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1	WHC-SD-PRP-HA-~~009~~ 014		0	T Plant Hazards Assessment	~~3~~S	1/2	1	

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
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7. Abstract

This document establishes the technical basis in support of Emergency Planning activities for the T Plant on the Hanford Site. The document represents an acceptable interpretation of the implementing guidance document for DOE ORDER 5500.3A. Through this document, the technical basis for the development of facility specific Emergency Action Levels and the Emergency Planning Zone is demonstrated.

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T-PLANT HAZARDS ASSESSMENT

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R. E. Broz

MASTER

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1.0 INTRODUCTION

This report documents the hazards assessment for the T-Plant Facilities located in the 200 West Area on the U.S. Department of Energy (DOE) Hanford Site. Operation of the T-Plant Decontamination Facility is the responsibility of Westinghouse Hanford Company (WHC), Solid Waste Disposal Division.

This hazards assessment was conducted to provide the emergency planning technical basis for all of the T-Plant facilities. DOE Order 5500.3A requires an emergency planning hazards assessment for each facility that has the potential to reach or exceed the lowest level emergency classification.

The purpose of this document is to summarize the applicable information in the T-Plant Safety Analysis Report (SAR), inventory lists, and other related safety documents. The hazardous material is identified and screened. Potential SAR accidental release scenarios are reviewed to determine the appropriate emergency classification of the scenarios, and Emergency Planning Zones (EPZs).

2.0 FACILITY AND PROCESS DESCRIPTIONS

Detailed descriptions of 200 West Area of the Hanford Site and the T-Plant complex are found in section 5 of the T-Plant SAR, SD-C-SAR-007, Rev.1. The following brief summary is derived from these and other descriptions.

2.1 Facility Mission

T-Plant is the first of the original World War II era chemical separations plants. The plant was one of three identical separations facilities completed in 1944 to extract plutonium from spent reactor fuel using the Bismuth Phosphate ($BiPO_4$) precipitation process. T-Plant is unique from the other two, in that a semi-works test facility was constructed as a "head-end" to the heavily shielded canyon building to validate the proposed chemical separations process. The facility operated with this chemical separations mission until 1956 when it was deactivated after newer plants came on line. Most of the original process equipment has subsequently been removed.

In 1957, T-Plant was placed in service with the mission of a beta-gamma decontamination facility and as a support complex for experiments or other operations requiring confinement or isolation. It has continued to perform these functions until the present, although now it functions primarily as a decontamination and packaging/repackaging facility.

2.2 Facility Location

The T-Plant complex is located in the 200 West Area on the DOE'S Hanford Site. The federally owned site occupies approximately 1478 kilometer^2 (km^2) (570 mi^2) of a semiarid region in southcentral Washington State, Figure 2.1.

T-Plant's location in the 200 West Area is shown in Figure 2.2. The nearest site boundary is 13.1 km east. The Columbia River is 8.6 km to the North. Land uses in the surrounding area include urban and industrial, plus irrigated and dryland farming.

2.3 Facility Descriptions

The T-Plant complex consists of sixteen buildings which are described in detail in section 5 of the T-Plant Safety Analysis Report. The main facilities include the 221-T Canyon Building, the 271-T Services Building, and the 2706-T Low Level Decontamination Facility.

Table 2.1 T-Plant Complex Facilities

FACILITY	FUNCTION	FACILITY	FUNCTION
211-T	Chemical storage	2715-T	Storage
214-T	Chemical storage	2716-T	Canyon Change Trailer
221-T	Equip. decon. facility	277-T	Shop and Storage
221-TA	Fan house	291-T	HEPA filter and stack
2706-T	Low-level decontamination	292-T	FP* release laboratory
MO-0433	2706-T Change Trailer/Offices	MO-371	Women's change trailer
271-T	Shops and Offices	MO-739	Change trailer

* FP = fission product

2.3.1 221-T Canyon Building

The Canyon Building is a reinforced concrete structure that is 259 meters (m) (850 feet) long, 20.7 m wide, and 22.6 m high. The building consists of the process area, or canyon, three galleries (electrical, pipe, and operating), a crane cab way, and a "head end" facility. The structure is divided into twenty sections with transverse section joints at approximately 12.2 m intervals.

2.3.1.1 221-T Canyon Service Area (Canyon Deck)

The canyon area consists of 37 cells and a railroad tunnel entrance/exit. The cells are grouped into 12.2 m sections arranged in a single row running the length of the building. The 0.9-1.2 m thick concrete roof is 12.2 m above the canyon deck. The "head end" is isolated from the canyon by a metal wall located at the beginning of section 2. Shielding walls of 2.7 m thick reinforced concrete separate the cells from the electrical and

Figure 2.1 Hanford Site in Southeastern Washington

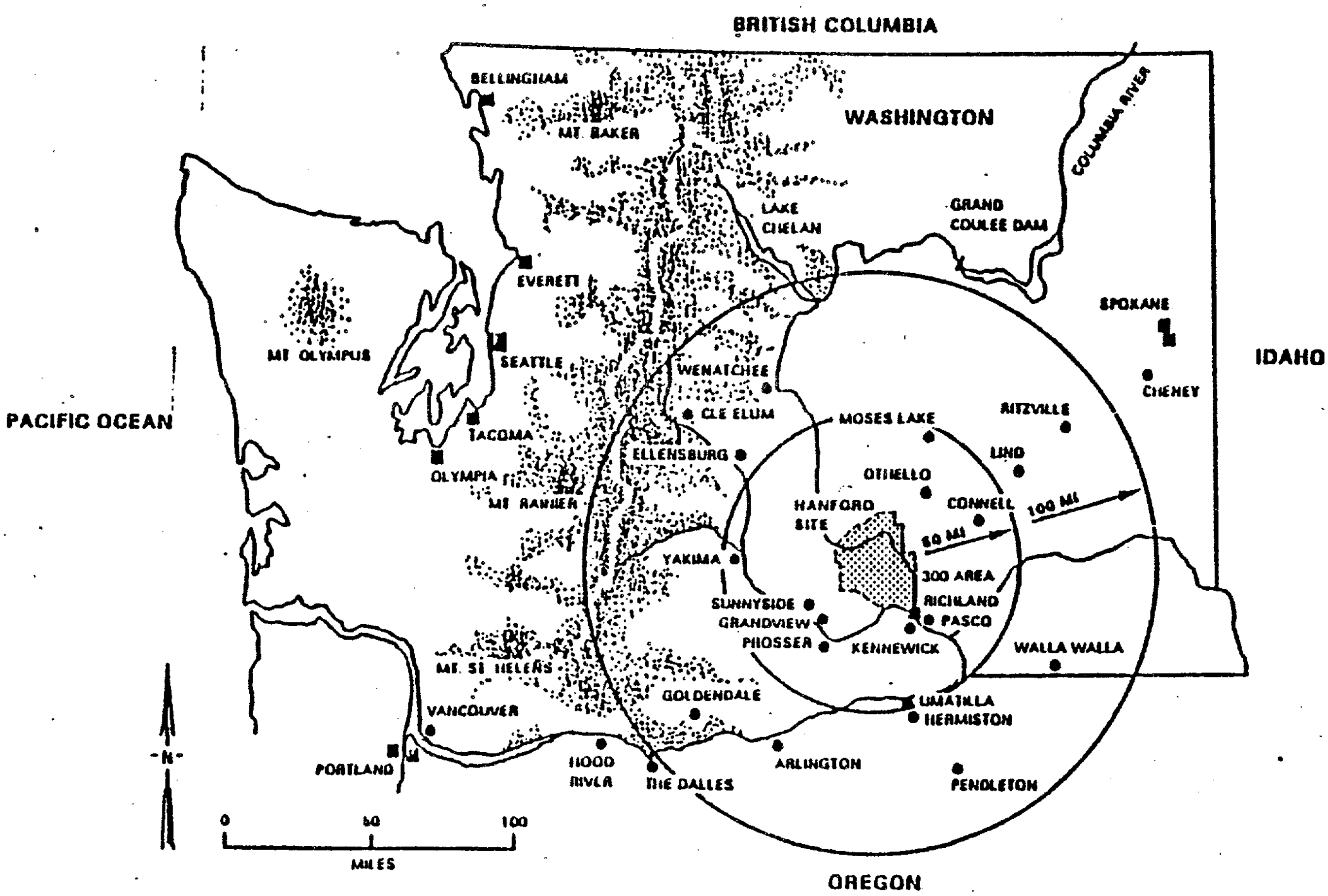


Figure 2.2 T-Plant's Location in the 200 West Area

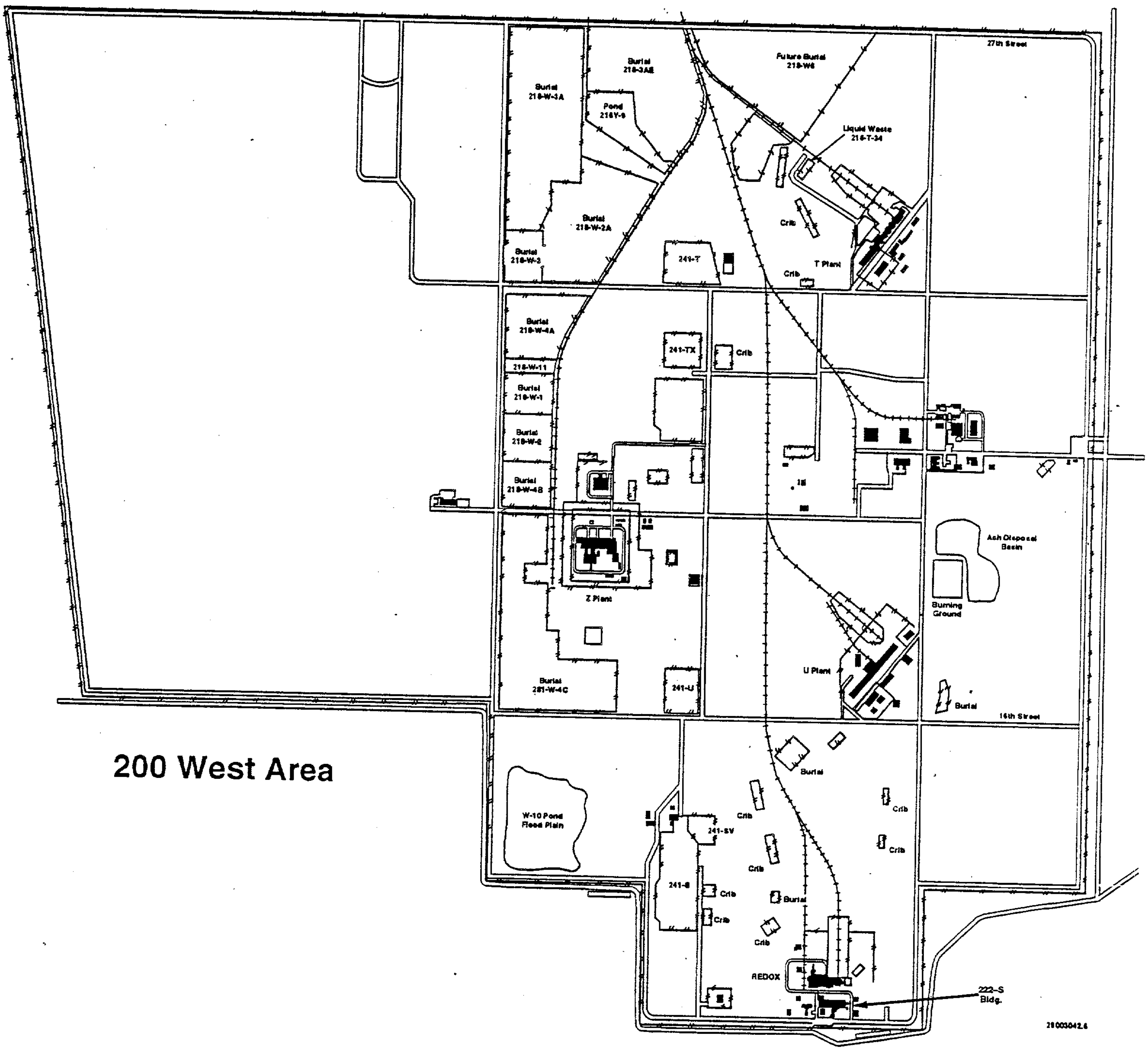
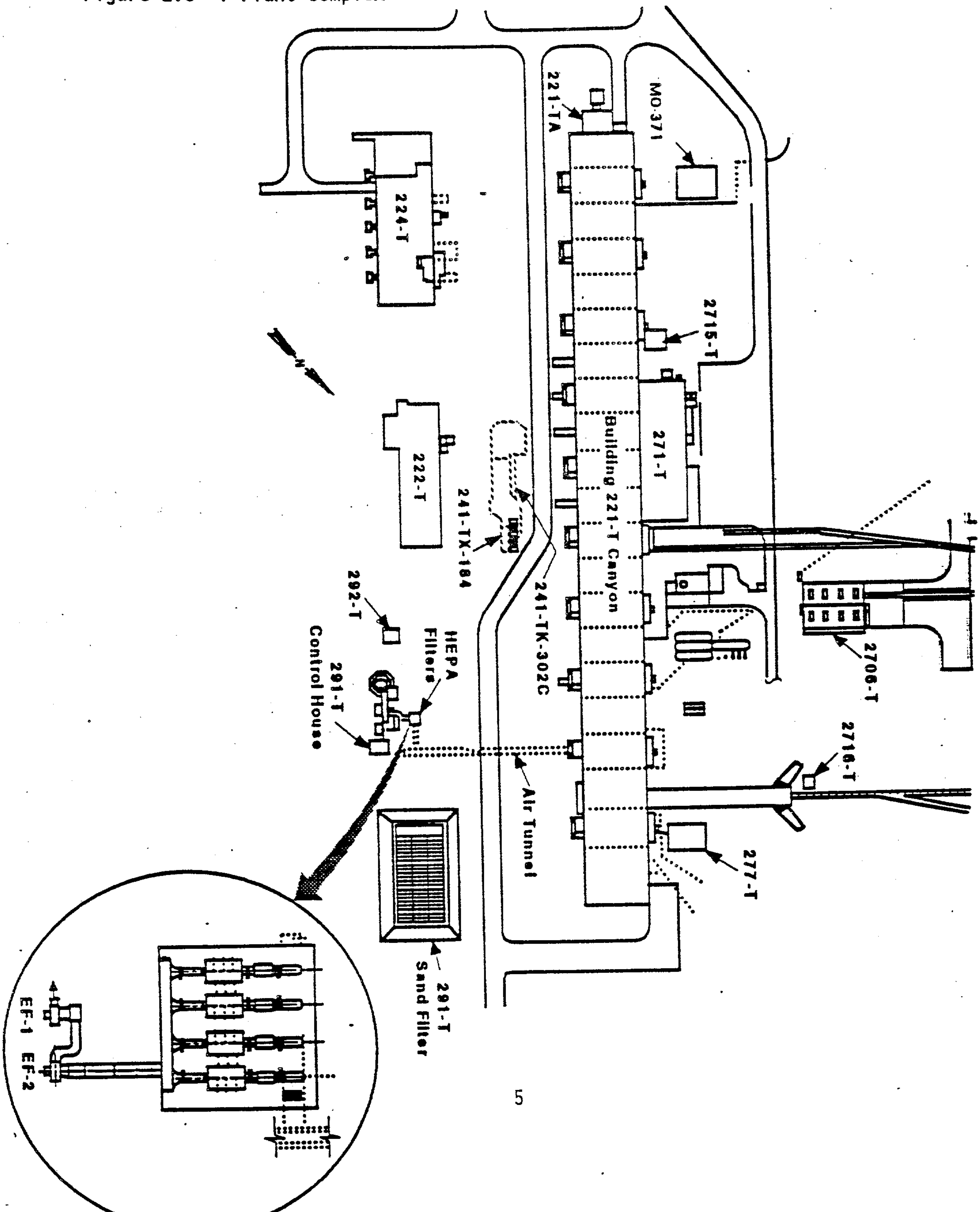


Figure 2.3 T-Plant Complex



pipe galleries. The operating gallery is separated from the canyon deck by a 2.1 m thick reinforced concrete wall, and the crane cab is protected by a 1.5 m thick concrete wall that extends part way 2.7 m to the ceiling. Most of the cells are covered by 1.8 m thick reinforced concrete blocks, which are stepped to eliminate a direct path for radiation streaming. These cover blocks form the canyon deck. Cover blocks for cells 11R, 13R, and 15R are 2 feet thick and are covered by a 9.5E-3 m thick stainless steel decontamination pad. Each cover block has a carbon steel lifting bale to allow access into the cells. Cells 2L, 2R and 3L are not covered and are used for the railroad tunnel, and storage of PWR core II blanket fuel. The railroad tunnel enters the plant at cell 2L (section 2) through a 4.88 m wide by 6.71 m high opening in the side of the canyon building at cell floor level.

The original building design provided two overhead bridge cranes with capacities of 9072 kgs and 40824 kgs. The cranes move parallel to the canyon, allowing easy access to the canyon deck and the cells, and allow remote decontamination and maintenance activities. A crane repair catwalk at section 20 allows hands-on maintenance of the crane.

The standard canyon cells are 5.4 m long, 4 m wide and 8.5 m deep and can be covered by four 1.8 m thick concrete cover blocks. There are two cells in each section separated by a 2.1 m thick reinforced concrete wall. Each cell floor slopes to a drain which drops into a 0.6 m concrete tile chemical drain running the length of the building and empties into cell 5, tank 5-7. All lines that service the cells are encased in the concrete walls and terminate in a row of connector flanges on the cell wall 2.7 m below canyon deck level. Process lines go directly through the wall between cells in the same section. Piping to another section is routed through an 2.4 m deep, 3.3 m wide pipe trench that runs parallel to the cells for the length of the building. The pipe trench is covered by 1.4 m thick reinforced concrete blocks which are also stepped to prevent radiation streaming.

A 3.2 m square exhaust air tunnel runs the length of the building underneath the pipe trench providing exhaust for the cells and the pipe trench. At section 3, a 1.2 m by 2.1 m duct runs underground about 61 m connecting the tunnel to a HEPA filter system and the 291-T exhaust stack.

2.3.1.2 221-T Building Galleries

These extremely long rooms run parallel with and essentially the length of the canyon structure. The electrical gallery is the lowest of the three galleries and is at the same level as the floor of the canyon cells. It is 232 m long and 4.3 m wide running parallel to the process cells and contains the main electrical lines, motor control centers and the electrical distribution centers for the building. Electrical and instrument shops are now located at sections 17 through 20.

The pipe gallery is also 232 m long and 4.3 m wide at the level just above the electrical gallery but below the level of the canyon deck. This corridor contains most of the nonradioactive chemical, process, and utility piping.

The operating gallery is 244 m long and 4.4 m wide and is the control center for remote operation of the canyon equipment. It is at the level of the canyon deck and the second floor of the 221-T Building.

The crane cab way is directly above the operating gallery and has similar dimensions. It is a meter above the level of the third floor of 271-T Building. The crane cab way is open to the area above the canyon deck through the space between the top of the parapet wall and the canyon ceiling. The 75 ton crane is operated from a crane cab which is shielded by 7.6E-2 m of lead and traverses the crane cab way as the bridge crane moves. Operation of the crane requires the use of installed periscopes. Nine stairwells, one at each odd numbered section connect all of the galleries. Access to the crane cab way is normally allowed only at sections 11 and 13 from the 271-T building. The other stairwells are locked to prevent access but allow exit if necessary.

2.3.1.3 271-T Service Building

The 271-T Building is attached to the center of the gallery side of the Canyon Building (221-T). This reinforced concrete and cement block structure 48.8 m long, 14.6 m wide, and 16.4 m high, has three floors and a basement.

The basement is at the level of the electrical gallery, and contains machine shops, riggers loft, various offices and store rooms, process air compressor room, filters for the building ventilation air supply, and the bottom halves of two chemical makeup tanks and their related pumps and power switches. The first floor is at the pipe gallery level, and provides space for several offices and shops, a lobby, an instrument electronics laboratory, and rest rooms. The chemical makeup room contains the two large chemical makeup tanks. The second floor, at the level of the operating gallery contains administrative and supervisory offices and a small lunch room. The third floor contains several unused chemical make up head tanks, space for dry chemical storage, several offices and a rest room.

2.3.1.4 221-T Head End

In 1964 a Containment Systems Experiment (CSE) facility was installed in the "head end" of the canyon building. A large carbon steel containment vessel 7.6 m in diameter and 20.4 m in overall height enclosing 849.6 m^3, was fitted in the space between the cell floor and the canyon ceiling. After the shut down of that program in 1970, it was converted in 1975 to a Containment Systems Test Facility (CSTF) which was designed with the unique capability to spill controlled quantities of liquid sodium into the containment vessel for in depth testing of emergency air cleaning systems. This vessel is now "isolated" from the facility.

A control room for the Containment Systems Test Facility (CSTF) is located on the second floor (operating gallery) and an aerosol sampling laboratory on the first floor (pipe gallery). This facility has been out of service since 1989, however there is 816.5 kg of solidified bulk sodium remaining in storage vessels in the crane cab way.

2.3.2 2706-T Low Level Decontamination Facility

This 15.2 m wide, 20.1 m long, and 7.6 m tall, prefabricated steel building was constructed in 1959 for the decontamination of railroad equipment, buses, trucks, and earth moving equipment. Low-Level radioactive equipment is defined as contaminated with less than 1E-3 gray (Gy)/hr at the surface and no detectable alpha contamination.

Two large metal roll up doors on the west side of the building allow access by both rail cars or highway vehicles. An overhead 9072 kg capacity crane travels the length of the building. There is a large building ventilation system with HEPA filtration, continuous instrument monitoring, and an exhaust stack (296-T-7). Two 1.8 m deep cleaning pits allow ready access to the underside of vehicles or equipment. The railroad pit is 16.8 m long and 5.2 m wide, while the automotive pit is 9.1 m long and a little more than 1.2 m wide. A drain system for the building and the two cleaning pits collects the water in a sump which is transferred into the 221-T canyon.

2.3.3 T-Plant Support Facilities

2.3.3.1 221-TA Canyon Air Supply Fans

This building contains two air supply fans for the canyon deck service area. Each fan is rated at 1133 m^3/minute and consists of a preheater, filter, evaporative cooler, and reheater designed to maintain year around canyon temperature between 70 and 80°F. Controls for these fans are interconnected with the canyon building roof exhaust fans. This air is supplied through duct work into the canyon crane cab way where it enters the canyon service area.

The addition of an exhaust system mounted on the canyon building roof at section 4 pulls canyon air through an opening in the roof, a prefilter and two stages of HEPA filtration. This system consists of the filters, an exhaust fan rated at 1982 m^3/minute and a 4.6 m high stack mounted on the roof.

2.3.3.2 291-T Canyon Exhaust Filter and Stack

The small 5.8 m by 5.2 m concrete building adjacent to the 61 m high concrete stack, houses the controls for the two 657 m^3/minute exhaust fans which pull air from the canyon air tunnel, and exhaust it out the stack. Air from the canyon service area is drawn past the cell cover blocks down into the cells and pipe trench, where openings allow flow into the exhaust air tunnel. This system is a part of the original 1944 canyon construction project.

Four parallel filter housings have been added downstream of a large sand filter and just ahead of the exhaust fans. Each filter consists of a pre-filter and two stages of HEPA filtration.

2.3.3.3 292-T Fission Product Release Laboratory

This is a small concrete building which has been used as a measurement laboratory. It is now laid away.

2.3.3.4 211-T and 214-T Chemical Storage Facilities

These two small storage facilities were used to store bulk chemicals. 211-T is an outdoor tank farm and was the receiving point for liquid sodium hydroxide. All but one of these tanks have been eliminated. The last tank is disconnected and awaiting decontamination and decommissioning. The 214-T building is used for chemical storage and waste storage.

2.3.3.5 277-T Storage Building

A prefabricated steel building now used for storage.

2.3.3.6 2715-T Maintenance Shop

This prefabricated metal building is used as storage for Material Control personnel.

2.3.3.7 2716-T Canyon Tunnel Storage

This prefabricated steel building is located near the railroad tunnel entrance to the canyon and is used for storage and base of operations at the tunnel.

2.4 Processes and Operations

2.4.1 Operations in Building 221-T (Canyon)

The 221-T canyon deck is used for decontamination services, repair and temporary storage. The amount and type of equipment stored on the canyon deck and in the cells vary with decontamination and support requirements.

Section 2 is used as the PWR core II storage pool and contains seventy two 3.7 m long irradiated blanket fuel elements in 8.5 m of water. An ion exchange column recirculating system is used to limit the accumulation of radioisotopes in the pool water.

Sections 4 through 10 are used as staging and storage areas for contaminated and decontaminated equipment. All decontamination work is performed in sections 11 through 15. Contact maintenance work is performed in sections 16 through 20. A centrifuge run-in stand is located on the deck in section 17. A pump run-in station is located in section 19, with a 15141 l recirculating tank in cell 19R. Many cells are used for storage and handling of radioactive waste.

Examination of equipment is performed on the canyon deck, and the type of cleaning to be used determined. Processes used include chemical spray cleaning, abrasive cleaning, immersion chemical cleaning, and hands-on chemical or physical cleaning.

Air from the canyon exhaust tunnel exits the 221-T building at section 3 through a 1.2 m wide by 2.1 m high underground concrete duct that runs 44.2 m to a 130 kilowatt electrical duct heater. The air is pulled through four parallel pre-filters and four walk-in two stage HEPA filters. The four parallel channels for these above ground insulated filter housings are rated at 283 m^3/minute each with individual dampers for each channel. The four channels are recombined into a common 1.4 m diameter steel duct and connected to the exhaust fans. The HEPA housings are designed to test filter integrity by aerosol testing of each filter stage individually and the combination. The pressure drop across each filter stage and the prefilter are indicated by gauges on the filter housings. A local alarm panel provides both audible and visual alarm upon a high pressure differential ($\geq$7.6E-2m of water) across any of the filter stages or if the duct heater is unable to maintain the set point temperature differential across the duct heater.

The exhaust system mounted on the canyon building roof at section 4 pulls canyon air through an opening in the roof, a prefilter and two stages of HEPA filtration and into the exhaust fan rated at 2682 m^3/minute and a 4.6 m high stack mounted on the roof. This system is monitored by the same type of differential pressure monitors, a radiation monitor and alarms at the 291-T facility.

Each of the pre-filters and HEPA filters are required to be isolated and replaced when the differential pressure across the filter increases to the extent indications are that it is becoming plugged.

2.4.2 Operations in Building 221-T (Galleries)

The pipe gallery has been modified to meet current operating requirements, and has been divided into four areas. Two compressor/condenser units for the PWR core II storage pool are at Section 2, as well as the power supplies for these units and the ion exchange column.

Sections 2 through 15 of the pipe gallery are used for chemical storage. Sections 11 through 18 is a maintenance shop and the SWP change room, shower and locker rooms are at sections 19 and 20.

In the operating gallery, Section 2 houses the PWR core II operating station. Various panel control boards are located in sections 5 through 15 (only panels in 5, 11, and 15 are currently in use). Sections 16 through 19 contain offices and a lunch room. The office adjacent to section 19 contains controls for canyon air, water, steam, lights and the centrifuge run-in station. The office adjacent to section 18 contains controls for the canyon pump run-in station. A canyon entry area and decontamination shower are at section 20. The 221-TB Laundry storage facility is attached to the end of the building at section 20.

The 271-T building together with 221-T galleries have an independent ventilation system with supply at the operating gallery level and exhaust at the pipe gallery.

2.4.3 Operations in Building 2706-T (Low Level Decontamination)

The decontamination of railroad equipment, buses, trucks, and earth moving equipment can be carried out here. Low-Level radioactive equipment is defined as contaminated with less than 1E-3 Gy/hr at the surface and no detectable alpha contamination. Processes used include chemical spray cleaning, abrasive cleaning, immersion chemical cleaning of smaller items, and hands-on chemical or physical cleaning. This facility will also package/repackage waste.

An overhead ten ton capacity crane travels the length of the building and allows handling of large or heavy items. There is a large building ventilation system with HEPA filtration, continuous instrument monitoring of the exhaust, and an exhaust stack (296-T-7). Two 1.8 m deep cleaning pits allow ready access to the underside of vehicles or equipment. A drain system for the building and the two cleaning pits collects the water in a sump which is transferred into the 221-T canyon.

2.4.4 Operations in the 211-T (Chemical Storage Areas)

211-T is an outdoor tank farm and is the receiving point for the sodium hydroxide.

3.0 IDENTIFICATION AND SCREENING OF HAZARDS

The hazardous and radioactive material in the T-Plant decontamination complex consists mainly of the residual contamination on process equipment brought in to the facility, sludge and liquids in process tanks. Ultimately, all liquid wastes from the T-Plant canyon are collected in tank 15-1, where it is sampled and transferred to the tank farms. The radioactive inventory listed in Table 3.1 does exceed the screening values specified in 10 CFR 30.72 Schedule C for ^{239}Pu (7.4E+10 bequerels (Bq)) but not for ^{137}Cs (1.1E+14 Bq) or for ^{90}Sr (3.3E+12 Bq), but when using the inventory, facility boundary dose equivalents are above the level which require emergency planning.

Criticality is a concern in the T-Plant canyon and is labeled as a limited control area with detectors and has criticality specifications. 2706-T is considered a fissile exempt facility.

Since the operation does not lend itself to the quantification of an inventory of radioactive material, the identification of areas for safety analysis was accomplished by using three criteria:

- The presence of significant hazards
- The chemical or physical nature of the hazard
- The presence of working conditions that could cause a loss of control of these hazards and result in an accident

All chemicals used at T-Plant are received and used in quantities below the threshold planning quantities. Sodium hydroxide (caustic) is the largest volume of hazardous material used and is delivered as 50% solution by tank truck and pumped into holding tanks in the 211-T Tank farm. The caustic is usually used as a 25% solution. Chemicals are made up in the quantities needed for each job and then pumped through installed piping to the canyon work space.

In 1983, a heavy use year, T-Plant disposed of the chemicals shown in Table 3.1. All these chemicals went into the building 221-T liquid radioactive waste system. No chemicals are disposed of into any non canyon waste streams.

Table 3.1 Chemicals Expended at T-Plant (1983)[1]

HNO_3	871 l	TURCO Desealzit	1060 l
NaOH	2.8E+5 l	TURCO 4521	159 kg
$KMnO_4$	4.2E+3 l	TURCO 4502	512 kg
TURCO 4518	1452 kg	$NaNO_2$	2268 kg
TURCO 4512A	1136 l	Caustic Soda	408 kg

[1] Table 7-1 in the Safety Analysis Report for T-Plant, WHC-SD-C-SAR-007 REV 1, May 1993

TURCO 4518 has oxalic acid as the main ingredient (90%). Oxalic acid is not listed in 40 CFR 355, Appendix A as an extremely hazardous substance. TURCO 4512A has phosphoric acid as the main component (56%). This acid is not listed in 40 CFR 355, Appendix A as an extremely hazardous substance. TURCO Deseal-zit's main ingredients are dichloromethane (85%) and acetic acid (10%). These materials are not listed in 40 CFR 355, Appendix A as extremely hazardous substances. TURCO 4521 has ammonium oxalate as its main ingredient (80%) and this compound is not listed as an extremely hazardous substance in 40 CFR 355, Appendix A. TURCO 4502 has potassium hydroxide has its main ingredient (70%) and is not listed in 40 CFR 355, Appendix A as extremely hazardous substances.

The sodium stored in the "head end" presents a separate and unique hazard which is addressed from the perspective of storage. Processing or removal of the sodium is not considered.

Table 3.2 Listing of Facility and Total Activity and/or Released Activity

Facility	Isotopes of Interest	Total Facility Activity (Bq)	Activity (Bq) Released In Scenarios
221-T Exhaust[2]	^{239}Pu, ^{90}Sr, ^{90}Y	3.1 E+9 1.1 E+10 1.1 E+10	2.3 E+8 8.5 E+8 8.5 E+8
221-T, Tank 15-1	^{137}Cs,[1] ^{239}Pu,[2] ^{90}Sr,Y,[1] ^{99}Tc,[1] ^{129}I[1]	2.5 E+11 2.3 E+14 1.6 E+9 1.9 E+9 5.9 E+7	2.6 E+7 2.4 E+10 1.7 E+8 2 E+4 6.2 E+3
221-T, PWR Core 2	^{85}Kr[1]	4 E+12	4 E+12

1 SD-WM-PSH-002, Rev. 0, Hazard Level Classification for T-Plant, April 5, 1990

2 WHC-SD-CP-SAR-007, Rev. 1, Safety Analysis Report for T-Plant, April 14, 1993 (Limit for SNM is 2 grams/liter)

4.0 HAZARD CHARACTERIZATION

The screening process identified sodium in the "head end" of the T-Plant canyon, however there is no postulated scenario which could cause a release of it or its products of combustion beyond the facility boundary. There is a relatively large inventory of sodium hydroxide which will be analyzed. The radionuclide inventory consists primarily of the large and widely variable amounts of contamination and contaminated equipment in the plant. Exhaust ventilation filters for both 2706-T and 221-T are potential sources of concentrated activity. The packaged, contaminated equipment and their containers are another source of activity. 2706-T was not considered a hazard from the perspective that the impact of a stack release would not exceed the prescribed limits beyond the facility boundaries.

4.1 Plutonium

4.1.1 Inventory and Properties

Inventory of the plutonium that is involved in the postulated accidents is shown in Table 3.2. Resuspension factors are included in the calculation to determine the effective dose equivalent (EDE). The resuspension factors are different for the various scenarios and are provided in the FSAR. Plutonium's critical organ is the bone surface with the resultant dose factored into the EDE.

4.2 Cesium

4.2.1 Inventory and Properties

Inventory of the cesium that is involved in the postulated accidents is shown in Table 3.2. Resuspension factors are different for the various scenarios and are included in the calculation to determine the EDE. The resuspension factors are provided in the FSAR. Cesium's critical organ is the whole body with the resultant dose factored into the EDE.

4.3 Strontium

4.3.1 Inventory and Properties

Inventory of the strontium and yttrium that is involved in the postulated accidents is shown in Table 3.2. Resuspension factors are different for the various scenarios and are included in the calculation to determine the EDE. The resuspension factors are provided in the FSAR. Strontium's critical organ is the bone surface and the resultant dose factored into the EDE.

4.4 Sodium Hydroxide/Potassium Hydroxide

4.4.1 Inventory and Properties

Sodium hydroxide solution is a potentially hazardous material used in small quantities in most decontamination procedures. The average inventory is approximately 1724 kgs. An additional inventory of 512 kgs of TURCO 4502 may be stored in 214-T. Most of the sodium hydroxide inventory is in the first floor, 271-T AMU.

NaOH (caustic Soda) 50% solution and potassium hydroxide is corrosive to the skin and an eye irritant. Effects of inhalation of mists vary from mild irritation of the nose at 2 ppm (2 mg/m^3) to severe inflammation of the respiratory tract. NaOH solution possesses negligible fire hazard when exposed to heat or flame.

Table 4.1 Physical Properties of Sodium Hydroxide Solution

Molecular Weight	=	40.00
Specific Gravity	=	1.5
Melting Point	=	5-11°C
Boiling Point	=	140°C
Vapor Pressure	=	13 mm Hg @ 60°C

Sodium hydroxide has a low vapor pressure even at elevated temperatures and, therefore, has a low evaporation rate. The main concerns are a pressurized mist release and reactions with other chemicals that generate toxic gases.

Table 4.2 Exposure Limits for Sodium Hydroxide

TWA	2 ppm	(2.0 mg/m^3)
ERPG 1	2 ppm	(2 mg/m^3)
ERPG 2	40 ppm	(40 mg/m^3)
ERPG 3	100 ppm	(100 mg/m^3)
IDLH	250 ppm	(250 mg/m^3)

4.5 Bulk Sodium

4.5.1 Inventory and Properties

816 kgs of bulk sodium are stored in two stainless steel vessels in the head end portion of the 221-T Canyon. The volume of one is 94.6 l and the other 1893 l. Approximately 90.7 kgs of solidified sodium remains in the smaller tank and about 726 kgs in the larger tank.

Sodium is a reactive alkali metal with a very low melting point. It is a soft, low density metal easily cut with a knife. In an inert atmosphere freshly cut sodium has a pinkish, bright metallic luster. In air, the cut surface quickly forms a white or light grey coating of sodium oxide, hydroxide, and carbonate. Nitrogen, argon, and helium are inert to sodium and can be used as a cover gas in processes utilizing sodium.

Simple hydrocarbons such as mineral oil, kerosene, xylene, and toluene neither dissolve sodium nor react with it, and are used as media for sodium dispersions. Sodium can be stored in high boiling hydrocarbons such as mineral oil or kerosene to retard oxidation. Sodium is a good conductor of heat and electricity. It is thermally stable in dry, inert atmospheres such as nitrogen or argon and will not explode or detonate from heat or shock.

Table 4.3 Physical Properties of Sodium

Atomic Weight	= 22.99
Melting Point	= 97.8°C (208°F)
Boiling Point	= 881.4°C (1618°F)
Volume increase on melting	= 2.6%

Sodium melts to a silvery white, low-viscosity liquid resembling mercury. Because of its good thermal conductivity, even large volumes of sodium will melt or freeze as a unit. Liquid sodium burns in air with a yellow flame, giving off dense acrid white smoke that is predominately sodium monoxide (Na_2O). Some sodium peroxide (Na_2O_2) also forms, especially at higher temperatures and in the presence of excess oxygen. If moisture is present, the oxides are converted to sodium hydroxide.

Sodium causes severe burns of skin and eyes by reactive formation of sodium hydroxide. Contact with moist skin is especially hazardous, as severe burns result from both thermal and chemical effects. Fumes from sodium fires irritate the nose, throat and lungs if inhaled. Aside from burns, sodium is not known to cause any systemic or chronic effects.

Sodium metal has a low vapor pressure. Airborne sodium is the result of sodium burning and is sodium monoxide. The recommended exposure limit is 1.0 ppm or 2 mg/m^3, 8-hour time-weighted average (TWA). When moisture is present, sodium hydroxide will form and the exposure limits in Table 4.2 should be used.

Carbon dioxide gas shows little tendency to react with sodium at room temperature. At somewhat higher temperatures, sodium carbonate or sodium oxalate is formed. Carbon dioxide gas can support the combustion of sodium. Accordingly, neither CO_2 nor CO_2 powered fire extinguishers are used on sodium fires. Solid CO_2 (dry ice) can react explosively with sodium on contact.

Sodium is a powerful reducing agent. It reacts vigorously with water forming sodium hydroxide and hydrogen gas with release of considerable heat. Hydrogen usually ignites with explosive violence in the presence of air or oxygen. It is essential to avoid all air and water contact in sodium storage and handling.

Sodium will auto-ignite in air temperatures of approximately 120-125°C and above. Contact between sodium and halogenated hydrocarbons may cause an explosive reaction.

4.5.2 Conditions of Storage

The Containment Systems Test Facility was designed with the unique capability to spill controlled quantities of liquid sodium into the containment vessel for in depth testing of emergency air cleaning systems. Two stainless steel storage tanks, with electrical heaters, are in the crane cab way (third floor) to store the sodium. The volume of one is 94.6 l and the other 1893 l. Approximately 90.7 kgs of solidified sodium remains in the smaller tank and about 725.8 kgs in the larger tank. These two tanks are isolated by blanks in all connected piping, and electrical power to the heaters is disconnected. The sodium was allowed to solidify in the storage tanks, and they remain at ambient temperatures.

The two sodium storage tanks are enclosed in a sheet metal box 2.4 m by 2.4 m by 3.0 m tall, which could be filled with inert gas for fire suppression. The area in which the sodium is stored is a reinforced concrete structure with "baffled" openings into the "head end" canyon cell structure. This facility has been out of service since 1989. No cover gas for the sodium is currently used, and the piping for a nitrogen cover gas from a 11356 l liquid nitrogen storage dewar located outside the building has been disconnected. All water supply to the area is shut off, and power to the sodium heaters is disconnected at the transformer.

5.0 EVENT SCENARIOS

The T-Plant SAR identifies several scenarios that could breach the barriers that maintain control over each of the hazardous materials discussed in the previous sections. However, most of the scenarios do not have an impact beyond the facility. The paragraphs below describe scenarios that are appropriate for the facilities.

5.1 T-Plant Radioactive Material Release

5.1.1 T-Plant Filter Failure

5.1.1.1 Failure of Primary Barrier

The primary barrier to radioactive material release are the facility structure and ventilation system. Releases have been postulated and results calculated for failure of the T-Plant filter system from a truck running into the filter bank, rupturing the filters and a fire started by the vehicle fuel burning the filter medium with the ventilation not running. The radioactive material from Table 3.2 is released at ground level. The mechanical plus fire release fraction for this scenario was 0.07% (WHC-SD-CP-SAR-007, Rev 1).

5.1.1.2 Effects of Other Barriers

The facility has administrative barriers such as operators and their procedures which limit the release and reduce the likelihood of events like this happening.

5.1.2 Radioactive Liquid Release

5.1.2.1 Failure of Primary Barriers

Liquid radioactive waste is routinely pumped from tank 15-1 to a railroad tank car for transport to the tank farms. This scenario postulates that a misaligned line allows a spray to occur for the duration of the pumping. A total of 5.26 liters is released to the environment at ground level. The flow rate of the liquid is 0.027 l/minute. The rail car cut door is accidently left open during the pumping activity. The release inventory is shown in Table 3.2. A building wake of 4645 meters^2 was used. Conservative meteorological conditions of F stability and wind speed of 1 meter per second were used.

5.1.2.2 Effects of Other Barriers

The rail car cut ventilation is considered another barrier to the escape of radioactive material. The door must be closed for normal operations.

5.1.3 T-Plant Criticality

5.1.3.1 Failure of Primary Barrier

Primary barriers to this event occurring are the numerous samples taken of the liquids in the tanks and the requirement to limit the fissile material on a piece of equipment arriving for decontamination. Tank 15-1 in the canyon of 221-T is assumed to receive enough plutonium from tank 5-7 to initiate the excursion. Fission products are released through the filters and out the 291-T stack. High efficiency particulate air filters reduce the particulates but not the noble gasses. Table 5.1 shows the isotopes lost out the stack.

Table 5.1 Radioisotopes and Inventory Released as a Result of T-Plant Criticality[a]

ISOTOPE	ACTIVITY (Bq)	ISOTOPE	ACTIVITY (Bq)
^{83m}Kr	4.1E+12	^{133}I	5.9E+12
^{85m}Kr	2.6E+12	^{133m}Xe	8.1+10
^{85}Kr	3.0E+7	^{133}Xe	1.0E+10
^{87}Kr	1.6E+13	^{134}I	1.6E+14
^{88}Kr	8.5E+12	^{135}I	1.7E+13
^{89}Kr	4.8E+14	^{135m}Xe	1.2E+14
^{131}I	4.1E+11	^{135}Xe	1.5E+13

ISOTOPE	ACTIVITY (Bq)	ISOTOPE	ACTIVITY (Bq)
^{131m}Xe	3.7E+9	^{137}Xe	1.8E+15
^{132}I	4.4E+13	^{138}Xe	4.1E+14

[a] From Regulatory Guide 3.35, July 1979

5.1.3.2 Effects of Other Barriers

Administrative controls limit the type and quantity of fissile material which can be brought into T-Plant.

5.1.4 PWR Core II Fuel Assembly Damage

5.1.4.1 Failure of Primary Barrier

Primary barriers for release of radioactive material from these irradiated fuel rods is the fuel element cladding and the pool of water which surround the elements. In this scenario, it is assumed that a seismic event occurs which dislodges concrete blocks which fall into the pool, crushing one fuel assembly, releasing 4.0E12 Bq of ^{85}Kr to the canyon and to the environment through the stack. The particulates are captured by the water and HEPA filters of the ventilation system.

5.1.4.2 Effects of Other Barriers

The age of the irradiated fuel (1978) helps reduce the quantity of radioactive material available for release. The only postulated isotope released are the fission gasses and ^{85}Kr has a half-life long enough to remain.

5.2 Hazardous Material Release Scenarios

5.2.1 NaOH Pressurized Line Leak/Spray

A leak is postulated in a pipeline fitting, valve, or pump in the 211-T chemical tank farm during transfer of NaOH. The estimated source term of 23.6 milligrams/second from the equivalent of a 1.6E-1 cm diameter hole. This hole size results in the generation of the largest amount of respirable aerosols.

Using the Emergency Predictive Information Code (EPI), and F stability, 1 meter per second wind speed, the onsite (100 m) and site boundary concentrations for this release are less than ERPG-1 values and do not require further analysis.

5.2.2 Sodium Metal Explosion

The postulated release scenario is that moist air leaks into the storage container resulting in a buildup of hydrogen inside the tank. The hydrogen explodes breaching the primary barrier of the storage tank and dispersing the sodium hydroxide reaction product.

Eight hundred sixteen kgs of sodium are stored in the two stainless steel vessels. This storage facility is well ventilated from a ceiling exhaust and is constructed of thick reinforced concrete walls. Due to the large void space of the entire "head-end" structure, there is no postulated scenario which would destroy the building and release significant reaction products (sodium hydroxide) into the environment but since an explosion has occurred further discussion will occur.

5.3 Natural Emergencies

Seismic events, high winds/tornados, floods, ash/snow roof loading, and range fires are natural phenomena with potential emergency consequences. The SAR concludes that a flood is not credible since the facility is on the 200 Area plateau. Guidance for classifying other events is provided below based on the scenario results above and the general Hanford policy on events of this type.

5.3.1 Earthquake

Hanford Site facilities are exposed to the possibility of moderate earthquake damage (Zone 2) both from active seismic zones of western Washington and closer shocks originating in the seismic zone that includes Walla Walla. The T-Plant facility is not a seismically qualified structure and a seismic scenario is included in this section. The 221-T filter is assumed to be crushed. The activity released is shown in Table 3.2. The ventilation flow rate does not affect the release since the stack flattens the duct and since the fans draw the air through the HEPAs, no motive force remains. The fraction of material assumed to be in respirable form is assumed to be 0.01% for a mechanical release (DOE-STD-0013-93). The radioactive material is released at ground level. Conservative meteorological conditions with F Stability and a 1 meter/second wind speed were used.

5.3.2 High Winds/Tornado

Some damage is expected if high winds or a tornado strike the T-Plant complex, but the offsite impact is not expected to be significant. The survivability varies with building. For example, a tornado may topple the T-Plant stack but cause little damage to the ventilation system except as in the earthquake scenario. The buildings have experienced two wind storms in recent years with gust to 3.6E+5 m/second (1972) and 3.3E+5 m/second (1990) with no damage.

5.3.3 Range Fire

The Hanford Site is in a semiarid region with sagebrush and grasses growing between areas. Range fires periodically occur and can sweep over large regions before they are controlled. The summer months are historically the most likely time for a large fire to occur because of the combustible condition of the natural grasses.

The T-Plant complex would probably not be affected by a range fire since the ground near the buildings is devoid of vegetation. Furthermore, many of the buildings are concrete and, therefore, not particularly susceptible to a fire initiated from outside the building. As a precaution, a scenario with fire and the HEPA filters, similar to a truck accident and fire has been calculated.

5.3.4 Ash Fall

Table 5.3 below indicates the estimated ash depth deposited at the Hanford Site from past volcanic eruptions in the region. Although a heavy deposition could present health hazards to site workers due to respiration of ash, and water supply contamination, it is not expected that such an event would cause a significant release from the T-Plant facilities. There would probably be ample warning of an approaching large ash fall and the facility could be placed in a stable condition and steps taken to protect workers. Therefore, a release is not expected even if roof damage occurred.

Table 5.2 Estimated Ash Depth at Hanford from Major Eruptions

Volcano	Time	Depth of Ash	Equivalent Roof Loading Dry (psf)	Equivalent Roof Loading Wet (psf)
Glacier Peak	12,000 B.P.	0.025 m	6	8.4
Mt Mazama	6,000 B.P.	0.15 m	36	50
Mt. St. Helens	3,600 B.P.	0.025 m	6	8.4
Mt. St. Helens	1980	0.013 m	3	4.2

5.3.5 Flood

The Probable Maximum Flood (PMF), calculated by the Corps of Engineers, is based on the concurrence of the worst of several natural phenomena, including a record snowfall in the Columbia River watershed, no melting of this snow until late spring, then warm, heavy rain. This hypothetical flood would have a flow of 2.4 E9 l/hr and is estimated to be well below the elevation of T-Plant. No emergency declaration should be made.

5.4 Security Contingencies

DOE Order 5500.3A specifies that the facility hazards assessment shall consider the broad range of emergency events that could affect the facility. These events may result from hostile attack, terrorism, sabotage, or malevolent acts as well as the more traditional accidents and natural phenomena covered in the SAR. Closely related DOE Order 5630.3 requires a graded assessment of radiological and toxicological sabotage vulnerability. Events of this type are not within the scope of a SAR. The paragraphs below reflect the general Hanford emergency preparedness policy toward events of this type and the potential for onsite and offsite significant consequences.

5.4.1 Explosive Device

The presence of an explosive device in a low hazard facility such as T-Plant is classified as an emergency. Activation of the emergency response organization will assist in building evacuation and access control. Furthermore, activation of the emergency response organization when the device is found will speed the response if the device detonates. An explosive device which detonates near or on the railcar loading equipment when filling a railcar could if the railroad tunnel door was up require declaration of a SITE AREA Emergency.

5.4.2 Sabotage

Confirmed physical damage from sabotage which threatens facility integrity is classified as an emergency since the level of safety has been degraded and there could be additional damage that has not yet been discovered. Any release that occurs due to sabotage is classified based on the known or potential severity of the release.

5.4.3 Hostage Situation/Armed Intruder

A confirmed hostage situation, armed intruder, credible security threat, or ongoing security compromise involving physical attack on the building is classified as an emergency. The resources of the emergency response organization will be useful in controlling access to the area and identifying and assessing potential damage scenarios. Any release that occurs from the action of intruders should be classified based on the known or potential severity of the release.

5.4.4 Aircraft Crash

A light aircraft crash near the facility may not release any material whereas a direct hit from a commercial jet liner could cause extensive damage to the facility and a release. The classification of any aircraft crash near or at the facility is an emergency. The assumed accident is a plane crash into the contaminated HEPA filters with an accompanying fire. This accident is fully described in section 5.1.1.

6.0 EVENT CONSEQUENCES

6.1 Calculational Models

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

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

6.1.1 Radiological Releases

6.1.1.1 T-Plant Filter Release

The filter housing is run into and severed by a truck, the truck fuel ignites the truck and filter medium, the release is injected into the atmosphere at ground level. The HUDU calculated EDE at 100 meters (facility boundary) is calculated to be 19 rem and the EDE at the site boundary is 0.0001 sieverts (Sv). This event requires declaration of a SITE AREA Emergency since the EDE at the facility boundary is greater than 0.01 Sv.

6.1.1.2 Tank 15-1 Spray Release

Tank 15-1 contents are being pumped to a railroad tank car and a line misalignment causes the contents to be lost to the environment. The rail car cut door is left open which allows for a path to the environment. The loss rate is assumed to be 2.65 E-2 liters/minute. A total of 5.26 liters of waste are released. A building wake of 4645 meters^2 is assumed. Tank 15-1 released activity is shown in Table 3.2. The maximum EDE at 100 meters is calculated to be 0.037 Sv and 0.0014 Sv at the nearest offsite boundary. This accident requires that a SITE AREA Emergency be declared since the EDE at the facility boundary is greater than 0.01 Sv. If the pump releases the liquid at a constant rate, dividing the worst case effective dose equivalent by 200 minutes (SAR assumption), equates to 0.00019 Sv/minute of pump run. If the pumps runs for $\geq$5minutes the facility boundary effective dose equivalent is $\geq$0.001Sv.

6.1.1.3 T-Plant Criticality

Tank 15-1 in the canyon of 221-T is assumed to receive enough plutonium from tank 5-7 to initiate the excursion. Fission products and noble gasses are released through the filters and out the 60 meter high, 1.8 meter radius stack. The assumed stack flow rate is 16.99 $meters^3$ per second. Released activity is shown in Table 5.1. The maximum EDE at 100 meters is calculated to be 0.0003 Sv for A Stability and a 1 meter per second wind speed. The largest offsite boundary EDE is 0.00003 Sv for F Stability and 1 meter per second wind speed. This accident does not require that an emergency be declared but with events in progress an ALERT LEVEL Emergency shall be declared, since a criticality indicates a loss of facility operational control.

6.1.1.4 PWR Core 2 Fuel Assembly Damage

Fission products and noble gasses are released through the canyon and to the HEPA filters and out the 60 meter high, 1.8 meter radius stack. The assumed stack flow rate is 16.99 $meters^3$ per second. Released activity is shown in Table 3.2. The maximum EDE at 100 meters is calculated to be <0.00001 Sv for A Stability and a 1 meter per second wind speed. The largest offsite boundary EDE is <0.00001 Sv for F Stability and 1 meter per second wind speed. This accident does not require that an emergency be declared but with events in progress an ALERT LEVEL Emergency shall be declared.

6.2 Natural Emergencies

Seismic events, high winds/tornados, floods, ash/snow roof loading, and range fires are natural phenomena with potential emergency consequences. Guidance for classifying other events is provided below based on the scenario results above and the general Hanford policy on events of this type.

6.2.1 Earthquake

From section 5.3.1 scenario input, calculations were performed which show that the 100 meter EDE is 0.003 Sv and the nearest offsite boundary EDE is <0.00001 Sv. This event will require declaration of an ALERT LEVEL Emergency since the facility boundary EDE is ≥0.001Sv.

6.2.2 High Winds/Tornado

A graded precautionary approach is required for high winds at the T-Plant complex. An ALERT LEVEL Emergency should be declared if sustained winds exceed 4.0E+1 m/second, and damage from high winds is observed. The 4.0E+1 m/second wind speed is suggested for consistency with the Emergency Action Levels (EALs) at other Hanford facilities.

6.2.3 Range Fire

The Hanford Site is in a semiarid region with sagebrush and grasses growing between areas. Range fires periodically occur and can sweep over large regions before they are controlled. The summer months are historically the most likely time for a large fire to occur because of the combustible condition of the natural grasses.

The T-Plant complex would probably not be affected by a range fire since the ground near the buildings is devoid of vegetation. Furthermore, many of the buildings are concrete and, therefore, not particularly susceptible to a fire initiated from outside the building. As a precaution, it is required that an ALERT LEVEL Emergency be declared if a range fire or intra 200 West Area fire threatens the T-Plant hazardous material storage areas. The emergency declaration is based on the potential degradation of safety at the facility and the calculated section 6.1.1.1 Filter Release consequence.

6.2.4 Ash Fall

Table 5.3 indicates the estimated ash depth deposited at the Hanford Site from past volcanic eruptions in the region. Although a heavy deposition could present health hazards to site workers due to respiration of ash, and water supply contamination, it is not expected that such an event would cause a significant release from the T-Plant facilities. There would probably be ample warning of an approaching large ash fall and the facility could be placed in a stable condition and steps taken to protect workers. Therefore, a release is not expected even if roof damage occurred.

6.3 Security Contingencies

Security event consequences are discussed in the following sections.

6.3.1 Explosive Device

This event is considered to be similar to the in cell explosion. The presence of an explosive device in a hazardous facility such as T-Plant is classified as an ALERT LEVEL Emergency, if the device is located in proximity to hazardous material storage areas.

6.3.2 Sabotage

Confirmed physical damage from sabotage which threatens facility integrity is classified as an ALERT LEVEL Emergency since the level of safety has been degraded and there could be additional damage that has not yet been discovered.

6.3.3 Hostage Situation/Armed Intruder

A confirmed hostage situation, armed intruder, credible security threat, or ongoing security compromise involving physical attack on the building is classified as an ALERT LEVEL Emergency.

6.3.4 Aircraft Crash

The range of possible releases from an aircraft crash is quite large. A light aircraft crash near the facility may not release any material whereas a direct hit from a commercial jet liner could cause extensive damage to the facility and a large release. The classification of any aircraft crash near or at the facility is an ALERT LEVEL Emergency. In the unlikely event that a plane crashes into the T-Plant filter system and a fire occurs, a SITE AREA Emergency declaration is required due to the greater than 0.01 Sv EDE at the facility boundary.

6.4 Non-Radiological Hazardous Material Releases

The Emergency Prediction Information (EPI) Code, version 5.0, was used to calculate the non-radiological material concentrations at the onsite and offsite receptor locations.

6.4.1 Sodium Releases

It is assumed that moist air or water leaks into the storage container resulting in a buildup of hydrogen to an explosive concentration within the tank. An explosion occurs releasing the sodium hydroxide and an ALERT LEVEL Emergency should be declared since an event has occurred which involve an actual or potential substantial degradation of the level of safety of the facility with an increased potential for a release.

6.5 Receptor Locations

Facility Boundary Receptor:

The nearest receptor outside of the facility is considered to be 100 meters down wind.

Site Boundary Receptor:

The nearest receptor outside of the Site boundary is considered to be 13 kilometers in the west direction.

7.0 THE EMERGENCY PLANNING ZONE

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

7.1 The Minimum EPZ Radius

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

Radiological

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

Non-Radiological

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

Conclusion

All of the analyzed releases, were below the ESHE criteria at the default distance of the already declared 10 mile EPZ for the combined 200 Areas. The derived EPZ is 2 kilometers since the greatest accident consequence is a Site Area Emergency.

7.2 Tests of Reasonableness

1. Are the maximum distances to PAG/ERPG-level impacts for <u>most</u> of the analyzed accident scenarios equal to or less than the EPZ radius selected?

The EPZ bounds all analyzed accident scenarios, and includes the most severe events postulated.

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

The EPZ radius is large enough to include response activities on and immediately off of the Hanford Site.

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

Yes, the EPZ radius extends enough to support this effort.

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

The EPZ does not conform to natural and jurisdictional boundaries at this point in time. The geopolitical boundaries associated with all Hanford EPZs will be defined during FY 94 in conjunction with the State of Washington and the local county emergency management organizations.

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

This situation is the primary reason for extending the proposed EPZ beyond the range of the ESHE distances. The interim EPZ for the Waste Tank facilities was identified as 16.1 km in FY 92, and it has enhanced facility and site preparedness stature through additional planning and coordination.

8.0 EMERGENCY CLASSES, PROTECTIVE ACTIONS, AND EMERGENCY ACTION LEVELS

8.1 Emergency Classes

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

Table 8.1 Radiological Release Criteria

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

Table 8.2 Non-Radiological Release Criteria

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

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

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

ALERT

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

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

SITE AREA

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

GENERAL

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

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

8.2 Emergency Action Levels

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

9.0 MAINTENANCE/REVIEW OF THIS HAZARDS ASSESSMENT

The Manager of Hanford Hazards Assessment is responsible for ensuring that this Hazards Assessment is regularly reviewed and maintained current. The review requirement is specified in the Hanford Emergency Response Plan, DOE/RL-94-02, Section 4.0.

10.0 REFERENCES

ARHCO-2714, Criticality Safety Analysis Report, Storage of Plutonium in 224-T Building, 1973, Atlantic Richfield Hanford Company, Richland WA, 99352

ARHCO-1459, Design Criteria Modifications to 224-T Building for Plutonium Scrap and Liquid Storage, 1970, Atlantic Richfield Hanford Company, Richland WA, 99352

ARHCO-1929, General Criteria for Storage of Plutonium, 1969, Atlantic Richfield Hanford Company, Richland WA, 99352

Ames, R. R., 1990, Building Emergency Plan, 224-T Transuranic Storage and Assay Facility. WHC-IP-0263-224T, Westinghouse Hanford Company, Richland, Washington.

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

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

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

NRC, Assumptions used for Evaluating the Potential Radiological Consequences of Accidental Nuclear Criticality in a Plutonium Processing Plant of Fuel Fabrication Plant, Regulatory Guide 3.35, U. S. Nuclear Regulatory Commission, Washington, D.C. July, 1979.

Safety Analysis Reports Group, 1989, General Safety Assessment Document for Rockwell-Managed Nonreactor Nuclear Facilities. WHC-DS-LL-SAD-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington. (Formerly dated 6/80.)

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

WHC-SD-C-SAR-007, Rev 1, Safety Analysis Report for T-Plant, May 1993, Westinghouse Hanford Company, Richland, Washington

WHC-SD-WM-PSH-002, Rev 0, Hazard Level Classification for T-Plant, April 1990, Westinghouse Hanford Company, Richland, Washington

APPENDIX A: T-PLANT FACILITY INDEX OF EMERGENCY CONDITIONS

No. 1A
FACILITIES EMERGENCY EVENTS
(sheet 1 of 5)

RADIATION RELEASE

Initiating Condition	Emergency Action Level	Event Classification
A HEPA filter failure at 291-T	A confirmed or indicated HEPA filter failure with Dp loss	**ALERT LEVEL EMERGENCY**
HEPA filter release at 291-T	Confirmed failure and fire	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 1B
FACILITIES EMERGENCY EVENTS
(sheet 2 of 5)

RADIATION RELEASE

Initiating Condition	Emergency Action Level	Event Classification
A liquid spill occurs in the T-Plant railroad tunnel.	A liquid waste spray is observed or indicated and occurs for $\geq$5but $\leq$55 minutes with rail cut door open.	**ALERT LEVEL EMERGENCY**
A liquid spill occurs in the T-Plant railroad tunnel.	A liquid waste spray is observed or indicated and occurs for $\geq$55minutes with rail cut door open.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 1C
FACILITIES EMERGENCY EVENTS
(sheet 3 of 5)

RADIATION RELEASE

Initiating Condition	Emergency Action Level	Event Classification
PWR Core 2 fuel element damage	Canyon CAM alarms.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 1D
FACILITIES EMERGENCY EVENTS
(sheet 4 of 5)

CRITICALITY

Initiating Condition	Emergency Action Level	Event Classification
Too much plutonium accumulates in tank 15-1.	A criticality has occurred in the T-Plant AND Canyon CAMs alarm	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 1E
FACILITIES EMERGENCY EVENTS
(sheet 5 of 5)

HAZARDOUS MATERIAL RELEASE

Initiating Condition	Emergency Action Level	Event Classification
An explosion has occurred in the Sodium Storage area of T-Plant.	An explosion has occurred in head end of the 221-T facility.	ALERT LEVEL EMERGENCY

Note: No Site Area or General Emergency classes identified.

No. 2A
NATURAL EMERGENCIES
(sheet 1 of 3)

EARTHQUAKE

Initiating Condition	Emergency Action Level	Event Classification
Earthquake occurs in the 200 Areas.	Earthquake is felt by T-Plant personnel and confirmed by Hanford Meteorological Station.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 2B
NATURAL EMERGENCIES
(sheet 2 of 3)

HIGH WINDS/TORNADO

Initiating Condition	Emergency Action Level	Event Classification
High wind or tornado occurs in the 200 Areas.	Sustained high winds (>4.0E5 m/s) or tornado causes damage to structures at T-Plant.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 2C
NATURAL EMERGENCIES
(sheet 3 of 3)

RANGE FIRE

Initiating Condition	Emergency Action Level	Event Classification
A range fire occurs in the 200 West Area.	A range fire burns within the T-Plant facility boundary.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 3A
SECURITY CONTINGENCIES
(sheet 1 of 5)

EXPLOSIVE DEVICE

Initiating Condition	Emergency Action Level	Event Classification
Explosive device	A confirmed explosive device is located within a T-Plant facility.	**ALERT LEVEL EMERGENCY**
Explosive device	An explosion has occurred in the rail cut loadout facility while loading a railcar.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 3B
SECURITY CONTINGENCIES
(sheet 2 of 5)

SABOTAGE

Initiating Condition	Emergency Action Level	Event Classification
Confirmed sabotage.	Confirmed damage to a T-Plant facility	**ALERT LEVEL EMERGENCY**
Confirmed sabotage..	Damage to the rail cut loadout facility while pumping to the rail car.	**SITE AREA EMERGENCY**

Note: No General Emergency class identified.

No. 3C
SECURITY CONTINGENCIES
(sheet 3 of 5)

HOSTAGE SITUATION

Initiating Condition	Emergency Action Level	Event Classification
Hostage situation.	A confirmed hostage situation is occurring within a T-Plant facility.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.

No. 3D
SECURITY CONTINGENCIES
(sheet 4 of 5)

ARMED INTRUDER

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

Note: No Site Area or General Emergency classes identified.

No. 3E
SECURITY CONTINGENCIES
(sheet 5 of 5)

AIRCRAFT CRASH

Initiating Condition	Emergency Action Level	Event Classification
An aircraft crash has occurred at or near the T-Plant.	An aircraft crash has occurred AND has or is likely to have an adverse affect on the facility's safety, or has or is likely to release radioactive/hazardous material to the environment.	**ALERT LEVEL EMERGENCY**

Note: No Site Area or General Emergency classes identified.