOE 1992).

3.3.2.2.1 Inventory During Phase I. The WRAP 1 facility inventory during Phase I operations shall be maintained less than the Hazard Category 3 threshold in DOE-STD-1027-92. The radiological inventories involved in Phase I will include those from drums of LLW, mixed waste, and TRU waste received in the Shipping and Receiving and NDE/NDA areas. Sealed radioactive sources, according to DOE-STD-1027-92, are excluded from the summation of the facility's radioactive inventory, as is the radiological inventory contained in any type B container.

It is the intent of Phase I operations to operate WRAP 1 as a radiological facility, which is a facility whose inventory does not meet or exceed the Hazard Category 3 threshold quantity values published in DOE-STD-1027-92, but still contains some quantity of radioactive material above quantities discussed in Appendix B to 40 CFR 302.

For a preliminary hazard categorization, each of the isotopes is normally compared to its threshold quantity and a sum of the ratios is calculated if more than one isotope is available. WRAP 1 will operate as a radiological facility based on administratively restricting radioactive material inventories. The radioactive inventories are restricted such that the entire inventory will not exceed the total inventory limit in grams or curies ($\leq$ Category 3 threshold quantity) for a radiological facility.

3.3.2.2.2 Comparison to Guidelines. Hazard categorization analyses are performed by determining the radionuclide inventory present in the facility and comparing that inventory with the threshold quantities listed in DOE-STD-1027-92. For example, the threshold quantity for Hazard Category 3 is listed as 0.52 Ci or 8.4g of Pu-239.

3.3.2.2.3 Results of the Hazard Categorization Determination. Because the facility inventory for the Phase I operation will be maintained at a level below the Hazard Category 3 threshold, WRAP 1 is determined to be a radiological facility. Phase I operations will not contain non-radiological hazardous material inventories that are equal to or exceed 29 CFR 1910.119 thresholds.

If radiological contents of drummed wastes are discovered to be higher than expected, appropriate recovery actions will be implemented to maintain the established radiological facility limit. Recovery actions include, but are not limited to, removing the container from the facility, loading the waste drum into an approved Type B overpack, and/or performing a safety

assessment to determine and verify the safety and acceptability of the container in the facility. The recovery actions will be completed within 3 working days.

3.3.2.3 Hazard Evaluation. Hazard evaluation for WRAP 1 consists of a two step process: (1) creating a MLD to verify completeness of accident consideration, and (2) developing event trees and supporting fault trees that describe specific accident progressions, considering mitigative and preventive features. Event trees serve as guides to accident sequence selection, binning, and frequency. For each area analyzed (shipping and receiving, and NDE/NDA), event trees were developed for the hazards identified in Section 3.3.2.1. Each event tree and its description appears in Appendix 3B.

Master Logic Diagram Description. One function of the MLD is to organize the information needed to verify that the important accident initiators have been identified. The MLD groups data according to deductive level from general to specific information. The WRAP 1 MLD is shown in Appendix 3B.

The top level of the WRAP 1 MLD represents the condition of an undesired release of material. This level defines the overall problem being considered.

The second level of the MLD considers the location in the facility where the release occurs. Location may have a significant effect on the quantity of material available for dispersal or its ability to leave the facility.

The third level of the MLD considers the type of event initiator. In the case of a drum explosion, for example, two types of initiators are considered: natural phenomena and events that arise from normal facility process activities.

The fourth level of the MLD addresses the way material contained in waste drums may be released or dispersed.

The fifth level of the MLD is a refinement of the fourth level to ensure the completeness and detail of the information used in the analysis.

Following are results of the MLD evaluation of possible events that could result in release of material from WRAP 1:

- There are three ways that waste drum material can be dispersed: mechanical breaching of the waste drum, explosion of the drum and subsequent burning of the contents, and fire without an explosion. In the third case (fire without explosion), it is assumed that the drum that burns does so due to breaching of the drum.
- Two types of initiators can result in releases from WRAP 1: internal events, such as forklift accidents, drum drops, or ignition accidents involving flammable gases or incompatible chemicals; and external events such as floods, winds, or earthquakes. Section 3.3.2.1 shows that external human-caused events such as missiles, vehicles, and aircraft impacts are eliminated from consideration, and among natural phenomena only seismic events are of concern.

- There are two areas where releases can occur: the shipping/receiving area, and the NDE/NDA area. Event tree analysis in Appendix 3B shows that similarities between the areas reduces the total number of areas to be considered in the accident evaluation to the shipping/receiving area.

Event Tree Development. Event trees for each of the accidents listed below are documented in Appendix 3B.

- Shipping and Receiving Area Drum Fire
- NDE/NDA Area Drum Fire
- Shipping and Receiving Area Toxic Release
- NDE/NDA Area Toxic Release
- Shipping and Receiving Area Explosion
- NDE/NDA Area Explosion
- Design Basis Seismic Event.

3.3.2.3.1 Planned Design and Operational Safety Improvements. Since WRAP 1 is a new facility, there are no planned design and operational safety improvements beyond those already provided in the facility construction and operational procedures.

3.3.2.3.2 Defense in Depth. Defense in depth is a fundamental approach to hazard control for nuclear facilities. This approach builds in layers of defense against release of hazardous materials so that no one layer, regardless of effectiveness, is solely relied upon. To compensate for potential human and mechanical failures, defense in depth is based on several layers of protection with successive barriers to prevent the release of hazardous materials to the environment. While physical barriers provide an important contribution to defense in depth, they do not represent the total approach. Competent and trained operating personnel also provide defense in depth. The contribution of emergency response actions to minimize consequences of an accident also represents defense in depth. WRAP 1 has several layers of protection to provide defense in depth.

Each 55-gal drum that enters WRAP 1 is a strong tight container. Additionally, LLW and TRU waste are packaged in multiple plastic bags within the container. To provide better characterization and identify any potentially hazardous contents, the container undergoes NDE and the results are compared with the shipping documents. The NDA station provides an estimate of radioactive material within the container, to verify that the shipping information is correct. The NDE and NDA stations therefore contribute to defense in depth.

Additional features that further contribute to defense in depth include: (1) the WRAP 1 building enclosure, (2) the facility-wide fire protection system, (3) strategically located CAMS, (4) trained and experienced operators, (5) curbs to contain liquid spills, (6) emergency response plans, and (7) WRAP 1 safety management programs that are under development.

3.3.2.3.3 Worker Safety. Workers are the population principally at risk from a radiological facility. Individuals not located in WRAP 1 and not associated with its operations are considered workers if they are within the

WRAP 1 emergency planning area, and risks to this population from radiological and toxic chemical hazards are assessed qualitatively for WRAP 1.

Risk to WRAP 1 workers is controlled through accident prevention, safety programs, and overall safety management as discussed in Chapters 6.0 through 15.0. Institutional safety programs include radiological protection, industrial hygiene, industrial safety, radiological and hazardous As Low As Reasonably Achievable (ALARA) programs, and emergency preparedness.

Safety management principles implemented through WHC-IP-1252, *Solid Waste Disposal Operations Health and Safety Plan*, and WHC-CM-5-34, Section 1.2, "Hazardous Communication Program," contribute to worker safety for toxic chemical hazards and industrial safety concerns. Radiological protection is implemented through the Hanford Site Radiological Control Manual (HSRCM-1) to protect workers from ionizing radiation. The Project Hanford-wide criticality safety program implemented through WHC-CM-5-36, Chapter 4-29, is applicable to the WRAP 1 facility.

Adherence to conduct of operations principles, including training, written operating procedures, communications, and formal work control measures, augments the worker safety program elements described above.

Accident prevention is actively addressed in facility operations through prejob safety meetings which address hazards and other safety issues prior to the commencement of a job or work evolution. Additionally, a Job Hazards Analysis (JHA) may be discussed in the meeting. If radiological issues are present the radiological work permit (RWP) is reviewed to keep worker awareness at a high level. Hanford Site and WRAP 1 specific emergency preparedness plans contribute to onsite and facility worker safety. Included in emergency response is the ability to medically treat radiation exposure victims.

A qualitative analysis of the consequences to workers from each of the accident groups discussed in Section 3.4.2 is presented in the following paragraphs. The nominal effects on the workers that the accident might yield are discussed. These effects are neither worst case nor best case and some variation would be expected if the scenario actually occurred.

These discussions of worker safety highlight institutional and organization controls that mitigate consequences of accidents and minimize unnecessary exposure. Fire alarms, automatic fire sprinklers and suppression systems, Hanford Fire Department response, conduct of operations, emergency procedures, medical aid, training, and WRAP 1 waste acceptance criteria all contribute to a predictable response that minimizes adverse impacts of occurrences.

Mechanical Release Scenarios. The mechanical release type of accident can be initiated by a forklift impacting one or two drums, the jib crane dropping a drum, or a misprogrammed or misaligned AGV. While this type of accident potentially has a lower impact in terms of radiological or toxic chemical release than a fire or an explosion, it is also less obvious to other facility workers. Operator training and experience provide the first layer of defense for the safety of the worker. Conduct of operations requires another operator to be present for many tasks, and training teaches employees how to

respond to accidents and to alert WRAP 1 management to the event. Injury as a result of an impact is an OSHA issue and is not addressed in the accident analysis.

In a mechanical release type of accident, the equipment operator and any other nearby personnel would immediately evacuate the accident area and await clearance from a Radiological Control Technician before re-entering. The doses to individuals in the immediate area would be less than a rem for radiological materials and the time of exposure to potentially harmful concentrations of toxic materials would be less than one minute. Should workers remain in the area (contrary to WRAP 1 procedures), they would be exposed for a longer period and the doses could become several rem. Workers could become incapacitated from toxic material releases if the drums contain toxic materials in large quantities. Even if the workers remain in the area, most areas of the facility are under surveillance by control room personnel, who would direct the workers to exit the area. Before the accident area could be re-entered by unprotected WRAP 1 personnel, the Building Emergency Director would evaluate entry requirements with support from Industrial and Radiological Safety. Continued WRAP 1 operations would be evaluated pending the outcome of the survey results.

Fire Release Scenarios. A fire release would likely be caused by events similar to those that cause a mechanical release. Operator training and experience provide a layer of defense for the safety of the worker. Conduct of operations provides for another operator to be present for many tasks, and training teaches employees how to respond to the accident and to alert WRAP 1 management to the event. Injury as a result of the impact and/or the fire is an OSHA issue and is not addressed in this accident analysis. The worker has readily available, easy to locate and use, hand-held portable fire extinguishers that may be used to assist in evacuation or for a quick response to a small non-hazardous material fire. After taking appropriate action to stabilize the situation (shut down forklift, activate fire alarm, evacuate the area), the worker must notify the supervisor. Should workers ignore these well defined responses and procedures and remain in the area, they will be exposed to contamination from the smoke and fumes. The fire is not expected to propagate because conduct of operations limits combustibles and surveillances are conducted to enforce this limitation. The fire and smoke detection and fire suppression system will also minimize the release and alert the Hanford Fire Department to respond.

Exposure would be expected to be small from the initial container damage to either the forklift operator or other facility personnel in the area. If the workers were able to avoid the release from the drum or the smoke plume from the fire, doses would remain low. If they become immersed in the cloud and take several breaths of contaminated air, they could receive doses up to a rem. While this would not be immediately injurious, it is a matter of considerable concern and workers are instructed during training to avoid fire fighting in WRAP 1.

Explosion Release Scenarios. The initiating events for a drum explosion are similar to those for mechanical releases and fires. However, the release from the drum could occur more quickly, providing little if any warning time. A drum that might explode may be detected by visual inspections (for bulging) upon arrival at WRAP 1, as well as by periodic inspections of stored drums.

All TRU drums accepted into WRAP 1 will have NUCFIL filters or equivalent to allow escape of built-up gases.

If a drum explosion occurred, it would be heard by nearby worker(s) who would see the plume and possibly a fire. The explosion could also be accompanied by the expulsion of objects (such as a drum lid or drum contents) that could seriously injure workers in the vicinity.

Procedures require workers to immediately evacuate the area. Doses would be slightly greater than from a mechanical release if no fire occurs. If a fire also occurs, the workers would evacuate the area and await a response from the Hanford Fire Department. Doses to the workers would be comparable to those from the fire discussed above. If no worker is in the area of the explosion and if a significant amount of radioactive material is released, the continuous air monitors would provide a warning to facility workers located elsewhere as well as to WRAP 1 control room personnel.

Earthquake Scenario. The seismic event has the potential to affect all WRAP 1 areas at the same time and is therefore considered a common mode event. The common mode nature of the event has implications for the safety of workers, primarily because recovery from a dropped drum or other scenario may be delayed while assessments are made for each area and the most urgent needs are addressed. These include personnel trapped in the building, electrical lines down or areas without power, broken water lines that could lead to flooding, and numerous possibilities for slips, trips, and falls from debris and uneven surfaces. The potential for release of contamination from fire and fallen drums is so limited that worker exposure to radionuclides is expected to be only slightly greater than in the other release scenarios described previously. Secondary effects of the earthquake, such as fires caused by electrical arcing or flooding caused by broken water lines could present greater hazards to workers. The greatest hazard likely in a seismic event is the potential for injury from falling onto fixed objects during the event or from non-fixed objects falling onto the worker.

Environmental protection programs and features are addressed in Chapter 8.0, Hazardous Material Protection; Chapter 9.0, Radioactive and Hazardous Waste Management; and Chapter 12.0, Procedures and Training.

3.3.2.3.4 Accident Selection. The event trees described in the hazard evaluation (Section 3.3.2.3) and developed in Appendix 3B describe a large number of accident sequences. In keeping with the graded approach, these sequences were qualitatively evaluated to select accidents that are bounding, unique, or representative for further detailed analysis.

The first step in selecting these accidents was to identify sequences with similar relative consequences, as shown in Table 3-9. The relative consequences are numbered in order of descending relative severity. The "-1" consequence is the most severe and the "-5" is the least. The letter preceding the severity descriptor indicates what type of accident the consequence is related to (consequence descriptor). For example, "B" is a drum breach without fire with radiological consequences. The footnotes to Table 3-9 define the consequence descriptors.

The event tree sequences were evaluated to identify the accidents warranting further analysis on the basis of estimated frequency and relative consequences. Sequences with high frequency, severe relative consequences, or unique accident progression were selected for further analysis. Sequences with low frequency and insignificant consequences were not selected. These sequences are bounded by those with higher frequencies and larger relative consequences.

Selection of the accidents for further analysis relies on a degree of engineering judgement. In each grouping of accident sequences, some only roughly fall into the same range. For example, a drum breach was considered in shipping and receiving only, and not in other areas of the facility, because the shipping and receiving area involves the greatest quantity of material and has the fewest barriers to prevent escape of material. Therefore, analysis of a breach accident in this area should bound similar accidents in the other areas. The same is true of fires.

The highlighted entries in Table 3-9 were chosen as candidates for further analysis because these sequences are (1) bounding, (2) representative of many other sequences, or (3) unique and should be examined to determine if the uniqueness is important.

The following six accidents were selected using the MLD and event trees for detailed analysis, described in Section 3.4.

- Shipping and receiving area drum mechanical release
- Shipping and receiving area drum fire
- Shipping and receiving area drum explosion
- Fire toxic release
- Explosion toxic release
- Seismic event release.

3.4 ACCIDENT ANALYSIS

Accident analyses documented in safety analyses should demonstrate that facility design and operation incorporate adequate features to protect the public, facility and onsite workers, and the environment from the unacceptable consequences of credible accident scenarios. The design must incorporate appropriate engineered or administrative safety barriers for postulated hazards to prevent the occurrence of accidents or to mitigate the resulting accident consequences to acceptable levels. Bounding accidents, whether requiring mitigation or not to reach acceptable consequences, are referred to as design basis accidents (DBA). These accidents are the most severe circumstances for which facility features must comply with functional goals to prevent unacceptable consequences to the public, facility and onsite workers, and the environment. DBAs are analyzed and compared against criteria outlined in Section 3.4.1.4.

3.4.1 Methodology

To demonstrate that the facility design and operation incorporate adequate safety controls, the following analytical process was applied to the accident scenarios identified in Section 3.3.2.3:

1. Develop accident sequence(s) using event trees, linking the accident initiating the release event with preventive and mitigative events. Consider the failure or success of engineered safety features and administrative controls in defining the accident progression. Select limiting sequence(s) for detailed consequence analysis.
2. Determine the source term associated with limiting sequence(s), based on phenomenological and system response calculations.
3. Determine consequences of accident sequence(s) because of atmospheric dispersion and other relevant pathways.
4. Compare consequences (receptor dose/exposures) to safety-class or safety-significant criteria from Section 3.4.1.4. Identify safety-class or safety-significant structures, systems, and components (SSC) or administrative controls needed, if any, to remediate accident sequence(s) to below safety-class or safety-significant guidelines. Select the safety-class or safety-significant SSCs or administrative controls from the candidate preventive or mitigative barriers (engineered or procedural) identified in Step 1.
5. If safety-class or safety-significant mitigating barrier(s) are selected, reevaluate accident consequences taking credit for the selected barrier(s) to demonstrate that the barriers are adequate to limit consequences to below safety-class or safety-significant limits.

Sections 3.4.1.1 through 3.4.1.4 provide more details on the methodology used in this accident analysis to develop accident sequences, to determine accident doses for comparison to safety-class or safety-significant guidelines, to select any necessary safety-class or safety-significant SSC, and to determine accident frequencies. Categorization of the generic accidents identified for further analysis into DBAs was discussed in Section 3.3.2.3.4.

3.4.1.1 Accident Sequence Development. In this accident analysis, the potential accident sequences are developed with event trees (Appendix 3B). Event trees are graphical models showing the possible outcomes of an accident. The outcomes are the results of combinations of an initiating event with successes and failures of facility system safety functions (engineered or procedural) designed to respond to or prevent those initiating events.

Event trees are constructed from left to right. A column represents each equipment system or administrative control safety function. The successes and failures of the safety functions represented by the columns are displayed as separate branches on the tree. The success of the system is normally represented as the upper branch. Each left-to-right path on the tree

represents an accident sequence. The totality of the paths represents all possible success and failure combinations of the systems considered.

The event trees are used to define limiting accident sequences for detailed consequence analysis and to determine potential barriers for safety-class designation if the consequences are found to exceed the evaluation guidelines discussed in Section 3.4.1.4.

3.4.1.2 Source Term Analysis. The calculation of the amount of radioactive material made airborne in the respirable size range is referred to as the "source term." It represents the combination of the material at risk (MAR), the airborne release fraction and respirable fraction (ARF x RF) and the appropriate leakpath factor (LPF). The general equation for determining the source term is:

$$\text{Source Term} = \text{MAR} \times (\text{ARF} \times \text{RF}) \times \text{LPF}$$

For the purpose of this analysis, the MAR is considered to be the postulated maximum inventory involved in the particular accident scenario. The LPF represents the amount of radioactive material made airborne and respirable within a confined space, which then undergoes a depletion mechanism (such as plateout) that provides a reduction factor. Applying this reduction factor, or LPF, provides the actual airborne and respirable amount leaving the confined space (whether a damaged container or a facility).

3.4.1.2.1 Inventory Definition. As discussed in Section 3.3.1.1, the hazardous material inventory is composed of radioactive and nonradioactive hazardous materials, with amounts of each depending on the type and quantity of waste being processed or stored. From a radiological standpoint, two different waste types are present, LLW and TRU waste.

The TRU release is given in terms of plutonium-equivalent curie (PE-Ci) values. Wastes from several onsite generators have known TRU distributions and, through the use of correction factors from WHC-EP-0063, these distributions can be converted to PE-Ci values that effectively convert radiological consequences for the inhalation pathway for the mix to that of ²³⁹Pu alone. The most abundant of these distributions are 6% (nominal) ²⁴⁰Pu and 12% (nominal) ²⁴⁰Pu shown in Tables 1 and 2 of WHC-SD-WM-TI-517. The two isotopic distributions (6% and 12%) account for about 99% of the TRU processed at 234-5Z, historically the major generator of TRU waste stored at the Hanford Site. For this analysis, the bounding isotopic distribution of all TRU is assumed to be that for 12% (nominal) ²⁴⁰Pu 20 yr aged waste as shown in Table 2 of WHC-SD-WM-TI-517. This is conservative because the 12% distribution has higher potential radiological consequences than 6% or ²⁴⁰Pu. The use of aged plutonium data is reasonable because even though the waste may be from current operations (as opposed to retrieved waste), it is most likely from cleanup activities involving aged plutonium.

While the MFP associated with TRU containers are relatively small and MFP consequences are significantly less than for TRU, WRAP 1 will also process LLW containers with larger quantities (> 0.07 Ci/container of isotopes). To evaluate the potential accident consequences of processing such containers, a comparison is made of the inhalation dose conversion factors (DCFs) for a

large number of isotopes, and then each DCF of an isotope is compared to the DCF for ^{239}Pu . The ratio of the DCF for a particular isotope to that of ^{239}Pu is the "dose conversion factor ratio" shown in the last column of Table 3-10. Multiplying the number of curies of the isotope times the dose conversion factor ratio provides a total Ci value defined as "dose equivalent Ci (DE-Ci)" of the isotope. For a container with more than one isotope, the number of curies of each isotope is multiplied by each isotope's dose conversion factor ratio. The sum of all isotopes' DE-Ci values is then used to obtain the DE-Ci value of the container. For example, if a container has 0.06 Ci of ^{90}Sr and 0.01 Ci of ^{137}Cs , the DE-Ci value of the container is derived as follows:

$$(0.06 \text{ Ci } ^{90}\text{Sr}) \times (3.02 \times 10^{-3}) = 1.81 \times 10^{-4} \text{ DE-Ci}$$

$$(0.01 \text{ Ci } ^{137}\text{Cs}) \times (7.44 \times 10^{-5}) = 7.44 \times 10^{-7} \text{ DE-Ci}$$

$$\text{Total for container} = 1.81 \times 10^{-4} \text{ DE-Ci}$$

For containers with PE-Ci values, since all TRU isotopes have been converted to the equivalency of ^{239}Pu , the DE-Ci value of a TRU container is identical to its PE-Ci value.

Currently, the inventory limit defined for Phase I operation in WRAP 1 will be administratively limited to levels below Category 3 threshold values. Sum of fractions of all isotopes will be used at WRAP 1 to maintain total inventory less than Category 3 threshold quantities.

Before receipt of any container at WRAP 1, the inventory (sum of the isotopic ratios) for that container and all containers in the shipment, will be calculated using the SWITS data for the container(s). All sum of the ratios calculations for each container will be independently verified. When a shipment arrives at WRAP 1, before actually being brought into the facility, each container will have its PIN/CIN matched to the calculations previously done for that container. No container will be accepted that does not have calculations completed and verified. The ratios for all containers in a shipment will be transmitted to the control room operator who will verify that receipt of all containers will not increase the facility inventory to greater than 1.00. Only after this verification is completed will containers be received into the WRAP facility.

The Category 3 threshold quantity for Pu^{239} is 0.52 Ci. Since expected DE-Ci quantities of MFP are small in comparison to the amount allowed for Pu^{239} , as shown in the calculations above, a conservative MAR assumption of 0.51 DE-Ci of Pu^{239} for the total facility inventory will be used for calculations in this analysis. This potential release bounds the consequences for any larger quantities of other isotopes, so long as the sum of the fractions is always maintained less than one.

As discussed in Section 3.3.1.1, WHC-SD-WM-RPT-056 contains an annotated list of the hazardous/dangerous chemicals and materials believed to be present in the solid waste stored or disposed in the Hanford Site 200 Area burial grounds. Detailed information, including incompatibilities, is provided about the materials in the list. Table 3-2 of WHC-SD-WM-RPT-056 contains

information gathered for this selected group of hazardous constituents. The chemicals and materials listed were judged to pose the greatest risk to the safety of onsite (nonoccupational) individuals and offsite persons not directly involved in handling waste containers. This judgement was based on the toxicity and hazard potential of the materials and chemicals involved.

3.4.1.2.2 Airborne Release Fractions: Respirable Fraction Values. Section 3.3.2.3.5 outlined the types of accidents that could occur during operation of WRAP 1. From Section 3.3.2.3.5, it can be concluded that potential events contributing to an airborne release of radiological contamination could occur in the following categories:

- Mechanical releases from drums
- Fire releases
- Explosion releases

The bases for most of the postulated releases and their associated ARF and RF are taken from DOE-HDBK-3010-94, *Airborne Release Fractions/Rates, and Respirable Fractions for NonReactor Nuclear Facilities*. The factors in DOE-HDBK-3010-94 are based on experimental data and provide a distillation of these experiments. The ARF and RF from DOE-HDBK-3010-94 were used for the analyses performed in this ASA, and are briefly described in the following paragraphs.

Mechanical Releases From 208-L (55-Gal) Drums. A distinction is made for impact releases as to whether the base material is packaged or unpackaged. For unpackaged materials with appreciable mass that generate significant forces upon impact with a surface (forces adequate to result in dislodgement of the surface contamination), the bounding ARF and RF for the suspension of surface contamination from shock, 1×10^{-3} and 1.0 (described in Section 5.3.3.2.2 of DOE-HDBK-3010-94) are considered to be bounding.

For the situation where combustible material is packaged in a reasonably robust container (e.g., drum) that fails due to impact, the bounding ARF and RF assigned in DOE-HDBK-3010-94, Section 5.2.3.2 are 1×10^{-3} and 0.1. This value is the same as that assigned to suspension of powder in a can due to debris impact (DOE-HDBK-3010-94), which bounds this phenomenon. Therefore, the bounding overall fraction that is respirable is 1×10^{-4} . Standard waste boxes have a wall thickness more than twice that of 55-gal drums. As a consequence, drums are more susceptible to mechanical releases than standard waste boxes (SWBs).

To determine the amount of material that potentially leaves the 208-L (55-gal) drums during a mechanical release due to a rupture, crush, or fall, a LPF as described in DOE-HDBK-3010-94 is used. The material is conservatively considered to be in powder form. However, because the metal drum and waste are wrapped in multiple layers of plastic, various levels of confinement are provided, depending on the accident scenario.

A series of 17-C 208-L (55-gal) drum drop tests documented in SAND80-2517, *Analysis, Scale Modeling, and Full-Scale Tests of Low-Level Nuclear-Waste-Drum Response to Accident Environments*, onto hard, unyielding surfaces revealed that new drums with 90-mil plastic liners could sustain substantially higher drop heights than those specified for DOT Type A

containers before release of the drum lid occurred. With drum weights of approximately 318 kg (700 lbs), a drop height of 13 m (44 ft) was required before the drum lids were breached. In these cases, no drum contents were ejected from the 90 mil liners. For drop heights of 1 m (4 ft) or less, no breach of drums is assumed to take place based upon the DOT type A criteria. For heights greater than 1 m (4 ft), because of the multiple wrapped material in the drums, a LPF of 0.01 is believed to be reasonable because no release of material occurred in the cited tests.

This LPF is multiplied by the ARF and RF of 1×10^{-3} and 0.1 to yield an overall respirable release fraction of $1 \times 10^{-3} \times 0.1 \times 0.01 = 1 \times 10^{-6}$. For a vehicle impacting a 55-gal drum, due to the higher energy involved, a LPF of 0.1 is allowed because of the potential for greater damage to the drum, yielding an overall ARF of 1×10^{-5} . For a drum puncture from a forklift tine, a LPF of 0.01 is used because of the relatively small hole a tine would cause.

Fire Releases (Thermal Stress). For surface contaminated solids, DOE-HDBK-3010-94 categorizes the ARFs and RFs resulting from thermal stress into three categories: (1) packaged combustible waste, (2) uncontained, combustible materials, and (3) contaminated noncombustible solids. All three categories may result from accident scenarios and the experimental bases for these ARFs and RFs are reported in DOE-HDBK-3010-94.

Packaged Waste. DOE-HDBK-3010-94 recommends a bounding ARF and RF of 5×10^{-4} and 1.0 and a median ARF and RF of 8×10^{-5} and 1.0. The packaged waste values are based upon a set of eleven experiments in which large cardboard boxes containing mixed waste (paper, rags, tape, plastic, cardboard, oil) contaminated with uranium dioxide powder, uranyl nitrate liquid, and air-dried uranyl nitrate were burned. The pre-contaminated wastes were packaged in 46-cm x 46-cm x 61-cm (18-in. x 18-in. x 24-in.) high cardboard boxes with a 40-mil thick polyethylene bag liner. The bag was twisted tightly and the carton was placed on a grill-like holder in a 3 m diameter x 3 m (10-ft diameter x 10-ft) high stainless steel vessel. The carton was ignited and allowed to burn until it extinguished under natural convection. The eleven experiments consisted of burning three types of packaging. The first type of packaging consisted of 50% contaminant in 10 sealed plastic bags randomly placed in the container with the remaining 50% dispersed unpackaged in the container. The box was then closed and tape-sealed. The second package type consisted of unbagged contaminant in a closed, tape-sealed box. The third type was the same as the second, except that the box was not sealed. Up to 64.1 g of contaminant were mixed with 4.4 to 4.7 kg of combustible waste in the three types of packaging.

Uncontained, Combustible Materials. For uncontained, combustible surface-contaminated materials that are burning, a bounding ARF and RF of 1×10^{-2} and 1.0 and a median ARF and RF of 5×10^{-4} and 1.0 was used (DOE-HDBK-3010-94). The values for uncontained, combustible materials undergoing burning are based upon the three sets of experimental conditions involving contaminated cellulosic material: (1) in an upflow of air during combustion, (2) with very small specimens in a stainless steel shallow dish, in an upflow of approximately 60 mm (.25 in.)/s, and (3) in a shallow aluminum pan centered in a 0.18 cm (7-in.) inner diameter quartz tube. Up to 4.82 g of

contamination was used with up to 10 g of combustible material in the three sets of experiments.

Contaminated, Noncombustible Solids. For thermal stress of contaminated, noncombustible solids, a bounding ARF and RF value of 6×10^{-3} and 0.01 is used. This is based on the suspension of reactive powders under thermal stress in a flowing airstream and results in an overall respirable fraction of 6×10^{-5} .

Explosion Releases. Experimental data on the behavior of combustible solids, such as trash, during explosive events is unavailable (DOE-HDBK-3010-94). Like other materials, combustible solids will undergo fragmentation due to the shattering effect of detonation. However, some extremely flexible materials (thin sheets of paper, rubber, or plastic) may be more subject to dislodgement by shock-vibration at very short distances from the blast interface. No experimental data on the airborne release of contaminants from this phenomenon were identified (DOE-HDBK-3010-94). DOE-HDBK-3010-94 assigns an ARF of 1×10^{-3} and a RF of 1.0 for shock effects due to detonation for materials with a flexible substrate based on data obtained from impact/vibration releases from nonbrittle materials. As noted for impact/vibration releases, flexing of the substrate is the primary mechanism for aerodynamic entrainment. The ARF x RF value given for that phenomenon (i.e., 1×10^{-3}) is essentially identical to the next most applicable phenomena, release from powders because of accelerated flow parallel to the surface (ARF x RF = 1.5×10^{-3}). Accordingly, the ARF and RF of 1×10^{-3} and 1.0 are assessed to be bounding.

As DOE-HDBK-3010-94 points out, because of high temperatures that may be generated during explosive releases and the dispersive action of the pressure impulse from the explosion, burning of the combustible material may be a concern and should be considered a risk.

3.4.1.3 Consequence Analysis. Radiological doses are determined in this analysis by estimating the amount of material aerosolized and made airborne in the accident and then multiplying this release amount by the appropriate atmospheric dispersion factor (χ/Q') and a dose conversion factor. This process is summarized in the following equation:

$$\text{Dose} = (R)(\chi/Q')(\text{DCF}) \quad (1)$$

where

Dose = inhalation effective dose equivalent (EDE) (50-year committed effective dose equivalent), in rem
 R = respirable airborne release, in Ci
 χ/Q' = atmospheric dispersion coefficient, in s/m^3
 DCF = dose conversion factor, in $\text{rem/Ci} \times \text{m}^3/\text{s}$ (breathing rate included, and for a χ/Q' of 1.0 s/m^3).

The respirable airborne releases from each of the accident scenarios are determined as previously described in Section 3.4.1.2. The χ/Q' 's for the various receptor locations are summarized in Table 3-20 and are applied as described in the following section.

3.4.1.3.1 Atmospheric Dispersion. The degree of atmospheric dispersion between the source term release point and a receptor location can be characterized with an atmospheric dispersion coefficient, or χ/Q' (where χ = airborne concentration at a given receptor, in Ci/m³ or mg/m³; and Q' = source term release rate, in Ci/s or mg/s).

For the purposes of this analysis, χ/Q' for two different potential receptors were determined. The first receptor is a hypothetical site worker. For WRAP 1, the hypothetical site worker is at PFP, located 800 m SE.

The second receptor is a hypothetical member of the public residing at the existing Hanford Site boundary 11.7 km W. For these maximally exposed receptors, χ/Q' were determined with the GXQ computer code in WHC-SD-GN-SWD-30002, *GXQ Program User's Guide*. This is a microcomputer-based program for calculating atmospheric dispersion using the Hanford Site specific joint frequency weather data. It is used to provide dispersion factors (χ/Q') for the maximally exposed offsite receptor for various release scenarios. The GXQ code calculates χ/Q' using a straight-line Gaussian plume model, with no terrain effects. Radiological and toxicological releases are assumed to occur coincident with adverse atmospheric dispersion conditions (e.g., releases are assumed to be released into a stable atmosphere with low wind speed). Using Hanford Site meteorological data, 99.5 percentile χ/Q' were determined for these receptors in accordance with the methodology outlined in NRC Regulatory Guide 1.145. In implementing the NRC methodology, the GXQ code determines the 99.5 percentile χ/Q' based on wind speed/stability class joint frequency data for each of the 16 different wind directions or sectors (e.g., S, SSE, SE, ESE, or E) and receptor distances defined by the user for each of these wind directions. The 99.5 percentile χ/Q' is expected to be exceeded no more than 0.5% of the time at the given receptor location.

The first receptor, called the maximum onsite receptor and the second receptor, called the maximum offsite receptor, are used to determine doses and toxicological airborne concentrations for comparison against the evaluation guidelines.

The onsite and offsite receptor χ/Q' for WRAP 1 are summarized in Table 3-11. Calculations for the values in Table 3-11 are documented in WHC-SD-WM-CN-030. Building wake was taken into account in all cases. The χ/Q' with building wake correction are used to model accident releases from WRAP 1. The wake effect is related to the area (height and width) of the smallest face of the building from which the release is occurring. For the onsite and offsite receptors, χ/Q' s were calculated with no plume meander.

3.4.1.3.2 Radiological Doses. Simple unit analyses of the consequences of the release of 1.0 DE-Ci (respirable) of ²³⁹Pu in both the oxide and nitrate form were calculated using the GENII code from *GENII--The Hanford Environmental Radiation Dosimetry Software System* with an assumed χ/Q' of 1.0 s/m³. Similarly, for the MFP, a total of 1.0 Ci, as defined in Section 3.4.1.2.1, was calculated. Table 3-12 provides the unit releases for the plutonium in an oxide form, as would occur from a fire, and in nitrate form. The nitrate form is used when it is questionable whether the accident scenarios can assure the material is in oxide form. The exposure pathways for the maximally exposed onsite and offsite receptors include both inhalation and submersion.

To determine the radiological dose consequences, the amount of the material respirable in curies is multiplied by the appropriate χ/Q' and then multiplied by the appropriate ratio to account for form (1.4 for nitrate or 1.0 for oxide) of the plutonium to determine the EDE in rem. For example, in a nonfire release with 0.01 Ci respirable TRU, the onsite dose would be: $0.01 \text{ Ci} \times 6.07 \times 10^{-4} \text{ s/m}^3 \times 1.4 \times 10^5 \text{ rem/Ci per s/m}^3 = 8.5 \times 10^{-1} \text{ rem EDE}$. The offsite receptor would be calculated in a similar manner. Onsite and offsite evaluation guidelines are found in Tables 3-13 and 3-14 and Figures 3-1 and 3-2, respectively.

3.4.2 Design Basis Accidents

Following the methodology of Section 3.4.1, to demonstrate that the facility design and operation incorporate adequate safety controls, accident analysis fully develops and evaluates the representative accidents identified in the hazards analysis.

It is shown in the following DBA analyses that, upon comparison of consequences to the safety-class criteria, no consequences warrant SSC safety-class designation. No mitigated consequences are calculated, as the unmitigated consequences fall below safety criteria. For each scenario, bounding and nominal consequences are calculated to demonstrate the conservatism of the release fractions and methods used to determine the source terms.

Several of the DBAs identified involve fires. As discussed in Section 11.4, the fire protection system for WRAP 1 was evaluated in the *WRAP 1 Fire Hazards Analysis* in accordance with DOE Orders 5480.7A, *Fire Protection*, and 6430.1A, *General Design Criteria*. DOE Order 5480.7A requires that DBAs analyzed in SARs be consistent with FHAs. The WRAP 1 FHA assumed that fires started in a drum or near drums could spread and involve others in close proximity. One significant condition assumed to be present was a pool of combustible liquid around the drums.

After the FHA was completed, two series of tests were conducted to examine the propagation of fires from 208-L (55-gal) drums under various burning conditions (WHC-SD-WM-TRP-233 and WHC-SD-WM-TRP-246). These fire tests are summarized in Section 11.4.1.5.

The operating areas of WRAP 1 that contain drums during Phase I are the shipping and receiving area, and NDE/NDA area. The only potential location of a fuel spill is the depressed truck ramp area adjacent to the shipping and receiving area. The truck ramp is not used during Phase I operations. The only other significant sources of combustibles in the drum areas are the contents of the drums themselves. WRAP 1 receives wooden pallets at the two dock-height waste unloading stations but subsequently does not use wooden pallets. After the drums are brought into WRAP 1 on wooden pallets, they are transferred to metal pallets. The wooden pallets are then removed from WRAP 1.

In these DBA analyses, it is a basic tenet that drums must be ruptured or otherwise opened for the contents to ignite and burn.

Various system attributes are used to model the accident scenario as follows:

- Releases of radioactive materials can occur in the form of solids, liquids, or airborne releases. Since airborne contamination is the most prevalent health and safety risk, the accident analysis focuses primarily on airborne releases.
- Nonradiological hazardous material releases are bounded by the analyses described in Sections 3.4.2.6 and 3.4.2.7.

3.4.2.1 Mechanical Release From Container Handling Accident. Any release resulting from drum or waste box damage or loss of container integrity in which the hazardous material is separated from the waste material and becomes airborne but a fire does not start is considered to be a mechanical release.

3.4.2.1.1 Initiating Event and Sequence of Events. A mechanical release in the shipping and receiving or NDE/NDA areas is postulated to occur because of a handling accident causing damage to drums or boxes. A handling accident in the shipping and receiving area or NDE/NDA area would most likely involve a fork lift or an AGV. A fork lift could puncture drums or boxes or cause drums to fall from elevated positions through unintended contact or a rapid stop or start. A puncture of a drum or box by a forklift tine would make a hole in the container and plastic liners that could create a path for material escape. Dropping of drums from heights greater than 4 feet could result in lid seal loss or lid separation, allowing material to escape. The deck of an AGV where pallets of drums are transported and moved to conveyors is less than 1 m (4 ft) above the floor, but sudden stops or conveyor movements could increase momentum to drums such that drops to the floor could result in lid seal loss or separation. Other possible accidents involving the automated stacker/retrieval system (AS/RS), jib cranes, or conveyors are described in the equipment safety evaluation in Tables 3-7 and 3-8, but the result, an opening in the container to provide an escape path for the contained hazardous material, would be the same. Damage to drums as described here could also initiate a fire or explosion, as described in Sections 3.4.2.2 and 3.4.2.3, respectively.

A handling accident in the shipping and receiving area would involve no more than two drums. A fork lift could possibly puncture two drums, but operating speed would be insufficient to penetrate through to additional neighboring drums. A tipped pallet of four drums could possibly distort and dislodge the lids of the two drums initially impacting the floor, but the fall of the other two would be cushioned.

3.4.2.1.2 Source Term Analysis. The released source term is quantity of contaminated material released during the accident sequence. From Section 3.4.1.2.1, the maximum total facility inventory was conservatively assumed to be 0.51 DE-Ci. The development of the source term that would result from a rupture involving the total facility inventory in the shipping and receiving area is as follows:

$$\text{The TRU MAR} = 5.1 \times 10^{-1} \text{ DE-Ci}$$

Bounding Release. The assumptions used to determine the amount of material released are as follows:

- The release fraction for respirable material made airborne because of a mechanical release is 1.0×10^{-6} . The basis for this is provided in Section 3.4.1.2.2.
- During the unmitigated release scenario, as unloading occurs doors to the shipping and receiving area, and doors to the NDE/NDA area are considered to be open. No credit for material plateout is taken.

The release source term for a mechanical release from the drum is:

$$5.1 \times 10^{-1} \text{ DE-Ci} \times 1.0 \times 10^{-6} \text{ release in drum rupture} \\ = 5.1 \times 10^{-7} \text{ DE-Ci}$$

Nominal Release. In Section 3.4.1.2.2, only a bounding release fraction of 1.0×10^{-6} and no median release value for respirable material made airborne because of a mechanical release is given. Therefore, the nominal release for this case is the same as for the bounding release.

3.4.2.1.3 Consequence Analysis. The assumption used to determine the dose consequences from material released is as follows:

- The ^{239}Pu is conservatively assumed to be in the nitrate form for these calculations because it is not specifically known to exist in an oxide form. The nitrate form provides a higher dose than the oxide form.

Bounding Consequences. The radiological dose consequences for the accident are determined by multiplying the source term released in PE-Ci by the appropriate unit dose conversion factor, taking into account the form (nitrate or oxide) of the plutonium, and then multiplying by the appropriate dispersion factor (χ/Q') to obtain the EDE consequence in rem. Using the dispersion factors from Table 3-11 and unit release generated from Table 3-12 the consequences resulting from a mechanical release are calculated as shown below and summarized in Table 3-15.

The maximum onsite EDE is:

$$5.1 \times 10^{-7} \text{ DE-Ci} \times 1.4 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 6.07 \times 10^{-4} \frac{\text{s}}{\text{m}^3} \\ = 4.3 \times 10^{-5} \text{ rem}$$

The maximum offsite fenceline EDE is:

$$5.1 \times 10^{-7} \text{ DE-Ci} \times 1.4 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 1.73 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 1.2 \times 10^{-6} \text{ rem}$$

The maximum near river bank EDE is:

$$5.1 \times 10^{-7} \text{ DE-Ci} \times 1.4 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 2.48 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 1.8 \times 10^{-6} \text{ rem}$$

3.4.2.1.4 Comparison to Guidelines. Dose consequences for the bounding and nominal mechanical release from the SWB accident are presented in Table 3-15.

The frequency of the event, as described in Section 3.3.2.3.4 and listed in Table 3-9 has an initiator annual frequency in the anticipated ($> 10^{-2} < 10^{-0}$) event frequency category. The risk associated with a mechanical release from a container-handling accident is determined by comparing the consequences of the event (4.3×10^{-5} rem EDE for the maximum onsite receptor and 1.2×10^{-6} rem EDE for the maximum offsite fenceline receptor) and the frequency of the event to the risk acceptance criteria in Tables 3-13 and 3-14. Based upon the risk acceptance guidelines repeated in Table 3-15, the risk associated with the mechanical release from the SWB handling accident is determined to be acceptable.

3.4.2.1.5 Summary of Safety-Class and Safety-Significant Evaluations. The unmitigated offsite dose from a mechanical release accident is less than the safety-class criterion of 0.01 rem EDE (Table 3-14). Therefore, this analysis establishes that the WRAP 1 SSC involved in the mechanical release scenarios need not be designated as either safety-class, based on risk to the public, or safety-significant, based on threat to worker safety or maintenance of defense in depth.

3.4.2.2 Fire Resulting from Drum Handling Accident. A fire in the shipping and receiving or NDE/NDA areas is postulated due to mixing of incompatible materials or damage to the packaging of combustible or pyrophoric materials in the presence of an energy source that allows ignition to take place.

3.4.2.2.1 Initiating Event and Sequence of Events. Table 3-2 of WHC-SD-WM-RPT-056 (Chapter 2.0) lists hazardous/dangerous constituents that could be present in drummed waste handled by WRAP 1. Among the contents are pyrophoric materials and incompatible materials that could interact and result in a fire.

A handling accident resulting in a fire would be initiated in the same manner as a mechanical release described in Section 3.4.2.1. A fork lift could puncture drums while attempting to insert its tines into a pallet or could cause drums to fall from elevated positions through unintended contact or through a rapid stop or start. If pyrophoric or incompatible materials were present (initially in separate containers, probably one liter plastic jars, but possibly glass) in a drum that was punctured or dropped as described in Section 3.4.2.1, breaking or opening of the separate containers could result from the damage induced by the accident, mixing of incompatible materials could occur, and a fire could result. Exposure of pyrophoric material to moisture or the combining of two or more incompatible materials could cause a fire. A puncture of a drum by a forklift tine would make a hole in the drum and plastic liners that could create a path for the inflow of air to support combustion. Dropping of drums from heights greater than 4 ft could result in lid seal loss or lid separation, which would also allow air to enter and support combustion.

A handling accident in the shipping and receiving area would involve no more than two drums. A fork lift could possibly puncture two drums, but operating speed would be insufficient to penetrate through to additional neighboring drums. A tipped pallet of four drums could possibly distort and dislodge the lids of the two drums initially impacting the floor, but the fall of the other two would be cushioned.

As discussed in Section 3.4.2, the limited amount of combustible material in only two drums and the absence of any fuel spill would not support fire propagation to additional drums.

3.4.2.2.2 Source Term Analysis. The release source term is that quantity of contaminated material released from WRAP 1 during the accident sequence. The development of the source term for a rupture and fire in a drum containing waste in the shipping and receiving area involving the total facility inventory of 0.51 DE-Ci is as follows:

$$\text{The Tru MAR} = 5.1 \times 10^{-1} \text{ DE-Ci}$$

Bounding Release. The assumptions used to determine the amount of material released are those from Section 3.4.2.1.2 that are applicable, with the addition or reemphasis of the following:

- The ^{239}Pu is assumed to be in the oxide form for the calculations where the release is because of a fire.
- WHC-EP-0225 states that approximately two-thirds of the TRU waste in drums to be received at WRAP 1 is combustible material (paper, plastic, rubber, etc.) and the remaining one-third is noncombustible (metal and glass). Table 4-5 of WHC-EP-0225 lists the waste components and their percentage contribution. A summation of combustible material percentages yields 65%. It is assumed that the TRU material is distributed evenly throughout the drum contents. Therefore, for all scenarios involving the burning of waste container contents, it is further assumed that only 65% of the TRU material is released by combustion. The remaining 35%, which is the

contamination associated with the noncombustible waste material, is released by heating from the fire.

- The release fraction for respirable material made airborne because of a fire involving combustible materials is 5.0×10^{-4} . This is based on Section 3.4.1.2.2, in which ARFs are provided for fire releases for packaged waste and uncontained combustible materials. Reviewing the two categories and considering the quantities of combustible waste material involved (tens of kg); the fact the contaminated waste in a pile will be in individual plastic packets (often with multiple wraps); and the fact that the packaged waste values were derived from waste burning in a cardboard box with a plastic liner, the bounding ARF of 5×10^{-4} for packaged waste is deemed most appropriate. Furthermore, the heap of material will burn from the top and sides inwardly. Therefore, although initially (for a cm or so) the ARF may be more representative of uncontained combustible materials, subsequent burning material vapors (from the greatest portion of the material) will have to pass through the "filtering effect" provided by the first and subsequent layers of previously burnt material. This "filtering effect" suggests that the entire heap is best characterized as burning of packaged waste. Also contributing to the choice of the release fraction for packaged waste is the fact that the unpackaged waste tests used 2-3 paper towels, which is not representative of actual waste in the drums.
- The release fraction for respirable material made airborne because of a fire heating noncombustible materials is 6.0×10^{-5} . Section 3.4.1.2.2 provides the basis for this release fraction.
- During the unmitigated release scenario, doors to the shipping and receiving area and doors to the NDE/NDA area are considered to be open as truck unloading occurs.

The component of the source term for a release from the two ruptured drums due to burning of combustible material is:

$$5.1 \times 10^{-1} \text{ DE-Ci} \times 0.65 \times 5.0 \times 10^{-4} \text{ release in combustion} \\ = 1.7 \times 10^{-4} \text{ DE-Ci}$$

The component of the source term for a release from the two ruptured drums due to heating of noncombustible material is:

$$5.1 \times 10^{-1} \text{ DE-Ci} \times 0.35 \times 6.0 \times 10^{-5} \text{ release by heating} \\ = 1.1 \times 10^{-5} \text{ DE-Ci}$$

The total release source term from the two ruptured and burning drums is therefore $1.8 \times 10^{-4} \text{ DE-Ci}$.

Nominal Release. The above assumptions are used to determine the amount of material released with the substitution of the following:

- The release fraction for respirable material made airborne because of a fire involving combustible materials has a median value of 8.0×10^{-5} .

- The release fraction for respirable material made airborne because of a fire heating noncombustible materials is 6.0×10^{-5} . Section 3.4.1.2.2 provides the basis for this release fraction.

The component of the source term for a release from the two ruptured drums due to burning of combustible material is:

$$5.1 \times 10^{-1} \text{ DE-Ci} \times 0.65 \times 8.0 \times 10^{-5} \text{ release in combustion} \\ = 2.6 \times 10^{-5} \text{ DE-Ci}$$

The component of the source term for a release from the two ruptured drum because of the heating of noncombustible material is:

$$5.1 \times 10^{-1} \text{ DE-Ci} \times 0.35 \times 6.0 \times 10^{-5} \text{ release by heating} \\ = 1.1 \times 10^{-5} \text{ DE-Ci}$$

The total release source term from the two ruptured and burning drums is therefore, $3.7 \times 10^{-5} \text{ DE-Ci}$.

3.4.2.2.3 Consequence Analysis.

Bounding Consequences. The radiological dose consequences for the accident are determined by multiplying the source term in DE-Ci by the appropriate unit dose conversion factor, taking into account the form (nitrate or oxide) of the plutonium, and then multiplying by the appropriate dispersion factor χ/Q' to obtain the EDE consequence in rem. Using the dispersion factors from Table 3-11 and unit release from Table 3-12, the consequences resulting from a fire release are calculated as shown below and summarized in Table 3-16.

The maximum onsite EDE is:

$$1.8 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 6.07 \times 10^{-4} \frac{\text{s}}{\text{m}^3} \\ = 1.1 \times 10^{-2} \text{ rem}$$

The maximum offsite fenceline EDE is:

$$1.8 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 1.73 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 3.1 \times 10^{-4} \text{ rem}$$

The maximum near river bank EDE is:

$$1.8 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 2.48 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 4.5 \times 10^{-4} \text{ rem}$$

Nominal Consequences. The radiological doses to the onsite and offsite receptors are determined from the released source term, the dispersion factors from Table 3-11 and unit release from Table 3-12. The consequences of a fire release are therefore calculated as shown below and summarized in Table 3-16.

The onsite EDE is:

$$3.7 \times 10^{-5} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 6.07 \times 10^{-4} \frac{\text{s}}{\text{m}^3} \\ = 2.2 \times 10^{-3} \text{ rem}$$

The offsite fenceline EDE is:

$$3.7 \times 10^{-5} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 1.73 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 6.4 \times 10^{-5} \text{ rem}$$

The near river bank EDE is:

$$3.7 \times 10^{-5} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 2.48 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 9.2 \times 10^{-5} \text{ rem}$$

3.4.2.2.4 Comparison to Guidelines. Dose consequences for the bounding and nominal fire release from two drums are presented in Table 3-16.

The frequency of such an event, as described in Section 3.3.2.3.4 and listed in Table 3-9 has an initiator annual frequency of 2.0×10^{-3} . The risk of the fire release from two drums is determined by comparing the consequences of the event (1.1×10^{-2} rem EDE to the maximum onsite receptor and 3.1×10^{-4}

rem EDE to the maximum offsite fence line receptor) and the frequency of the event to the evaluation guidelines in Tables 3-13 and 3-14. Based on the evaluation guidelines repeated in Table 3-16, the risk associated with the fire release from two drums is determined to be acceptable.

3.4.2.2.5 Summary of Safety-Class Safety-Significant Evaluations. The unmitigated offsite dose resulting from a fire release from two drums is less than the safety-class criterion of 0.5 rem EDE (Table 3-14). This analysis therefore concludes that the WRAP 1 SSC involved need not be classified as either safety-class, based on risk to the public, or safety-significant, based on a threat to worker safety or maintenance of defense in depth.

3.4.2.3 Explosion Resulting from Container Handling Accident. An explosion in the shipping and receiving or NDE/NDA areas is postulated due to mixing of incompatible materials, unvented hydrogen buildup or the ignition of propane from discarded cylinders.

3.4.2.3.1 Initiating Event and Sequence of Events. Table 2-10 lists hazardous/dangerous constituents that could be present in drummed waste handled by WRAP 1. Among the waste contents are incompatible materials that could interact, discarded propane cylinders, and the potential for hydrogen buildup.

A handling accident resulting in an explosion would be initiated in the same manner as a mechanical release described in Section 3.4.2.1. A fork lift could puncture drums while attempting to insert its tines into a pallet or could cause drums to fall from elevated positions through unintended contact or through a rapid stop or start. If incompatible materials were present (initially in separate containers, probably one liter plastic jars but possibly glass) in a drum that was punctured or dropped as described in Section 3.4.2.1, breaking or opening of the separate containers could occur from the damage induced by the accident, mixing of incompatible materials or ignition of hydrogen gas could occur, and an explosion could result. A puncture of a drum by a forklift tine would make a hole in the drum and could damage multiple containers or a propane cylinder. The piercing by the forklift tine could provide the spark to ignite the propane or hydrogen gas. Dropping of drums from heights greater than 4 feet could result in lid seal loss or lid separation and could also provide an ignition spark.

Handling accidents in the shipping and receiving area would involve no more than two drums. A fork lift could possibly puncture two drums. A tipped pallet of four drums could possibly distort and dislodge the lids of two of the drums as they take the impact of the four. It is estimated that 10% of a drum's gross contents will be ejected in an explosion accident, based on experimental explosive testing of drums containing simulated waste at INEL (EG&G 1983). Although the drums investigated at INEL are not necessarily identical of those to be processed in WRAP 1, they do represent a database that provides useful information for analysis of potential drum explosions. The INEL drums' contents consisted of various combination of materials including free liquids, compressed gases, particulates, uncemented sludges, resins, plexiglass, combustibles, and mixed waste. Important conclusions in the INEL studies follows:

- Of eighty 12-yr-old unvented drums, only one contained H_2 greater than 14% by volume and greater than 5.1% O_2 (a flammable/explosive mixture)
- During explosion tests for 14% H_2 and 62% O_2 , the drums did not rupture, but bulging of the drums occurred
- At 30% H_2 and 15% O_2 , the drums always ruptured, blowing the lid off, with no rupture to the side of the drums
- A maximum of 41% of the contents was released when the drums ruptured. This usually was accompanied with burning of the simulated waste material.

To determine the amount of material that might be released from a drum explosion, sampling and testing data from INEL were used. From experiments with sealed 55-gal drums, it was determined that when a mixture of 14 volume percent (vol%) H_2 and stoichiometric volume of O_2 were ignited by a spark source within the drum, drums bulged but did not breach. In a series of four tests with 30 vol% H_2 , all drums ruptured, lids were recovered up to 200 ft away and various amounts of the simulated wastes (combustibles plus metals) were released. The release values for the four tests were: 7%, 14%, 27%, and 41%. In three of the tests, the material also burned.

From the INEL retrieval and gas sampling, of eighty 12-yr-old drums, 29 had a H_2 buildup greater than 4% and only one had a buildup greater than 14%. The maximum H_2 buildup was found to be 17.1%. Because no tests were performed between 14 and 30 vol% of hydrogen, and the maximum INEL H_2 buildup was between these two values, interpolation between these two values are done. The assumption is made that above 14% H_2 concentration, a drum would breach and a linear relationship exists between percent waste released from the drum and H_2 buildup. The maximum observed release of 41% at 30 vol% was used as one endpoint of a line with the other end point being 0% released at 14 vol%. From a 17.1% H_2 initial concentration, 8% of the drum contents would be ejected. To assist in ease of calculations and to add additional conservatism, this value is rounded up to 10%. Since material burned in three of the four tests discussed above, it is assumed in this analysis that material expelled and remaining in the drum burns. Based upon the fire testing discussed in Section 3.4.2, the burning of combustible material in only one drum provides insufficient energy to involve additional drums. Furthermore, the material that is ejected and burned, based on fire tests, is not capable of propagating fire to additional drums.

Therefore, the source term for an explosion in one drum and the subsequent fire involving a second drum consists of five components:

- A release caused by the blast effects of the explosion (A_1)
- A release caused by the burning of ejected combustible waste (A_2)
- A release caused by the heating of ejected noncombustible waste (A_3)
- A release caused by the burning of the combustible waste remaining in the drum (A_4)

- A release caused by the heating of the noncombustible waste remaining in the drum (A_5).

3.4.2.3.2 Source Term Analysis. The development of the source term that would be caused by an explosion of one drum in the shipping and receiving area involving the total facility inventory of 0.51 DE-Ci is as follows:

$$\text{The TRU MAR} = 5.1 \times 10^{-1} \text{ DE-Ci}$$

Bounding Release. The assumptions from Sections 3.4.2.1 and 3.4.2.2 are used to determine the amount of material released with the addition of or reemphasis of the following:

- The total facility inventory is in the exploded drum to maximize the consequences.
- Material that burns is considered to be in an oxide form for determining inhalation doses
- Since this scenario involves releases because of fire and explosion damage, dose calculations need to account for both oxide and nitrate forms of TRU material. Table 3-21 contains the unit dose consequences for TRU in both the nitrate form and the oxide form. To simplify the dose consequence calculations, the nitrate material is accounted for by increasing its quantity by the ratio of the nitrate unit dose to the oxide unit dose. Therefore, to determine the dose due to TRU material PE-Ci in nitrate form, the material released by mechanical action is multiplied by the ratio of the unit doses from Table 3-10:

$$\frac{1.4 \times 10^5}{1.0 \times 10^5} = 1.4$$

Material made airborne by the explosion is considered to be in a nitrate form (if it is not known specifically to be oxide) for determining inhalation doses. Material made airborne by burning is considered to be in the oxide form.

- The release fraction for respirable material made airborne because of an explosion is 1.0×10^{-5} . The basis for the ARF is from Section 3.4.1.2.2. Most of the contaminated material has a flexible substrate (paper, rubber, cloth, etc.) and little fragmentation is expected to occur. Since all drums will have been vented before arriving in WRAP 1, an explosion is extremely unlikely. Based on the cited INEL drum explosion tests, no damage to adjacent drums is anticipated.
- In all scenarios involving the burning of waste container contents, only 65% of the TRU material is released directly by combustion.

The remaining 35%, which is the contamination associated with the noncombustible waste material, is released by heating from the fire.

- The release fraction for respirable material made airborne by a fire involving combustible materials ejected by an explosion is 1.0×10^{-2} , as discussed in Section 3.4.1.2.2.
- The release fraction for respirable material made airborne because of a fire involving noncombustible materials is 6.0×10^{-5} . The basis for this is provided in Section 3.4.1.2.2 and only a bounding value is provided.
- During the unmitigated release scenario, all doors to the shipping and receiving area and the NDE/NDA area are considered to be open.

The release source term calculation is performed as follows. The quantity of the first drum contents ejected in the explosion is:

$$5.1 \times 10^{-1} \text{ DE-Ci} \times 0.1 = 5.1 \times 10^{-2} \text{ DE-Ci}$$

The component (A_1) of the source term for respirable contamination released from the first drum contents ejected in the explosion is:

$$\begin{aligned} 5.1 \times 10^{-2} \text{ DE-Ci} \times 1.4 \times 1.0 \times 10^{-3} \text{ release in explosion} \\ = 7.1 \times 10^{-5} \text{ DE-Ci} \end{aligned}$$

The component (A_2) of the source term for a release from the first drum because of burning combustible material ejected in the explosion is:

$$\begin{aligned} (5.1 \times 10^{-2} - 7.1 \times 10^{-5}) \text{ DE-Ci} \times 0.65 \times 1.0 \times 10^{-2} \text{ release in combustion} \\ = 3.3 \times 10^{-4} \text{ DE-Ci} \end{aligned}$$

The component (A_3) of the source term for a release from the first ruptured drum because of heating noncombustible material ejected in the explosion is:

$$\begin{aligned} (5.1 \times 10^{-2} - 7.1 \times 10^{-5}) \text{ DE-Ci} \times 0.35 \times 6.0 \times 10^{-5} \text{ release by heating} \\ = 1.1 \times 10^{-6} \text{ DE-Ci} \end{aligned}$$

The quantity of material remaining in the drum after the explosion is:

$$5.1 \times 10^{-1} \text{ DE-Ci} - 5.1 \times 10^{-2} \text{ DE-Ci} = 4.6 \times 10^{-1} \text{ DE-Ci}$$

The component (A_4) of the source term for a release from the first drum because of burning combustible material remaining in the drum is:

$$\begin{aligned} 4.6 \times 10^{-1} \text{ DE-Ci} \times 0.65 \times 5.0 \times 10^{-4} \text{ release in combustion} \\ = 1.5 \times 10^{-4} \text{ DE-Ci} \end{aligned}$$

The component (A_5) of the source term for a release from the first drum because of heating noncombustible material remaining in the drum is:

$$\begin{aligned} 4.6 \times 10^{-1} \text{ DE-Ci} \times 0.35 \times 6.0 \times 10^{-5} \text{ release by heating} \\ = 9.7 \times 10^{-6} \text{ DE-Ci} \end{aligned}$$

The total release source term from the exploding and burning drum and from a second burning drum is therefore 5.6×10^{-4} DE-Ci.

Nominal Release. Assumptions from Sections 3.4.2.1 and 3.4.2.2 are used to determine the amount of material released, with addition or reemphasis of the following:

- The release fraction for respirable material made airborne because of an explosion is 1.0×10^{-3} . The basis for the ARF is from Section 3.4.1.2.2. Most of the contaminated material has a flexible substrate (paper, rubber, and cloth, etc.) and little fragmentation is expected to occur. Since all drums will have been vented before arriving in WRAP 1, an explosion is extremely unlikely. Based on the cited INEL drum explosion tests, no damage to adjacent drums is anticipated.
- The release fraction for respirable material made airborne by a fire involving uncontained combustible materials ejected from the explosion has a median value of 5.0×10^{-4} , as discussed in Section 3.4.2.2.
- The release fraction for respirable material made airborne because of a fire involving packaged combustible materials not dispersed by the explosion has a median value of 8.0×10^{-5} , as discussed in Section 3.4.2.2.
- The release fraction for respirable material made airborne because of a fire involving noncombustible materials is 6.0×10^{-5} . The basis for this is provided in Section 3.4.2.2 and only a bounding value is provided.

The quantity of the first drum contents ejected in the explosion is:

$$5.1 \times 10^{-1} \text{ DE-Ci} \times 0.1 = 5.1 \times 10^{-2} \text{ DE-Ci}$$

The component (A_1) of the source term for respirable contamination released from the first drum contents ejected in the explosion is:

$$\begin{aligned} 5.1 \times 10^{-2} \text{ DE-Ci} \times 1.4 \times 1.0 \times 10^{-3} \text{ release in explosion} \\ = 7.1 \times 10^{-5} \text{ DE-Ci} \end{aligned}$$

The component (A_2) of the source term for a release from the first drum because of burning combustible material ejected in the explosion is:

$$\begin{aligned} (5.1 \times 10^{-2} - 7.1 \times 10^{-5}) \text{ DE-Ci} \times 0.65 \times 5.0 \times 10^{-4} \text{ release in combustion} \\ = 1.7 \times 10^{-5} \text{ DE-Ci} \end{aligned}$$

The component (A_3) of the source term for a release from the first ruptured drum because of heating noncombustible material ejected in the explosion is:

$$\begin{aligned} (5.1 \times 10^{-2} - 7.1 \times 10^{-5}) \text{ DE-Ci} \times 0.35 \times 6.0 \times 10^{-5} \text{ release by heating} \\ = 1.1 \times 10^{-6} \text{ DE-Ci} \end{aligned}$$

The quantity of material remaining in the drum after the explosion is:

$$5.1 \times 10^{-1} \text{ DE-Ci} - 5.1 \times 10^{-2} \text{ DE-Ci} = 4.6 \times 10^{-1} \text{ DE-Ci}$$

The component (A_4) of the source term for a release from the first drum because of burning combustible material remaining in the drum is:

$$4.6 \times 10^{-1} \text{ DE-Ci} \times 0.65 \times 8.0 \times 10^{-5} \text{ release in combustion} \\ = 2.4 \times 10^{-5} \text{ DE-Ci}$$

The component (A_5) of the source term for a release from the first drum because of heating noncombustible material remaining in the drum is:

$$4.6 \times 10^{-1} \text{ DE-Ci} \times 0.35 \times 6.0 \times 10^{-5} \text{ release by heating} \\ = 9.7 \times 10^{-6} \text{ DE-Ci}$$

The total release source term from the exploding and burning drum and from a second burning drum is therefore $1.2 \times 10^{-4} \text{ DE-Ci}$.

3.4.2.3.3 Consequence Analysis.

Bounding Consequences. The radiological dose consequences for the container explosion accident are determined by multiplying the source term released in PE-Ci by the appropriate unit dose conversion factor, accounting for the form (nitrate or oxide) of the plutonium, and then multiplying by the appropriate dispersion factor χ/Q' to obtain the EDE consequence in rem. Using the dispersion factors from Table 3-11 and unit release from Table 3-12, the consequences resulting from one drum exploding and a second drum burning are calculated as shown below and summarized in Table 3-17.

The maximum onsite EDE is:

$$5.6 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 6.07 \times 10^{-4} \frac{\text{s}}{\text{m}^3} \\ = 3.4 \times 10^{-2} \text{ rem}$$

The maximum offsite fenceline EDE is:

$$5.6 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 1.73 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 9.7 \times 10^{-4} \text{ rem}$$

The maximum near river bank EDE is:

$$5.6 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 2.48 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 1.4 \times 10^{-3} \text{ rem}$$

Nominal Consequences. The radiological doses to the onsite and offsite receptors are determined using the released source term, the dispersion factors from Table 3-11, and unit releases from Table 3-11. Therefore, the consequences resulting from one drum exploding and a second drum burning are calculated as shown below and summarized in Table 3-17.

The onsite EDE is:

$$1.2 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 6.07 \times 10^{-4} \frac{\text{s}}{\text{m}^3} \\ = 7.3 \times 10^{-3} \text{ rem}$$

The offsite fenceline EDE is:

$$1.2 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 1.73 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 2.1 \times 10^{-4} \text{ rem}$$

The near river bank EDE is:

$$1.2 \times 10^{-4} \text{ DE-Ci} \times 1.0 \times 10^5 \frac{\text{rem}}{\text{Ci}} \times \frac{\text{m}^3}{\text{s}} \times 2.48 \times 10^{-5} \frac{\text{s}}{\text{m}^3} \\ = 3.0 \times 10^{-4} \text{ rem}$$

3.4.2.3.4 Comparison to Guidelines. Dose consequences for the bounding and nominal explosion release from a container handling accident are presented in Table 3-17.

The frequency of such an event as described in Section 3.3.2.3.4 and listed in Table 3-9 has an initiator annual frequency of 3.0×10^{-3} . The risk of the explosion release from a drum-handling accident is determined by

comparing the consequences of the event (3.9×10^{-2} rem EDE to the maximum onsite receptor and 1.1×10^{-3} rem EDE to the maximum offsite fence line receptor) and the frequency of the event to the risk acceptance criteria in Tables 3-13 and 3-14. Based on the risk acceptance guidelines repeated in Table 3-17, the risk associated with the explosion release from a drum-handling accident is acceptable.

3.4.2.3.5 Summary of Safety-Class and Safety-Significant Evaluations.

The unmitigated offsite dose from a container accident with explosion is less than the safety-class criterion of 0.5 rem EDE (Table 3-14). For the explosion release from the accident, this analysis establishes that the WRAP 1 SSC involved need not be classified as either safety-class, based on risk to the public, or safety-significant, based on a threat to worker safety or maintenance of defense in depth.

3.4.2.4 Fire Involving Restricted Waste. The accident scenario for this analysis is the same as for the radiological safety analysis (i.e., containers rupture and burn). Table 3-18, reproduced from Table 3-2 of WHC-SD-WM-RPT-056, contains hazardous/dangerous constituents that could be present in drummed waste handled by WRAP 1.

3.4.2.4.1 Initiating Event and Sequence of Events. A fire in a container is postulated due to mixing of incompatible materials or damage to the packaging of pyrophoric material that allows ignition to take place.

3.4.2.4.2 Source Term Analysis. An accident-release quantity determination is performed to establish the amount of contamination released from the facility (the release source term).

The metals in Table 3-18, with the exception of sodium, are all noncombustible except when in the form of fines. Sodium hydroxide is noncombustible in solid form, while the acids are noncombustible liquids. Liquids are susceptible to rapid evaporation in the presence of heat from a fire, so the accident is evaluated on that basis.

3.4.2.4.3 Consequence Analysis. The analysis of the burning or volatilization of hazardous materials in the WRAP 1 facility is summarized in Table 3-19.

The relationship that is used to calculate the onsite and offsite exposures to the hazardous chemicals listed in Table 3-19 is:

$$\text{Downwind concentration} = (\text{Source term}) \times \chi/Q^1$$

The source term in the analysis is calculated by dividing the available mass of MAR by the release duration. A release duration of 15 minutes is used to determine the average downwind concentrations for all of the materials in Table 3-18 in accordance with guidance in WSRC-MS-92-206, *Toxic Chemical Hazard Classification and Risk Acceptance Guidelines For Use in DOE Facilities*, which specifies that "concentrations for comparison with the guidelines must be calculated as the peak 15-minute average concentrations, which are then compared with the guideline concentration limits."

The χ/Q' values are a function of windspeed, atmospheric stability class, and distance downwind from the release. The onsite (as described in Section 3.4.1.3) and offsite χ/Q' values used were taken from the GENII calculations that were performed for related radiological safety analyses and provide the 95% worst dispersion factor. For the toxicological release calculations, uncorrected χ/Q' values with respect to plume meander for onsite and offsite receptors are used as directed in WHC-CM-5-34. These values are listed in Table 3-19 along with the results of the calculations of onsite and offsite exposures to hazardous chemicals determined using the above relationship for downwind concentrations.

Tables 3-13 and 3-14 show that ERPG-2 values are bounding for the onsite risk acceptance criteria and ERPG-1 values are bounding for the offsite risk-acceptance criteria. From the ratio column of Table 3-19, where the ERPG limits of the onsite and offsite downwind concentrations are shown, it can be seen that all toxicological consequences are bounded by the evaluation guidelines.

3.4.2.4.4 Comparison to Guidelines. Onsite and offsite airborne concentrations of nonradiological hazardous material are calculated in the analysis of a fire involving restricted waste. To make the determination that the concentrations are under the risk-acceptance criteria, as specified by Tables 3-13 and 3-14, they are compared to the applicable chemical ERPG (AIHA 1989) in Table 3-19.

3.4.2.4.5 Summary of Safety-Class and Safety-Significant Evaluations. In the analysis of a fire involving restricted waste, onsite airborne concentrations are less than ERPG-2 or alternative values and offsite concentrations are less than ERPG-1 or alternative values. This analysis, therefore, concludes that the WRAP 1 SSC involved need not be classified as either safety class, based on the risk to the public, or safety-significant, based on a threat to worker safety or maintenance of defense in depth.

3.4.2.5 Explosion Involving Restricted Waste.

3.4.2.5.1 Initiating Event and Sequence of Events. An explosion involving restricted waste is postulated due to mixing of incompatible materials or the ignition of propane from discarded cylinders. This analysis evaluates the potential for release of nonradiological hazardous material as the result of an explosion involving restricted waste.

3.4.2.5.2 Source Term Analysis. A description of the nonradiological hazardous material inventory is given in Section 2.5.1.2 and in Section 3.4.2.4 where a fire involving restricted waste management (RWM) material is analyzed.

3.4.2.5.3 Consequence Analysis. The metals shown in Table 3-19 are not expected to be in powder form, so small release values would result. However, because of the large quantity of cadmium in one of the drums, cadmium is investigated in a slightly different manner than is done for radiological releases. The cadmium in two drums (90 kg in one) is identified as a solid sheet, based upon a review of the disposal record. To determine the ARF and RF, the Steindler-Seefeldt (1980) correlation is used.

DOE-HDBK-3010-94 states that experimental data on the behavior of combustible solids, such as trash, during explosive events have not been compiled, and that combustible solids will undergo fragmentation from the shattering effect of detonation, like other materials. However, because of the extreme flexibility of some materials (thin sheets of paper, rubber, plastic), these materials may be more subject to dislodgement by shock-vibration at very short distances from the blast interface. No experimental data on the airborne release of contamination from this phenomenon are available (DOE-HDBK-3010-94). It is pointed out in DOE-HDBK-3010-94 that if the solid is fragmented by the shock wave, the Steindler-Seefeldt correlation for fragmentation by detonation indicates that 100% of the material impacted would be fragmented to 10 micron aerodynamic equivalent diameter (AED) and less at a mass ratio of 1.0. The mass ratio is defined by Steindler-Seefeldt as the ratio of the mass of the MAR to the mass of the trinitrotoluene (TNT) equivalent of the explosive. The configuration of the explosive material and the MAR examined by Steindler-Seefeldt was typically spherical or cylindrical, with a height-to-diameter ratio near one. The explosive was usually placed at the center with the material to be dispersed in the surrounding annular space. DOE-HDBK-3010-94 arbitrarily assigns an ARF of 1×10^{-3} and a RF of 1.0 for shock effects due to a detonation for materials with a flexible substrate. Figure 4 of Steindler-Seefeldt (Figure 3-1) shows the weight of airborne material as a function of the mass ratio.

The weight of airborne material less than the indicated diameter in microns, times the grams of TNT equivalent explosion yields the total grams of material made airborne. To examine the release fraction for explosive events in WRAP 1 for nonflexible substrates at risk, the mass ratio of a 208-L (55-gal) drum and its contents are determined using a full propane bottle containing 900 g of propane from Table 3-18. From WHC-EP-0225, the average 208-L (55-gal) drum containing TRU waste weighs 174 lb (79.1 kg). For example, for an explosion involving 900 g of propane, the TNT equivalent is derived as follows:

- The ratio of the heat of combustion for propane to the heat of detonation of TNT (e_{HC}/e_{TNT}) is 11.07 (NUREG-1320).
- Therefore, the TNT equivalent of 900 g propane is $900 \times 11.07 = 9,963$ g. Since WHC-SD-W026-TI-007 reports that a detonation is incredible, this value is reduced by a factor of 10 (Section 3.4 of NUREG/CR-4593) and modeled as a deflagration. Therefore, the TNT equivalent becomes 996.3 g.

The mass ratio for this case becomes 7.91×10^4 g/ 9.96×10^2 g = 79.4. A review of Figure 3-3 shows 1×10^{-4} grams made airborne (AED <10 micron) per gram of exploded material. If the explosion occurs on the sorting table immediately after the contents of the drum are deposited there, the mass of the drum should be subtracted to determine the mass ratio. From WHC-SD-W026-PSE-001, the heavier of a 17 C or 17 H 55-gal drum is 26.9 kg, so this lesser mass of material being impacted by the explosion is $79.1 \text{ kg} - 26.9 \text{ kg} = 52.2 \text{ kg}$. In this case, the mass ratio becomes 5.2×10^4 g/ 9.96×10^2 g = 52. Figure 3-1 shows approximately 5×10^{-4} grams of material made airborne with particles less than 10 micron, per gram of explosion for this scenario. Therefore, the total grams made airborne are $5 \times 10^{-4} \times 996 \text{ g} = 0.5 \text{ g}$. The overall release fraction therefore becomes

0.5 g/52,200 g = $\sim 1 \times 10^{-5}$. This value is conservative, as the mass of the sorting table (also considered nonflexible) that is in direct contact with the mass of waste material is ignored. Furthermore, the mass of the MAR and sorting table are not suspended in the middle of the enclosure, but rather at a location that would not provide the optimization of material made airborne below 10 micron as assumed in the Steindler-Seefeldt correlation.

Assuming 900 g of propane as discussed above, the mass ratio becomes 52,200 g/996 g = 52. Using Figure 3-1 and entering the curve for < 10 micron at 52, approximately 5.0×10^{-4} g of material are released below 10 micron per g of explosion. The amount of cadmium released as respirable is 500 mg. Assuming the release takes place over a 10-s period, the release rate is 50 mg/s. Using the onsite χ/Q' of 6.07×10^{-4} , the onsite concentration is 0.3 mg/m³ below the ERPG-2 value of 4 mg/m³. The offsite concentration would be 8.7×10^{-3} mg/m³, below the ERPG-1 value of 0.2 mg/m³.

For the remaining materials in Table 3-18, the downwind concentrations would be the same as in Table 3-19 since the concentrations for comparison with the guidelines may be calculated as the peak 15-minute average concentrations.

For the combustible liquids, fires are anticipated after the explosion and releases as discussed in Section 3.4.2.4 would occur. For hazardous material releases, as opposed to radiological material releases, the total material that is released is not as important as the release rate and resulting concentrations. For all types of hazardous material releases, the more dangerous materials are those that are more volatile or in powder form, with relatively low ERPG-1 and ERPG-2 values.

3.4.2.5.4 Comparison to Guidelines. Offsite and onsite airborne concentrations of nonradiological hazardous material are calculated in the analysis of an explosion involving restricted waste in the process enclosures. To make the determination that the concentrations are under the risk acceptance criteria as specified by Tables 3-13 and 3-14, they must be compared to the applicable chemical ERPG. WHC-CM-5-34 specifies that in the absence of ERPGs for specific chemicals, similarly derived values shall be used.

3.4.2.5.5 Summary of Safety-Class and Safety-Significant Evaluations. In the analysis of an explosion involving restricted waste, offsite airborne concentrations are less than ERPG-2 or alternative values for extremely unlikely frequencies and less than ERPG-1 or alternative values for unlikely or anticipated frequencies. This analysis, therefore, concludes that the WRAP 1 SSC involved need not be classified as either safety class, based on risk to the public, or safety-significant, based on a threat to worker safety or maintenance of defense in depth.

3.4.2.6 Design Basis Earthquake (DBE). Because the preliminary safety evaluation (WHC-SD-W026-PSE-001) identified WRAP 1 as a low hazard facility, the seismic criteria of SDC 4.1, Rev. 12, specified the structure as Safety-Class 3 and therefore, required it to withstand a free-field horizontal acceleration of 0.12 g. However, during a DBE, even though the basic structural integrity of the facility remains intact, internal events can still

result, such as equipment disruption, drums falling, etc. Therefore, possible consequences within each of the major areas are investigated for a DBE.

3.4.2.6.1 Initiating Event and Sequence of Events. An explosion and fire release in the AS/RS in the shipping and receiving area and mechanical releases in the NDE/NDA and process areas are postulated due to a seismic event that causes damage to the waste packaging and materials. However, since the total facility inventory of 0.51 DE-Ci has been analyzed for these types of releases, the consequences of a DBE are bounded by the previous analysis.

3.5 REFERENCES

- 29 CFR 1910.119, *Process Safety Management*, Code of Federal Regulations.
- 40 CFR 302, *Designation, Reportable Quantities, and Notification*, Code of Federal Regulations, as amended.
- AIHA, 1989, *Concepts and Procedures for the Development of Emergency Response Planning Guidelines (ERPGs)*, American Industrial Hygiene Association ERPG Committee, Washington, D.C., 1989.
- DOE-HDBK-3010-94, *Recommended Values and Technical Bases for Airborne Release Fractions (ARFs), Airborne Release Rates (ARRs), and Respirable Fractions (RFs) for DOE Non-Reactor Nuclear Facilities*, U.S. Department of Energy, Washington, D.C., 1994.
- DOE Order 5480.7A, *Fire Protection*, U.S. Department of Energy, Washington, D.C., 1986.
- DOE Order 5480.23, *Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C., 1992
- DOE Order 6430.1A, *General Design Criteria*, U.S. Department of Energy, Washington, D.C., 1992
- DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C., 1992.
- DOE-STD-3009-94, *DOE Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports (SAR)*, Chapter 3, "Hazard and Accident Analyses", U.S. Department of Energy, Washington, D.C., 1994.
- EG&G, 1983, *Gas Generation: Year End Report*, FY-1983-RHB-387-83, EG&G Idaho Incorporation, Idaho Falls, Idaho, 1983.
- GENII--*The Hanford Environmental Radiation Dosimetry Software System*, PNL 6584, Pacific Northwest Laboratory, Richland, Washington, 1988.
- Guidelines for Hazard Evaluation Procedures, American Institute of Chemical Engineers, 1992.

ID-EGG-RWMC-1990-0005, *Idaho National Engineering Laboratory, Radioactive Waste Management Complex*, Idaho National Engineering Laboratory, Idaho Falls, Idaho, 1990.

Initial Concept on Energetics and Moss Releases During Nonnuclear Explosive Events in Fuel Cycles, NUREG/CR-4593, U.S. Nuclear Regulatory Commission, Washington, D.C., 1986.

NRC Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1983.

NRC Regulatory Guide 3.26, *Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plants*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1975.

Nuclear Fuel Cycle Facility Accident Analysis Handbook, NUREG-1320, U.S. Nuclear Regulatory Commission, Washington, D.C., 1988.

Occurrence Reporting and Processing of Operations Information, DOE Order 232.1, U.S. Department of Energy, Washington, D.C., 1995.

SAND-80-2517, *Analysis, Scale Modeling, and Full-Scale Tests of Low-Level Nuclear-Waste-Drum Response to Accident Environments*, Sandia National Laboratories, Albuquerque, New Mexico, 1983.

SDC 4.1, *Hanford Plant Standards, Standard Architectural - Civil Design Criteria Design Load for Facilities*, Rev. 12, U.S. Department of Energy Richland Field Office, Richland, Washington, 1993.

Steindler, M. J. and W. H. Seefeldt, *A Method for Estimating the Challenge to An Air Cleaning System*, Proceeding of the 16th DOE Air Cleaning Conference (M. W. First, Ed.), Harvard Air Cleaning Laboratory, Boston, Massachusetts, 1980.

WRAP 1 Fire Hazards Analysis, Project 6237.007, United Engineers and Constructors, Denver, Colorado, 1993.

WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0225, *Contact-Handled Transuranic Waste Characterization Based on Existing Records*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1990.

WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Document (S/RID)*, Rev. 4, Westinghouse Hanford Company, Richland, Washington, 1995.

WHC-IP-1252, *Solid Waste Disposal Operations Health and Safety Plan*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1996.

WHC-SD-GN-SWD-30002, *GXQ Program User's Guide*, Rev. 1, Westinghouse Hanford Company, Richland, Washington, 1995.

- WHC-SD-WM-CN-030, *GXQ and GENII Calculations for WRAP FSAR*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1996.
- WHC-SD-W026-PSE-001, *Preliminary Safety Evaluation W-026 for Waste Receiving and Processing Module 1 Facility*, Rev. 0-B, Westinghouse Hanford Company, Richland, Washington, 1993.
- WHC-SD-W026-TI-007, *Probability of An Explosion in WRAP-1 Gloveboxes*, Westinghouse Hanford Company, Richland, Washington, 1993.
- WHC-SD-W236A-ANAL-002, *Additional Analysis Related to the Multi-Function Waste Tank Facility*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1994.
- WHC-SD-WM-RPT-056, *Solid Waste Stream Hazardous and Dangerous Components*, Westinghouse Hanford Company, Richland, Washington, 1992.
- WHC-SD-WM-TI-517, *Radioisotopic Characterization of Retrievably Stored Transuranic Waste Containers at the Hanford Site*, Rev. 1, Westinghouse Hanford Company, Richland, Washington, 1993.
- WHC-SD-WM-TRP-233, *Analytical and Experimental Evaluation of Solid Waste Drum Fire Performance, Volumes I and II*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1995.
- WHC-SD-WM-TRP-246, *Solid Waste Drum Array Fire Performance*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1995.
- WSRC-MS-92-206, *Toxic Chemical Hazard Classification And Risk Acceptance Guidelines for use in DOE Facilities*, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina, 1993.

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Figure 3-1. Onsite Radiological Evaluation Guidelines.

Figure 3-2. Offsite Radiological Evaluation Guidelines.

Figure 3-3. Weight of Airborne Material Versus Mass Ratio.

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Table 3-1. Types of Waste Handling Abnormal Operations Experienced at DOE Facilities Similar to WRAP 1.

Classification	Number of Hanford occurrences 1987 to 4/92	Number of occurrences in ORPS (DOE wide) 9/90 to 5/92
Loss of control of radioactive waste (contamination spread)	315	68
Loss of control of hazardous waste	125	76
Skin contamination	86	26
Loss of administrative control	39	67
Container break or rupture	27	1
Heating and ventilation system malfunction (including containment)	17	8
Accidents involving waste drum handling	12	8
Vehicle accident or traffic violation	2	--
Mishandling by fork lift	1	37
Fire	1	3
Unmonitored exposure	1	--
Potential internal deposition	1	2
Criticality limit exceeded	1	5
Mishandling by crane	0	3
Radiation monitoring lapses or failures	0	1
Effluent monitoring lapses or failures	0	15

ORPS = Occurrence Reporting and Processing System

Table 3-2. Waste Receiving and Processing Facility Module 1 Preliminary Hazards Analysis (Shipping/Receiving/Storage Area).

Hazard/energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Probability	Severity
			Engineered	Administrative		
I. Shipping/Receiving/Storage Area						
Kinetic - Rotational	1. Fork lift drops containers or causes them to rupture.	Radiation exposure to occupational worker. Dose consequences to onsite and offsite persons. Release of toxic material to the environment.	Fork lift designed to applicable criteria. All retrieved (underground storage) containers are overpacked.	Qualified operator. Operating procedures.	Unlikely	Category III
	2. Jib cranes drop drums.	Same as above.	Crane designed to applicable criteria.	Same as above.	Unlikely	Category III
	3. Conveyors cause drums to fall.	Same as above.	Sensors and limit switches to prevent misoperation.	Same as above.	Unlikely	Category III
	4. AGVs cause drums to fall.	Same as above.	Same as above.	Same as above.	Unlikely	Category III
	5. AS/RS drops drums or causes them to rupture.	Same as above.	Same as above.	Same as above.	Unlikely	Category III
Chemical Reaction	6. Above events cause ignition and fire in container contents.	Same as above.	Same as above.	Same as above.	Extremely unlikely	Category II
	7. Above events cause explosion in container.	Same as above.	Same as above.	Same as above.	Extremely unlikely	Category I
Kinetic - Rotational	8. TRUPACT conveyor causes drums to fall.	Same as above.	Same as above.	Same as above.	Unlikely	Category III
	9. Overhead crane drops containers	Exposure of occupational worker to radiation. Dose consequences to onsite and offsite persons. Release of toxic material to the environment.	Crane designed to applicable criteria	Qualified operator. Operating procedures.	Unlikely	Category III
Fire	10. TRUPACT truck catches on fire.	Same as above.	Same as above.	Same as above.	Extremely unlikely	Category II
Seismic	11. Seismic activity causes containers to fall.	Same as above.	Seismic qualified Structures.		Extremely unlikely	Category I
Strong Winds	12. Containers are pierced by wind-generated missiles.	Same as above.			Extremely unlikely	Category III
Criticality	13. Geometric array of fissile materials within the waste, changes, or moderating materials such as water intrude.	Same as above.		Criticality safety evaluations and criticality prevention specifications are in place.	Beyond extremely unlikely	Category I

TRUPACT = transuranic package transporter

Table 3-3. Waste Receiving and Processing Facility Module 1
Preliminary Hazards Analysis (NDE/NDA Area).

Hazard/energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Probability	Severity
			Engineered	Administrative		
II. NDE/NDA Area						
Kinetic - Rotational	1. Fork lift drops boxes or causes them to rupture.	Radiation exposure to occupational worker. Dose consequences to onsite and offsite persons. Release of toxic material to the environment.	Fork lift designed to applicable criteria.	Qualified operator. Operating procedures.	Unlikely	Category III
	2. AGV causes drums to fall.	Same as above.	AGV designed to applicable criteria.	Same as above.	Unlikely	Category III
	3. Conveyors cause drums to fall.	Same as above.	Sensors and limit switches to prevent misoperation.		Unlikely	Category III
Chemical Reaction	4. Above events cause ignition and fire in container contents.	Same as above.	Same as above.		Extremely unlikely	Category II
	5. Above events cause explosion in container.	Same as above.	Same as above.		Extremely unlikely	Category I
Fire	6. Electrical equipment failure/malfunction causes fire.	Same as above.	Same as above.		Unlikely	Category II
Seismic	7. Seismic activity causes containers to fall.	Same as above.			Extremely unlikely	Category I
Strong Winds	8. Containers are pierced by wind-generated missiles. HEPA filters fail.	Same as above.			Extremely unlikely	Category III
	9. Geometric array of fissile materials within the waste changes, or moderating materials such as water intrude.	Exposure of occupational worker to radiation. Dose consequences to onsite and offsite persons. Release of toxic material to the environment.		Criticality safety evaluations and criticality prevention specifications are in place.	Extremely unlikely	Category I

AGV = automated guided vehicle
NDA = nondestructive analysis/assay
NDE = nondestructive examination

Table 3-4. Waste Receiving and Processing Facility Module 1
Preliminary Hazards Analysis (External Area).

Hazard/energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Probability	Severity
			Engineered	Administrative		
IV. External Area						
Truck accident	1. Loss of control results in impact to facility.	Occupational worker injuries and potential exposure to contamination. Facility/property damage.	Elevated loading dock and concrete building foundations extending beyond likely point of impact.	Qualified operator Operating procedures	Unlikely	Category II
Fire	2. Helicopter crashes into the facility.	Same as above.			Beyond extremely unlikely	Category II
	3. Airplane crashes into the facility.	Same as above.			Beyond extremely unlikely	Category II
Fire	4. Grass fire or fire at nearby facility causes contamination.	Same as above.	Fire fighting equipment available.		Extremely unlikely	Category III
Flood	5. Excess rainfall or flood water enters facility.	Same as above.	Elevation above Columbia River makes flooding unlikely.		Extremely unlikely	Category III
Volcanic Activity	6. Accumulation of ash causes building structure failure.	Same as above.			Extremely unlikely	Category III
Seismic	7. Earthquake damages facility.	Exposure of occupational worker to radiation. Dose consequence to onsite and offsite persons. Released of toxic material to the environment. Facility/property damage.	All retrieved (underground storage) containers are overpacked.		Extremely unlikely	Category I
Strong Wind	8. Wind damages facility or generates wind driven missile. HEPA filters fail.	Same as above.	Same as above.		Extremely unlikely	Category III

AGV = Automatic Guide Vehicle.
TRUPAC = transuranic package transporter.
HEPA = high-efficiency particulate air.
NDE/NDAs = nondestructive examination/nondestructive assay.
RWM = Restricted Waste Management.

Table 3-5. Probability Category Definition.

Probability category	Category description	Nominal range of annual probability
Anticipated	An offnormal condition that individually may be expected to occur once or more during plant lifetime	1 E-02 to 1
Unlikely	Individually, the condition is not expected to occur during plant lifetime, but collectively events in this category may occur several times	1 E-04 to 1 E-02
Extremely unlikely	Extremely low probability conditions that are not expected during plant lifetime, but that present extreme or limiting cases of faults identified as possible. This category includes design basis accidents	1 E-06 to 1 E-04
Beyond extremely unlikely	Accidents for which no credible scenario can be identified	<1 E-06

Table 3-6. Qualitative Accident Severity Levels.

Severity categories	Consequences to the public, workers, or environment
Category I	May cause deaths onsite or loss of the facility/operation, major injuries or illness offsite, radiation exposure to offsite individuals in excess of annual limits, or severe impact to the environment
Category II	May cause severe injuries or severe occupational illness onsite, exposure to onsite individuals in excess of annual limits, major damage to a facility/operation, minor illness or injury offsite, exposure of offsite individuals to radiation below annual limits, or major impacts to the environment
Category III	May cause minor injury or minor occupational illness onsite, exposure of onsite individuals to radiation below annual limits, negligible impact offsite, or minor impact to the environment
Category IV	Will not result in injury, occupational illness, or exposure onsite or offsite, or result in a significant impact to the environment

Table 3-7. Waste Receiving and Processing Facility Module 1
Equipment Safety Evaluation (Shipping and Receiving Area).

Equipment	Drum failure
Pallet Fork Truck/Waste Box Fork Truck	Could drop or puncture multiple drums, causing contents to mix and chemicals to cause a vapor release, fire, or explosion.
Pallet Storage/Retrieval	Could ram drum with transfer platform or drop drum; contents spill, causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum Jib Crane	Could drop drum or collide with another object; contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum Infeed Conveyor/Drum Scale Conveyor	Drum could fall off conveyor; contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Automated Guide Vehicle	Drum could fall off AGV or AGV could collide with object; contents spill causing a vapor release, fire, or explosion due to spark from room electrical equipment.
Drum Discharge Conveyor	Drum could fall off conveyor; contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.

AGV = automated guided vehicle.

TRUPAC = transuranic package transporter.

Table 3-8. Waste Receiving and Processing Facility Module 1
Equipment Safety Evaluation (NDE/NDA Area).

Equipment	Drum failure
NDE/NDA Drum Transfer Conveyor	Drum could fall off conveyor or conveyor could bump drum into something; contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum Storage Carousel	Drum could fall off carousel or carousel could bang drum into object; contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Automated Guided Vehicle	Drum could fall off vehicle or vehicle could collide with object; contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum Transfer Conveyor	Drum could fall off conveyor or conveyor could bump drum into object; contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.

NDE/NDA = Nondestructive examination/nondestructive assay.

AGV = Automated guided vehicle.

Table 3-9. Event Tree Quantification Results. (2 sheets)

From event trees in Appendix 3B				Comments
Initiation frequency	Sequence frequency	Sequence name (Refer to comments)	Consequence (See Footnotes)	
1.00 E-03	1.00 E-03	Any tree	SE-1	Seismic initiator
1.00 E+00	4.00 E-04	S&RM-4	B-1	Shipping and receiving mechanical release (S&RM)
1.00 E+00	3.60 E-03	S&RM-3	B-1	Shipping and receiving mechanical release
1.00 E+00	9.96 E-02	S&RM-2	B-2	Shipping and receiving mechanical release
1.00 E+00	8.96 E-01	S&RM-1	B-3	Shipping and receiving mechanical release
5.00 E-03	5.00 E-06	S&RT-4	BT-1	Shipping and receiving toxic release (S&RT)
5.00 E-03	4.50 E-05	S&RT-3	BT-1	Shipping and receiving toxic release
5.00 E-03	4.95 E-04	S&RT-2	BT-2	Shipping and receiving toxic release
5.00 E-03	4.45 E-03	S&RT-1	BT-3	Shipping and receiving toxic release
3.00 E-03	1.50 E-05	S&RE-4	E-4	Shipping and receiving explosion only
3.00 E-03	1.35 E-04	S&RE-3	E-5	Shipping and receiving explosion only
3.00 E-03	1.35 E-04	S&RE-2	E-5	Shipping and receiving explosion only
2.00 E-03	4.80 E-13	S&RF-12	F-1	Shipping and receiving fire
2.00 E-03	4.32 E-12	S&RF-6	F-1	Shipping and receiving fire
2.00 E-03	4.80 E-08	S&RF-9	F-1	Shipping and receiving fire
2.00 E-03	4.32 E-07	S&RF-3	F-1	Shipping and receiving fire
2.00 E-03	8.00 E-07	PRF-7	F-1	Process area fire
2.00 E-03	7.95 E-11	S&RF-11	F-2	Shipping and receiving fire
2.00 E-03	7.16 E-10	S&RF-5	F-2	Shipping and receiving fire
2.00 E-03	7.95 E-06	S&RF-8	F-2	Shipping and receiving fire
2.00 E-03	7.16 E-05	S&RF-2	F-2	Shipping and receiving fire
3.00 E-03	2.23 E-11	S&RE-16	FE-1	Shipping and receiving explosion and fire
3.00 E-03	2.01 E-10	S&RE-10	FE-1	Shipping and receiving explosion and fire
3.00 E-03	1.80 E-08	S&RE-13	FE-1	Shipping and receiving explosion and fire
3.00 E-03	2.59 E-07	S&RE-7	FE-1	Shipping and receiving explosion and fire
3.00 E-03	5.99 E-07	PRE-9	FE-1	Process area explosion and fire
3.00 E-03	7.42 E-09	S&RE-15	FE-2	Shipping and receiving explosion and fire
3.00 E-03	6.68 E-08	S&RE-9	FE-2	Shipping and receiving explosion and fire
3.00 E-03	5.97 E-06	S&RE-12	FE-2	Shipping and receiving explosion and fire
3.00 E-03	5.38 E-05	S&RE-6	FE-2	Shipping and receiving explosion and fire
3.00 E-03	1.79 E-07	S&RE-14	FE-3	Shipping and receiving explosion and fire

Table 3-9. Event Tree Quantification Results. (2 sheets)

From event trees in Appendix 3B				Comments
Initiation frequency	Sequence frequency	Sequence name (Refer to comments)	Consequence (See Footnotes)	
3.00 E-03	1.61 E-06	S&RE-8	FE-3	Shipping and receiving explosion and fire
3.00 E-03	1.44 E-04	S&RE-11	FE-3	Shipping and receiving explosion and fire
3.00 E-03	1.29 E-03	S&RE-5	FE-3	Shipping and receiving explosion and fire

NOTE: Shaded blocks are accidents selected for analysis.

SE = Seismic initiator.

B = Drum breach with radioactive material release, no explosion or fire.

BT = Drum breach with toxic chemical release, no explosion or fire.

E = An explosion releasing radioactive material, no fire.

F = A fire involving radioactive material, no explosion.

FE = An explosion releasing radioactive material, consequent fire.

Number following description designates the qualitative severity of the accidents on a scale of 1 to 5 where the smallest number (i.e., 1) designates the worst severity

Table 3-10. Dose Conversion Factor Ratios Used for DE-Ci Calculations. (6 sheets)

Full isotopic names	Isotope symbol	SpA (Ci/g)	Dose conversion factor ratio (unitless)
Actinium	²²⁷ Ac	7.24 E+01	4.00 E+00
	²²⁸ Ac	2.24 E+06	7.18 E-04
Silver	^{110m} Ag	4.71 E+03	1.87 E-04
Americium	²⁴¹ Am	3.44 E+00	1.03 E+00
	^{242m} Am	9.72 E+00	9.91 E-01
	²⁴³ Am	1.99 E-01	1.02 E+00
Gold	¹⁹⁵ Au	3.64 E+03	3.01 E-05
Barium	¹³³ Ba	2.51 E+02	1.81 E-05
	¹⁴⁰ Ba	7.29 E+04	8.70 E-06
Beryllium	⁷ Be	3.50 E+05	7.47 E-07
	¹⁰ Be	2.24 E-02	8.25 E-04
Bismuth	²⁰⁷ Bi	4.55 E+01	4.66 E-05
	²¹² Bi	1.46 E+07	5.02 E-05
	²¹⁴ Bi	4.44 E+07	1.53 E-05
Berkelium	²⁵⁰ Bk	3.89 E+06	1.75 E-05
Carbon	¹⁴ C	4.46 E+00	4.86 E-06
Calcium	⁴⁵ Ca	1.78 E+04	1.54 E-05
Cadmium	¹⁰⁹ Cd	2.64 E+03	2.66 E-04
	^{113m} Cd	2.17 E+02	3.56 E-03
Cerium	¹⁴¹ Ce	2.85 E+04	2.08 E-05
	¹⁴⁴ Ce	3.19 E+03	8.70 E-04
Californium	²⁵⁰ Cf	1.09 E+02	6.10 E-01
	²⁵¹ Cf	1.58 E+00	1.37 E+00
	²⁵² Cf	5.38 E+02	3.65 E-01
Chlorine	³⁶ Cl	3.31 E-02	5.11 E-05
Curium	²⁴⁰ Cm	2.03 E+04	1.87 E-02
	²⁴¹ Cm	1.65 E+04	3.42 E-04
	²⁴² Cm	3.31 E+03	4.02 E-02
	²⁴³ Cm	5.16 E+01	7.15 E-01
	²⁴⁴ Cm	8.09 E+01	5.77 E-01

Table 3-10. Dose Conversion Factor Ratios Used for DE-Ci Calculations. (6 sheets)

Full isotopic names	Isotope symbol	SpA (Ci/g)	Dose conversion factor ratio (unitless)
Curium (Cont.)	²⁴⁵ Cm	1.72 E-01	1.06 E+00
	²⁵⁰ Cm	2.07 E-01	2.18 E+01
Cobalt	⁵⁶ Co	2.97 E+04	9.22 E-05
	⁵⁷ Co	8.45 E+03	2.11 E-05
	⁵⁸ Co	3.18 E+04	2.53 E-05
	⁶⁰ Co	1.13 E+03	5.09 E-04
Chromium	⁵¹ Cr	9.24 E+04	7.78 E-07
Cesium	¹³⁴ Cs	1.29 E+03	1.08 E-04
	¹³⁵ Cs	1.15 E-03	1.06 E-05
	¹³⁷ Cs	8.65 E+01	7.44 E-05
Einsteinium	²⁵⁴ Es	1.86 E+03	9.56 E-02
Europium	¹⁵² Eu	1.76 E+02	5.14 E-04
	¹⁵⁴ Eu	2.83 E+02	6.66 E-04
	¹⁵⁵ Eu	4.85 E+02	9.65 E-05
Iron	⁵⁵ Fe	2.41 E+03	6.25 E-06
	⁵⁹ Fe	4.96 E+04	3.44 E-05
Gallium	⁶⁸ Ga	4.06 E+07	3.22 E-07
Gadolinium	¹⁵² Gd	2.14 E-11	5.67 E-01
	¹⁵³ Gd	3.53 E+03	5.54 E-05
Germanium	⁶⁸ Ge	6.69 E+03	1.20 E-04
Tritium	³ H	9.67 E+03	1.49 E-07
Hafnium	¹⁷⁵ Hf	1.07 E+04	1.30 E-05
	¹⁸¹ Hf	1.70 E+04	3.59 E-05
Mercury	²⁰³ Hg	1.38 E+04	1.70 E-05
Iodine	¹²³ I	1.93 E+06	6.90 E-07
	¹²⁴ I	2.52 E+05	4.50 E-05
	¹²⁵ I	1.75 E+04	5.62 E-05
	¹²⁹ I	1.74 E-04	4.04 E-04
	¹³¹ I	1.24 E+05	7.66 E-05

Table 3-10. Dose Conversion Factor Ratios Used for DE-Ci Calculations. (6 sheets)

Full isotopic names	Isotope symbol	SpA (Ci/g)	Dose conversion factor ratio (unitless)
Indium	^{113m} In	1.67 E+07	9.56 E-08
	^{114m} In	2.31 E+04	2.06 E-04
	¹¹⁵ In	6.22 E-12	8.70 E-03
	^{115m} In	6.07 E+06	3.09 E-07
	^{117m} In	1.38 E+07	4.12 E-07
Potassium	⁴⁰ K	6.98 E-06	2.87 E-05
Krypton	⁸⁵ Kr	3.92 E+02	1.64 E-14
Lanthanum	¹⁴⁰ La	5.56 E+05	1.12 E-05
Manganese	⁵⁴ Mn	7.74 E+03	1.56 E-05
Molybdenum	⁹³ Mo	1.10 E+00	6.62 E-05
Sodium	²² Na	6.25 E+03	1.78 E-05
	²⁴ Na	8.69 E+06	2.81 E-06
Niobium	⁹⁵ Nb	3.93 E+05	1.35 E-05
	^{95m} Nb	3.81 E+05	5.68 E-06
Nickel	⁶³ Ni	5.68 E+01	7.23 E-06
Neptunium	²³⁷ Np	7.05 E-04	1.25 E+00
Phosphorus	³² P	2.86 E+05	3.61 E-05
Protactinium	²³¹ Pa	4.72 E-02	2.99 E+00
Lead	²¹² Pb	1.39 E+06	3.93 E-04
	²¹⁴ Pb	3.28 E+07	1.81 E-05
Palladium	¹⁰⁷ Pd	5.14 E-04	2.97 E-05
Polonium	²¹⁰ Po	4.49 E+03	2.18 E-02
Praseodymium	¹⁴⁴ Pr	7.55 E+07	1.00 E-07
Plutonium	²³⁸ Pu	1.71 E+01	9.13 E-01
	²³⁹ Pu	6.21 E-02	1.00 E+00
	²⁴⁰ Pu	2.28 E-01	1.00 E+00
	²⁴¹ Pu	1.01 E+02	1.92 E-02
	²⁴² Pu	3.93 E-03	9.56 E-01
	²⁴³ Pu	2.60 E+06	3.82 E-07

Table 3-10. Dose Conversion Factor Ratios Used for DE-Ci Calculations. (6 sheets)

Full isotopic names	Isotope symbol	SpA (Ci/g)	Dose conversion factor ratio (unitless)
Radium	²²³ Ra	5.12 E+04	1.82 E-02
	²²⁴ Ra	1.59 E+05	7.35 E-03
	²²⁵ Ra	3.92 E+04	1.81 E-02
	²²⁶ Ra	9.89 E-01	2.00 E-02
	²²⁸ Ra	2.73 E+02	1.11 E-02
Rubidium	⁸⁶ Rb	8.14 E+04	1.54 E-05
Rhenium	¹⁸⁷ Re	3.82 E-08	1.26 E-07
Rhodium	^{103m} Rh	3.26 E+07	1.18 E-08
	^{106m} Rh	1.36 E+07	4.97 E-07
Ruthenium	¹⁰³ Ru	3.22 E+04	2.08 E-05
	¹⁰⁶ Ru	3.35 E+03	1.11 E-03
Sulfur	³⁵ S	4.28 E+04	5.76 E-06
Antimony	¹²² Sb	3.93 E+05	1.19 E-05
	¹²⁴ Sb	1.75 E+04	5.86 E-05
	¹²⁵ Sb	1.04 E+03	2.84 E-05
	¹²⁶ Sb	8.35 E+04	2.73 E-05
	^{126m} Sb	8.14 E+09	7.90 E-08
Scandium	⁴⁶ Sc	3.39 E+04	6.90 E-05
	⁴⁷ Sc	8.14 E+05	4.29 E-06
Selenium	⁷⁵ Se	1.45 E+04	1.97 E-05
	⁷⁹ Se	6.96 E-02	2.29 E-05
Silicon	³¹ Si	3.86 E+07	5.19 E-07
	³² Si	3.99 E+01	2.36 E-03
Samarium	¹⁴⁷ Sm	2.25 E-08	1.74 E-01
	¹⁵¹ Sm	2.55 E+01	6.98 E-05
Tin	¹¹³ Sn	1.00 E+04	2.48 E-05
	^{117m} Sn	7.97 E+04	1.00 E-05
	^{119m} Sn	3.74 E+03	1.45 E-05
	¹²¹ Sn	9.66 E+05	1.18 E-06
	^{121m} Sn	5.91 E+01	2.68 E-05

Table 3-10. Dose Conversion Factor Ratios Used for DE-Ci Calculations. (6 sheets)

Full isotopic names	Isotope symbol	SpA (Ci/g)	Dose conversion factor ratio (unitless)
Tin (Cont.)	¹²³ Sn	8.23 E+03	7.57 E-05
	^{123m} Sn	3.82 E+07	1.07 E-07
	¹²⁵ Sn	1.08 E+05	3.60 E-05
	¹²⁶ Sn	2.84 E-02	2.31 E-04
Strontium	⁸² Sr	6.37 E+04	1.43 E-04
	⁸⁵ Sr	2.36 E+04	1.17 E-05
	^{87m} Sr	1.28 E+07	1.00 E-07
	⁸⁹ Sr	2.90 E+04	9.65 E-05
	⁹⁰ Sr	1.37 E+02	3.02 E-03
Tantalum	¹⁸² Ta	6.24 E+03	1.04 E-04
	¹⁸³ Ta	1.43 E+05	1.21 E-05
Technetium	⁹⁹ Tc	1.70 E-02	1.93 E-05
Tellurium	¹²¹ Te	6.35 E+04	4.43 E-06
	^{121m} Te	7.19 E+03	3.71 E-05
	¹²³ Te	2.42 E-10	2.45 E-05
	^{123m} Te	8.87 E+03	2.46 E-05
	^{125m} Te	1.80 E+04	1.69 E-05
	¹²⁷ Te	2.62 E+06	7.41 E-07
	^{127m} Te	9.43 E+03	5.00 E-05
	¹²⁹ Te	2.08 E+07	2.08 E-07
	^{129m} Te	3.03 E+04	5.57 E-05
Thorium	²²⁸ Th	8.20 E+02	7.95 E-01
	²³⁰ Th	2.02 E-02	7.58 E-01
	²³¹ Th	5.31 E+05	2.04 E-06
	²³² Th	1.10 E-07	3.81 E+00
	²³⁴ Th	2.32 E+04	8.16 E-05
Thallium	²⁰⁴ Tl	4.65 E+02	5.60 E-06
Thulium	¹⁷⁰ Tm	5.95 E+03	6.12 E-05

Table 3-10. Dose Conversion Factor Ratios Used for DE-Ci Calculations. (6 sheets)

Full isotopic names	Isotope symbol	SpA (Ci/g)	Dose conversion factor ratio (unitless)
Uranium	²³² U	2.14 E+01	1.53 E+00
	²³³ U	9.64 E-03	3.15 E-01
	²³⁴ U	6.26 E-03	3.08 E-01
	²³⁵ U	2.16 E-06	2.86 E-01
	²³⁶ U	6.47 E-05	2.92 E-01
	²³⁷ U	8.16 E+04	8.22 E-06
	²³⁸ U	3.36 E-07	2.75 E-01
Vanadium	⁴⁹ V	8.05 E+03	8.04 E-07
Xenon	^{131m} Xe	8.36 E+04	6.07 E-12
	¹³³ Xe	1.87 E+05	4.70 E-13
Tungsten	¹⁸⁵ W	9.40 E+03	1.75 E-06
Yttrium	⁸⁷ Y	4.48 E+05	4.08 E-06
	⁸⁸ Y	1.39 E+04	6.54 E-05
	⁹⁰ Y	5.44 E+05	1.96 E-05
	⁹¹ Y	2.45 E+04	1.13 E-04
Zinc	⁶⁵ Zn	8.24 E+03	4.75 E-05
Zirconium	⁹³ Zr	2.56 E-03	7.47 E-04
	⁹⁵ Zr	2.15 E+04	5.51 E-05

¹Derived using maximum inhalation Effective Dose Equivalent Dose Conversion Factor values from EPA Federal Guidance Report No. 11 (EPA 1988).

$$\text{Dose Conversion Factor Ratio} = \frac{\text{Dose Conversion Factor for Isotope}}{\text{Dose Conversion Factor for } ^{239}\text{Pu}}$$

Table 3-11. Onsite and Offsite Atmospheric Dispersion Factors (χ/Q') Used in Determining Radiological Doses.

Receptor location	Type of release	χ/Q' (s/m^3)
Onsite	Ground release with building wake	6.07 E-04
Offsite Fenceline	Ground release with building wake	1.73 E-05
Near River Bank	Ground release with building wake	2.48 E-05

χ/Q' = atmospheric dispersion coefficient factor.

Table 3-12. Dose Consequences in Rem per Curie (Respirable) of Transuranic and Mixed Fission Products with χ/Q' of 1.0 s/m^3 .

Isotope	Effective dose equivalent (rem/Ci)
TRU (nitrate form)	1.4 E+05
TRU (oxide form)	1.0 E+05
MFPs	2.0 E+03

MFPs = mixed fission products.

TRU = transuranic.

Table 3-13. Onsite Evaluation Guidelines.

Event frequency category	Event frequency (yr^{-1})	Radiological limit EDE (offsite)	Toxic chemical limit (offsite)
Anticipated	$>10^{-2}$ to $\leq 10^{-1}$	5 to 1 rem	$\leq$ ERPG-2
Unlikely	$>10^{-4}$ to $\leq 10^{-2}$	25 to 5 rem	$\leq$ ERPG-2
Extremely Unlikely	$>10^{-6}$ to $\leq 10^{-4}$	100 to 25 rem	$\leq$ ERPG-3

EDE = effective dose equivalent

ERPG = emergency response planning guideline

Table 3-14. Safety-Class and Offsite Evaluation Guidelines.

Event frequency category	Event frequency (yr ⁻¹)	Radiological limit EDE (offsite)	Toxic chemical limit (offsite)
Anticipated	$>10^{-2}$ to $\leq 10^0$	0.5 to 0.01 rem	$\leq$ ERPG-1
Unlikely	$>10^{-4}$ to $\leq 10^{-2}$	4 to 0.5 rem	$\leq$ ERPG-1
Extremely Unlikely	$>10^{-6}$ to $\leq 10^{-4}$	25 to 4 rem	$\leq$ ERPG-2

ERPG = emergency response planning guideline

Table 3-15. Dose Consequences and Evaluation Guidelines for Mechanical Release Resulting from Drum Handling Accident.

Receptor location	Bounding consequence EDE (rem)	Nominal consequence EDE (rem)	Evaluation guideline EDE (rem)
Onsite	4.3 E-05	4.3 E-05	1.0
Offsite Fenceline	1.2 E-06	1.2 E-06	0.01
Near River Bank	1.8 E-06	1.8 E-06	0.01

EDE = effective dose equivalent

Table 3-16. Dose Consequences and Evaluation Guidelines for Fire Release Resulting from Drum Handling Accident.

Receptor location	Bounding consequence EDE (rem)	Nominal consequence EDE (rem)	Evaluation guideline EDE (rem)
Onsite	1.1 E-02	2.2 E-03	5.0
Offsite Fenceline	3.1 E-04	6.4 E-05	0.5
Near River Bank	4.5 E-04	9.2 E-05	0.5

EDE = effective dose equivalent

Table 3-17. Dose Consequences and Evaluation Guidelines for Explosion Release Resulting from Drum Handling Accident.

Receptor location	Bounding consequence EDE (rem)	Nominal consequence EDE (rem)	Evaluation guideline EDE (rem)
Onsite	3.4 E-02	7.3 E-03	5.0
Offsite Fenceline	9.7 E-04	2.1 E-04	0.5
New River Bank	1.4 E-03	3.0 E-04	0.5

EDE = effective dose equivalent

Table 3-18. Candidate List of Potential Hazardous Constituents in the Retrieved Waste Feedstream.*

Component	Total number of containers	Number of containers with amounts listed	Max. amount in one container (kg)	Median (kg)
Ammonia	5	5	0.4500	0.4500
Ammonium nitrate	3	3	7.8900	7.4400
Beryllium	1,006	118	7.0000	1.8144
Cadmium	159	157	89.9923	0.0003
Cyclohexane	6	4	3.7500	2.2200
Dioxane	2	1	25.2196	25.2196
Hydrogen peroxide	4	4	0.4999	0.1000
Indole-2-C14 picrate	1	1	<0.0001	<0.0001
Manganese	2	2	0.0600	0.0400
Mercury	220	184	43.5446	0.0410
Naphthylamine tritium	1	1	102.0600	102.0600
Nitric acid	177	149	34.9990	0.0200
Phosphoric acid	205	44	49.9856	2.9996
Propane	1	1	0.8999	0.8999
Sodium	7	2	2.5601	1.2821
Sodium hydroxide	3,030	3,011	37.1900	0.0004
Sodium hypochlorite	1	1	0.0075	0.0075
Sodium oxide	16	16	48.2600	48.2600
Styrene/styrene monomer	6	6	2.7501	0.5561
Tetrahydrofuran	6	6	1.3499	0.0007
Tetralin	1	1	<0.0001	<0.0001
Uranyl nitrate hexahydrate	7	7	6.1099	0.6999
Vinyl ester/acetate resins	4	4	2.7501	0.9500
Vinyl chloride/resins	11	11	4.0960	0.4536
Zirconium	752	187	0.8600	11.6421

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

Table 3-19. Toxic Material Consequences and Guidelines Evaluation for Fire Accident Scenario.

Flammable material	Material at risk (mg) ^a	Source term (mg/sec)	X/Q (s/m ³) ^b		Average downwind concentration ^c (mg/m ³)		ERPG ^d (mg/m ³)		Ratio concentration/ERPG ^e	
			Onsite	Offsite	Onsite	Offsite	2	1	Onsite/ERPG2	Offsite/ERPG1
Ammonia	4.5 E+05	5.0 E+02	6.07 E-04	1.73 E-05	3.0 E-01	8.7 E-03	1.4 E+02	1.8 E+01	2.2 E-03	4.8 E-04
Cyclohexane	3.75 E+06	4.2 E+03	6.07 E-04	1.73 E-05	2.6 E+00	7.3 E-02	1.0 E+03	--	2.5 E-03	--
Dioxane	2.52 E+07	2.8 E+04	6.07 E-04	1.73 E-05	1.7 E+01	4.8 E-01	9.1 E+02	--	1.9 E-02	--
Hydrogen peroxide	5.0 E+05	5.6 E+02	6.07 E-04	1.73 E-05	3.4 E-01	9.7 E-03	3.5 E+01	--	9.7 E-03	--
Indole-2-C14 picrate	1.0 E+02	1.1 E-01	6.07 E-04	1.73 E-05	6.7 E-05	1.9 E-06	1.0 E-01	--	6.7 E-04	--
Mercury	4.1 E+04	4.6 E+01	6.07 E-04	1.73 E-05	2.8 E-02	8.0 E-04	1.3 E-01	7.5 E-02	2.1 E-01	1.1 E-02
Nitric acid	2.0 E+04	2.2 E+01	6.07 E-04	1.73 E-05	1.3 E-02	3.8 E-04	6.6 E+01	5.2 E+00	2.0 E-04	7.3 E-05
Phosphoric acid	5.0 E+07	5.6 E+04	6.07 E-04	1.73 E-05	3.4 E+01	9.7 E-01	1.2 E+02	3.0 E+00	2.8 E-01	3.2 E-01
Propane	9.0 E+05	1.0 E+03	6.07 E-04	1.73 E-05	6.1 E-01	1.7 E-02	1.8 E+03	--	3.4 E-04	--
Sodium	2.56 E+06	2.8 E+03	6.07 E-04	1.73 E-05	1.7 E+00	4.8 E-02	4.0 E+01	2.0 E+00	4.2 E-02	2.4 E-02
Styrene	2.75 E+06	3.1 E+03	6.07 E-04	1.73 E-05	1.9 E+00	5.4 E-02	1.0 E+03	2.1 E+02	1.9 E-03	2.6 E-04
Tetrahydrofuran	1.35 E+06	1.5 E+03	6.07 E-04	1.73 E-05	9.1 E-01	2.6 E-02	5.9 E+02	--	1.5 E-03	--
Uranyl nitrate hexahydrate	6.11 E+06	6.8 E+03	6.07 E-04	1.73 E-05	4.1 E+00	1.2 E-01	7.5 E+01	5.0 E+00	5.5 E-02	2.4 E-02
Vinyl acetate	2.75 E+06	3.0 E+03	6.07 E-04	1.73 E-05	1.8 E+00	5.2 E-02	2.6 E+02	1.7 E+01	7.0 E-03	3.1 E-03
Vinyl chloride	4.10 E+06	4.5 E+03	6.07 E-04	1.73 E-05	2.7 E+00	7.8 E-02	1.3 E+01	1.3 E+01	2.1 E-01	6.0 E-03

^aBased on waste characterization data given in Table 2-11.^bTaken from GXQ calculations. Plume meander effect not considered.^cCalculated by dividing the waste mass by the release duration to obtain the release rate, then multiplying by the X/Q.^dThe emergency response planning guideline (ERPG) values are given.^eCalculated by taking the ratio of the offsite calculated concentration to the ERPG.

ERPG = emergency response planning guideline

APPENDIX 3A
WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
PRELIMINARY HAZARDS ANALYSIS

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SUMMARY

To assist in identifying and focusing on potential abnormal and accident scenarios in WRAP 1, a team, consisting of an experienced hazards identification leader, project engineers, operations specialists, and safety analysis engineers, was assembled and a hazards evaluation analysis was performed. The analysis was conducted in the form of a hybrid Hazard and Operability (HAZOP) Analysis, a What-If Analysis, and a Preliminary Hazard Analysis (PHA), where the containers were tracked from arrival at the WRAP 1 to departure.

The purpose of a HAZOP Analysis is to carefully review a process or operation in a systematic way to determine whether process deviation can lead to undesirable consequences. In the procedure, a team leader guides a team through the plant design using a fixed set of guide words. These guide words are applied at specific points or nodes in the plant design and are combined with specific process parameters to identify potential deviations from the plant's intended operation. For example, the guide word "No" combined with the process parameter "Flow" results in the deviation "No Flow."

Operational hazards for the WRAP 1 facility were identified based on process flow diagrams developed from the modified HAZOP Analysis. The diagrams are displayed in this Appendix A. Every stop or transfer to a piece of equipment was considered a node. Instead of applying guide words, that were not applicable to this mechanical process, the What-If and PHA processes were applied and the questions "what can go wrong" and "what energy sources are available" were asked in each step. Each of the cognizant area engineer(s) led the task team through the design drawings for their area; identifying inventories, equipment, facility features, primary and secondary process material flow streams, and interfaces. In every instance where the task team could identify a potential accident or hazardous scenario, it was recorded in a PHA-type table (see Section 3.3.2.1 for the PHA information tables).

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APPENDIX 3B
HAZARD IDENTIFICATION, DEVELOPMENT,
AND RISK QUANTIFICATION

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APPENDIX 3B**HAZARD IDENTIFICATION, DEVELOPMENT,
AND RISK QUANTIFICATION****B.1 HAZARD DEVELOPMENT AND RISK QUANTIFICATION**

Operational hazards generally constitute the majority of events which can result in the release of hazardous material. These hazards are the result of the handling and transportation of the waste storage containers within the WRAP 1. The purpose of a HAZOP analysis is to carefully review a process or operation in a systematic fashion to determine whether process deviation can lead to undesirable consequences. In the procedure, a team leader guides a team through the plant design using a fixed set of guide words. These guide words are applied at specific points or nodes in the plant design and are combined with specific process parameters to identify potential deviations from the plant's intended operation. For example, the guide word "No" combined with the process parameter "Flow" results in the deviation "No Flow." A modification of the standard Hazard and Operability (HAZOP) Analysis method was used to identify accidents for analysis in the Waste Receiving and Processing Facility Module 1 (WRAP 1) Auditable Safety Analysis (ASA).

To assist in identifying and focusing on potential abnormal and accident scenarios in WRAP 1, a team was assembled and a Preliminary Hazards Analysis (PHA) was performed. The PHA was conducted in the form of a modified HAZOP analysis where the containers were tracked from arrival at the WRAP 1 to departure. Operational hazards for the WRAP 1 facility were identified based on process flow diagrams developed for the modified HAZOP study (see Appendix 3A for diagrams). Every stop or transfer to a piece of equipment was considered a node. Instead of applying guide words, which were not applicable to this mechanical process, the question "what can go wrong" was asked for each step. Each of the cognizant area engineer(s) led the task team through the design drawings for their area identifying inventories, equipment, and facility features as well as primary and secondary process material flow streams and interfaces. In every instance where the task team could identify a potential accident or hazardous scenario it was recorded in a HAZOP type table.

Operational hazard information was further organized by reviewing the HAZOP information to group challenges to the waste containers. The process consisted of listing any equipment which caused the drums to be moved or elevated and determining if errors in that portion of the operating process could cause a loss of confinement. These challenges to material confinement were organized and documented on Equipment Safety Evaluation forms based on segmenting the WRAP into the following two areas:

- Storage and receiving
- Non-Destructive Examination/Non-Destructive Assay NDE/NDA.

The results of this process is documented on the Equipment Safety Evaluation forms for each of these four areas (Tables B-1 and B-2). As a final step, a Master Logic Diagram (MLD) (Figure B-1) was used to organize the

PHA information in a generalized manner to verify that important accident considerations have been identified in the reduced HAZOP methodology.

B.2 MASTER LOGIC DIAGRAM DEVELOPMENT

Master Logic Diagrams provide a method for organizing information to verify that important accident initiators have been identified. The MLD organizes the information into levels of indenturement, that is, progressively finer differentiation of information.

The top level of the WRAP 1 MLD (Figure B-1, page 1) represents the condition of an undesired release of material from the WRAP 1 facility. This level defines the overall problem being considered.

The second level of the MLD is consideration of the location within the WRAP 1 facility where the release occurs. Location may have a very significant effect on the quantity of material available for dispersal or the ease with which it can leave the facility.

The third level of the MLD considers the type of event initiator. In this case, two types of initiators are considered, natural phenomena and events that arise from normal facility process activities.

The fourth level of the MLD addresses the way material contained in waste drums may be released or dispersed.

The fifth level of the MLD is a refinement of the fourth level to ensure completeness of information treatment.

The result of the MLD organization of the events possible for release of material from WRAP 1 is as follows:

- 1) There are three ways that waste drum material can be dispersed; mechanical breaching of the waste drum, explosion and subsequent fire involving the contents of a waste drum, and fire without explosion involving the contents of a waste drum. In the third case, one has to assume that the drum containing the material no longer has the capability of acting as a barrier to fires, implying breaching of the drum or intentional opening and dumping of the drum contents.
- 2) There are two types of initiators of events that result in possible releases from the facility; events internal to the facility such as fork lift accidents, drum drops, or ignition accidents involving flammable gasses or incompatible chemicals, and events external to the facility such as floods, winds, or earthquakes. Section 3.3.2 shows that only seismic events are of concern.
- 3) There are four distinct areas where releases can occur; the shipping/receiving area, the NDE/NDA area, the process area, and the process enclosure area. Similarities between the areas reduces the number of areas to the shipping/receiving area, and the enclosures that require accident evaluation.

B.3 INITIATOR DEVELOPMENT

The initiators developed from the hazard identification process are applied to the event trees developed from the hazard evaluation. The result is a quantitative definition of potential WRAP 1 accidents. The event tree top nodes derived from the HAZOP reflect those features capable of mitigating an accident. The quantified sequences derived from the event trees are binned according to frequency, area, and initiators. Sequences are selected from these bins for detailed analysis in order to define any potential releases from the WRAP 1.

The preparation of the modified HAZOP analysis for each area is based on completing the area safety evaluation form. The series of questions are intended to serve as a guide to identifying contributing factors to the propagation or mitigation of an accident for an area. It is these results which then support development of the event tree. Important contributors to the propagation or mitigation are the top nodes of the event trees, for which probability figures are derived.

Hazards were identified in Section 3.3.2.1 as having the potential for the release of materials during a loss of confinement that could result in a toxic vapor release, fire, or explosion. Once this type of event has occurred the course of the accident becomes dependent upon design features within the WRAP 1 facility. These design features include mitigative capabilities due to system design and confinement capability dependent upon physical design features. A HAZOP approach was employed as described in Section 3.3.1.2. Results of this analysis are tabulated in Tables B-3 and B-4. The outcome consists of a series of statements regarding the systems capability as well as the important physical features.

B.4 INITIATING EVENT FREQUENCIES

Initiating event frequencies for each of the event trees listed below were developed.

- 1) Shipping and Receiving Area Drum Fire
- 2) NDE/NDA Area Drum Fire
- 3) Shipping and Receiving Area Toxic Release
- 4) NDE/NDA Area Toxic Release
- 5) Shipping and Receiving Area Explosion
- 6) NDE/NDA Area Explosion.

The initiating event frequencies are calculated in the following manner:

$$f_i = f_{dd} f_{hm} f_{hz_i}$$

where f_i is the initiating event frequency per year and i represents the initiating event frequencies one through nine, f_{dd} is the dropped or ruptured drum frequency for each of the three areas, f_{hm} is the probability that a drum

contains hazardous chemicals, and f_{hz_j} is the conditional probability of each of three hazards (fire, explosions, and toxic releases) given that f_{hm} equals one. The indices $j = 1, 2, 3$ represent the shipping and receiving, NDE/NDA, and the process areas, respectively and the indices $k = 1, 2, 3$ represent fire, explosion and toxic releases hazards, respectively.

The frequency is the product of the probabilities that a drum is dropped and given it is dropped, the probability it contains hazardous materials, and given it has hazardous materials the likelihood the material results in a fire or an explosion or a toxic release.

The calculation will assume that the dropped or ruptured drum frequency is the same in each of the three areas (i.e., $f_{dd_1} = f_{dd_2} = f_{dd_3} = f_{dd}$) even though there is a variation in drum handling equipment from one area to another. Fork truck and jib crane operations are unique to the shipping and receiving area. In the NDE/NDA and process areas, drum drops and ruptures are caused mainly by faulty AGV and conveyor operations. Nevertheless, the drum drop or rupture frequency is not apt to vary widely from one part of the facility to the next. In addition, an area specific frequency would require detailed fault trees for each specific operation and/or extensive operation history data for similar facilities. This is not merited for a Hazard Category 3 facility such as WRAP 1. In general, the initiating and top events will be quantified based on Hanford and DOE facility operation history, simple fault tree analysis and engineering judgement.

A dropped or ruptured drum frequency can be inferred from Table B-5, which shows Hanford and DOE-wide abnormal operational occurrences. Table B-5 shows that during a five year period at Hanford, there were 27 rupture or broken container events (about five per year), and 12 waste drum handling/fork lift events (about 2.4 per year). Through the DOE, there were 8 waste drum handling/fork lift events between September, 1990 and May, 1992 (about 5 per year) and 1 rupture or broken container events during the same period (0.6 per year). These values are for a number of facilities, though, and they overstate the annual event frequency that could be expected the WRAP facility. These data do suggest that drum drops and ruptures should be anticipated events, nevertheless. Therefore, f_{dd} is set equal to 1.0 per year.

Not all drums contain hazardous materials. From [Olson, 1992] it is estimated that one drum in a hundred contains hazardous materials. Thus, $f_{hm} = 0.01$ is used in this analysis. [Siemer, 1993] reviewed chemical consequences for various chemical pairs. From this work an estimate of each conditional probability for the various hazards was derived as $f_{hz_1} = 0.20$, $f_{hz_2} = 0.30$, and $f_{hz_3} = 0.50$. Event frequencies for the first ten initiating events are then tabulated in Table B-6 using these probabilities.

B.5 EVENT TREE DESCRIPTIONS

Five representative event trees have been developed to assist in identifying accident scenarios that are bounding, unique, or representative. These trees are:

- 1) Shipping and receiving/NDE/NDA mechanical breach of waste drum event tree
- 2) Shipping and receiving/NDE/NDA fire event tree
- 3) Shipping and receiving/NDE/NDA explosion event tree
- 4) Toxic release in shipping and receiving area due to drum breach
- 5) Seismic event caused release from facility.

B.5.1 SHIPPING AND RECEIVING/NDE/NDA MECHANICAL BREACH OF WASTE DRUM EVENT TREE

The shipping and receiving and NDE/NDA areas are similar in size and configuration, and they have the same hazards and mitigative and preventive systems; one event tree can be used to describe accidents in both areas. The event tree chosen was a mechanical in the shipping and receiving area. Figure B-2 shows the event tree. Given a mechanical breach initiator, two top events determine accident progression and source term: heating, ventilating, and air conditioning (HVAC) shutdown, and condition of area doors.

Supply fans de-energized if high radiation alarms from local alpha and/or beta monitors are detected. A fault tree describing HVAC system shutdown failure is shown by Figure B-3. With four air changes per hour the maximum time for HVAC system shutdown should be 15 minutes. If HVAC shutdown does not occur airborne contaminants are spread from the source area to other parts of the building sharing the HVAC system. For example, without successful HVAC shutdown airborne contamination would be transported to the NDE/NDA area in the case of a drum breach in shipping and receiving area. Similarly, a breach in the NDE/NDA area would result in airborne contamination being transported to the shipping and receiving area if the HVAC is not shut down.

Area doors are also part of the control of contamination spread. If doors are open and the HVAC shuts down, there is a path for contamination to easily leave the facility.

B.5.2 SHIPPING AND RECEIVING/NDE/NDA FIRE EVENT TREE

The shipping and receiving and NDE/NDA areas are similar in size and configuration, and they have the same hazards and mitigative and preventive systems; one event tree can be used to describe accidents in both areas. Figure B-4 shows the event tree. Given a fire initiator, four top events determine accident progression and source term: area door condition, fire dampers, HVAC shutdown, and fire sprays.

Area doors are part of the control of contamination spread. There is a probability that either area could have an open door. The shipping and receiving area has roll-up doors for loading and unloading pallets of drums onto or from trucks, which provide a direct release path to the environment. There is also a roll-up door separating the shipping and receiving area from NDE/NDA area that opens to allow the AGV to enter and allows communication between the two areas. The failure probability of this top event then is simply the fraction of time these two doors are open while the facility is operating. If doors are open there is a path for contamination to more easily leave the facility.

Dampers located in the supply and exhaust ducts prevent HVAC airflow into or out of the shipping and receiving and NDE/NDA area in the event of a fire. Fire dampers are thermally activated, with fusible links. Success for this top event is that the two fire dampers in the area with the drum fire close when the fusible link temperatures exceed the design temperature limits. Failure means that one or more of the dampers do not close even with the fusible link temperatures exceed the design temperature limits.

If one or more fire dampers fail to close, HVAC shutdown is the next top event. Event tree structure assumes that HVAC shutdown is moot if all the fire dampers close. HVAC system operation during upset conditions is described in (UE&C 1993). When smoke is detected by a supply duct smoke detector, supply and exhaust fans will be de-energized. Supply fans are also de-energized if high radiation alarms from local alpha and/or beta monitors within the ducts are detected. If thermal detectors in the area signal the PCS, the operator can respond by shutting the system down manually. A fault tree describing HVAC system shutdown failure is shown by Figure B-5. With four air changes per hour the maximum time for HVAC system shutdown should be 15 minutes. If HVAC shutdown does not occur and all of the fire dampers do not shut, smoke and airborne contaminants are spread from the source area to other parts of the building sharing the HVAC system. For example, without successful HVAC shutdown and fire damper closure, smoke and airborne contamination would be transported to the NDE/NDA area in the case of a drum fire in the shipping and receiving area.

Both the shipping and receiving and NDE/NDA areas are covered by fire sprinklers. Sprinklers are equipped with fusible links. In addition to extinguishing fires, sprays reduce source term by reducing room temperature and removing airborne aerosols. Lowering room temperature increases the vapor pressure of volatile species, thereby condensing vapors and suppressing vapor generation. Sprays droplets scrub or sweep-out the smaller aerosol particles from the room atmosphere and into a pool on the floor. The pool should be contained, as there are no slopes or floor drains, but there are 6" curbs at the floor perimeters.

B.5.3 SHIPPING AND RECEIVING/NDE/NDA EXPLOSION EVENT TREE

The shipping and receiving and NDE/NDA areas are similar in size and configuration, and they have the same hazards and mitigative and preventive systems; one event tree can be used to describe accidents in both areas. Figure B-6 shows the event tree. Given a waste drum explosion initiator, five

top events determine accident progression and source term: consequent fire, area door condition, fire dampers, HVAC shutdown, and fire sprays.

If a drum explosion occurs, there are two possible outcomes. The explosion disperses a certain amount of radioactive material, but no fire results, or, the explosion results in a consequent ignition of the waste drum contents. If a fire results, the event progression is the same as the drum fire described previously. If no fire results, the only considerations are whether the airborne contamination detectors shutdown the HVAC and whether the facility doors are open or closed at the time of the event.

Area doors are part of the control of contamination spread. There is a probability that either area could have an open door. The shipping and receiving area has roll-up doors for loading and unloading pallets of drums onto or from trucks, which provide a direct release path to the environment. There is also a roll-up door separating the shipping and receiving area from NDE/NDA area that opens to allow the AGV to enter and allows communication between the two area. The failure probability of this top event then is simply the fraction of time these two doors are open while the facility is operating. If doors are open there is a path for contamination to more easily leave the facility.

Dampers located in the supply and exhaust ducts prevent HVAC airflow into or out of the shipping and receiving and NDE/NDA areas in the event of a fire. Fire dampers are thermally activated fusible links. Success for this top event is that the two fire dampers in the area with the drum fire close when the fusible link temperatures exceed the limit. Failure means that one or more of the dampers do not close even with the fusible link temperatures above the limit.

If one or more fire dampers fail to close, HVAC shutdown is the next top event. Event tree structure assumes that HVAC shutdown is moot if all the fire dampers close. HVAC system operation during upset conditions is described in (UE&C). When smoke is detected by a supply duct smoke detector, supply and exhaust fans will be de-energized. Supply fans are also deenergized if high radiation alarms from local alpha and/or beta monitors within the ducts are detected. If thermal detectors in the area signal the PCS, the operator can respond by shutting the system down manually. With four air changes per hour the maximum time for HVAC system shutdown should be 15 minutes. If HVAC shutdown does not occur and all of the fire dampers do not shut, smoke and airborne contaminants are spread from the source area to other parts of the building sharing the HVAC system. For example, without successful HVAC shutdown and fire damper closure, smoke and airborne contamination would be transported to the NDE/NDA area in the case of a drum fire in shipping and receiving area.

Both the shipping and receiving and NDE/NDA areas are covered by fire sprinklers. Sprinklers are equipped with fusible links. In addition to extinguishing fires, sprays reduce source term by reducing room temperature and removing airborne aerosols. Lowering room temperature increases the vapor pressure of volatile species, thereby condensing vapors and suppressing vapor generation. Sprays droplets scrub or sweep-out the smaller aerosol particles

from the room atmosphere and into a pool on the floor. The pool should be contained, as there are no slopes or floor drains, but there are 15-cm (6-in.) curbs at the floor perimeters.

B.5.4 SHIPPING AND RECEIVING/NDA/NDA TOXIC EVENT RELEASE EVENT TREE

This event tree, illustrated in Figure B-7, contains two top events: door closed and HVAC shutdown. The first top event in this tree is defined to be the same as the last top event of the fire event tree. HVAC shutdown is again critical to isolate hazards to the one area (assuming doors are closed). The fault tree given by Figure B-3 can be used to find the HVAC shutdown failure probability. For a toxic release, the thermal detectors will not signal the PCS and the smoke detectors will not de-energize the supply and exhaust fans. The tree is therefore structured so that the HVAC system continues to operate unless manual action is taken to shutdown the system. It is assumed in this scenario that insufficient quantities of radioactive materials are released to be detected by the airborne radioactive material detectors. Only HVAC operation and door closure are important to toxic events.

B.5.5 SEISMIC EVENT CAUSED RELEASE EVENT TREE

The seismic event caused release event tree shown in Figure B-8 has only one top event in addition to the seismic initiator: whether the seismic event affects the drums and damages the facility. This event tree becomes the front end of all of the event trees discussed previously, as a seismic event can initiate mechanical breaching, fires, and explosions. The purpose for placing this event tree on the front of the other event trees is to determine the frequency of the resulting releases. It is assumed that for the design basis earthquake that the facility remains intact, since it was designed for this magnitude of stresses.

B.6 EVENT TREE QUANTIFICATION

Event tree top events and fault tree events require probability and/or frequency values to determine accident frequencies. For the accident sequences described above, WRAP 1 mitigative and preventive systems can fail in one of three ways: (1) a failure on demand, or, (2) a failure to run for the required duration, or, (3) a consequential failure due to the conditions created by the hazards; i.e., excessive temperature, pressure, or shock wave blast degrades or destroys a detector, fan, HEPA filter, etc. The total failure probability is then the sum of these three failure contributors. Failure to run, failure on demand and standby failure rates are quantified by using database values for system components. As discussed above, the electrical power, HVAC, and plant management systems are available at the time of the accident initiator, otherwise the WRAP facility would have been shut down administratively. Other mitigative or preventive systems, such as fire

sprinklers, detectors, and dampers may fail in standby or on demand. A standby failure rate, p , is computed from the following:

$$p = \frac{1}{2} m \lambda$$

where m is the preventive maintenance interval in hours, and λ is the hazard rate per hour.

Tables B-7 through B-9 list failure rates used for each of the WRAP 1 facility event trees and fault trees.

B.7 REFERENCES

1. WHC-SD-W026-SAR-001, February, 1994, "Waste Receiving and Processing Facility Module 1 Preliminary Safety Analysis Report (Rev. 1)."
2. DOE-STD-3009-94, Chapter 3, "Hazard and Accident Analyses."
3. DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports."
4. DOE ORDER 5480.23, "Nuclear Safety Analysis Reports."
5. "Guidelines for Hazard Evaluation Procedures," copyright 1992, American Institute of Chemical Engineers.
6. UE&C, 1993, "Project W-026 WRAP Module 1 Detailed Design Report."
7. Joyce, 1993, "Radioisotopic Characterization of Retrievably Stored Transuranic Waste Containers at the Hanford Site," WHC-SD-WM-TI-517(R1).
8. FAI/94-118, "Methodology for WRAP Fire and Explosion Analysis."
9. Sax, 1984, "Dangerous Properties of Industrial Materials," Van Nostrand Reinhold Company
10. Levinson S., Yeater, M., 1983, Methodology to Evaluate the Effectiveness of Fire Protection Systems at Nuclear Power Plants, Nuclear Engineering and Design.
11. NRC, 1990, NUREG/CR-4550, "Analysis of Core Damage Frequency Internal Events Methodology."
12. Kitzmiller, 1995, Personal Communication transmitting NPRDS data.
13. McCormick, Reliability and Risk Analysis, Academic Press, Inc., 1981.
14. Henly, Kunamoto, Probabilistic Risk Assessment, IEEE Press, 1991.

15. SFPE, 1988, The SFPE Handbook of Fire Protection Engineering, Society of Fire Protection Engineers.
16. Kuchta, Joseph M., 1986, "Investigation of Fire and Explosion Accidents in Chemical, Mining and Fuel-Related Industries - A Manual," U.S. Bureau of Mines Bulletin 680.

Figure B-1. Master Logic Diagram. (9 sheets)

Figure B-1. Master Logic Diagram. (9 sheets)

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Figure B-1. Master Logic Diagram. (9 sheets)

Figure B-1. Master Logic Diagram. (9 sheets)

Figure B-1. Master Logic Diagram. (9 sheets)

Figure B-2. Shipping and Receiving NDE/NDA Mechanical Breach Event Tree.

Figure B-3. HVAC Shutdown Fault Tree for CAM Initiation.

Figure B-4. Shipping and Receiving NDE/NDA Fire Event Tree.

Figure B-5. HVAC Shutdown Fault Tree.

Figure B-6. Shipping and Receiving NDE/NDA Explosion Event Tree.

Figure B-7. Shipping and Receiving - Toxic Release Event Tree.

Figure B-8. Seismic Event Tree.

DBA LEVEL EARTHQUAKE OCCURS	SEISMIC ACTIVITY AFFECTS DRUMS AND (NO SIGNIFICANT FACILITY DAMAGE)	SEQ. PROB.	CLASS
EARTHQUAKE	DRUMS AFFECTED		
1.00E-03 EARTHQUAKE		0.00E+00	SAFE
	1.0 DRUMS AFFECTED	1.00E-03	ANY TREE

SEISMIC EVENT RELEASE FROM WRAP 1

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Table B-1. WRAP-1 Equipment Safety Evaluation.
Area: Shipping and Receiving

(Ref. H-2-131846)

Equipment	Drum Failure
Pallet Fork Truck/Waste Box Fork Truck	Could drop or puncture multiple drums causing contents to mix and chemicals to cause a vapor release, fire, or explosion.
Pallet Storage/Retrieval	Could impact drum with transfer platform or drop drum, contents spill, causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum Jib Crane	Could drop drum or collide with another object, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum Infeed Conveyor/Drum Scale Conveyor	Drum could fall off conveyor, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Pallet Transfer Car	Drum could fall off car, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Pallet Stretch Wrapper	Drum could fall off stretch wrapper, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
TRUPACT Accumulation Conveyor	Drum could fall off conveyor, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
TRUPACT Bridge Crane	Could drop drum or TRUPACT, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Automated Guided Vehicle AGV	Drum could fall off AGV or AGV could collide with object, contents spill causing a vapor release, fire, or explosion due to spark from room electrical equipment.
Drum Discharge Conveyor	Drum could fall off conveyor, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.

Table B-2. WRAP-1 Equipment Safety Evaluation.
Area: NDE/NDA

(Ref. H-2-131853, Sheet 1)

Equipment	Drum Failure
AGV	See "Shipping and Receiving"
NDE/NDA drum transfer conveyor	Drum could fall off conveyor or conveyor could impact drum into object, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Process drum storage conveyor	Drum could fall off conveyor or conveyor could impact drum into object, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum storage carousel	Drum could fall off carousel or carousel could impact drum into object, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Automated guided vehicle	Drum could fall off vehicle or vehicle could collide with object, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum transfer conveyor	Drum could fall off conveyor or conveyor could impact drum into object, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.
Drum airlock conveyor	Drum could fall off conveyor or conveyor could impact drum into object, contents spill causing a vapor release, fire or explosion due to spark from room electrical equipment.

Table B-3. WRAP-1 Area Safety Evaluation.
Area Evaluated: Shipping and Receiving

Question	Comment
Are high energy lines in the area?	No lines of pressure which could whip and knock containers over were found from review of plant system description.
Are potential missiles in the area?	Ref: H-2-131846 No high speed rotating equipment.
Are open flames in the area?	No flame released equipment listed in the project description.
Are floor drains provided?	Ref. H-2-131770/H-2-131760 No floor drains indicated.
Are floors sloped to control and direct spills?	Ref. H-2-131770/H-2-131789 Sloped floors in truck loading areas only.
Are objects overhead of the path or areas used for transportation and storage of waste drums?	H-2-131776/H-2-131848 Sheet 1 of 2 Cable tray, lights and HVAC duct overhead not a factor.
Are curbs provided to control spills?	Ref. H-2-131770 Curb provided around area perimeter, curb will prevent spill from entering doorway steps.
Do doors to adjacent areas close automatically?	Since doors are not airtight, assume they could be open.
Are walls fire rated?	Ref. H-2-131881 Interior walls are 2 hr rating. Exterior walls are not.
Could vibration induce container failure?	Pen note 9 H-2-131759 0.12g ground acceleration.
Fire detection provided?	Ref. H-2-131887 Thermal detectors signal central control. No auto operation of equipment.
Fire dampers included?	Operate at setpoint cutting off HVAC into the area and out of the area.
Sprinkler system provided?	Wet pipe sprinklers provided.
Radiation detectors provided?	Alpha/Beta detector in HVAC duct to initiate shutdown.
Smoke detectors provided?	Will trip supply on detection of smoke in the duct. HVAC is a feedback air flow system.

Initiator

None

Contributing Events

- Human response to a fire thermal detector may not occur.
- Fire dampers may not all work at setpoint causing passage of smoke and combustible products to the NDE/NDA.
- Liquid spills will remain at location, no slope, no floor drains and curbs at perimeter.
- Smoke detectors may not sense smoke after filter.
- Doors could be open allowing airborne releases to leave room.
- Sprinklers may or may not work.

Table B-4. WRAP-1 Area Safety Evaluation.
Area Evaluated: NDE/NDA

Question	Comment
Are high energy lines in the area?	90 psig compressed air system - will not impact waste containers.
Are potential missiles in the area?	Ref. H-2-131853, Sheet 1 No high speed rotating equipment.
Are open flames in the area?	No flame released equipment listed in project description.
Are floor drains provided?	Ref. H-2-131770, Sheet 2 and H-2-131760, Sheet 2 No floor drains indicated.
Are floors sloped to control and direct spills?	Ref. H-2-131770, Sheet 2 No sloped floor.
Are objects overhead of the path or areas used for transportation and storage of waste drums?	Ref. H-2-131776, H-2-132080, and H-2-132081 Cable trays, lights and HVAC duct overhead not a factor.
Are curbs provided to control spills?	Ref. H-2-131770 Curb provided around area perimeter, landing at NDE/NDA airlock keeps spills from entering airlock.
Do doors to adjacent areas close automatically?	To shipping and receiving - No To waste process - Yes
Are walls fire rated?	Ref. H-2-131887 Interior walls are 2 hr rating. Exterior walls are not.
Could vibration induce container failure?	General Note 9.8. H-2-131759 Peak ground accelerator 0.12g.
Fire detection provided?	Ref. H-2-131887 Thermal detectors signal central control. No auto operation of equipment.
Sprinkler system included?	Wet pipe sprinklers provided.
Radiation detectors provided?	Alpha/beta detector in HVAC duct to initiate shutdown.
Smoke detectors provided?	Will trip supply on detection of smoke in duct.

Initiators

None

Contributing Events

1. Human response to fire thermal detector may not occur.
2. Liquid spills will remain at location, no slope, no floor drains and curbs at perimeter.
3. Smoke detectors may not sense smoke after filter.
4. Doors could be open to shipping and receiving, allowing airborne releases to leave room.
5. Sprinklers may or may not work.

Table B-5. Types of Waste Handling Abnormal Operations Experienced at DOE Facilities Similar to WRAP 1.

Classification	Number of Hanford occurrences 1987 to 4/92	Number of occurrences in ORPS (DOE wide) 9/90 to 5/92
Loss of control of radioactive waste (contamination spread)	315	68
Loss of control of hazardous waste	125	76
Skin contamination	86	26
Loss of administrative control	39	67
Container break or rupture	27	1
Heating and ventilation system malfunction (including containment)	17	8
Accidents involving waste drum handling	12	8
Vehicle accident or traffic violation	2	--
Mishandling by fork lift	1	37
Fire	1	3
Unmonitored exposure	1	--
Potential internal deposition	1	2
Criticality limit exceeded	1	5
Mishandling by crane	0	3
Radiation monitoring lapses or failures	0	1
Effluent monitoring lapses or failures	0	15

ORPS = occurrence reporting and processing system

Table B-6. Event Frequencies.

Initiating event	Dropped drum frequency (per year)	Probability of chemical hazard	Conditional probability of toxic release	Conditional probability of explosion	Conditional probability of fire	Initiator frequency (per year)
Shipping and receiving drum breach	1.00					1.00
Shipping and receiving fire	1.00	0.01			0.20	2.00 E-03
NDE/NDA fire	1.00	0.01			0.20	2.00 E-03
Shipping and receiving toxic release	1.00	0.01	0.50			5.00 E-03
NDE/NDA toxic release	1.00	0.01	0.50			5.00 E-03
Shipping and receiving explosion	1.00	0.01		0.30		3.00 E-03
NDE/NDA explosion	1.00	0.01		0.30		3.00 E-03

NDA = nondestructive assay

NDE = nondestructive examination

Table B-7. Shipping/Receiving/NDE/NDA Drum Breach Event Tree.

Event	Failure rate/probability	Source/comments
HVAC system shutdown fails	1 E-5/D	HVAC System Shutdown Fault Tree
Door closed fails	0.1	Shipping and Receiving: Doors are open 10 minutes to unload pallets, twice per day; doors are open 10 minutes to load pallets, twice per day [UE&C, 1993]. Calculate probability door is open: $\text{Prob} = \frac{40 \text{ mins}}{8 \text{ hrs}} = 0.1$

HVAC = heating, ventilation, and air conditioning

Table B-8. Shipping/Receiving/NDE/NDA Fire and Explosion Event Trees.

Event	Failure rate/probability	Source/comments
Fire dampers fail	6 E-3/D	Demand failure rate for ventilation damper open is 3 E-3 (NRC 1990). Assume closing and open failure rate are equal. Two dampers must close.
HVAC system shutdown fails	1 E-5/D	HVAC System Shutdown Fault Tree
Fire sprinklers fail	0.04/D	[Levinson, 1983]
Door closed fails	0.1	Shipping and Receiving: Doors are open 10 minutes to unload pallets, twice per day; doors are open 10 minutes to load pallets, twice per day [UE&C, 1993]. Calculate probability door is open: $\text{Prob} = \frac{40 \text{ mins}}{8 \text{ hrs}} = 0.1$

HVAC = heating, ventilation, and air conditioning

Table B-9. Shipping and Receiving/NDE/NDA
Toxic Release Event Tree Quantification.

Event	Failure rate/frequency	Source
Door not closed	0.1/D	Table B-12
HVAC shutdown fails	4 E-3/D	Use HVAC shutdown fault tree, excluding smoke detection; i.e., smoke detector failure = 1.0.

HVAC = heating, ventilation, and air conditioning

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CHAPTER 4.0
Safety Structures, Systems,
and Components

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LIST OF TERMS

SSC Structures, systems, and components

4.0 SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS

4.1 INTRODUCTION

DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, establishes a safety classification system for structures, systems, and components (SSC) that are significant to public and worker safety and environmental protection. The purpose of the classification system is to ensure that appropriate design, procurement, construction, test, operation, maintenance, modification, oversight criteria, and other requirements provide the degree of reliability commensurate with the risk/consequences of failure of the item. This system classifies SSC as follows:

- **Safety-class SSC** — include primary environmental monitors and portions of process systems, whose failure could adversely affect the environment, or safety and health of the public as identified by safety analyses.
- **Safety-significant SSC** — are not designated as safety-class SSC, but their preventive or mitigative function is a major contributor to defense in depth (i.e., prevention of uncontrolled material releases) and/or worker safety as determined from hazard analysis.

This chapter describes the basis for classification of SSC for WRAP 1. The amount of detail provided is based on the graded approach and is appropriate for the magnitude of the potential hazards identified for WRAP 1.

4.2 REQUIREMENTS

The design and analysis for safety-significant SSC must comply with the requirements for natural phenomena hazards (i.e., wind, floods, seismic, and snow loads) established in *Hanford Plant Standards, Standard Architectural-Civil Design Criteria Design Load for Facilities*, SDC 4.1.

4.3 SAFETY-CLASS OR SAFETY-SIGNIFICANT STRUCTURES, SYSTEMS AND COMPONENTS

Based on the accident analysis performed for WRAP 1 and documented in Chapter 3.0, it has been established that WRAP 1 contains no DOE safety-class or safety-significant SSC.

4.4 REFERENCES

DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C, 1994.

HPS-SDC-4.1, *Hanford Plant Standards, Standard Architectural-Civil Design Criteria Design Load for Facilities*, Rev. 12, U.S. Department of Energy Operations Office, Richland, Washington, 1993.

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**CHAPTER 5.0
Safety Requirements;
Requirements for Maintaining Radiological Facility Status;
and Worker Protection Requirements**

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LIST OF TERMS

AS/RS	automated stacker/retrieval system
ASA	Auditable Safety Analysis
NDA	Nondestructive Assay
NDE	Nondestructive Examination
TRUPACT	transuranic package transporter
USQ	unreviewed safety question

5.0 SAFETY REQUIREMENTS; REQUIREMENTS FOR MAINTAINING RADIOLOGICAL FACILITY STATUS; AND WORKER PROTECTION REQUIREMENTS

5.1 INTRODUCTION

Safety Requirements define acceptable conditions, safe boundaries, and management or administrative controls required to ensure safe operation of a nuclear facility and reduce the potential risk to the public and workers from uncontrolled releases of radioactive materials or from radiation exposure because of inadvertent criticality.

WRAP 1 is classified in Chapter 3.0 as a radiological facility, and the graded approach to safety analysis has been applied based on that level of hazard.

5.2 WORKER PROTECTION

Actions to maximize worker safety are presented in the following chapters of this Auditable Safety Analysis (ASA): Hazardous Material Protection (Chapter 8.0); Radioactive and Hazardous Waste Management (Chapter 9.0); Operational Safety (Chapter 11.0); Procedures and Training (Chapter 12.0); Emergency Preparedness (Chapter 14.0); and Management, Organization, and Institutional Safety (Chapter 15.0).

5.3 INVENTORY CONTROL

A program is established, implemented, and maintained so that WRAP 1 will operate within the approved safety basis and the inventories assumed in the hazard categorization and documented in Chapter 3.0 will not be exceeded.

Potential waste streams to be processed during Phase 1 operations include previously characterized waste containers from the Hanford Central Waste Complex (CWC) and the Transuranic Waste Storage and Assay Facility (TRUSAF).

Approximately 300 drums of debris waste and a limited number of newly generated drums have been identified to be processed through WRAP 1 during Phase 1 operations. These drums will be x-rayed to insure they meet Generator Waste Acceptance Service's (GWAS) criteria for waste storage and disposal. A preliminary assessment of the 300 debris drums indicates that the sum of the ratios of isotopes for all 300 drums would not exceed a sum of the fractions of 1.00. The typical drum fraction is 0.0003.

Before receipt of any container at WRAP 1, the inventory (sum of the isotopic ratios) for that container and all containers in the shipment, will be calculated using the SWITS data for the container(s). All sum of the ratios calculations for each container will be independently verified. When a shipment arrives at WRAP 1, before actually being brought into the facility, each container will have its PIN/CIN matched to the calculations previously done for that container. No container will be accepted that does not have calculations completed and verified. The ratios for all containers in a

shipment will be transmitted to the control room operator who will verify that receipt of all containers will not increase the facility inventory to greater than 1.00. Only after this verification is completed will containers be received into the WRAP facility.

5.4 DESIGN FEATURES

The facility is designed to DOE 6430.1A criteria for construction and operation. Changes to design features are considered significant modifications. The unreviewed safety question (USQ) process in WHC-CM-5-34 will be used as a best-management practice to address significant modifications. The design features of WRAP 1 that would have a significant effect on safe operation if altered or modified are listed below by functional area.

Shipping and Receiving Area

Design features for the shipping and receiving area include the following:

- The automated stacker/retrieval system (AS/RS) maintains structural integrity during a seismic event to prevent drums from falling and rupturing. It also maintains the drum array and stacking integrity.
- A 30-cm (12-in.) concrete shield wall around the AS/RS/transuranic package transporter (TRUPACT) payload storage unit provides worker protection.

Nondestructive Examination/Nondestructive Assay Area

Design features for the nondestructive examination (NDE)/nondestructive assay (NDA) area include the following:

- A concrete shield wall partially surrounding the drum storage carousel provides for worker protection.

5.5 REFERENCES

DOE Order 6430.1A, *General Design Criteria*, U.S. Department of Energy, Washington, D.C., 1989.

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CHAPTER 6.0
Prevention of Inadvertent Criticality

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6.0 PREVENTION OF INADVERTENT CRITICALITY

6.1 INTRODUCTION

Based on the Hazard Categorization in Chapter 3.0, WRAP 1 is a radiological facility. As a radiological facility, the allowable facility inventory of fissionable material is such that a criticality is not possible.

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**WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
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**CHAPTER 7.0
Radiation Protection Program**

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TERMS

ACL	Administrative Control Level
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
AS/RS	Automated Stacker/Retrieval System
CAM	continuous air monitor
CEDE	committed effective dose equivalent
CFR	Code of Federal Regulations
DAC	derived air concentration
DOE	U.S. Department of Energy
FHS	fixed-head sampler
HSRCM	Hanford Site Radiological Control Manual
JCS	Job Control System
NRC	U.S. Nuclear Regulatory Commission
PAPR	powered air-purifying respirator
PNAD	personal neutron accident dosimeter
PNNL	Pacific Northwest National Laboratory
RWP	Radiological Work Permit
SWD	Solid Waste Disposal
TLD	thermoluminescent dosimeter
TRUPACT	transuranic package transporter
UE&C	United Engineers and Constructors
WMO	Waste Management Operations

7.0 RADIATION PROTECTION PROGRAM

7.1 INTRODUCTION

This chapter describes features of the WRAP 1 facility that ensure occupational and public radiation exposures are maintained as low as reasonably achievable (ALARA) and below applicable standards. Design features, programs, and procedures that control the radiation exposures received by the public and workers are described, as are radiation monitoring provisions, waste management operations ALARA policies and programs, and radiation exposure record management programs.

7.2 REQUIREMENTS

The WRAP 1 Radiation Protection Program is conducted in accordance with the requirements of 10 CFR 835, *Occupational Radiation Protection*, by implementation of the *Hanford Site Radiological Control Manual* (HSRCM-1). Specific radiological protection requirements for workers are provided in HSRCM-1, which requires that exposures to radiation from DOE operations be maintained as far below limiting values as reasonably achievable.

7.3 RADIATION PROTECTION PROGRAM AND ORGANIZATION

The WRAP 1 organizational structure that administers the Radiation Protection Program is shown in Chapter 15.0, Figures 15.2 and 15.3. According to Waste Management Operations (WMO) line management is responsible for the safe operation of facilities. The Radiological Control organization provides services and overview necessary for a functional health and safety program to meet the operational needs of WRAP 1. The Radiation Control Officer assists in developing policies and guidance for WRAP 1 provides oversight of the program. The facility radiation control officer assists WRAP 1 line management in implementing policies and requirements related to Radiation Control and ALARA. The overall Radiation Control program consists of health physics, ALARA operational support, audits, and compliance with 10 CFR 835, DOE Orders, and standards.

The WMO performs an independent oversight role for conduct of operations and conducts regular safety appraisals of each nuclear facility to ensure compliance with applicable documents.

7.4 THE ALARA POLICY AND PROGRAM

Management policy and organizational structure for maintaining occupational radiation exposures ALARA for the WRAP 1 facility are the same as for other WMO facilities. Specific policies, standards, and general guidance for the Radiation Protection Program are included in HSRCM-1 as follows:

- Excellence in Radiological Control
- Radiological Standards
- Conduct of Radiological Work

- Radioactive Materials
- Radiological Health Support Operations
- Training and Qualification
- Radiological Records.

Solid Waste Disposal Operations Administration, WHC-CM-5-34, Section 1.14, "ALARA Program," outlines the ALARA Program in detail. The goal of the ALARA Program is to "minimize human and environmental exposures to radiation and hazardous substances and conditions, commensurate with sound economics and operating policies." This program, in addition to the Radiological Work Permit (RWP) requirements for specific activities and operations in the WRAP 1 facility, effectively ensures that occupational exposures are within DOE guidelines and that exposures are ALARA.

The ALARA guidance philosophy is implemented by use of American National Standards Institute (ANSI) N13.2, which has been incorporated into the management policy and organizational structure. Management is committed to ALARA, and those responsible for implementing the program are alert to opportunities for reducing exposures. The ALARA policy is consistent with the guidance provided by the Pacific Northwest National Laboratory (PNNL), PNL-6577, *Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low as Reasonably Achievable (ALARA)*.

The radiation exposure of employees, visitors, and members of the general public originating from company operations is controlled to levels that are less than applicable regulatory, DOE, and company limits. Such radiation exposures are further limited to levels that are ALARA. WHC-CM-5-34, Section 1.14, "ALARA Program," describes the organizational structure and the methods for controlling and ensuring that human exposures to hazardous substances and conditions are maintained ALARA.

WRAP 1 line management is responsible for the radiological safety of the personnel assigned to the WRAP 1 facility and visitors. The WRAP 1 facility line management and the Radiological Control organization work together to identify the radiation protection needs of WRAP 1 and to implement the Radiation Protection and ALARA Programs.

A facility ALARA committee is appointed by WRAP 1 management to provide oversight to ensure the ALARA Program is integrated into daily activities. The ALARA team chairperson aids the plant manager and the plant ALARA team members in the application and documentation of ALARA.

Plant personnel are made aware of management's commitment to ALARA via the establishment of WRAP 1 facility ALARA goals, ALARA activities discussions, and pre-job meetings. The plant performance report tracks cumulative personnel exposure and skin contaminations and includes a report on plant ALARA activities. Modifications have been made and will continue to be made to the facilities and plant procedures to implement ALARA improvements. Any person in the plant may submit ALARA-based suggestions for changes to plant procedures or modifications of plant facilities for reduction of personnel exposure to radiation or hazardous materials.

In addition to the ALARA Program, the Safety organization conducts periodic audits and appraisals of company operations. The purpose is to

provide independent radiological control assessment to ensure that the applicable radiological safety standards and ALARA are being followed.

7.5 RADIOLOGICAL PROTECTION TRAINING

The Sitewide safety training program covers general safety awareness, nuclear safety, hazardous materials, and waste management. A multi-tiered radiation protection training course provides a level of training commensurate with an individual's classification: radiation worker or nonradiation worker and the specific work assignment. Requirements for radiation protection training are defined in HSRCM-1, Chapter 6, Part 3, "Radiological Worker Training," and are consistent with the requirements stated in DOE/EH-0256T, *Radiological Control Manual*. Training is provided by technical and training specialists from Site Support and Safety.

WRAP 1 workers receive initial and continuing Radiation Safety Training, Environmental and Hazardous Material Safety Training, and Hanford General Employee Training. Qualification requires employees to successfully complete general and job-specific self-study, classroom, and on-the-job training requirements. Most training is required on a biennial basis, except for hazardous waste training, which is provided annually. Unqualified employees are not permitted to work in the facility without the supervision of a certified employee. WRAP 1 management is responsible for ensuring that new employees are trained and qualifications are maintained.

Required training is based on an analysis of tasks and responsibilities for each job position and includes emergency preparedness training to respond effectively to events such as emergency monitoring equipment alarms, container failures, vehicle accidents, earthquakes, fires, or groundwater contamination.

Visitors must complete the Site Visitor/Vendor Orientation Training, which covers essential safety and security topics such as the master safety rules, hazard warning signs, and response to emergency alarms.

Following completion of the training, evidence of the satisfactory completion (completed forms, rosters, and examinations) is sent to Training Services. These records are entered into a computerized Training Records Information System. An individual's training status is also entered into another computer database that is available to managers. Records such as rosters and completed training forms are retired quarterly to a records retention facility.

7.6 RADIATION EXPOSURE CONTROL

To control radiation exposure, the design of the WRAP 1 facility implements engineered controls first, administrative controls second, and personal protective equipment as a last resort where engineered or administrative controls are not feasible. Additionally, administrative and operational restrictions have been implemented to minimize personnel occupancy and exposures.

7.6.1 Administrative Limits

The design philosophy used throughout the WRAP 1 facility is based on the premise that any unnecessary radiological exposure of personnel shall be avoided, and occupational exposures shall be maintained ALARA. This policy is reflected in the design objective that occupational internal and external radiation doses should be ALARA and not exceed the *Radiological Control Manual* and 10 CFR 835 limit of 5,000 mrem/yr. The objective is to maintain personnel radiation exposure well below regulatory limits and have established, challenging, numerical Administrative Control Levels (ACL) below the regulatory limits of 10 CFR 835. The *Radiological Control Manual* places a more restrictive ACL of 2,000 mrem/yr per person for DOE activities. Approval by the Program Secretarial Official or designee is required before allowing a person to exceed 2,000 mrem/yr. The *Radiological Control Manual* further requires that each contractor senior site executive establish a more restrictive limit than the ACL of 2,000 mrem/yr. This control level is reevaluated annually. The choice of a level for one year does not preclude choosing a higher or lower level in a subsequent year. The *Radiological Control Manual* further states that for most facilities, an annual facility ACL of 500 mrem or less should be challenging and achievable. WRAP 1 management will establish goals for each year of operation. No person will be allowed to exceed the facility ACL without the prior approval of the WMO senior site executive.

7.6.2 Radiological Work Practices

Activities that involve radiological exposure are performed in compliance with the requirements of HSRM-1, which includes a description of the format and content of RWPs. Entry into, and the work performed in, any radiological area is governed by the provisions of the RWP that is issued for that job or area. Radiological Control issues RWPs with the review and concurrence signature of WRAP 1 management. The RWPs are the most detailed level of radiation protection documents. They are written to specifically describe radiation protection requirements for a unique operation, activity, or location. The RWP provides instructions to workers and the radiological control technician regarding unique radiological control requirements and ALARA practices for specific tasks. The *Radiological Design Guide* (WHC-SD-GN-DGS-30011) establishes radiation shield design criteria that permit occupancy based on exposure levels.

Administrative measures are developed where physical measures cannot be implemented or do not provide satisfactory assurance that radiological exposures can be controlled. The RWP, operating procedures, "need-for-entry" requirements, and training are included as administrative measures.

Stay-time control is incorporated in written procedures and is part of radiation worker training. The RWP, operating procedures, and emergency procedures are developed with personnel exposure in mind. Radiological conditions such as dose rates, contamination levels, and potential airborne radioactivity levels are discussed in these procedures and are used to determine radiological stay-times.

Internal radiation exposure primarily results from exposure to airborne radioactive contamination. Control of airborne radioactivity concentrations is accomplished by employing the design requirements of the *Radiological Design Guide* (WHC-SD-GN-DGS-30011) and operating waste receipts in accordance with WHC-EP-0063-04, *Hanford Site Solid Waste Acceptance Criteria*. Minimizing the actual amount of removable contamination and maintaining good housekeeping are two effective controls used to minimize the potential for airborne radioactive concentrations. No waste containers are planned to be opened during Phase 1 operations; therefore airborne contamination is unlikely.

The WRAP 1 design ALARA assessment (United Engineers & Constructors [UE&C] 1992a) demonstrated that the WRAP 1 design features are in compliance with DOE ALARA requirements. The dose rate assessments performed by United Engineers and Constructors (UE&C 1992a, 1992b, 1992c, and 1992d) provide details on the shield wall thicknesses. Dose calculations were performed using the QUAD-CGGD code. The source shielding in each area of the facility is summarized as follows:

- Administrative Areas
 - Assessment documented that no additional shielding would be required for the administrative areas other than that provided by the facility structure and radiation shielding in the plant processing areas.
- Shipping and Receiving Area
 - 30-cm (12-in.) thick reinforced concrete shield wall around the automated stacker/retrieval system (AS/RS) and transuranic package transporter (TRUPACT) payload storage unit
 - 20-cm (8-in.) thick concrete shield walls between the jib cranes and the crane operators
 - Lead glass shielding for the drum transfer forklift
- Nondestructive Examination/Nondestructive Assay Area (shielding in this unstaffed area is required to support assay detection limits)
 - 61-cm (24-in.) concrete shield walls around the Boxed Waste Assay System
 - 84-cm (33-in.) concrete shield wall between the drum passive active neutron units
 - 30-cm (12 in.) concrete shield walls around drum gamma energy assay units
- Maintenance
 - Assessment concluded that temporary shielding may be required during the performance of maintenance on the AS/RS crane and transfer car

- Control Room
 - 20-cm (8-in.) wall between the shipping and receiving area and the control room.

Boundaries, Posting, and Controls

The definition, procedures and requirement for posting, labeling, or signifying boundaries for areas in the WRAP 1 facility are discussed in detail in HSRCM-1.

Personnel access into controlled radiological areas or facilities is administratively controlled by a computerized tracking system. These data are entered into the system before personnel enter a radiological area. If problems or deficiencies are found on an individual worker's data, radiological area entries are denied to the individual.

The radiological areas are classified based on the radiological conditions encountered. The following are examples of radiological areas that may be used in WRAP 1.

- Radioactive Materials Area--An area or structure where radioactive material is used, handled, or stored.
- Radiological Buffer Area--An intermediated area established to prevent the spread of radioactive contamination or to protect personnel from radiation exposure.
- Contamination Area--An area where contamination levels are greater than the values specified in Table 2-2 of HSRCM-1, but less than or equal to 100 times those values.
- Airborne Radioactivity Area--Any area where the concentration of airborne radioactivity, above natural background, exceeds, or is likely to exceed 10% of the derived air concentration values. DAC values are contained in Appendix C of 10 CFR 835.
- Radiation Area--An area where an individual can receive a dose equivalent of >5 mrem but ≤ 100 mrem in 1 hour at 30 cm (12 in.) from the radiation source or from any surface through which the radiation penetrates.
- High-Radiation Area--An area where an individual can receive a dose equivalent of >100 mrem at 30 cm (12 in.) in 1 hour, but <500 rad in 1 hour at 100 cm (40 in.) from the radiation source or from any surface through which the radiation penetrates.
- Very-High Radiation Area--An area where an individual can receive a dose equivalent of >500 rad in 1 hour at 100 cm (40 in.) from the radiation source or from any surface through which the radiation penetrates.

Entry and Exit Control Program

Physical and administrative measures for controlling access and stay-times for radiological areas are discussed in Chapter 3 of HSRCM-1. Physical and administrative measures for controlling access to radiological areas have been developed for WRAP 1. Physical measures include building structures and radiological posting. Administrative measures are developed where physical measures cannot be implemented or do not provide satisfactory assurance that radiological exposures can be controlled. The RWP, operating procedures, "need-for-entry" requirements, and training are included as administrative measures.

All entries into a radiological area are performed in accordance with the access system requirements or equivalent system for the facility.

Radiological conditions within the WRAP 1 areas typically do not warrant monitoring of stay-time. However, if work activities should involve entry into a high radiation area (>100 mrem/h), stay-time is monitored by personnel and/or equipment. Requirements for radiological control coverage are specified in the RWP for each job. The RWP, operating procedures, and emergency procedures are developed with personnel exposure in mind. Radiological conditions such as dose rates, contamination levels, and potential airborne radioactivity levels are discussed in these procedures and are used to determine radiological stay-times.

Activities that involve radiological exposure are performed in compliance with the requirements of HSRCM-1, which includes a description of the format and content of RWPs. Entry into, and the work performed in, radiological areas is governed by the provisions of the RWP that is issued for that job or area. Radiological Control issues RWPs with the review and concurrence signature of line management. The RWPs are the most detailed level of radiation protection documents. They are written to specifically describe radiation protection requirements for a unique operation, activity, or location. The RWP provides information to workers and radiological control technicians regarding unique radiological control requirements and ALARA practices for specific tasks.

Exit and entry controls are placed at appropriate locations throughout the WRAP 1 facility. The purpose of entry controls is to ensure that personnel entering radiologically controlled areas have received requisite training, including radiation safety training, and are wearing appropriate dosimetry and clothing, such as special work permit clothing, when required. Exit controls are intended primarily to ensure that required monitoring is completed before personnel leave a controlled area and to prevent the spread of contamination from one area to another.

7.6.3 Dosimetry

External Dosimetry. This section provides information on the external dosimetry program at the Hanford Site. Guidance provided by Nuclear Regulatory Commission (NRC) Regulatory Guides 8.3, 8.4, and 8.9 and applicable ANSI standards have been followed, with exception of the criteria for film

badge performance. Thermoluminescent dosimeters (TLD) are used to monitor personnel dose rather than film badges. The specific performance criteria applied to the TLD program meet or exceed the intent of ANSI N13.15.

The use of dosimeters is discussed in HSRCM-1. TLDs used at the WRAP 1 facility are processed by a DOE Laboratory Accreditation Program-accredited laboratory. Spectral studies ensure the TLDs are calibrated correctly for Hanford Site facilities. The following dosimeters may be used at WRAP 1:

Hanford Standard Dosimeter--The Hanford Standard Dosimeter is issued to Hanford Site personnel assigned a dosimeter, with the exception of neutron workers. The dosimeter is used to record the shallow, eye, and deep dose of record in beta and photon radiation fields. Although not intended for use to record dose from neutron radiation, the dosimeter has a neutron-sensitive chip for neutron detection capability. The neutron response is intended to identify personnel who should be wearing the Hanford Combination Neutron Dosimeter with its superior neutron dose capabilities.

Hanford Combination Neutron Dosimeter--The Hanford Combination Neutron Dosimeter is used to record the shallow, eye, deep, and neutron dose for employees working in beta, photon, and neutron radiation fields.

Finger Ring Dosimeter--The finger ring dosimeter consists of two chips in a sealed plastic ring. The rings are designed to measure photon and beta exposures to the extremities.

Supplementary Dosimeter--There are two supplementary self-reading dosimeters: the gamma ray pencil dosimeter and the gammacoms dosimeter. Requirements to wear the supplementary dosimeter are called out in the RWP for a work area.

Personal Neutron Accident Dosimeters (PNAD)--A PNAD is used to estimate the neutron dose to a person carrying the device during a nuclear criticality accident. The PNADs are issued to personnel who work in or visit facilities in which a nuclear criticality accident is possible. In the event of a criticality or high-level radiation event, the PNADs will be collected by radiological control personnel and transported to Pacific Northwest National Laboratory (PNNL) for analysis.

Internal Dosimetry. Two dosimetry programs are used to monitor personnel dose. Specific dosimetry information is provided in Chapter 5 of HSRCM-1.

Exposure to internally deposited radionuclides is assessed by in vitro (excreta analysis) or in vivo (whole-body or chest count) bioassay measurements. Routine evaluations typically consist of in vivo and urinalysis at an employee's annual or biannual physical examination. If required, a urinalysis typically is scheduled for 6 months after the routine in vivo evaluation.

In vivo counting, whole-body or chest, is used to determine the quantity and types of radionuclides inhaled or ingested by personnel. The equipment provides a gamma ray energy spectrum determination and a total energy release rate that is converted into a dose equivalent. This, in turn, is used to calculate the dose commitment that the individual will receive. This

information becomes part of the individuals's permanent record and may be used to determine future exposure limitations. Bioassays, urine and fecal, are also used to track and verify past and current doses accumulated by personnel. Usually, a chest count is performed and urine collection is initiated for those personnel involved in an airborne plutonium release, while blood and urine samples would be collected for a plutonium-contaminated wound situation.

Based on field information, the Radiological Control Dosimetry section determines if in vivo or bioassay analyses are required when a person is suspected of having received a significant intake of radioactive material. Any person is monitored who has a potential for having received a 100-mrem annual committed effective dose equivalent (CEDE) from any intake or 10% of the tissue dose equivalent for a particular organ. The initial determination of an intake and need for an in vivo examination is usually made by field indicators, e.g., nasal smears, air samples, or personal contamination surveys. The Radiological Control Dosimetry section, with the advice of the PNNL exposure evaluator, determines the need for specific bioassay analyses to confirm an uptake of radioactive material. Employees give their written approval for medical tests.

Supervisors are required to notify Radiological Control of any changes in an employee's work assignment that may affect the potential for internal exposure. If there is reason to suspect that an intake of radioactive material has occurred, employees are required to notify their supervisor and Radiological Control, and an appropriate evaluation is scheduled. Any injuries that occur in a radiological area are reported to Radiological Control for evaluation of possible internal contamination through wounds. Guidelines for indication of internal contamination and emergency response procedures are described in Chapter 5 of HSRCM-1. Sampling programs for workers are performed in accordance with HSRCM-1.

7.6.4 Respiratory Protection

The purpose of the respiratory protection standard is to define the requirements governing the use of respirators for protection against harmful air contaminants and/or oxygen deficient atmospheres. Respirators are used only if preferred controls, including engineering and/or administrative controls (such as enclosures, ventilation, or the substitution of less hazardous materials) are not available. Only approved respirators are used. Employees are medically screened and trained to use the respirators. The standard establishes requirements for selection, testing, storage, cleaning, and inspections of respirators.

HSRCM-1, Part 2, Chapter 3 dictates the specific respiratory requirements for work within radiological areas, and WHC-CM-5-36, *SWD Internal Requirements*, Chapter 1-11, Section 15, discusses toxic chemical environments.

Respiratory Protective Equipment. Respiratory protection is used when entering an area with high potential for airborne contamination or having known airborne contamination, during operations that could or would cause airborne contamination, and where there is an oxygen-deficient environment. An atmosphere with oxygen content less than 19.5% by volume is considered immediately dangerous to life or health. Respiratory protection devices

prescribed include: full-face piece, air-purifying respirator (e.g., MSA Ultraview, Norton, Scott O' Vista), powered air-purifying respirator (PAPR), supplied airline respirators with escape provisions, and self-contained breathing apparatus. The Radiological Control organization is responsible for determining respiratory protection requirements based on real or potential hazards from airborne contamination. The respirator type selected is based on actual or potential expected levels of airborne contamination and the type of work to be performed.

7.7 RADIOLOGICAL MONITORING

This section provides details regarding the area and airborne radiation monitoring programs that are provided for the WRAP 1 facility. The design, installation, and operation of the area and airborne radiation monitoring systems, as required, are in accordance with Section 10.0, "Sampling and Monitoring," of WHC-SD-GN-DGS-30011, *Radiological Design Guide*; Section 12.0, "Airborne Radioactive Materials, Evaluation and Controls," of *Hanford Site Radiological Control Manual (HSRCM-1)*; ANSI N323-1978, *Radiation Protection Instrumentation Test and Calibration*; NRC Regulatory Guide 8.2, *Guide for Administrative Practices in Radiation Monitoring*; Regulatory Guide 8.6, *Standard Test Procedure for Geiger-Mueller Counters*; and ANSI N13.1, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*.

The air sampling and monitoring program warns personnel of the unexpected release of airborne radioactive materials, provides data regarding potential personnel exposures and the effectiveness of containment systems, and determines if exposures are maintained ALARA. The intent is to restrict airborne radioactive materials to ALARA levels and not to exceed levels in the applicable DOE Orders. This statement is also applicable to the effluent monitors.

Fixed-head samplers (FHS) may be used to sample room air for evaluation of potential inhalation hazards to personnel. The FHSs are placed in locations to evaluate average airborne concentrations of contamination at work locations.

The FHS filters are exchanged by the Radiological Control personnel at a frequency specified by their management. These filters are exchanged if an incident involving airborne contamination occurs, because they provide an integrating sample over a period of time and continuous air monitors (CAM) provide immediate notification of a problem. These filters may be exchanged at the discretion of Radiological Control management to help evaluate an airborne contamination event. These data also may be used to support the concentrations recorded by a CAM alarm. The sample filter is counted by Radiological Control and may be sent for analysis at one of the Site laboratories.

The Radiological Control organization periodically checks each FHS for adequacy of airflow, along with filter changeouts.

The routine past evaluations of operations personnel at the Hanford Site facilities whole-body counting and bioassay results indicate that the airborne radioactivity control and respiratory protection programs are effective.

Continuous air monitors sample and monitor the air and are designed to provide early warning of a significant release of radioactive material. They are installed in WRAP 1 areas where an individual is likely to be exposed to a concentration of airborne radioactivity exceeding one DAC as specified in 10 CFR 835, Appendix A, or where there is a need to alert personnel to unexpected increases in airborne radioactivity levels because of equipment or confinement failure. Because of the need for frequent changes of sample filters, CAMs normally are not used to establish breathing zone air concentrations or to quantify chronic low-level airborne exposures. Where the CAM sample is the only air sample being drawn, care is taken to ensure that it is run as long as possible between filter changeouts.

Continuous air monitors, portable alpha survey instruments, and portable beta-gamma survey instruments are located at or near workstations and room exits, as appropriate.

Contamination Control

Requirements and guidelines relevant to contamination control at WRAP 1 are based on requirements in 10 CFR 835, Appendix D.

If the contamination cannot be isolated by an engineered barrier, the next step in preventing personnel contamination is the use of protective clothing. Protective clothing is stored in WRAP 1. Clothing that is damaged and will not provide protection from contamination is discarded. Used clothing is placed in appropriately labeled hampers located in each changeroom or at the step-off pad at the exit point for a contamination control area. Personnel are allowed to exit to a survey point after completing an on-the-spot personal survey. Bags of used protective clothing are surveyed by Radiological Control before removal from the facility.

Surveys are conducted at WRAP 1 on a routine basis for penetrating whole-body radiation and for alpha and/or beta contamination in compliance with HSRCM-1.

The methods, frequencies, and procedures for conducting radiation surveys are determined based on the materials handled (form, element, isotope), the type of area in which the work is to be performed, the radiological condition, and type of operations conducted (dose rate, contamination level, or airborne potential). Employees are required to perform, or have Radiological Control perform, a contamination survey when exiting a radiological area controlled for contamination. Survey instrumentation is selected based on the materials handled to ensure that appropriate equipment is used.

Bases and methods to control contamination are discussed in HSRCM-1. Actions to be taken if defined limits of contamination control are exceeded address personnel contamination and subsequent decontamination and documentation, along with control of equipment and surfaces that exhibit contamination. Should an individual become contaminated, equipment and supplies are in place to remove or minimize its effects. Available methods of personnel decontamination include washing, scrubbing, chemical reacting, and chelating. Equipment is available to monitor residual personnel and internal contamination.

Tools and equipment being removed from the radiological area must be surveyed by Radiological Control before being removed from the area. Contaminated tools are decontaminated to the extent possible before being removed from the radiological area. Tools that cannot be decontaminated must be kept in a radiological area except while in transit, at which time tools must be contained to prevent the spread of contamination.

7.8 RADIOLOGICAL PROTECTION INSTRUMENTATION

This section describes examples of health and safety-related portable equipment, instruments, and facilities available to support the Radiation Protection Program for the WRAP 1 facility. Special-purpose equipment, instrumentation, and facilities are available to support aspects of the Radiation Protection Program. The design, installation, operation, and calibration of radiological control instrumentation is in accordance with WHC-SD-GN-DGS-30011, *Radiological Design Guide*; HSRM-1; and WHC-IP-0718, *Health Physics Procedures Manual*. The DOE has listed NRC documents as reference standards to supplement subjects not fully addressed in DOE documents.

Portable radiation monitoring and surveying instruments are provided to Hanford Site contractors from a central instrument pool operated for the DOE by PNNL. The instruments are described in detail in the *Radiation Protection Instrumentation Manual*; operational aspects are contained in facility procedures.

Instruments considered for use on the Hanford Site are evaluated against criteria given in applicable DOE Orders, the environmental criteria given in ANSI N42.17, *Performance Specifications for Health Physics Instruments*, and other applicable ANSI Standards. Samples of the criteria involved in procurement considerations are as follows:

- Adequacy of performance levels and capabilities to meet requirements
- Superior features (ruggedness, sensitivity, ease of operation, energy dependence, etc.)
- Physical and electronic ability to remain operable under normal and abnormal use and environmental conditions
- Superior detection capabilities such as sensitivity, energy response, time response, output response, range, and stability are sufficient
- Ease of calibration
- Availability of spare parts
- Zero or minimal special tooling needed
- Ease of operation

- Reasonable battery life (if a portable unit)
- Approval by the Hanford Site Instrumentation Evaluation Committee, indicating that these criteria have been evaluated.

Portable radiation monitoring and surveillance instruments, including airborne contamination detection equipment, are provided to Hanford Site contractors from a central Site instrument pool operated for the DOE by PNNL. Part of the responsibilities in operating the instrument pool are to maintain, repair, and calibrate portable surveillance instruments. The frequency and method of calibrations of portable surveillance instruments are defined in HSRCM-1, Chapter 5, Part 6 and PNL-MA-0562, *Radiation Protection Instrumentation Manual*.

Area monitors and portable alpha CAMs are serviced by qualified laboratories and/or personnel. Personal survey devices and beta CAMs are serviced by qualified personnel. WRAP 1 radiological control technicians and instrument technicians periodically check the instruments for response to a check source. The air monitors are checked as required, and their sample filters are changed as determined by Radiological Control. Portable survey instruments have radiation sources attached to the instruments, permitting response checking before a survey is performed. Other sources are available in the field office located in the WRAP 1 facility. Survey instruments are checked functionally before each use.

Radioactive samples (air samples, filter papers, and water samples) collected by Radiological Control personnel are analyzed at WRAP 1 and/or an applicable site laboratory. The Hanford Environmental Health Foundation performs drinking water sampling at the Site. The sampling performed by the Hanford Environmental Health Foundation includes the 200 Area sanitary water system that provides water to the lunchroom, drinking fountains, and the men's and women's change rooms at WRAP 1. Detailed procedures, methods, and radionuclide concentration guides for the Washington State drinking water supply system are established in WAC 246-290, "Public Water Supplies."

Radiological Control Technicians conduct radiation and contamination surveys as part of the Scheduled Radiation Survey Program. This program establishes requirements and methods for determining current radiological status within and outside of radiological areas. Information on radiological status is used to determine abnormal conditions, initiate corrective actions, and provide a method of determining long-range trends in radiological evaluations. The program is described in HSRCM-1.

WRAP 1 conducts surveys on a routine basis for penetrating whole-body radiation and for alpha and/or beta contamination in compliance with HSRCM-1. Instruments used for these surveys are identified in the *Radiation Protection Instrumentation Manual*. Most portable surveillance instruments are maintained, repaired, and calibrated at the central Site instrument pool operated by PNNL. The operating contractor calibrates and maintains certain beta counters.

7.9 RADIOLOGICAL PROTECTION RECORD KEEPING

Radiological protection record-keeping guidance is included in HSRCM-1, *Hanford Site Radiological Control Manual*. This manual describes the plans and procedures governing the generation, retention, and disposition of records.

Radiation Program Records. The radiation protection policies and standards, developed primarily by Radiological Control, are documented in various controlled manuals. These manuals establish the scope and organization of the Radiation Protection Program and program requirements (e.g., training, frequency, and techniques used in the measurement of radiation exposures, radiation and contamination control procedures, plans for emergencies, and recording and reporting requirements).

Records of maintenance and calibration of portable and semiportable radiation detection instruments are generated and maintained by PNNL.

Records generated by plant calibration of alpha CAMs and criticality monitors are maintained by the Job Control System (JCS). These and other records relative to the Radiation Protection Program are generated and maintained by appropriate organizations.

Radiological Status of Work Area Records. Records of the radiological status of work areas generated by Radiological Control include documentation such as radiation and contamination survey reports; air sample counter logs, which document the results of the analysis of air samples counted by Radiological Control; RWPs; and radiation problems and incident reports. These records are maintained in the WRAP 1 facility for a period and are then retired to a records retention facility.

Personnel access into controlled radiological areas or facilities is administratively controlled by a formal access control system.

ALARA Records. The Hanford Site has a formal program to ensure that radiation exposures are reduced to ALARA. Dosimetry reports are provided to facility managers for guidance in facility planning (e.g., maintenance activities).

The retention periods for Radiation Protection Program records are identified in the Records Inventory and Disposition System. The established retention periods meet or exceed the guidelines of ANSI N13.6. Generally, the organization producing the record maintains the record in the field in accordance with requirements and retires it to the records retention facility as applicable.

NRC Regulatory Guide 8.7 and ANSI N13.6 provide only general guidance for the physical protection of records. Both HSRCM-1 and ANSI/ASME NQA-1-1994-IA, Supplement 175.1, *Quality Assurance Program Requirements for Nuclear Facilities*, provide specific requirements for record storage. Personnel radiological records are maintained by the Hanford Site Radiological Records Projects.

Occupational Exposure Records and Reports. Permanent records of exposure for occupational workers are stored in the occupational radiation exposure computer database that is maintained by PNNL.

Radiation exposure reports, based on supplemental dosimetry measurements, are provided for occupational workers who may approach any of the weekly, monthly, quarterly, or annual exposure control limits. Otherwise, employees are provided a statement of their occupational exposure status annually, or as soon as possible after involvement in a radiation incident. Radiation exposure reports are reviewed by management to assist in controlling occupational worker exposures to within established limits.

Reporting of dosimetry information to management and the occupational worker is performed under the requirements of the *Radiological Control Manual*. Employees may request a copy of their occupational exposure record from the Dosimetry and Medical Services group at any time.

7.10 OCCUPATIONAL RADIATION EXPOSURE

This section identifies the person-rem doses from calculated radiological exposures to facility workers and stack emissions during normal process operations. There are no significant airborne radioactivity dose and exposure contributions anticipated to the facility worker.

Dose assessment calculations were performed by UE&C (1992b, 1992c, 1992d, and 1992e) for various areas of the WRAP 1 facility, and facility worker exposures were found to be <1,000 mrem/yr per person, based on an 8 h/day, 5 days/wk, 50 wk/yr at 0.5 mrem/h. The *WRAP 1 Facility Design ALARA Assessment* (UE&C 1992a) evaluated the WRAP 1 design for radiation protection criteria of WHC-CM-1-6, *WHC Radiological Control Manual* (now superseded by HSRCM-1). This assessment identified ALARA protective measures for the facility that would reduce the facility worker exposures even further. This ensures that individual doses will be within the guidelines established in HSRCM-1 for occupational radiation exposure and National Institute of Safety and Health guidelines. The dose rate assessments performed in UE&C 1992b, 1992c, 1992d, and 1992e used the source terms for the WRAP 1 facility, personnel task assignments, and durations as defined in the WRAP 1 Facility Time and Motion Analysis, and the facility building and shielding configurations to analyze worker exposure. These dose rate assessments and consequent annual person-rem determinations are very conservative because it was assumed that the average drum reads 10 mrem/h at contact, and the facility contains a maximum drum in each area that reads 200 mrem/h at contact. WRAP 1 Operations and Maintenance personnel bounding exposures were found to be within the DOE ACL of 2,000 mrem/yr per person.

7.11 REFERENCES

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

- ANSI N13.1, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, American National Standards Institute, Washington, D.C., 1969.
- ANSI N13.15, *Radiation Detection - Personnel Thermoluminescence Dosimetry Systems - Performance*, American National Standards Institute, Washington, D.C., 1985.
- ANSI N13.2, *Administrative Practices in Radiation Monitoring* (A Guide for Management), American National Standards Institute, Washington, D.C., 1982.
- ANSI N13.6, *Practice for Occupational Radiation Exposure Records Systems*, American National Standards Institute, Washington, D.C., 1989.
- ANSI N323-1978, *Radiation Protection Instrumentation Test and Calibration*, American National Standards Institute, Washington, D.C., 1978.
- ANSI N42.17, *Performance Specifications for Health Physics Instruments*, American National Standards Institute, Washington, D.C., 1989.
- ANSI/ASME NQA-1-1994-IA, *Quality Assurance Program Requirements for Nuclear Facilities*, American National Standards Institute, American Society of Mechanical Engineers, New York, New York, 1994.
- DOE/EH-0256T, *Radiological Control Manual*, U.S. Department of Energy, Washington, D.C., 1992.
- HSRCM-1, *Hanford Site Radiological Control Manual*, Hanford Site Contractors, Richland, Washington.
- NRC Regulatory Guide 8.2, *Guide for Administrative Practices in Radiation Monitoring*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1973.
- NRC Regulatory Guide 8.3, *Film Badge Performance Criteria*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1973.
- NRC Regulatory Guide 8.4, *Direct Reading and Indirect Reading Pocket Dosimeters*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1973.
- NRC Regulatory Guide 8.6, *Standard Test Procedure for Geiger-Mueller Counters*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1973.
- NRC Regulatory Guide 8.7, *Instructions for Recording and Reporting Occupational Radiation Exposure Data*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1992.
- NRC Regulatory Guide 8.9, *Acceptable Concepts, Module Equations, and Assumptions for a Bioassay Program*, U.S. Nuclear Regulatory Commission, Washington, D.C., 1973.
- PNL-6577, *Health Physics Manual of Good Practices for Reducing Exposure to Levels that are as Low as Reasonably Achievable (ALARA)*, Pacific Northwest Laboratory, Richland, Washington, 1988.

- PNL-MA-0562, *Radiation Protection Instrumentation Manual*, Pacific Northwest National Laboratory, Richland, Washington, 1989.
- UE&C, 1992a, *WRAP 1 Facility Design ALARA Assessment*, Revision B, United Engineers and Constructors, Richland, Washington.
- UE&C, 1992b, *WRAP 1 Process Area Dose Assessment, Glovebox Dose Rate Assessment, HVAC Room Dose Assessment and Adjacent Areas Dose Rate Assessment Submittal*, (Correspondence No. 9205831, September), United Engineers and Constructors, Richland, Washington.
- UE&C, 1992c, *WRAP 1 Shipping and Receiving Area Operator Assessment and NDE/NDA Dose Assessment*, (Correspondence No. 9205824, September), United Engineers and Constructors, Richland, Washington.
- UE&C, 1992d, *WRAP 1 Assessment of Compacted Waste on Personnel Dose Rates and Control Room Dose Rates Assessment*, (Correspondence No. 9205809, August), United Engineers and Constructors, Richland, Washington.
- UE&C, 1992e, *WRAP 1 Maintenance Dose Assessment*, (Correspondence No. 9205868, November), United Engineers and Constructors, Richland, Washington.
- WAC 246-290, "Public Water Supplies," *Washington Administrative Code*, as amended.
- WHC-CM-1-6, *WHC Radiological Control Manual*, Westinghouse Hanford Company, Richland, Washington. (Document recalled December 1994.)
- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.
- WHC-EP-0063-04, *Hanford Site Radioactive Solid Waste Acceptance Criteria*, Rev. 4, Westinghouse Hanford Company, Richland, Washington, 1993.
- WHC-IP-0718, Rev. 0, *Health Physics Procedures Manual*, Westinghouse Hanford Company, Richland, Washington, 1993.
- WHC-SD-GN-DGS-30011, Rev. 0, *Radiological Design Guide*, Westinghouse Hanford Company, Richland, Washington, 1994.

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WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
AUDITABLE SAFETY ANALYSIS
Revision 0

CHAPTER 8.0
Hazardous Material Protection

February 1997

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TERMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
AMW	ALARA management worksheet
CFR	Code of Federal Regulations
ECG	Environmental Compliance Group
LLW	low-level waste
MSDS	material safety data sheet
OJT	on-the-job training
OSHA	Occupational Safety and Health Administration
PHMC	Project Hanford Management Contractor
RWP	radiation work permit

8.0 HAZARDOUS MATERIAL PROTECTION

8.1 INTRODUCTION

This chapter summarizes the provisions for hazardous material protection, other than radiological hazards, in WRAP 1. Because WRAP 1 does not use significant amounts of hazardous material in processing and most of the hazardous material that enters the facility is contained in the waste, the potential for exposure or release is limited. Therefore, in accordance with the graded approach, this chapter does not fully describe the hazardous material protection program applicable to Hanford, but only outlines the essential features of the program as specifically related to WRAP 1 safety.

This chapter presents a brief description of the elements of the hazardous material protection program, which are as follows:

- The overall hazardous material protection program and organization
- The hazardous material as low as reasonably achievable (ALARA) policy and program
- The hazardous material training program
- Hazardous material exposure control, including identification of hazardous material, administrative limits, occupational medical programs, and respiratory protection
- Hazardous material monitoring to protect workers, the public, and the environment
- Hazardous material protection instrumentation
- Plans and procedures for maintaining hazardous material records, hazard communications, and occupational exposures.

Chapter 2.0 contains a listing of the hazardous materials that could potentially enter WRAP 1.

8.2 REQUIREMENTS

This chapter provides information that satisfies the requirements of DOE Order 5481.1B, *Safety Analysis and Review System*.

Criteria governing WRAP 1 waste management practices are contained in WHC-EP-0063-04, *Hanford Site Radioactive Solid Waste Acceptance Criteria*, and WHC-SD-W026-FDC-001, *Waste Receiving and Processing (WRAP) Facility Module 1 Functional Design Criteria*.

Any uncharacterized low-level waste (LLW) suspected to contain hazardous constituents or have hazardous characteristics will be returned to the generator.

8.3 HAZARDOUS MATERIAL PROTECTION AND ORGANIZATION

This section summarizes the hazardous material protection policies applied to WRAP 1 and the organizational structure that administers the hazardous material protection program for the Project Hanford Management Contractor (PHMC). Because of the limited potential for hazardous material exposure or release in WRAP 1, the facility does not have staff solely dedicated to this function.

8.3.1 Organizational Structure

The organizational structure outlined in Chapter 15.0 administers the PHMC hazardous material protection program, which applies on a graded basis to WRAP 1. Waste generators who send waste to WRAP 1 have the responsibility to ensure that those hazardous wastes are labeled and handled appropriately and that they meet WRAP 1 waste acceptance criteria. When receiving and handling waste containers that may contain hazardous materials, WRAP 1 personnel have the following responsibilities:

- Managers and supervisors ensure that employees are trained to perform their responsibilities using safe working practices and approved procedures.
- Operators maintain daily operating logs and ensure that waste generators use correct designations, waste packaging information, and shipping instructions.
- Designated operators obtain appropriate samples and analyses of unverified wastes to ensure proper designations.
- Environmental compliance officers promptly report spills or releases from drums containing hazardous wastes in accordance with WHC-CM-5-36, *Solid Waste Disposal Internal Requirements*, Chapter 7-5, "Environmental Compliance" to Environmental Services and the Hanford Fire Department.

Each employee is responsible for promptly notifying management of events and conditions that could have adverse safety or environmental implications.

Staff of the following organizations provide assistance to WRAP 1 personnel in achieving hazardous material protection goals.

Pollution Prevention. The Pollution Prevention Program is significant to the hazardous material protection strategy because this program minimizes the generation of wastes requiring processing. Pollution prevention services are provided to waste generators by Waste Management Operations.

Environmental Services. Environmental Services staff provide guidance on waste designation issues, and conduct assessments to ensure compliance with environmental control requirements.

Analytical Services. Hanford Analytical Services management have the following responsibilities:

- Provide guidance regarding the number of samples, sample type, sample quantity, and types of analyses required.
- Review sampling and analysis plans received from the waste generators for consistency with requests for laboratory services and capabilities.
- Provide data validation and verification, and coordinate laboratory support.

8.3.2 Staffing Levels and Qualifications

The WRAP 1 Plant Manager has the overall responsibility and authority for determining the qualifications of personnel to work in the facility. As noted in Chapter 12.0, the training requirements for all employees are outlined in WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Section 1.8, "Solid Waste Disposal Operations Training Administration." The Plant Manager ensures that employees assigned to tasks involving hazardous materials have the training required to do the job safely. A substantial part of employee training and retraining includes procedures and methods for handling, disposal, and shipping of hazardous waste.

8.3.3 Interfaces With Others

The Waste Management Operations organization described in Chapter 15.0 is a centralized function that serves all waste management operating units including WRAP 1. The safety organization provides training, independent oversight, and expertise to the operating groups in carrying out the hazardous material protection program. WRAP 1 has assigned safety personnel who interface regularly with their peers in other facilities and with the Waste Management Operations Health and Safety organization.

8.4 ALARA POLICY AND PROGRAM

This section summarizes the ALARA policy and program for the WRAP 1 facility. Hazardous materials have been evaluated assuming very low limits for hazardous materials, below which very little harm is associated with exposures (e.g., Occupational Safety and Health Administration [OSHA] permissible exposure limits). The ALARA Program for WRAP 1 has the goal of minimizing all exposures to hazardous substances and conditions as defined in WHC-IP-1043, *WHC Occupational ALARA Program Manual*. The ALARA Program at WRAP is enforced through WHC-IP-1043, WHC-CM-5-34, and WHC-CM-5-36. The concept of ALARA applies to hazardous material exposures and radiation exposures. The manuals require that the ALARA Program be implemented through an ALARA Committee.

8.4.1 ALARA Policy

The policy stated in Chapter 1-11 of WHC-CM-5-36 is to provide places and conditions of employment that are free from or protected against recognized hazards that cause or are likely to cause sickness, impaired health, and well-being, or significant discomfort and inefficiency among workers or those with whom they come into contact. This is achieved by controlling exposure to hazardous materials to levels ALARA. The ALARA Program was initially developed for control of radiological exposures, and has been adapted for implementation in the area of chemical exposures. The primary tenets of the ALARA Program as established by the U.S. Nuclear Regulatory Commission are as follows:

- Controlling the maximum dose to the individual as not being significant; the collective dose to the group must also be maintained ALARA
- Reasonably achievable will be judged by considering the state of technology and the economics of improvement in relation to the potential benefits
- Restricting the dose to individuals to a fraction of the applicable limit is not appropriate if the action results in the exposure of more persons.

The ALARA policy for WRAP 1 is to minimize exposure to hazardous materials and conditions. The concept of ALARA implies that each activity involving exposure to hazardous materials shall be scrutinized to determine if practices or materials can be used or modified to reduce exposure. However, the concept of ALARA does not imply that exposure levels should be reduced to levels that are significantly low, or trivial as to be inappropriate relative to the cost of hazardous material protection, controls, and reasonable allocations of health protection resources.

8.4.2 ALARA Program

The ALARA Program includes: pre-job planning, job monitoring, post-job reviews, lessons learned, project design and facility review, ALARA committees and teams, ALARA Awareness Program, ALARA Training, ALARA goals, and evaluations of the effects of the ALARA Program on workers, the public, and the environment. A coordinated effort through these subprograms ensures that the ALARA policy is enforced, maintained, and endorsed by management, workers, and the facility support groups.

8.4.2.1 Pre-Job Planning. Pre-job planning ALARA objectives are achieved primarily through use of the radiation work permit (RWP) and the ALARA management worksheet (AMW). Reviewing the ALARA checklist during pre-job planning ensures that ALARA considerations are factored into work activities and procedures. The AMW documents ALARA practices, pre-job ALARA considerations for planning, and estimated hazardous material exposure for performing the task. The AMW documents whether a post-ALARA review is required after completing the task.

8.4.2.2 Job Monitoring. Job monitoring ensures that the activities follow the plans and procedures for the job. Job monitoring also ensures against known or potential hazards that have been addressed through engineered and administrative controls.

8.4.2.3 Post-Job Review. The post-job review identifies any problems with the job, including an evaluation of the hazardous material controls and the AMW. Lessons learned and any recommended changes to the procedures or AMW, in order to reduce exposure or risks, are noted. It may be necessary, when approved by the job supervisor and other approval signers, to issue a new procedure, RWP, or AMW before starting the next similar job.

8.4.2.4 Project Design and Review of Nuclear Facilities. Projects involving the construction of new facilities or the modification of existing facilities use, to the extent practical, the lessons learned from the operating facilities. A review of the current procedures, RWPs, and AMWs helps to minimize hazardous material exposure by using known methods for containment and control. Any new project involves appropriate safety personnel who are knowledgeable of the specific facility and processes to ensure that hazardous material design criteria contain the ALARA concepts.

8.4.2.5 ALARA Committee and Teams. The ALARA committee is a Site-wide group that implements the ALARA Program. The WRAP 1 Plant Manager appoints an ALARA team that implements ALARA practices and program requirements for WRAP 1.

8.4.2.6 ALARA Awareness Program. The ALARA Awareness Program, administered by the ALARA Program Office and conducted by the WRAP 1 ALARA team, reinforces ALARA concepts through communications to the facility workers. Formal ALARA communications distributed to employees are reviewed by the ALARA Program Manager. In addition to training, information is conveyed by methods such as ALARA displays, videos, pamphlets, newsletters, contests and performance statistics.

8.4.2.7 ALARA Training. ALARA concepts are built into sitewide training programs including new employee orientations, on-the-job (OJT) training, safety training, operator training, and hazardous material training.

8.4.2.8 ALARA Goals. Hanford Site contractors typically submit ALARA goals to DOE annually and status reports quarterly. WRAP 1 will provide ALARA goals as required by WHC-CM-5-34. The goals are categorized into three primary areas: (1) hazardous material exposure reduction, (2) source reduction, and (3) administrative goals, which can include training, procedure improvement, and ALARA Program enhancement.

8.4.2.9 Application of ALARA to Environmental Releases. WHC-CM-5-36, Chapter 7-5, "Environmental Compliance," requires that releases of airborne or liquid hazardous materials be reduced in accordance with the best available technology. The hazardous material management program for the Hanford Site Contractors includes procurement, handling, processing, manufacture, use of chemical substances, and disposal activities. The specific goal is to minimize the effects of hazardous materials on workers, the public, and the environment. A cost-benefit analysis of hazardous materials controls determines the feasibility and cost-effectiveness of the measures proposed.

8.5 HAZARDOUS MATERIAL TRAINING

This section summarizes plans and procedures for general training of employees in hazardous material safety and specific training for workers, supervisors, and managers who are involved in hazardous materials protection activities.

8.5.1 Operator Training

General and specific safety and operational training are provided to prepare employees to operate and maintain WRAP 1 in a safe, effective, efficient, and environmentally sound manner.

Appropriate WRAP 1 workers receive initial and refresher hazardous material safety training. Qualification requires employees to successfully complete general and job-specific self-study, classroom, and OJT requirements. Required training is based on an analysis of tasks and responsibilities for each job, and includes emergency preparedness training to respond effectively to emergencies.

8.5.2 Operations Manager/Supervisor Training

Continuing education incorporates new management methods and technical advances, provides guidance for complying with regulatory requirements, including those related to hazardous waste management, and provides application and maintenance information for specific items of equipment.

8.5.3 Administration and Records

The WRAP 1 administration and records requirements for training are discussed in Chapter 12.0. Chapter 12.0 identifies personnel responsible for the training programs and for maintaining up-to-date records on the status of trained personnel, including schedules for refresher or upgrading training.

8.6 HAZARDOUS MATERIAL EXPOSURE CONTROL

This section summarizes WRAP 1 plans and procedures for controlling occupational exposure to hazardous materials and spread of hazardous material contamination.

8.6.1 Hazardous Material Identification Program

The WRAP 1 hazards communication program, based on WHC-CM-5-34, complies with the requirements of 29 CFR 1910.1200, "Occupational Safety and Health Administration Hazard Communication Program," by ensuring that the WRAP 1 managers know the hazards from chemical and physical agents in the workplace. WRAP 1 workers are informed of these hazards and are provided with adequate information and training to know and understand how to use the necessary protective control measures. The primary goal of the program is to provide

information to allow these materials or agents to be used, handled, stored, and disposed of safely. The WHC-CM-5-34 hazard communication program applies to WRAP 1 for purchase, receipt, use, and storage of hazardous chemicals and products; labeling and inventorying of hazardous substances; hazards communication training; physical hazards; carcinogens; and material safety data sheet (MSDS) administration.

8.6.1.1 Hazards Postings in Work Areas. Chemical and hazard information is posted as appropriate for WRAP 1. Postings are for specific chemicals stored or used in the facility including flammable, corrosive, reactive, toxic, and carcinogenic chemicals and other workplace hazards.

8.6.1.2 Labels. Each container of hazardous chemical products that is received at WRAP 1 is labeled with the required information identified in WHC-CM-5-36, Chapter 7-5. If a hazardous chemical is transferred from a primary container to another (secondary) container, the secondary container is labeled with a Hanford Site hazard label in accordance with WHC-CM-5-36, Chapter 7-5. The employee performing the transfer is responsible for labeling the secondary container.

8.6.1.3 Chemical Product List. Chemical products stored or used in WRAP 1 are listed on the facility chemical product list. The applicable Environmental Compliance Group (ECG) provides and maintains the list of chemical products, which includes the following:

- Chemical name
- Hanford Environmental Health Foundation-assigned MSDS identification number
- Manufacturer's name
- Determination of whether the product is a carcinogen
- Determination of whether the product is a regulated waste
- Date received or placed in inventory
- Locations approved for use or storage.

8.6.1.4 Material Safety Data Sheet. Each chemical used in WRAP 1 has a current MSDS on file. All employees have ready access to the files, either near the work area, by telephone, or through the Hanford Local Area Network.

8.6.1.5 Receipt of Hazardous Chemicals. Employees who receive hazardous chemicals verify the containers are properly labeled in accordance with WHC-CM-5-36, Chapter 7-5. Employees who handle hazardous chemicals are made aware of the associated exposure risks, hazards, personal protective equipment requirements, and emergency procedures. Training and information (including the MSDS) are provided for those using and handling a new chemical before the chemical is brought into WRAP 1.

8.6.2 Administrative Limits

Chapter 1-11 of WHC-CM-5-36 requires that WRAP 1 employee exposures to hazardous materials, including carcinogens, be maintained at less than OSHA limits and within the American Conference of Governmental Industrial Hygienists (ACGIH) air quality limits. Air quality limits are defined as permissible exposure limits by OSHA and threshold limit values by ACGIH.

The primary hazardous materials exposure concerns in WRAP 1 are related to drum and box handling operations. Exposure may occur through inhalation of built-up toxic gases during movement of the containers, or inhalation of container contents if a container is breached during operations, or when a previously breached container is moved. The WRAP 1 design provides engineering controls for exposure prevention in the form of double confinement for containers and building ventilation. Administrative controls limiting hazardous materials exposures and requirements for monitoring protective equipment are provided in facility operating procedures. The hazardous waste operations WHC-IP-1152, *Health and Safety Plan for Solid Waste Disposal Operations*, is prepared in accordance with 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response."

8.6.3 Occupational Medical Programs

For hazardous waste workers, bioassay and medical monitoring programs are conducted in accordance with the applicable section of WHC-CM-5-34. Baseline and annual medical monitoring are conducted as required. Medical monitoring is performed by the onsite occupational medical contractor. Medical records are maintained in perpetuity, and are available on request to the employee.

Bioassay requirements may be specified by the Industrial Hygiene organization for employees who have the potential for exposure to heavy metals, carcinogens, or compounds for which the ACGIH has specified biological exposure indices. These programs are required in accordance with 29 CFR 1910.120 and WHC-CM-5-36, Chapter 1-10, "Safety Manual."

8.6.4 Respiratory Protection

Exposures to toxic atmospheres are controlled by accepted engineering and/or administrative controls (such as enclosures, ventilation, or the substitution of less hazardous materials). Only when effective engineering and/or administrative controls are not feasible, or while they are in the process of being instituted, is the use of respiratory protection required. Respiratory protection complies with the requirements of 29 CFR 1910.134, "Occupational Safety and Health Act; Respiratory Protection." The respiratory protection requirements in this section parallel the requirements for the respiratory protection requirements in Chapter 7.0, Section 7.6.4.

Only respirators that have been approved by the National Institute for OSHA and/or mine safety and health administration are used. Employees are not assigned tasks requiring the use of respirators unless they have a respirator medical clearance. Employees are trained at least annually on the types of respirators they are required to use. The type of respirator to be used is

specified in writing on the applicable Job Hazard Analysis, maintenance procedure, operating procedure, or job-specific permit. Respirators are cleaned, disinfected, inspected, and tested after each use as part of the cleaning process to ensure proper operation. Employees inspect respirators for obvious defects before each use.

8.7 HAZARDOUS MATERIAL MONITORING

This section addresses the use of hazardous material monitoring programs at WRAP 1. This summary addresses facility monitoring to prevent the spread of hazardous materials, operational monitoring of workers, and monitoring and sampling to detect material release outside WRAP 1.

8.7.1 Facility Hazardous Material Monitoring

Hazardous material monitors are not needed for WRAP 1. If unidentified hazardous materials (solid, liquid, or gas) are detected outside of the process enclosures (assuming a breached drum, the affected area can be cordoned off to prevent unauthorized entry, and samples taken to identify the suspect/hazardous material(s). The sample analysis will identify the suspect/hazardous material and appropriate action, including occurrence reporting if necessary, will be taken to minimize the effects on workers, the public, and the environment.

8.7.2 Monitoring for Hazardous Material Releases

The nonradiological ALARA assessment (Project 6237.007) for WRAP 1 determined that monitoring for releases of hazardous material to the environment (soil, water, or airborne) is not necessary. The design features of WRAP 1 preclude significant releases of hazardous materials from the facility.

8.7.3 Air and Workplace Monitoring

General requirements for air and workplace monitoring are found in WHC-CM-5-36, Chapter 7-5, "Environmental Compliance" and WHC-SD-GN-TA-30001, *Criteria for Westinghouse Hanford Company Workplace Air Sampling Program*. The specific chemicals of concern and methods to be used are identified in the hazardous waste operations WHC-IP-1152, *Health and Safety Plan Solid Waste Disposal Operations* (DRAFT).

8.8 HAZARDOUS MATERIAL PROTECTION INSTRUMENTATION

No hazardous material monitoring/measuring instruments are identified for permanent installation in WRAP 1. Nearby laboratories (such as 222-S and the Waste Sampling and Characterization Facility) have instruments for measuring hazardous materials including organics (volatile, semivolatile, pesticides, and polychlorinated biphenyls), inorganics, physical, and miscellaneous characteristics. The safety analysis reports for these facilities contain a

more complete description of the instrument capabilities (i.e., WHC-SD-CP-HIE-001, *222-S Laboratory Facilities Hazards Identification and Evaluation* and WHC-SD-W011H-SAR-001, *Final Safety Analysis for the Waste Sampling and Characterization Facility*). WRAP 1 has access to this equipment for field monitoring when hazardous materials are being used.

8.9 HAZARDOUS MATERIAL PROTECTION RECORD KEEPING

WRAP 1 complies with requirements for exposure reporting and reporting of hazardous material releases contained in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*. Records on accidents or incidents related to hazardous material exposures are maintained in perpetuity and are available to the employee along with occupational medical records. Reports are transmitted annually to the Bureau of Labor Statistics.

8.10 HAZARD COMMUNICATION PROGRAM

The hazard communication program found in WHC-CM-5-34, in conjunction with the facility specific Hazard Communication program, bring WRAP 1 into compliance with the requirements of 29 CFR 1910.1200. The program includes the following elements:

- Identification of hazardous materials known to be in the workplace
- Labels and other forms of warning signs posted
- MSDS on file and readily available (in hard copy and computer database)
- Effective methods used to inform employees of hazards and mitigative measures
- Approved, proven methods and plans for employee training
- Responsible, competent personnel for all positions.

8.11 OCCUPATIONAL CHEMICAL EXPOSURES

The WRAP 1 facility is a new facility and has no previous operating data upon which to base estimates of occupational chemical exposures (WRAP 0284, *Facility Design ALARA Assessment*).

8.11.1 Estimated Annual Exposure

The predicted annual exposure to workers from hazardous materials in WRAP 1 is expected to be zero for normal operations. This estimate does not include exposures to workers during a postulated accident. The zero estimated annual exposures are based on the following assumptions.

- In drums of newly generated waste received into WRAP 1, hazardous materials are encased in plastic for secondary containments. The waste generator places the waste in a sealed plastic bag and then places the plastic bag into a container with a plastic liner. Thus, two layers of plastic separate the hazardous waste from the container wall.
- The WRAP 1 facility only processes containers with acceptable container wall integrity. Breached containers are placed into a larger intact container before they are brought into the facility (WRAP 0284).
- Incoming drums that do not meet the disposal criteria or drums containing noncompliant (restricted waste) waste are returned to the generator.

Controls at WRAP 1 that limit exposure to hazardous materials are designed to reduce exposures below OSHA-established guidelines or limits set by the ACGIH, whichever is most restrictive. In addition, the Hanford Site emergency response planning guideline for chemicals is intended for use in performing site safety classification, hazard evaluations, and emergency preparedness planning.

8.12 REFERENCES

- 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations*, as amended.
- 29 CFR 1910.134, "Occupational Safety and Health Act; Respiratory Protection," *Code of Federal Regulations*, as amended.
- 29 CFR 1910.1200, "Occupational Safety and Health Administration Hazard Communication Program," *Code of Federal Regulations*, as amended.
- DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, DOE Order 232.1, U.S. Department of Energy, Washington, D.C., 1995.
- DOE Order 5481.1B, *Safety Analysis and Review System*, U.S. Department of Energy, Washington, D.C., 1986.
- Project 6237.007, *WRAP 1 Facility Design ALARA Assessment*, Section 4.8, United Engineers and Constructors, Richland, Washington. 1994.
- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-5-36, *Solid Waste Disposal Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.
- WHC-EP-0063-04, *Hanford Site Solid Waste Acceptance Criteria*, Westinghouse Hanford Company, Richland, Washington, 1993.

WHC-IP-1043, *WHC Occupational ALARA Program Manual*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1995.

WHC-IP-1152, *Health and Safety Plan Solid Waste Disposal Operations*, Westinghouse Hanford Company, Richland, Washington, 1996.

WHC-SD-CP-HIE-001, *222-S Laboratory Facilities Hazards Identification and Evaluation*, Rev. 0-E, Westinghouse Hanford Company, Richland, Washington, 1992.

WHC-SD-GN-TA-30001, *Criteria for WHC Workplace Air Sampling Program*, Westinghouse Hanford Company, Richland, Washington, 1994.

WHC-SD-W011H-SAR-001, *Final Safety Analysis for the Waste Sampling and Characterization Facility*, Rev. 0, Westinghouse Hanford Company, Richland, Washington, 1994.

WHC-SD-W026-FDC-001, Rev. 2, *Waste Receiving and Processing (WRAP) Facility Module 1 Functional Design Criteria*, Westinghouse Hanford Company, Richland, Washington, 1994.

WRAP 0284, *WRAP 1, Facility Design ALARA Assessment*, United Engineers and Constructors, Richland, Washington, 1992.

**WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
AUDITABLE SAFETY ANALYSIS
Revision 0**

**CHAPTER 9.0
Radioactive and Hazardous
Waste Management**

February 1997

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TERMS

DOT	U.S. Department of Transportation
HEPA	high-efficiency particulate air (filter)
HVAC	heating, ventilating, and air conditioning
LLW	low-level waste
NDA	nondestructive assay
NDE	nondestructive examination
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
SWD	solid waste disposal
TRU	transuranic
TSD	treatment, storage, and disposal
WAC	Washington Administrative Code
WRAP 1	Waste Receiving and Processing Facility Module 1

9.0 RADIOACTIVE AND HAZARDOUS WASTE MANAGEMENT

9.1 INTRODUCTION

WRAP 1 feed material consists of contact-handled transuranic (TRU) waste, low-level waste (LLW), and mixed waste. Most containers are examined, assayed, and certified for shipment as LLW and TRU waste. The certified waste containers are the product of WRAP 1 operations. Provisions for confinement and management of secondary waste generated during waste processing operations or operation of the building systems are described in this chapter as they relate to worker, public, and environmental protection.

The graded approach is applied to WRAP 1 radioactive and hazardous waste management. Because WRAP 1 is a radiological facility (as determined in Chapter 3.0), the safety aspects for waste management are not as extensive as for nuclear facilities.

9.2 REQUIREMENTS

The *Hazardous and Solid Waste Amendments of 1984* to the *Resource Conservation and Recovery Act of 1976* (RCRA) require waste generators to implement waste minimization programs and use best available technology to treat, store, and dispose of all waste generated.

Hanford-specific criteria governing WRAP 1 waste management practices are contained in WHC-CM-5-36, *SWD Internal Requirements*, Chapter 7-5, *Environmental Compliance*; WHC-EP-0063-04, *Hanford Site Solid Waste Acceptance Criteria* and WHC-SD-W026-FDC-001, *Waste Receiving and Processing (WRAP) Facility Module 1 Functional Design Criteria*.

9.3 RADIOACTIVE AND HAZARDOUS WASTE MANAGEMENT PROGRAM AND ORGANIZATION

This section describes the policy basis and organizational structure for the WRAP 1 radioactive and hazardous waste management program. Also included are the plans, procedures, and training governing radioactive and hazardous waste management activities.

9.3.1 Waste Management Program Basis and Policy

The Hanford Site radioactive and hazardous waste management program, which applies to WRAP 1, is described in Chapter 7-5 of WHC-CM-5-36. This document provides guidance to operating organizations on conducting operations safely to ensure protection of the public, personnel, and the environment from hazards associated with radioactive, hazardous, or mixed wastes. The waste management requirements of WHC-CM-5-36 are consistent with DOE Order 5820.2A, *Radioactive Waste Management* and include criteria in the following areas:

- Design requirements for new facilities
- Design review for existing facilities
- Waste characterization
- Storage and transfer operations
- Monitoring, surveillance, and leak detection
- Spill contingencies and actions
- Waste minimization, treatment, and disposal.

9.3.2 Organizational Structure

The WRAP 1 organizational structure outlined in Chapter 15.0 administers the radioactive and hazardous waste management program. Generators who send waste to WRAP 1 are responsible for ensuring that all wastes are handled, stored, and disposed of in accordance with DOE Orders, Federal Regulations, Washington Administrative Codes (WACs), and WHC-CM-5-36. Upon acceptance of the waste, WRAP 1 personnel assume responsibility for its safe handling, processing, and shipment. In addition, WRAP 1 personnel are responsible for handling, storage, and disposal of all secondary waste generated in WRAP 1 operations. Following is an outline of WRAP 1 waste management responsibilities.

Plant Manager. The WRAP 1 Plant Manager has the following waste management responsibilities:

- Oversees the safe performance of all daily functions associated with storage, packaging, and disposal of wastes
- Assigns specific duties, responsibilities, and authorities to WRAP 1 personnel
- Ensures that employees are appropriately trained to perform their responsibilities using safe working practices and approved procedures
- Reviews daily operating logs and other records to ensure compliance with permits, regulations, and requirements.
- Ensures that waste generators provide correct designations, packaging information, and shipping paperwork
- Promptly reports to Environmental Compliance Support and the Hanford Fire Department spills or releases from drums or boxes containing

radioactive, hazardous, and mixed wastes in accordance with Chapter 7-5 of WHC-CM-5-36

- Coordinates waste disposal activities with onsite and offsite disposal facilities
- Oversees a waste minimization and pollution prevention program in order to minimize the generation of wastes in compliance with Chapter 7-5 of WHC-CM-5-36.

Plant personnel. Plant workers are responsible for carrying out waste management responsibilities assigned by the Plant Manager as follows:

- Perform daily functions associated with storage, packaging, and disposal of wastes
- Apply safe working practices and use approved procedures
- Maintain daily operating logs and required records to comply with permits, regulations, and requirements
- Confirm that waste generators are providing correct designations, packaging instructions, and shipping instructions
- Obtain appropriate samples and analyses of generated wastes in order to obtain proper designations and approve analytical requests for unknown wastes
- Conduct inspections; maintain required records and reports; track deficiencies; document corrective actions on inspection records; and develop inspection schedules, waste analysis plans, contingency plans, and emergency procedures.

Each employee is responsible for promptly notifying management of events and conditions that could have adverse safety impacts or environmental implications, including potential releases to the environment.

9.3.3 Waste Management Plans, Procedures, and Training

Waste management plans, procedures, and training applicable to WRAP 1 are described in Chapter 7-5 of WHC-CM-5-36, which is consistent with relevant statutory and regulatory requirements.

Waste Management Plans. WHC-CM-5-36 provides guidance on conducting operations safely to ensure protection of the public and operating personnel from hazards associated with all types of wastes. This plan complies with DOE Order 5820.2A, and prescribes requirements for:

- New facility design
- Design review for existing facilities
- Waste characterization
- Storage and transfer operations
- Monitoring, surveillance, and leak detection programs

- Spill contingencies and actions
- Waste minimization, treatment, and disposal
- Pollution prevention.

Waste Management Procedures. Procedures for managing wastes define the operational and safety requirements during generation, handling, storage, and disposing of wastes. The procedures include instructions to ensure safe operability of the facility under normal and accident conditions. Chapter 12.0, Section 12.3, contains a more complete description of the WRAP 1 procedure program.

Waste Management Training. Worker safety training, as described in Chapter 12.0, encompasses the following aspects:

- Radiological training using the requirements of HSRCM-1, *Hanford Site Radiological Control Manual*
- Training requirements for compliance with the environmental protection program in accordance with Chapter 7-5 of WHC-CM-5-36, *SWD Internal Requirements*, Section 11, "Environmental Training and Verification"
- Training program functions, responsibilities, and implementation as described in WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Section 1.8, "Training Administration."

9.4 RADIOACTIVE AND HAZARDOUS WASTE STREAMS AND SOURCES

Although WRAP 1 is designed to minimize the amount of facility-generated waste, small amounts of wastes are generated as a result of the process operations. These wastes include radioactive and nonradioactive gases, liquids, and solids from decontamination, maintenance, and miscellaneous operations, and failed equipment, as described in Section 9.4.2. The confinement, safe handling, and disposal of these wastes are principal goals of the WRAP 1 waste management policy and performance requirements.

9.4.1 Waste Management Process

To ensure the above goals are met, WRAP 1 complies with criteria specified in control manuals and acceptance criteria documents. These internal documents reflect the requirements specified in the appropriate DOE Orders, Hanford Site requirements, federal and state regulations, and industry standards. For contact-handled solid wastes, including TRU, LLW, and MW, the requirements are delineated in WHC-EP-0063-04, which also reflects the Washington State requirements for radioactive wastes and dangerous wastes as defined in WAC 173-303, "Dangerous Waste Regulations."

WRAP 1 waste management operations comply with criteria for confinement, safe handling, and disposal of liquid and gaseous effluent streams provided in Chapter 7-5 of WHC-CM-5-36.

Process waste is handled in accordance with the requirements of applicable federal and state regulations, DOE Orders, and Hanford Site procedures.

9.4.2 Waste Sources and Characteristics

This section discusses how and where the WRAP 1 waste is generated and how it enters the appropriate waste handling or treatment system. The following sections include a discussion of the waste types (radioactive, mixed, or hazardous), waste material form (gaseous, liquid, or solid), and the effluent discharges, emission limits, and permitting.

WRAP 1 is designed as a "dry facility" in the areas where process operations are conducted, to minimize the generation of secondary solid and liquid waste. WRAP 1 also is designed to function using the least amount of equipment and supplies in order to minimize the quantity and volume of secondary waste produced. No special equipment or systems (e.g., volume reduction, cooling, storage) are installed in WRAP 1 to handle the byproduct waste that is generated during operations. Nonradiological nonhazardous waste from all areas in WRAP 1 is released to a gravel basin or disposed of in a sanitary landfill. Radiological or hazardous waste is contained, characterized, and can be processed through WRAP 1 for shipment to other treatment, storage, and disposal (TSD) facilities. The disposition of WRAP 1 liquid waste is shown in Figure 9-1.

9.4.2.1 Radiological Wastes. This section identifies types and quantities of radiological wastes resulting from operation of WRAP 1. In general, the small quantities of liquid and solid radiological wastes generated during WRAP 1 operations are processed, packaged, and shipped to a TSD facility. The minimal airborne or particulate radiological emissions that occur are high-efficiency particulate air (HEPA)-filtered before release.

Radiological Wastes Nonconfinement Zone. A small amount of secondary radiological solid waste is generated in the shipping and receiving and nondestructive examination/nondestructive assay (NDE/NDA) areas because of the need to decontaminate shipping containers and shipping vehicles and to clean up and decontaminate spills or leaks from the drums. These wastes consist of paper towels and other absorbent material containing small amounts of decontamination liquid used for manual cleaning and decontamination. Used materials are placed in approved U. S. Department of Transportation (DOT) specification containers and processed in WRAP 1 along with other waste for disposal.

The newly-generated TRU waste drums in the shipping and receiving and NDE/NDA areas arrive with filters. The drums may still produce small quantities of radiological offgas. The quantity of radioactive material released is insignificant and does not pose a risk to facility personnel.

The quantities of radiological liquid waste generated in the shipping and receiving and NDE/NDA areas are not significant. The possibility exists that the fire sprinkler system could leak or release water, but the chance that the resulting runoff would be radioactive is considered to be remote. If such water is judged to be potentially contaminated, it will be collected, sampled,

and (if contaminated) transferred to the Hanford Site 200 East Area for disposal. Uncontaminated water is disposed of through the truck wash miscellaneous stream gravel basin.

9.4.2.2 Nonradiological Waste. This section identifies the WRAP 1 waste sources that are nonradiological and wastes that are normally nonradioactive, but have a small potential to become radiologically contaminated.

Gaseous, liquid, and solid nonradiological byproduct wastes are generated by WRAP 1 operations. Where a possibility exists that a byproduct waste could be hazardous, it is handled in accordance with the requirements of Chapter 7-5 of WHC-CM-5-36.

The WRAP 1 nonconfinement area heating, ventilating, and air conditioning (HVAC) chiller system normally produces water condensate from specific nonradiological and nonhazardous supply air systems. Also, the WRAP 1 building utility areas normally generate waste water from instrument air dryer systems and utility air compressors. Water from these sources is released to a gravel basin as miscellaneous waste.

A possibility exists that fire sprinklers or other water lines to the facility may leak or be inadvertently opened. If there is a possibility this water may be contaminated, it is collected and sampled. If a substantial quantity of water is found to be contaminated, it is transported to the 200 East Area for disposal. If it is not contaminated, it is disposed of through the WRAP 1 truck wash gravel basin. Sanitary wastes are discharged into the sanitary sewage system for disposal.

Small quantities of hydraulic oil, lubricating oil, and organic solvents are used in maintenance of WRAP 1 equipment. After use, these items are collected for disposal as noncontaminated organic liquids. Occasionally, some of these materials may become radiologically contaminated. If so, the materials are sampled and analyzed for radioactivity. If found to be contaminated, they are packaged for storage or disposal.

Shipping and Receiving and NDE/NDA Areas. Nonradiological waste is generated in the shipping and receiving and the NDE/NDA areas during normal operation of WRAP 1 from the use and/or consumption of normal operating supplies, support equipment, and utilities.

Room ventilation air is exhausted from the shipping and receiving and NDE/NDA areas and recycled to the air supply plenum. A portion of the recycled air is drawn into the system as supply air and a portion is exhausted to the atmosphere.

The type of nonradiological solid waste generated in the WRAP 1 shipping and receiving and NDE/NDA areas is primarily byproduct waste. Byproduct waste includes dirt transferred by waste transport trucks, waste drums, and personnel traffic into and out of the facility; used waste drum pallets and banding rings; and used operating supplies such as used or damaged tools, equipment, machines and their parts replaced during maintenance, clothes, tapes, various plastic sheets, bottles, and bags. Nonradioactive and nonhazardous waste meeting the requirements of Chapter 7-5 of WHC-CM-5-36, Appendix H, may be disposed of in a sanitary landfill.

9.4.2.3 Ventilation System. The waste generated by the ventilation system includes water condensate, and water/glycol solutions. Water is condensed from the air stream by the cooling coils located in the supply air handling systems and heat recovery coils in the exhaust plenums. This water is nonradiological and is disposed of through a miscellaneous stream gravel basin. In the unlikely event radioactive contamination is expected or detected, the waste water is collected and transferred to the Hanford Site 200 East Area for disposal. There is no radioactive liquid effluent discharge from WRAP 1 to the environment.

Operating Characteristics. The WRAP 1 ventilation system produces the only gaseous effluent that could potentially release any nonradiological pollutants to the atmosphere. The exhaust system is designed to minimize the release of radioactive and hazardous materials in the gaseous effluent during normal operation and anticipated operational occurrences and to limit the release of radioactive and hazardous materials resulting from natural phenomena hazards, equipment failures, and human-caused events, and the likelihood of a failure is small.

9.4.3 Waste Handling or Treatment Systems

There are no physical or chemical waste treatment systems in WRAP 1. Waste handling systems are limited to receipt of waste containers, assay, and verification. These functions are used primarily to ready wastes from other generators for treatment, storage, or disposal at other facilities. The small amount of secondary or byproduct waste generated during WRAP 1 operations is handled along with the received waste if appropriate, or packaged and sent to another storage facility if no treatment/disposal option is available.

9.5 REFERENCES

DOE Order 5820.2A, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C., 1988.

Hazardous and Solid Waste Amendments of 1984, 42 USC 6912(a), 6921, 6922, 6924, 6925, 6926, 6930, 6935, 6937, 6939, 6991, and 6993.

HSRCM-1, *Hanford Site Radiological Control Manual*, Hanford Site Contractors, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

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

WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0063-04, Rev. 4, *Hanford Site Solid Waste Acceptance Criteria*, Westinghouse Hanford Company, Richland, Washington, 1993.

WHC-SD-W026-FDC-001, Rev. 2, *Waste Receiving and Processing (WRAP) Facility Module 1 Functional Design Criteria*, Westinghouse Hanford Company, Richland, Washington, 1994.

WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
AUDITABLE SAFETY ANALYSIS
Revision 0

CHAPTER 10.0
Initial Testing, In-service Surveillance,
and Maintenance

February 1997

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TERMS

ALARA	as-low-as-reasonably-achievable
HSRCM-1	Hanford Site Radiological Control Manual
PHMC	Project Hanford Management Contractors
SSC	structures, systems, and components
SWD	Solid Waste Disposal

10.0 INITIAL TESTING, IN-SERVICE SURVEILLANCE, AND MAINTENANCE

10.1 INTRODUCTION

As part of the initial testing, in-service surveillance, and maintenance program, WRAP 1 is required to implement a preoperational testing program, initial acceptance criteria for structures, systems and components, and maintenance requirements, including in-service surveillance requirements. This chapter presents the basic features and functional requirements of the WRAP 1 testing and maintenance program. Commitment to the WRAP 1 testing and maintenance program is an integral part of the Project Hanford Management Contractors (PHMC) overall safety assurance philosophy.

10.2 REQUIREMENTS

The intent of this section is to provide only the requirements specific to this chapter and pertinent to the safety analysis. The following documents provide the safety basis for acceptance testing, in-service surveillance, and maintenance of WRAP 1: HSRM-1, *Hanford Site Radiological Control Manual*; WHC-CM-5-34, *Solid Waste Disposal Operations Administration*; and WHC-CM-5-36, *SWD Internal Requirements*.

The WRAP 1 testing and maintenance program is appropriate for a radiological facility and is tailored to reflect the relative importance of structures, systems, and components (SSC) for protection of personnel, public health and safety, and the environment. No items in the WRAP 1 design are designated safety class or safety significant for phase 1.

10.3 INITIAL TESTING PROGRAM

The initial testing program focused on testing of SSC to ensure compliance with design safety specifications and acceptance criteria. The construction contractor was required to submit to the operating contractor all documentation and operating data required for safe and efficient operation, and to demonstrate compliance with construction requirements, programmatic functional requirements, and specifications.

Testing and inspections were performed during construction on various systems, such as the following:

- High-efficiency particulate air filtration systems
- Excavation/backfill
- Sanitary waste treatment systems
- Radiological survey equipment
- Electrical components connecting WRAP 1 with the power line
- Building structures and substructures
- Mobile equipment
- Special processes
- Ventilation testing and balancing
- Leak tests for tanks and piping

- Sterilization for potable water supply
- Piping and electrical systems
- Process enclosures.

In accordance with the acceptance testing program, acceptance tests have been performed on:

- Fire protection systems
- Ventilation systems
- Exterior lighting of buildings
- Electrical systems
- Nondestructive assay systems
- Nondestructive examination systems
- Internal transport systems
- Compressed air systems.

An operational readiness review will be performed to ensure that operation can begin without undue risk to the public, onsite personnel, operating staff, or the environment. The WRAP 1 Plant Manager is responsible for preparing a plant readiness plan to ensure that an adequate level of readiness has been achieved for safe startup. This plan is prepared in accordance with the requirements of WHC-CM-5-34 or by an equivalent approved method. The initial testing program identifies activities requiring written procedures and verifies the existence of approved procedures. The Plant Manager is responsible for determining the details of the required startup process and obtaining concurrence from DOE-RL and appropriate Contractor organizations.

10.4 IN-SERVICE SURVEILLANCE PROGRAM

WRAP 1 is designated a radiological facility because there is no potential for an unmitigated accident with other than localized radiological consequences. The WRAP 1 design, therefore, provides no mitigative safety-related equipment that will require in-service surveillance testing. WRAP 1 equipment requiring periodic in-service testing includes cranes and lifts, fire protection systems, and radiological monitoring equipment. In-service testing will be performed in accordance with requirements specified in appropriate Hanford Site manuals.

Detailed requirements for the inspection, maintenance, and testing of cranes and lifts are found in DOE/RL-92-36, *Hanford Site Hoisting and Rigging Manual*. This manual specifies requirements for:

- Inspection of wire ropes, chains, hooks, and cranes
- Determination of inspection procedures and frequencies
- Load and operational tests
- Inspection, maintenance, and test records.

Document WHC-CM-5-34, Section 1.3, "Fire Protection," provides requirements for fire protection systems and for the periodic inspection, testing, and maintenance of fixed fire alarm and suppression equipment.

Requirements for the maintenance and inspection of radiation and air monitoring equipment are provided in HSRM-1, *Hanford Site Radiological Control Manual*. Calibration and maintenance of radiological instrumentation are discussed in Chapter 7.0.

In addition, requirements for training of personnel performing surveillance activities are provided in WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Section 1.8, "Training Administration."

10.5 MAINTENANCE PROGRAM

The Maintenance Program is described in WHC-CM-5-34, Section 2.11, "Job Control System." This manual describes the philosophy, responsibilities, and processes for management of work activities, including maintenance activities. The process involves work screening, work package preparation, work scheduling, work completion and retest, and post-work review. Health, safety, environmental, and as low as reasonably achievable (ALARA) factors are considered in each phase of the work management process. The process is biased to provide priority to work affecting systems or equipment relied on for safety.

For the Waste Management Operations organization, specific maintenance procedures are provided in WHC-CM-5-34, Section 3.6, "Operations Maintenance Requirements." Maintenance and repair work requires authorization through a job control system and must be planned and scheduled to comply with health, safety, and environmental criteria and support the needs of development and production schedules. The Waste Management Operations organization implements a combination of preventive and predictive philosophies in scheduling of maintenance activities. When higher reliability is required to meet health, safety, or environmental regulations, preventive maintenance priority is adjusted upward.

10.6 REFERENCES

- DOE/RL-92-36, *Hanford Site Hoisting and Rigging Manual*, U.S. Department of Energy, Richland Operations Office, Richland, Washington, 1992.
- HSRCM-1, *Hanford Site Radiological Control Manual*, Hanford Site Contractors, Richland, Washington.
- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.

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CHAPTER 11.0
Operational Safety

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TERMS

ALARA	as low as reasonably achievable
FHA	fire hazards analysis
HFD	Hanford Fire Department
HVAC	heating, ventilating, and air conditioning
NDA	nondestructive assay
NDE	nondestructive examination
NFPA	National Fire Protection Association
PIV	post-indicator valve
SWD	solid waste disposal
TRU	transuranic (waste)
WMO	Waste Management Operations

11.0 OPERATIONAL SAFETY

11.1 INTRODUCTION

This chapter discusses the general aspects of WRAP 1 operational safety, focusing on the bases for the conduct of operations program and fire safety. The elements of conduct of operations are discussed in various other chapters of this auditable safety analysis report, as are other aspects of the safety program. Chapter 11.0 includes:

- Identification of the aspects of conduct of operations directly applicable to the facility
- An integrated summary of the main features of the facility conduct of operations
- A description of the facility fire protection program.

The graded approach is applied to the provisions for operational safety in WRAP 1. Consequently, the conduct of operations and fire protection programs described in this chapter are appropriate for the hazards and complexity of the facility.

11.2 REQUIREMENTS

The intent is to provide only the requirements specific to this chapter and pertinent to the WRAP 1 safety analysis. The following design codes, standards, regulations, and DOE Orders govern the safety basis of the facility: WHC-CM-5-34, *Solid Waste Disposal Operations Administration*; WHC-CM-5-36, *SWD Internal Requirements*; WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Document*; and *Conduct of Operations Applicability Matrix*, (approval correspondence number 9406646 and matrix document number 9406247B-R1).

11.3 CONDUCT OF OPERATIONS

This section summarizes applicability of conduct of operations to WRAP 1 and briefly identifies features of the conduct of operations program. It does not define operational requirements.

11.3.1 Applicability of Conduct of Operations to WRAP 1

Waste Management Operations (WMO) has implemented the program as described in WHC-CM-5-34, "Solid Waste Disposal Operations Administration", Sections 3.7 through 3.31 (Conduct of Operations) and the "Conduct of Operations Applicability Matrix" (Approval Correspondence Number 9750712). Changes to WHC-CM-5-34, Sections 3.7, 3.9, 3.10, 3.13 through 3.24 and the Applicability Matrix document which decrease the effectiveness will be reviewed by DOE-RL.

11.3.2 Main Features of Conduct of Operations Program

This section summarizes applicability of conduct of operations to WRAP 1 and briefly identifies salient features of the conduct of operations program.

11.3.2.1 Shift Routines and Operating Practices. WHC-CM-5-34 establishes operating standards for WMO facilities.

On-shift Operating Crew. The on-shift operating crew is responsible for safe operations through adherence to operating procedures, interim operations specifications requirements, and in accordance with sound operating practices.

Operations Manager. The assigned operations manager or designee is responsible for all facility operations, including discipline and good employee conduct. This includes ensuring that assigned operators and other personnel working in the facility are fit and alert by evaluating personnel fitness for duty, completing necessary training for personnel, and ensuring safety of personnel and equipment.

Nuclear Process Operators. Nuclear process operators are responsible and accountable for the status of all systems components, for records in their assigned areas, and for all operations they conduct on their shifts.

All Personnel. All personnel are responsible for the following:

- Reporting to work in a fit condition.
- Being alert throughout their shift assignment.
- Being attentive to the work and tasks they perform to ensure that they are accomplished completely and accurately.

Personnel Protection. Facility personnel follow good personnel protection practices to maintain exposure to radiation, chemicals, toxic materials or other personnel hazards as low as reasonably achievable (ALARA). This is accomplished by adhering to personnel protection requirements, using appropriate monitoring instruments, being cognizant of exposure levels, being aware of radiation work permits, and reporting protection deficiencies as appropriate.

Response to Indications. Operators respond to instrument readings and treat them as accurate unless proven otherwise. Prompt corrective action taken after observing abnormal or unexpected indications will usually reduce the effects of the abnormality.

Resetting Protective Devices. When protective devices trip (e.g., circuit breakers, fuses), an attempt is made to understand the cause of the trip before resetting. Before action is taken, the employee ensures that no unsafe or abnormal conditions exist that would preclude reset.

Authority to Operate Equipment. Operations managers ensure that operators of facility equipment have the necessary training and qualifications. Operators are trained to follow procedures, and nonroutine operations do not occur without specific approval as specified in WHC-CM-5-34.

Shift Operating Bases. The operating base is the facility area where an operator returns when not performing other assigned duties. Each operating base has the necessary procedures for that area.

Potentially Distractive Devices and Written Materials. Entertainment devices (e.g., radios, televisions, tape players, and computer games) and written materials that do not relate to operations are prohibited from use in work areas by on-duty operations personnel to minimize distractions from their responsibilities.

11.3.2.2 Control Area Activities. Control area activities are conducted in a manner that achieves safe and reliable facility operation. This procedure applies to all personnel assigned to or entering the Control Area.

11.3.2.3 Communications. WHC-CM-5-34 describes emergency and operational audible communication practices. All personnel are responsible for the following:

- Conducting emergency and operational communications in accordance with procedure.
- Reporting defective communication equipment to their manager.

The proper use of audible communication equipment is essential during emergency situations and for operational clarity. Approved audible communication terminology and methods are specified.

11.3.2.4 Control of On-Shift Training. Guidelines for conducting the on-the-job training program ensure that WMO trainees satisfactorily achieve required training objectives and receive maximum learning benefit from hands-on training, while maintaining safe facility and field operations.

11.3.2.5 Control of Equipment and System Status. WHC-CM-5-34 specifies the methods for control of facility equipment and system status to ensure that facility configuration is maintained in accordance with procedural requirements, and that all personnel know the status of facility equipment and systems.

11.3.2.6 Lockout and Tagouts. WHC-CM-5-34 instructs personnel in the implementation of specific lockout/tagout activities. Lockout/tagout procedures apply to all personnel working in WRAP 1.

11.3.2.7 Independent Verification. WHC-CM-5-34 identifies the method used for the independent verification of the correct positioning of components considered critical to process, system, or facility safety.

11.3.2.8 Log Keeping. WHC-CM-5-34 provides instructions for formal written documentation of facility operations activities through logbook maintenance.

11.3.2.9 Operations Turnover. WHC-CM-5-34 establishes guidelines for shift assumption and closure to ensure that the information required to adequately perform shift responsibilities is documented by the off-going shift and reviewed by the on-coming shift. The primary purpose of turnover is to ensure that on-coming personnel have an accurate picture of overall facility status.

11.3.2.10 Operations Aspects of Facility Chemistry and Unique Processes. WHC-CM-5-34 implements requirements concerning hazardous chemical inventories and reporting for all WMO facilities.

11.3.2.11 Required Reading. WHC-CM-5-34 provides a method to establish and implement the requirements for selection and management of required reading materials, and to ensure timely and effective tracking of required reading.

11.3.2.12 Timely Orders to Operators. WHC-CM-5-34 describes requirements for issuing, communicating, documenting and reviewing timely orders to operators. They provide a method for management to rapidly distribute essential information and administrative instructions to personnel. Timely orders do not supersede approved procedures.

11.3.2.13 Operator Aid Postings. WHC-CM-5-34 provides instructions for requesting, reviewing, and approving operator aids, to ensure that they are current, correct, and useful.

11.3.2.14 Equipment and Piping Labeling. WHC-CM-5-34 provides a method to implement a standardized facility equipment and piping labeling program.

11.4 FIRE PROTECTION

The fire protection system for WRAP 1 was evaluated in *WRAP 1 Fire Hazards Analysis* in accordance with DOE Orders 5480.7A, Fire Protection, and 6430.1A, *General Design Criteria*, which is consistent with DOE "improved risk" objectives. This analysis identified the special fire protection and prevention features and controls needed to ensure that improved risk levels are achieved by the WRAP 1 fire protection program. The current fire protection program is discussed in WHC-CM-5-34, Section 1.3, "Fire Protection."

After the fire hazards analysis (FHA) was completed, two series of tests were conducted to examine the propagation of fires from 208-L (55-gal) drums under various burning conditions. These fire tests are summarized in Section 11.4.1.5.

11.4.1 Fire Hazards

This section summarizes the overall combustible loading and explosive loading in proximity to hazardous materials being protected. The information is based on and correlates with the accident descriptions in Chapter 3.0, "Hazard and Accident Analyses." This section also summarizes the *WRAP 1 Fire Hazards Analysis* and defines the main fire protection issues for this final safety analysis report. Fire interaction with the available combustible materials is also presented.

11.4.1.1 Combustible Loading. The FHA performed for WRAP 1 divided the building into four primary areas: shipping and receiving; nondestructive examination/nondestructive assay (NDE/NDA); process/process heating, ventilating, and air conditioning (HVAC); and administration. In addition, the *WRAP 1 Fire Hazards Analysis* estimated the combustible loadings for each

area. In the areas, the combustibles were divided into fuel packages where either equipment, walls, or storage locations grouped the combustibles together.

11.4.1.2 Explosive Loading. A study of the WRAP 1 fire loading, which estimated the contents in 388 average drums concluded that the maximum estimated quantities for reactive and unstable chemicals did not exceed the limits "for reactive materials, organic peroxides, or explosives" (*Wrap 1 Fire Hazards Analysis, Appendix M*).

11.4.1.3 Proximity to Hazardous Materials. Waste drums can contain radionuclides and hazardous chemicals intermingled with combustibles. It is assumed that during a fire a fraction of the radionuclides and hazardous materials become airborne because they are intermingled with the combustibles. The release fraction quantities form the basis for estimating onsite and offsite doses.

11.4.1.4 Primary Fire Protection Issues. The *Wrap 1 Fire Hazards Analysis* contains the following summary statements, which provide an overview of the primary fire protection issues for WRAP 1.

- The impact of a maximum credible fire and maximum possible fire have been assessed from the standpoint of cost and program interruption. For these purposes, WRAP 1 is considered to be a single-fire area.
- The maximum credible fire loss for this facility is estimated to be \$8.0 million with a program interruption of 10 months.
- The maximum possible fire loss for this facility is estimated to be \$91.0 million with a program interruption of 32 months.
- All criteria and objectives listed in DOE Order 5480.7A have been met by the design of this facility or are assumed to be met by operating and administrative procedures.
- Deviation requests to specific criteria in DOE Order 6430.1A and RLID 5480.7, *Fire Protection* are documented in the *WRAP 1 Fire Hazards Analysis*, Appendices F and G.

11.4.2 Fire Protection Program and Organization

The elements of the WRAP 1 fire protection program include an overall conceptual approach to fire and explosion prevention, the means to identify facility fire and explosion hazards, and the policy of periodic fire hazard reviews.

Details of the WRAP 1 organizational structure are given in Chapter 15.0, "Management, Organization, and Institutional Safety Provisions." The organizations within WMO that administer the WRAP 1 fire protection program, and the primary elements of the program, are discussed in the following subsections.

11.4.2.1 Fire Protection Policy. The WRAP 1 fire protection policy is designed to:

- Minimize the potential for the occurrence of a fire or related perils.
- Ensure that fire does not cause an unacceptable onsite or offsite release of hazardous material that will threaten the public health and safety or the environment.
- Establish requirements consistent with National Fire Protection Association (NFPA) 101-1991, *Safety to Life from Fire in Buildings and Structures*.
- Ensure that vital DOE programs will not suffer unacceptable delays (defined by the Program Secretarial Officer) because of fire and related perils.
- Minimize property damage from fire and related perils to levels acceptable to DOE.
- Ensure that process controls and safety systems are not damaged by fire or related perils.

11.4.2.2 Fire Protection Program. The following two separate organizations administer and address different aspects of the fire protection program.

- **WM Health and Safety** – Responsibilities include interpretations, independent review, and technical engineering support.
- **Hanford Fire Department** – Responsibilities include fire suppression, fire system inspection/testing, hazardous material response, and medical response for the Hanford Site.

11.4.2.3 Fire Protection. Fire protection for WRAP 1 includes design and operating features to prevent fire, detect fire, and minimize the effects of a fire should one occur. The following subsections outline the general construction features, the building fire protection systems, and the Site fire protection systems. DOE Orders 5480.7A (DOE 1993) and 6430.1A (DOE 1989) provided the design bases for WRAP 1 fire protection systems.

Construction Features. The WRAP 1 building is noncombustible metal, *Uniform Building Code* Type II-N (Type II – 000 in accordance with NFPA 101-1991 and NFPA 220-1992, with interior fire resistance-rated walls separating the building into four separate areas.

Building Fire Protection. WRAP 1 is protected by automatic fire suppression and alarm systems. With the exceptions noted in the following paragraphs, suppression systems are wet pipe automatic sprinkler systems.

The exterior loading dock is equipped with an automatic dry pipe sprinkler system to prevent freezing. This area is also equipped with thermal detectors.

All entire low-level waste, TRU waste, and restricted waste management enclosures are equipped with automatic dry chemical extinguishing systems. The systems are actuated automatically by thermal detectors in the enclosures and also can be actuated manually via external manual pull stations.

In addition to the automatic alarm and suppression systems, the facility is provided with the following manual alarm and extinguishing equipment:

- Manual pull stations (alarms)
- Manual extinguishers throughout the building
- Quick disconnects for manual portable fire suppression equipment in the process enclosures
- Fire hose connections (for Hanford Fire Department [HFD] use only).

Fire-related alarms and trouble signals are reported at the WRAP 1 fire alarm control panel located in the reception area of the building. A common alarm and a separate common trouble signal are relayed to the Plant Management System and the control room annunciator panel. Alarm and trouble signals are also sent to the HFD via the government-furnished radio fire alarm reporter.

Site Fire Protection. Mobile fire units are available on a 24-hour-per-day basis from the HFD locations within the Hanford Site. Any of the strategically located HFD units are available to respond to an emergency at WRAP 1. The primary mobile fire units to respond will come from the central fire station located approximately 8-10 minutes from the facility, and a remote station located approximately 10-15 minutes from the facility.

The current single source of fire protection water is an existing 30-cm (12-in.) potable water main located on two sides of the facility. An approved backflow preventer is provided in the potable water main into WRAP 1, as required by code.

Hydrants and post-indicator valves (PIVs) are located on laterals from the potable water main to provide Site and area protection. Two hydrants are provided, as required by DOE Order 6430.1A (DOE 1989), Section 0266-4. The hydrants are located such that exterior portions of the building are within a 90-m (295-ft) lay, as required by DOE Order 6430.1A, Section 1530-9.

The PIV on the lateral leading into the building is electrically supervised in the open position. Closing this valve causes a trouble signal to annunciate at the facility fire alarm control panel.

The HFD is considered to provide redundant fire protection for WRAP 1, as allowed by DOE Order 6430.1A, Section 1530-2.3.5.

11.4.2.4 Identifying Fire and Explosive Hazards. New facilities and existing nuclear facilities are required to have an FHA. The safety analysis report for each facility references the FHA. The WRAP 1 FHA was performed by the facility architect-engineer and approved by Projects, Independent Safety, and a fire protection engineer from the Fire Protection Programs group.

Section 11.4.1 provides a summary of the FHA results and identification of the FHA-evaluated fire and explosive hazards for WRAP 1.

11.4.3 Combustible Loading Control

This section summarizes the program used to prevent unnecessary combustible loading in WRAP 1. This includes the bases for the program; storage practices for allowed flammable, combustible, and reactive materials loading; the main mechanisms for limiting combustible loading during operations, maintenance (including the addition of any combustible loading required for such activities), etc., for the types of activities performed; and the frequency of inspections.

11.4.3.1 Program Bases. Controlling and minimizing combustible materials apply to WMO-managed facilities, operations, and activities.

11.4.3.2 Storage Practices. Monthly documented housekeeping inspections ensure that equipment and materials are maintained in an orderly arrangement at all times. The operators maintain clearance between the top of storage and the sprinkler head deflectors (this does not apply to storage shelves and cabinets against the wall). Accumulations of combustible materials are limited to the quantity required for current needs and are isolated from ignition sources.

11.4.3.3 Housekeeping Practices. General housekeeping requirements for WRAP 1 include maintaining workroom floors clean and dry to the extent practical, collecting combustible waste in metal containers with lids, and preventing the accumulation of combustible waste inside or adjacent to the building to the extent practicable.

11.4.3.4 Inspection Frequency. Periodic fire prevention/protection inspections ensure that combustible loading controls for fire safety are being maintained. Documentation of these inspections provides an auditable record that can be used by management, engineering, safety, and quality control. Inspection tour frequencies and record retention instructions are detailed in WHC-CM-5-34.

11.4.4 Fire Fighting Capabilities

The following sections summarize the fire fighting capabilities of the HFD.

11.4.4.1 Fire Fighting Equipment. The HFD has fully staffed and equipped stations located strategically across the Hanford Site. Each station contains the necessary equipment for responding to emergencies and terminating emergency situations, including fire suppression, hazardous materials response, emergency medical response, special rescue support activities, pre-fire planning, and hydrant flow testing.

11.4.4.2 Fire Response Procedures. The prevention division of the HFD reviews and approves fire system acceptance tests and the inspection, testing, and maintenance procedures.

11.4.4.3 Fire Fighter Training. The HFD considers training to be a responsibility shared with employees to ensure individual proficiency at the highest standards. The HFD Training and Resource department functions under the direction of the Deputy Fire Marshall and implements and administers the training program. Training programs are based on nationally recognized or state-certified materials and standards. Elements of the training program include apprenticeship, professional development, standards awareness and compliance, and physical fitness and medical qualifications.

11.4.4.4 Personnel Qualifications. Physical fitness and medical qualifications for HFD employees consist of a comprehensive health enhancement program that includes functional fitness assessments and individualized exercise, physical training, rehabilitation, and health intervention programs. A physical performance standard ensures that emergency response personnel remain physically fit for their duties. Medical qualifications for emergency response personnel are specified in the national fire codes and coordinated through the department's physician at the Hanford Environmental Health Foundation. Permanent individual health files, which include medical examination results, are accessible and maintained by Hanford Environmental Health Foundation.

11.4.4.5 Fire Fighting in Radiological and Hazardous Chemical Environments. Emergency response personnel receive special radiological worker training commensurate with the situations they are likely to encounter. The HFD functions as the designated response and incident command agency for hazardous materials events that occur within the boundaries of the Hanford Site.

11.4.5 Fire Fighting Readiness Assurance

This section summarizes the fire prevention inspection program, the types and frequencies of fire safety drills and exercises, and the fire protection program recordkeeping requirements in accordance with the requirements of WHC-CM-5-34.

11.4.5.1 Fire Prevention Inspection Program. Periodic fire prevention and protection inspections ensure that fire prevention/alarm/suppression systems for fire safety are being maintained. Documentation of these inspections provides an auditable record that can be used by management, engineering, safety, and quality control. Inspections are documented in logs or on inspections sheets as appropriate and placed in a filing system.

Fire protection system discrepancy corrective actions are the responsibility of the building manager, who has the primary responsibility of the fire protection systems. The building manager must be notified immediately of any fire protection discrepancy (deficiency, system restriction, planned impairment, or emergency impairment as defined in WHC-CM-5-34).

11.4.5.2 Fire Safety Drills and Exercises. Fire safety drills and other emergency exercises are completed each year in accordance with WHC-CM-5-34. The drill coordinator, facility manager, or shift manager can initiate a facility drill. Minor drills may be done by the shift manager with no prior approvals. Fire drills follow a preapproved plan. The drill coordinator

prepares a report on the drill and the objectives accomplished. This report may also include system deficiencies. The fire drill may be done concurrently with other required yearly drills.

11.4.5.3 Fire Protection Program Recordkeeping. WHC-CM-5-34 provides the retention period, cut-off instructions, and retirement instructions for fire protection records (e.g., inspections, fire watch, fire extinguisher history records, and fire station operating logs).

11.5 REFERENCES

- DOE Order 5480.7A, *Fire Protection*, U.S. Department of Energy, Washington, D.C., 1993.
- DOE Order 6430.1A, *General Design Criteria*, U.S. Department of Energy, Washington, D.C., 1989.
- NFPA 101-1991, *Safety to Life from Fire in Buildings and Structures*, National Fire Protection Association, Quincy, Massachusetts, 1992.
- RLID 5480.7, *Fire Protection*, U.S. Department of Energy, Richland Operations Office, Richland, Washington, 1994.
- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.

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**CHAPTER 12.0
Procedures and Training**

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LIST OF TERMS

S/RID
WMO

Standards/Requirements Identification Document
Waste Management Operations

12.0 PROCEDURES AND TRAINING

12.1 INTRODUCTION

This chapter describes the training, retraining, and procedure development and control programs implemented by Waste Management Operations (WMO) at WRAP 1. WRAP 1 is operated by the WMO organization.

12.2 REQUIREMENTS

The intent of this section is to provide those requirements that are specific to this chapter and pertinent to the safety analysis. The following documents provide the basis for WRAP 1 training and procedures: WHC-IP-0673, *Solid Waste Disposal Technical Procedure Writer's Guide*; WHC-CM-5-34, *Solid Waste Disposal Operations Administration*; WHC-CM-5-36, *SWD Internal Requirements*; and WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Documents (S/RIDs)*, Rev. 4.

These manuals establish programs for staff selection and qualification; and for development and maintenance of operating procedures to ensure the safe operation of WRAP 1.

12.3 PROCEDURE PROGRAM

A description of the Hanford Site procedure development process as implemented by the WMO organization is presented in WHC-CM-5-34.

12.3.1 Development of Procedures

WMO and the WRAP 1 Plant Manager are responsible for ensuring that complete, accurate, and up-to-date procedures are provided to WRAP 1 personnel to ensure safe operation of the plant. WRAP 1 operations require written operating procedures. Administrative procedures provide rules and instructions for administrative activities and convey WMO's operating philosophy and management policies to all personnel. Operating procedures are approved and controlled in accordance with the requirements of WHC-IP-0673. Administrative procedures are approved and controlled in accordance with the requirements of WHC-CM-5-34. A formal, documented implementation and control process is used with procedures relating to implementation of the operational and administrative controls, with reviews designed to ensure the safety basis requirements are adequately implemented.

The manager of the WMO Operations Baseline Management organization is responsible for developing WMO administrative procedures. The WMO managers assigned to WRAP 1 are responsible for developing WRAP specific administrative and operations-related procedures. The development of a new procedure may be initiated by a written request from any employee to their management.

During the development process, draft procedures are reviewed by all groups affected by procedure implementation. Comments from this review are

resolved through a formal review and comment record process. The process for preparing, reviewing, and approving procedures for the WMO organization is outlined in WHC-CM-5-34. The WRAP 1 Plant Manager is responsible for ensuring the training and guidance of WRAP 1 personnel in implementation of all procedures.

12.3.2 Maintenance of Procedures

WMO Operations Baseline Management is responsible for revising WMO administrative procedures while the facility management assigned to WRAP 1 is responsible for revising WRAP 1 specific administrative and operations procedures. Procedure and manual revisions are reviewed and issued through the process described in Section 12.3.1 and outlined in WHC-CM-5-34. Any employee may initiate revision of an existing procedure or development of a new procedure through their management.

12.4 TRAINING

Training requirements for the WMO organization, including WRAP 1, are specified in WHC-CM-5-34, Section 1.8, "Training Plan." Overall training/qualification goals and objectives are established by the requirements noted in this chapter.

Training relating to implementation of the operational and administrative controls uses a formal, documented implementation and control process because this training ensures that operations are maintained within the safety envelope described in the safety analysis.

WRAP 1 uses personnel from a variety of technical, administrative, and skilled trades for operation, repair, modification, administration, and maintenance of equipment and facilities. WHC-CM-5-34, Section 1.8, provides implementation requirements for the training program. The following training activities are performed by the training manager:

- Assignment of instructors to meet training requirements
- Indoctrination and training of assigned instructors
- Development and update of training materials
- Maintenance of training records and qualification status
- Scheduling of training classes.

The training program ensures that personnel receive appropriate generic site training (such as Hanford General Employee Training); Occupational Safety and Health Administration 24 Hour Hazardous Waste Worker training as required by State/Federal law and Hanford requirements; and facility specific training on items such as operating procedures and facility authorization basis.

WRAP 1 is designated as a radiological facility. While criticality training is required for operators and operations team leaders, they do not handle significant quantities of fissionable materials as defined in Chapter 4-29 of WHC-CM-5-36. Therefore, there are no certified positions in WRAP 1.

12.4.1 Development of Training

WHC-CM-5-34, Section 1.8, specifies the training requirements for new and continuing employees, and describes the training program in place for the WRAP 1 facility.

A combination of general and specific safety and operational training is provided to prepare employees to operate and maintain the WRAP 1 in a safe, effective, efficient, and environmentally sound manner. Training is provided by trainers and training specialists from Site Support, Safety, and internal training organizations. A typical WRAP 1 worker requires initial and continuing radiation safety training, environmental and hazardous material safety training, and Hanford General Employee Training. Operations personnel are required to successfully complete general and job-specific self-study, classroom, and on-the-job training, continuing training, and periodic requalification. Training materials are developed using a graded systematic approach to training.

12.4.2 Maintenance of Training

Requirements for maintenance of training materials are given in WHC-CM-5-34, Section 1.8. This procedure establishes a method for evaluating facility and operational changes that affect training materials. Training materials are based on job analysis and include training manuals, study guides, qualification cards, performance demonstrations, and exam banks.

When changes to safety analysis documentation, technical safety requirements, or plant configuration occur, training materials are revised as specified in WHC-CM-5-34, Sections 1.8 and 2.1. Upon notification of a required change to training, instructors revise training materials using a variety of techniques. Techniques include the use of subject matter experts, operator/manager feedback, and observation. Throughout the training material update process, efforts are coordinated with various support organizations to ensure that updates are made comprehensively. The Training manager reviews and approves all training materials to ensure compliance with WMO procedures.

12.4.3 Modification of Training Materials

Modification of training materials may be required when facility modifications or procedure changes are implemented, or when operating experience produces significant "lessons learned."

The WMO organization ensures that modifications to training are communicated to affected employees as soon as practicable through the continuing training program. This program specifies periodic required reading, on-the-job requalification, self-paced study, and lecture attendance for WRAP 1 personnel. The continuing training program covers drills and exercises for emergency response, and is discussed in Chapter 15.0.

12.5 REFERENCES

- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.
- WHC-IP-0673, *Solid Waste Disposal Technical Procedure Writer's Guide*, Westinghouse Hanford Company, Richland, Washington.
- WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Documents (S/RIDs)*, Rev. 4, Westinghouse Hanford Company, Richland, Washington.

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**CHAPTER 13.0
Quality Assurance**

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TERMS

LMSI	Lockheed Martin Services, Inc.
SSC	structures, systems, and components
SWD	Solid Waste Disposal
WMO	Waste Management Operations

13.0 QUALITY ASSURANCE

13.1 INTRODUCTION

This chapter describes the quality assurance program defined in WHC-CM-5-34, Section 1.9 and applied by the Waste Management Operations (WMO) organization to WRAP 1 operations. In keeping with the graded approach, the level of quality control required and the formality of the program are appropriate.

13.2 REQUIREMENTS

The quality assurance program for WRAP 1 is based on the requirements of 10 CFR 830.120 and the guidance of QAMS-004/80, EPA 600/8-83-024. The applicable controlled manuals are listed in Section 13.3. *Solid Waste Disposal Standards and Requirements Identification Documents (S/RIDs)*, WHC-IP-1120, lists the regulations and U.S. Department of Energy (DOE) directives governing WRAP 1 quality assurance.

13.3 QUALITY ASSURANCE PROGRAM AND ORGANIZATION

Figure 15-1 in Chapter 15.0 shows the WMO organization and its reporting relationships. The WMO quality assurance manager (Figure 15-3) is responsible for implementing the overall WMO program. WRAP 1 has an assigned quality assurance specialist who works with the WMO quality assurance manager to apply relevant requirements to WRAP 1. The WRAP 1 Plant Manager, with concurrence of the quality assurance organization, determines how the quality assurance program is implemented for WRAP 1.

The WRAP 1 quality assurance program implements policies, procedures, and requirements in the following controlled manuals:

- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*
- WHC-CM-5-36, *SWD Internal Requirements*.

Quality assurance program controls defined in these documents are applied to items and activities based on their importance to safety and quality. The graded system, used for approval of documents, is defined in WHC-CM-5-36, Chapter 3-5, *Document Control and Records Management Manual*, Section 12.7, "Approval of Emergency, Safety, and Quality Affecting Documents."

Compliance with the Waste Management Operations Quality Assurance Program Plan and WRAP 1 standard operating procedures provides assurance that required data are complete, scientifically valid, defensible, comparable, and of known precision and accuracy.

Data are collected, validated, stored, transferred, and reduced in accordance with approved standard operating procedures. Data validation is accomplished by qualified personnel not responsible for generation of the data.

13.3.1 Personnel Training and Qualification

WRAP 1 personnel receive training appropriate to their job scopes to assist them in performing their assigned work.

Assigned tasks that require personnel to be specially qualified are identified by job function. Responsible managers establish position descriptions for these job functions.

Training plans for WMO personnel are not limited to the attainment of initial qualification, but also provide for maintenance of proficiency and progressive improvement.

Training requirements are periodically reviewed to ensure adequacy. They are upgraded whenever improvements or other enhancements are identified.

The training program for WRAP 1, including personnel qualifications, is discussed in Chapter 12.0, "Procedures and Training."

13.4 QUALITY IMPROVEMENT

The Hanford Site Quality Assurance Program defined in WHC-CM-5-36, Chapter 4-2, *Quality Assurance Manual*, identifies situations requiring corrective action or improvement through review and trending of nonconformance reports, supplier surveillance activities, quality assurance surveillance and monitoring programs, quality assurance assessments, trend analyses, and occurrence reports. Corrective action is controlled and documented as described in WHC-CM-5-34, Section 1.22, "Corrective Action Management." Documentation of corrective actions includes identification of the cause(s) of the deficiency and action(s) taken to prevent recurrence.

Items, services, and processes that do not meet established requirements are identified and controlled in accordance with WHC-CM-5-36, Chapter 4-2, QR 15.0, "Control of Nonconforming Items."

13.5 DOCUMENTS AND RECORDS

Records that furnish documentary evidence of quality are specified, prepared, maintained, and stored in accordance with WHC-CM-5-36, Chapter 4-2, *Quality Assurance Manual*; WHC-CM-5-36, Chapter 6-1, *Standard Engineering Practices* and Chapter 3-5, *Document Control and Records Management Manual*. Documents shall be legible, identifiable, traceable, accurate, complete, and retrievable.

The Lockheed Martin Services, Inc. (LMSI), organization is assigned responsibility for operating a uniform records management system and designated central storage facilities for quality assurance records.

LMSI is responsible for ensuring that quality assurance records stored in designated facilities are protected from deterioration or loss. These records are updated, indexed, and retrievable when needed. LMSI also transfers records to the appropriate Federal Records Center for permanent storage.

13.6 QUALITY ASSURANCE PERFORMANCE

Work at WRAP 1 is performed under controlled conditions using approved instructions and procedures in accordance with WHC-CM-5-34. Development, maintenance and implementation of WRAP 1 procedures is described in Chapter 12.0.

13.6.1 Work Processes

The WRAP 1 quality assurance program is described in WHC-CM-5-34, Section 1.9, "Quality Assurance Program Plan," which implements the requirements of 10 CFR 830.120 applicable to operation and maintenance of WRAP 1. The quality assurance program ensures that equipment or tools used for activities affecting quality (such as data collection and process monitoring) are calibrated and controlled in accordance with established administrative controls.

Documentation defining WRAP 1 quality is prescribed by, and performed in accordance with, WHC-CM-5-36, Chapter 4-2, *Quality Assurance Manual*. Policies and procedures that control activities providing for the preparation, review, approval, distribution, and change of work defining documents and include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed activities have been satisfactorily accomplished. The approval designator of items affecting quality are as specified in WHC-CM-5-36, Chapter 3-5, *Document Control and Records Management Manual*. Instructions, procedures, and drawings affecting quality contain all of the necessary provisions to ensure that activities are properly performed and meet the requirements of WHC-CM-5-36, Chapter 4-2, QR 9.0, "Control of Work Processes."

13.6.2 Design

Design functions are controlled by the systems described in WHC-CM-5-36, Chapter 4-2, QR 3.0, "Design Control" and Chapter 6-1, *Standard Engineering Practices*.

13.6.3 Procurement

Responsible Waste Management Operations personnel ensure that purchased material, equipment, and services conform to the procurement documents. Control measures include provisions for source evaluation and selection, objective evidence of inspection at the contractor or subcontractor source, examination of products upon delivery, and audits. Documentary evidence that materials and equipment conform to code, regulation, or contract requirements is made available before installation or operation of the material or equipment. Identification and control of items are accomplished in accordance with WHC-CM-5-36, Chapter 4-2. Specific requirements for control of purchased materials, equipment, and services are contained in WHC-CM-5-34, Section 3.1, "Material Control" and WHC-CM-5-36, Chapter 4-2, *Quality Assurance Manual*.

13.6.4 Inspection and Testing for Acceptance

Requirements for inspection, surveillance, and testing of items and activities affecting quality during procurement, repair, modification, maintenance, installation, and operation are described or referenced in WHC-CM-5-36, Chapter 4-2.

In accordance with WHC-CM-5-34, Section 1.9, "Quality Assurance Program Plan," WRAP 1 ensures product quality with surveillance activities, in-process inspection, final inspection and testing. The approach uses instructions, procedures, drawings, checklists, travelers, or other appropriate means to verify the quality of items or services. If necessary, special processes are developed to determine the quality of items or services that cannot be readily determined by inspection or testing.

WHC-CM-5-36, Chapter 4-2, requires that appropriate tests be performed and documented to ensure satisfactory performance of structures, systems, and components (SSC). The WRAP 1 Engineering organization is responsible for identifying required tests to be conducted at WRAP 1.

The quality assurance organization monitors the effectiveness of the test program through planned inspection and surveillance at various test levels.

13.6.5 Independent Assessment

Hanford Site policies provide full authority to identify and perform assessments with complete access to records and personnel. Independent assessments are planned, scheduled, and performed by the individual(s) or group(s) assigned in accordance with written procedures or checklists. The purpose of these assessments is to verify compliance with requirements and procedures and to determine overall program effectiveness. External assessments include DOE or regulatory surveillances or audits.

13.6.6 Management Assessment

WRAP 1 management performs assessments of management processes in accordance with WHC-CM-5-34. These assessments may involve line management and staff and include the following two components:

- **Overview** — Includes integrated audits and periodic surveillances
- **Line Organization** — Conducted semiannually by WRAP 1 managers.

Based on results of assessments, findings and any necessary responses are documented by management. Management plans, tracks, and implements corrective actions and applies lessons learned as applicable.

13.7 REFERENCES

10 CFR 830.120, "Quality Assurance Requirements," *Code of Federal Regulations*, as amended.

EPA 600/8-83/024, *Guidelines and Specifications for Preparing Quality Assurance Program Plans*, QAMS-004/80, U.S. Environmental Protection Agency, Washington, D.C., 1983.

WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.

WHC-IP-1120, Rev. 4, *Solid Waste Disposal Standards and Requirements Identification Document (S/RIDs)*, Westinghouse Hanford Company, Richland, Washington, 1995.

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**CHAPTER 14.0
Emergency Preparedness Program**

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LIST OF TERMS

BED	Building Emergency Director
BEP	Building Emergency Plan
DOE-HQ	U.S. Department of Energy - Headquarters
DOE-RL	U.S. Department of Energy, Richland Operations Office
EAL	emergency action levels
ECC	Emergency Control Center
EEP	Emergency Preparedness Plan
EOC	Emergency Operations Center
HEHF	Hanford Environmental Health Foundation
ONC	Occurrence Notification Center
PNNL	Pacific Northwest National Laboratory
UDAC	Unified Dose Assessment Center

14.0 EMERGENCY PREPAREDNESS PROGRAM

14.1 INTRODUCTION

The philosophy, objectives, and organization of emergency preparedness functions that address credible emergencies postulated for the WRAP 1 facility are described in this chapter. Actions that ensure an adequate level of safety for the facility and onsite and offsite personnel are described. An assessment of the types of emergencies considered credible at WRAP 1 and an analysis of the bounding scenarios are provided in Chapter 3.0 of this document.

This chapter also describes the integration of WRAP 1 into the Hanford sitewide emergency planning efforts.

14.2 REQUIREMENTS

The following codes, standards, regulations, and DOE Orders specific to emergency preparedness functions establish the safety basis of WRAP 1: WHC-CM-5-36, *SWD Internal Requirements*; WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Document (S/RIDs)*; WHC-IP-1237, Section 1.3, *Administration Manual for WRAP 1, Building Emergency Guide for WRAP 1*; WHC-IP-0263-WRP1, *Building Emergency Plan For WRAP 1*; DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*; DOE Order 5500.1B, *Emergency Management System*; DOE Order 5500.2B, *Emergency Categories, Classes, and Notification and Reporting Requirements*; and DOE Order 5500.3A, *Planning and Preparedness for Operational Emergencies*.

14.3 SCOPE OF EMERGENCY PREPAREDNESS

Emergency action levels (EAL) for postulated WRAP 1 emergency scenarios are established as the basis for the facility Emergency Preparedness Plan (EEP). The bounding emergencies analyzed for the WRAP 1 facility are fires, explosions, natural phenomena, and mechanical accidents. The EALs addressed are "alert level emergency," "site area emergency," and "general emergency."

"Unusual occurrence" and "off-normal event" refer to nonemergency incidents of less consequence that may nonetheless require assistance from the building emergency response organization and/or from other areas of the Hanford Emergency Response Structure outside the facility (Figure 14-1). The emergency response procedures allow for escalation or de-escalation when new data pertaining to the nature and magnitude of the incident is obtained.

The event categories and facility response levels are described in WHC-CM-5-36, Chapter 4-43, "Emergency Management Procedures," in addition to being posted in the emergency response centers.

14.4 EMERGENCY PREPAREDNESS PLANNING

Relevant DOE Orders and directives are implemented by DOE/RL-94-02, *Hanford Emergency Response Plan*, for Hanford Site employees and facilities. Facility plans describe emergency response actions for facility or building personnel. Emergency planning directives for WRAP 1 are implemented through WHC-IP-0263-WRP1 and WHC-IP-1237, Section 1.3.

The operations contractor response organization, management responsibilities, and communication interfaces with the DOE-RL Emergency Operations Center (EOC) and with outside emergency response organizations, and interfaces between DOE-RL and outside agencies, are identified in the *Hanford Emergency Response Plan*. However, it is not expected that any accident or emergency at WRAP 1 would require this level of response, as WRAP 1 is a radiological facility.

For an emergency that would result in an onsite, limited-area condition, emergency response is applied in a graded approach based on the actions required (e.g., an event affecting one or a few staff members would be handled primarily by building management and cognizant safety and medical personnel). Emergency centers are activated when an alert or higher classification of emergency is declared.

A local emergency requiring support from several technical, engineering, maintenance, safety and security organizations would be under the direction of the Northern Area EOC as described in *Emergency Management Procedures* (Chapter 4-43 of WHC-CM-5-36). The operations contractor response is integrated with the *Hanford Emergency Response Plan*. Emergency actions involving offsite personnel are recommended by the DOE-RL and implemented by local, state, and federal agencies. See Subsection 14.4.1.4 for a discussion of coordination with outside agencies.

Emergency plans ensure that appropriate actions are taken to minimize the consequences of accidents. The plans already established for the 200 Areas were used in planning for the mitigation of the specific accidents developed in Chapter 3.0 of this document. These plans are summarized in Section 14.4.5. In summary, emergency plans facilitate mitigation of accident consequences by the following:

- Using predetermined accident consequences in planning
- Using facility conditions to determine EALs
- Predesignating responsibilities and procedures that must be carried out in response to an emergency
- Determining equipment and resources that must be available to respond to an emergency.

Emergency routes, access points, and assembly points for WRAP 1 are provided in the Building Emergency Plan (BEP).

Offsite emergency response activities are based on scenario-specific determinations made by responders to an emergency event. Emergency events are

classified in accordance with facility-specific recognition and classification procedures.

The areas addressed by emergency planning include the following:

- Emergency response organization
- Assessment actions
- Notification
- Emergency facilities and equipment
- Protective actions
- Training and exercises
- Recovery and reentry.

14.4.1 Emergency Response Organization

The emergency preparedness program, including identification of the individual responsibilities within the WRAP 1 organization, is described in the WRAP 1 Building Emergency Plan. The DOE Hanford Site Emergency Preparedness Program is described in the *Hanford Emergency Response Plan*.

The objective of the emergency preparedness organization is to deal effectively with all events, regardless of the action level. Performance requirements and supporting plans for the program stress that the program and plans be easy to understand and simple to implement.

14.4.1.1 Facility Emergency Preparedness Organization. Personnel are assigned to emergency response duties based on (1) similarity of the assignment to normal daily responsibilities, and (2) the individual's demonstrated ability to properly analyze data, assess situations, and make decisions under high stress conditions.

14.4.1.2 Hanford Site Contractor Emergency Organization. The Hanford Site Emergency Preparedness organization consists of (1) the emergency team, (2) supporting personnel, and (3) personnel responsible for generating, maintaining, and providing training in the Emergency Preparedness Program.

14.4.1.3 DOE-RL Emergency Organization. The DOE-RL Emergency Management Team, the Joint Information Center, the Unified Dose Assessment Center (UDAC), and other EOC support teams comprise the DOE-RL Emergency Response organization.

14.4.1.4 Medical Support. The Hanford Environmental Health Foundation (HEHF) provides professional medical help for the entire Hanford Site. HEHF medical personnel are trained to respond to cases of radioactive contamination or exposure to hazardous material(s). Ambulance service staffed with qualified emergency medical technicians and paramedics is provided 24 hours a day.

14.4.2 Assessment Actions

The UDAC provides onsite and offsite dose consequence projections. Initial onsite consequences also can be estimated by the area Emergency Control Center (ECC) staff.

14.4.3 Notification

Notification of an emergency event may be initiated by any employee who becomes aware of a condition that may affect occupants or operations. In some instances, the automatic or manual actuation of a building alarm is the alerting mechanism. The Building Emergency Director (BED) will notify WRAP 1 and waste management organization management. Further notifications (to DOE-RL Occurrence Notification Center [ONC] and other contractors) will depend on the severity of the accident.

14.4.3.1 Public Information. Emergency planning provides instructions for implementation and operation of the DOE Joint Information Center and its activities during emergency situations at the Hanford Site. The plans state that each event will be handled on a case-by-case basis to determine which provisions of the plan will be implemented. The Joint Information Center will always be activated in the event of an alert or higher classification of emergency.

Emergency Implementation Procedures, DOE-0223, directs the DOE and Hanford Site contractors to uphold their policy on making prompt and accurate activity information available to the public. The following audiences are served by the Joint Information Center:

- The media
- The local community
- Onsite employees and emergency workers
- Elected Federal, state, and local officials
- DOE-headquarters (DOE-HQ)
- Federal, state, and local agencies
- Special interest groups.

14.4.3.2 Records. The record keeping process for emergency preparedness includes taping telephone conversations with emergency response centers and collecting written records generated during the emergency. Much of the communication within and among emergency centers occurs via written emergency messages that can be stored for future reference.

14.4.4 Emergency Facilities and Equipment

The following emergency services and equipment are available on the Hanford site or in the Tri-Cities area.

14.4.4.1 Medical Assistance. As described in Subsection 14.4.1.4, professional medical help is available from HEHF to provide emergency assistance at any time for the entire Hanford Site.

14.4.4.2 Emergency Equipment. Emergency equipment is available at the following emergency response locations.

WRAP 1. Emergency equipment at WRAP 1 will be used primarily to mitigate an accident or incident. This may include protective clothing, respiratory protective equipment, hazardous chemical spill cleanup or control equipment, first aid kits, firefighting equipment, and emergency response team

identifiers. Lists of specific emergency equipment locations are provided in the WRAP 1 Building Emergency Plan (WHC-IP-0263-WRP1).

Hazardous Materials Response Vehicles. The Hanford Fire Department has a hazardous materials response vehicle and a crew of trained hazardous materials responders available at all times. The vehicle is equipped with the supplies necessary to detect, contain, and mitigate or neutralize hazardous materials.

Other Emergency Control Equipment and Supplies. Several sources of emergency control equipment and supplies are available on the Hanford Site for controlling and mitigating the consequences of an emergency situation. A large variety of light and heavy equipment and supplies that could be diverted from routine use to emergency use, if needed, are maintained at the Hanford Site.

14.4.5 Protective Actions

Protective actions are taken during an emergency to prevent or minimize actual and/or projected exposure to releases of hazardous radioactive and/or nonradioactive materials. Specific actions are typically in the form of sheltering and/or evacuation, or the use of time, distance, and shielding to reduce exposure to hazardous materials.

The WRAP 1 Building Emergency Director classifies the event as an operational emergency using facility EALs. Based on the event classification and contractor protective action guideline procedures, the Building Emergency Director implements protective actions.

14.4.6 Training and Exercises

14.4.6.1 Training. Emergency response training is conducted at all levels (e.g., the facility, area, Northern Area ECC, and DOE-RL EOC). Training includes initial training, and in many cases, retraining. In addition, periodic training is provided in the form of exercises and drills.

14.4.6.2 Drills and Exercises. Chapter 4-43 of WHC-CM-5-36 requires drills and exercises to be developed and conducted in accordance with applicable requirements. Specific details on exercise design are included in the WRAP 1 Building Emergency Plan. Drill scenarios are typically reviewed by the Exercise Project Officer, facility representatives, Safety, and Safeguards and Security. If appropriate, scenarios also are reviewed by the Environmental Program, Radiological Engineering, Hanford Patrol, Hanford Fire Department, HEHF Industrial Safety, an HEHF medical representative, and Pacific Northwest National Laboratory (PNNL).

Oral critiques with participants are conducted immediately following the drill or exercise. All comments noted in the evaluation are considered for input into the formal critique of the event. In addition, evaluators provide immediate feedback to the participants relative to accomplishment of the exercise objectives.

14.4.7 Recovery and Reentry

Emergency Management Procedures (Chapter 4-43 of WHC-CM-5-36) specify actions to be taken after an emergency situation has been stabilized. Actions generally are classified into the categories of emergency event termination, reentry, and recovery.

14.4.7.1 Emergency Event Termination. The emergency can be officially terminated when the event has been stabilized and onsite and protective actions have been implemented. Termination occurs after applicable criteria have been met and DOE-RL concurrence has been obtained.

Notification of termination of an event is made by the DOE-RL EOC to relevant onsite entities, DOE-HQ, and relevant state, county, and offsite agencies.

14.4.7.2 Reentry. Reentry is the act of reentering an evacuated area for the purpose of performing emergency activities, or to assess facility damage to determine if the emergency can be terminated and/or to determine the extent of required recovery activities. Reentry can be performed at any time before termination of the emergency and during recovery activities.

The DOE-RL EOC emergency manager must approve reentry to an event area except when time-urgent actions are required to save a life, minimize injuries, or prevent or minimize damage. When time-urgent actions are required, reentry may be authorized by the event commander or the Building Emergency Director.

14.4.7.3 Recovery. A Recovery organization is formed to plan and implement the activities necessary to return the affected facility and surrounding areas to normal upon termination of the emergency event.

14.5 REFERENCES

- DOE-0223, *Emergency Implementation Procedures*, U.S. Department of Energy, Richland Operations Office, Richland, Washington, 1993.
- DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, U.S. Department of Energy, Washington, D.C., 1995.
- DOE Order 5500.1B, *Emergency Management System*, U.S. Department of Energy, Washington, D.C., 1991.
- DOE Order 5500.2B, *Emergency Categories, Classes, and Notification and Reporting Requirements*, U.S. Department of Energy, Washington, D.C., 1991.
- DOE Order 5500.3A, *Planning and Preparedness for Operational Emergencies*, Section 11.c.(6), U.S. Department of Energy, Washington, D.C., 1991.
- DOE/RL-94-02, *Hanford Emergency Response Plan*, U.S. Department of Energy, Richland Operations Office, Richland, Washington, 1994.

WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.

WHC-IP-0263-WRP1, *Building Emergency Plan For WRAP 1*, Westinghouse Hanford Company, Richland, Washington, 1996.

WHC-IP-1120, *Solid Waste Disposal Standards and Requirements Identification Document (S/RIDs)*, Westinghouse Hanford Company, Richland, Washington, 1995.

WHC-IP-1237, *Administration Manual for WRAP 1*, Section 1.3, *Building Emergency Guide for WRAP 1*, Westinghouse Hanford Company, Richland, Washington, 1996.

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Figure 14-1. Typical Hanford Emergency Response Structure.

BED = Building Emergency Director
 BW = Building Warden
 ECC = Emergency Control Center
 ENS = Emergency Notification System
 EOC = Emergency Operations Center
 ONC = Occurrence Notification Center
 POC ■ Point of Contact

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**WASTE RECEIVING AND PROCESSING FACILITY MODULE 1
AUDITABLE SAFETY ANALYSIS
Revision 0**

**CHAPTER 15.0
Management, Organization, and Institutional
Safety Provisions**

February 1997

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LIST OF TERMS

ALARA	as low as reasonably achievable
DOE-HQ	U.S. Department of Energy - Headquarters
DOE-RL	U.S. Department of Energy, Richland Operations Office
HSRCM	Hanford Site Radiological Control Manual
IAEA	International Atomic Energy Agency
SWD	solid waste disposal
WMO	Waste Management Operations

15.0 MANAGEMENT, ORGANIZATION, AND INSTITUTIONAL SAFETY PROVISIONS

15.1 INTRODUCTION

The organizational structure, interfaces, and responsibilities for safe management and operation of WRAP 1 are described in this chapter. Programs that carry out the safety philosophy and enhance worker and public safety are also identified and described.

15.2 REQUIREMENTS

The following design codes, standards, regulations, DOE Orders are required for establishing or maintaining facility safety:

- DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*
- DOE Order 5480.3, *Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes*
- DOE Order 5480.24, *Nuclear Criticality Safety*
- DOE Order 5481.1B, *Safety Analysis and Review System*
- DOE Order 5500.1B, *Emergency Management System*
- DOE Order 5500.2B, *Emergency Categories, Classes, and Notification and Reporting Requirements*
- DOE Order 5820.2A, *Radioactive Waste Management*
- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*
- WHC-CM-5-36, *SWD Internal Requirements*.

15.3 ORGANIZATIONAL STRUCTURE, RESPONSIBILITIES, AND INTERFACES

This section describes the organizational structure, responsibilities, and interfaces for WRAP 1 as of the preparation date of this final safety analysis report. As circumstances change, the organization may change. However, the basic tasks and responsibilities are likely to continue in future organizations.

15.3.1 Organizational Structure

The Project Hanford Management Contract (PHMC) establishes Fluor Daniel Hanford as ultimately responsible to DOE for all PHMC facility operations. Responsibility for WRAP 1 is assigned to the PHMC Waste Management

subcontractor. The subcontractor's Waste Management Operations (WMO) organization provides management oversight for WRAP 1 operations. Figure 15-1 shows the WMO organization structure to the third level, where WRAP 1 appears. Figure 15-2 shows the WRAP 1 functional organization.

WMO manages and operates facilities and services required for the receipt, treatment, storage, shipment, and disposal of Hanford Site solid and liquid wastes. WRAP 1, a key facility for handling low-level waste and transuranic waste, is one element in an integrated waste management network and shares certain services with other WMO facilities. Environmental, Health and Safety Services are one of the shared services. The WMO Environmental Safety and Health organization that provides services to WRAP 1 is shown in Figure 15-3.

Other Hanford Site organizations also support WRAP 1 for the following functions:

- Safety analysis
- Radiation protection
- Fire protection
- Security
- Architect/engineer services.

However, WRAP 1 management is ultimately responsible for the safety and quality of all WRAP 1 operations and products, including those that involve services performed by other organizations.

15.3.2 Organizational Responsibilities

The primary responsibility for safe operation of WRAP 1 lies with facility line management, culminating in the plant manager. Line management is responsible for ensuring that safety analyses are performed, documented, reviewed, and approved according to DOE requirements and that the following safety functions are provided to WRAP 1:

15.3.2.1 Safety Officer. The Safety Officer for WRAP 1 is the single point-of-contact for all matters related to safety and health. This position is responsible to the Plant Manager, interfaces with management and staff, provides input related to safety and health for the work planning process, conducts safety walkthroughs of the facility and projects ongoing in the facility, and supports technical teams on technical issues.

15.3.2.2 Environmental Compliance. Environmental Compliance Officers function as the facility point-of-contact for environmental issues. The Environmental Compliance Officer advises facility management of environmental compliance status as well as new requirements, their impacts and recommended compliance mechanisms. The Environmental Compliance Officer ensures processes exist to perform and document self assessments, report environmental issues, review facility changes, and approve facility-specific policies, training courses and procedures that have environmental impacts.

15.3.2.3 Radiation Control. WRAP 1 operations are governed by the radiation protection program specified in WHC-CM-5-36, which is based on the requirements of 10 CFR 835, "Occupational Radiation Protection" and the *Hanford Site Radiological Control Manual* (HSRCM-1). With programmatic support from Waste Management Operations, the WRAP 1 Operations Radiation Control Manager is responsible for implementing these requirements and for ensuring the following:

- New or modified facilities, systems, or equipment are designed according to accepted radiological design principles to maintain exposure levels as low as reasonably achievable (ALARA).
- Operations involving radioactive materials and/or exposure to radiation are conducted safely and according to applicable radiological control procedures and ALARA principles.
- Workers who are or may be exposed to radiation or radioactive contamination are fully trained and qualified to perform jobs safely and according to applicable procedures.

15.3.2.4 Conduct of Operations. The WMO Conduct of Operations organization is chartered to oversee implementation of nuclear safety requirements for WMO facilities, including WRAP 1; establish and maintain criteria and procedures for nuclear safety; provide guidance to WMO managers concerning development and independent reviews of nuclear-safety related documentation; and promote continuous improvement by assisting WMO managers and personnel in implementation of the nuclear safety policy.

The Conduct of Operations organization reviews external standards, regulations, and DOE directives pertaining to nuclear safety for applicability. Applicable nuclear safety requirements and programmatic aspects are interpreted and implemented into appropriate WMO policy, standards, and manuals. The Conduct of Operations organization supports facility/plant operations in developing and maintaining programs that comply with and achieve nuclear safety requirements.

15.3.2.5 Safety Analysis Support. The Specialty Engineering organization of Fluor Daniel Northwest Inc. provides safety analysis preparation support for safety analysis for WRAP 1.

15.3.2.6 Fire Protection. The Hanford Fire Department provides the following fire protection functions:

- Maintains command of emergency response forces to perform the necessary actions to control and terminate fire-related incidents, provides emergency medical patient care, and acts as the incident command agency for hazardous materials emergency incidents
- Conducts fire protection system functional testing for Hanford Site facilities and maintains self-contained breathing apparatus
- Maintains an active fire prevention program through facility tours and inspections of flammable and reactive waste sites

- Maintains a highly trained emergency response team certified under a three-year State of Washington-approved fire fighter apprenticeship program
- Uses and maintains a modern fleet of emergency response vehicles consisting of pumper trucks, aerial ladder units, modular ambulances, command vehicles, wild land brush tankers, hazardous materials response vehicles, and specialized equipment designed to deal with the unique requirements and operations of the Hanford Site.

The Hanford Fire Department is party to mutual aid agreements with 10 surrounding fire departments and fire districts as well as contractual responsibilities for fire suppression and ambulance service to the Washington Public Power Supply System.

15.3.2.7 Security. Safeguards and security services are provided to all Hanford Site facilities by the facility services subcontractors. WRAP 1 receives protective force services, including command, control, and notification for emergency conditions, and enforcement of applicable federal, state, and local laws on a 24-hour basis. Security organization conducts activities in accordance with WHC-CM-5-36, Chapter 4-33, "*Security Manual*."

15.3.2.8 Additional Activities. Additional activities include the development of company-wide policies and procedures that cover hazardous materials transportation and packaging; support for institutional transportation programs; transportation programs; transportation and policy direction; qualification requirements and shipper training; preparation and maintenance of required shipping container safety documentation; hazardous materials packaging; design procurement support; analysis and testing; field support to the U.S. Department of Energy - Headquarters (DOE-HQ) Transportation Management Program; and other transportation management activities.

Support to WRAP 1 related to fire hazard analysis and documentation is provided by the Waste Management Operations Health and Safety organization through matrixed support.

15.3.3 Staffing and Qualifications

Operation of WRAP 1 requires a staff of qualified, competent personnel to conduct routine and long-range activities. Qualifications are determined by education and related industry experience, as well as company-offered job-specific training. The Plant Manager has ultimate authority for determining a potential or actual employee's qualifications for a position.

Training and qualification requirements for WRAP 1 are addressed in Chapter 12.0. The skill level, job category, and assigned work determine the qualifications for each position and the training requirements for each employee. Personnel may be qualified by education and related experience to start in a management or supervisory position. Company training meets essential qualification requirements for continued employment, given acceptable performance.

WRAP 1 maintains documentation of staff qualifications and any changes in qualifications as a result of continued training.

The Hanford Environmental Health Foundation provides reports of personnel injuries on the job. Each employee is trained to report to the nearest Health Service Center immediately if injured on the job. Reports of these injuries are investigated and summarized and appropriate corrective actions are taken to correct unsafe conditions. Also, plant personnel receive notices of recorded injuries as part of the injury awareness program.

15.4 SAFETY MANAGEMENT POLICIES AND PROGRAMS

15.4.1 Safety Review and Performance Assessment

Safety performance is assessed by line management, WMO Environmental Safety and Health, integrated assessment teams, and the Facility Evaluation Board. In addition, external reviews are performed by organizations such as DOE-RL, Washington State Department of Ecology, DOE-HQ, and the Project Hanford Management Contractor.

15.4.2 Configuration and Document Control

Configuration management activities establish and maintain consistency among design requirements, physical configuration, and facility documentation.

The facility documentation that supports facility operations includes the as-built configuration documentation and facility procedures for activities. Changes to the facility design are reflected in the facility physical configuration and facility documentation.

The configuration control process contains five elements: identification, evaluation, approval, authorization, and implementation.

15.4.3 Occurrence Evaluation

DOE Order 232.1 establishes a system for reporting and processing operations information related to emergencies, unusual occurrences, and off-normal occurrences. The plant manager or designee is available at all times to carry out the requirements of this order. Once the appropriate response is initiated by personnel to stabilize or return WRAP 1 to a safe condition, the Occurrence Notification Center duty officer for unusual occurrences or emergencies is notified. The duty officer will contact the DOE-RL facility representative. During the entire process of notification and reporting, the facility representative and duty officer use the current management chain established for the line organization in providing program direction to the operating contractor.

The criteria for when an event investigation is required are clearly established in WHC-CM-5-34. The operations manager is responsible for event investigations.

15.4.3.1 Corrective Action Determination. Appropriate corrective action is established for each event investigation, and specific personnel are assigned responsibilities for the corrective action. Corrective action can take the form of procedural changes, training, design modifications, or changes to administrative controls.

15.4.3.2 Event Training. In-house events are evaluated by the Operations manager to determine if the event should be included in the training program for Operations personnel.

15.4.3.3 Notification Procedures. Events that require notification of DOE personnel, as specified in WHC-CM-5-34 (and when appropriate, state and local officials), require a systematic, controlled method for gathering and transferring information. Responsibilities and the notification process are also detailed in WHC-CM-5-34. This procedure has been developed to fulfill the requirements in DOE Order 232.1.

15.4.4 Safety Culture

Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as the first priority, safety issues receive the attention warranted by their significance.

WMO addresses the following elements that are critical to the establishment and maintenance of the WMO safety culture:

- Individual awareness of the importance of safety
- Knowledge and competence conferred by training and instruction of personnel
- Commitment, at all levels of management, to demonstrate the high priority of safety and the need for individual adoption of common goals
- Motivation, through leadership, and establishing objectives and systems of rewards for exemplary safety performance
- Supervision through audit and review practices
- Responsibility through formal assignment, description of duties, and their understanding and acceptance by individuals.

15.5 REFERENCES

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, U.S. Department of Energy, Washington, D.C., 1995.

- DOE Order 5480.3, *Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes*, U.S. Department of Energy, Washington, D.C., 1985.
- DOE Order 5480.24, *Nuclear Criticality Safety*, U.S. Department of Energy, Washington, D.C., 1992.
- DOE Order 5481.1B, *Safety Analysis and Review System*, U.S. Department of Energy, Washington, D.C., 1986.
- DOE Order 5500.1B, *Emergency Management System*, U.S. Department of Energy, Washington, D.C., 1991.
- DOE Order 5500.2B, *Emergency Categories, Classes, and Notification and Reporting Requirements*, U.S. Department of Energy, Washington, D.C., 1991.
- DOE Order 5820.2A, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C., 1988.
- HSRCM-1, *Hanford Site Radiological Control Manual*, Hanford Site Contractors, Richland, Washington.
- WHC-CM-5-34, *Solid Waste Disposal Operations Administration*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-5-36, *SWD Internal Requirements*, Westinghouse Hanford Company, Richland, Washington.

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Figure 15-1. Waste Management Operations.

H96110296.3
WRAP

LEF - Liquid Effluent Facility
WRAP 1- Waste Receiving and Processing Facility Module 1

Figure 15-2. Waste Receiving and Processing.

H96110286.2
WRAP

WRAP 1- Waste Receiving and Processing Facility Module 1

Figure 15-3. Environmental, Safety, and Health.

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