ENGINEERING CHANGE NOTICE

Page 1 of 2

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ECN

2. ECN Category (mark one) Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. R.T. Stordeur, LEF, L6-04, 372- 3452	4. USQ Required? ☐ Yes ☒ No	5. Date 9/26/96
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13a. Description of Change Changes include the incorporation of the only outstanding ECN (626165) against the affected document. Other changes were related primarily to physical alterations that have occurred at the facility or to revisions of control documentation e.g.: the switch from steam to electric heat; elimination of the need to maintain the stack carbon adsorbers; the removal of heat sensors from 340-A, imminent plans to cease liquid waste storage operations at 340 prior to 1999; and the discontinuation of safety class 1, 2, 3 divisions in WHC-CM-4-46. Appendix A was deleted as obsolete and no longer relevant; there were no changes to appendices B-D; and Appendix E was updated and renamed "A". Other clarifications were incorporated based upon RL input related to the review of prior drafts and the preparation of the associated Safety Evaluation Report.			
14a. Justification (mark one) Criteria Change ☐ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☒ Facilitate Const ☐ Const. Error/Omission ☐ Design Error/Omission ☐			
14b. Justification Details Annual reviews and any needed updates are required by WHC-CM-4-46, "Safety Analysis Manual", Chapter 8.0, Section 3.1, Paragraph 5. The existence of outstanding ECN #626165 is itself sufficient cause for this update, however there are a number of other revisions needed to conform with Control Manual evolution, and changes to the plant configuration and mission (see examples in block 13a).			
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340 Waste Handling Facility Interim Safety Basis

R.T. Stordeur

Westinghouse Hanford Company, Richland, WA 99352

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Key Words: 340 Facility, safety analysis, preliminary hazards analysis, interim safety basis, radioactive liquid waste system, storage tanks, 300 Area, operational safety requirements, risk assessment, USQ process.

Abstract: This document presents an interim safety basis for the 340 Waste Handling Facility classifying the 340 Facility as a Hazard Category 3 facility. The hazard analysis quantifies the operating safety envelop for this facility and demonstrates that the facility can be operated without a significant threat to onsite or offsite people.

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James Bishop 10-4-96
Release Approval Date

Approved for Public Release

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FEDERAL SERVICES OF HANFORD

Manual Document Change**MDC INITIATOR: COMPLETE BLOCKS 1-7**

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300 Area Liquid Effluent Facilities	R. T. Stordeur	PHONE	372-3452
		TODAY'S DATE	10/01/96

7. PROPOSED CHANGE

This manual/procedure was found acceptable for incorporation and implementation by Rust Federal Services Hanford (RFSH) with the following changes:

- 1) All references to Westinghouse Hanford Co. (WHC) shall be considered as RFSH or in the broader sense Fluor Daniel Hanford (FDH) or the applicable FDH team company.
- 2) All references to WHC level II or level III manuals shall be considered as references to the applicable FDH team replacement manual.

These changes will be incorporated into this manual during the next planned review/revision which must occur not later than October 1, 1997.

RESPONSIBLE ORGANIZATION: COMPLETE BLOCKS 8-10**8. RESPONSIBLE ORGANIZATION DISPOSITION**

300 Area Liquid Effluent Facilities

9. DISPOSITIONED BY	10. DATE
L. W. Roberts <i>LW Roberts</i>	10/1/96

**340 WASTE HANDLING FACILITY INTERIM
SAFETY BASIS**

WHC-SD-WM-ISB-003

Rev. 1

September 1996

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LIST OF TERMS

ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
CSER	criticality safety evaluation report
DOE	U.S. Department of Energy
EDE	effective dose equivalent
ERPG	Emergency Response Planning Guideline
FGE	fissile gram equivalent
FSAR	final safety analysis report
HSRCM	Hanford Site Radiological Control Manual
HEPA	high-efficiency particulate air (filter)
HPT	health physics technician
IOSR	interim operational safety requirements
ISB	interim safety basis
PHA	preliminary hazards analysis
Pacific Northwest	Pacific Northwest National Laboratory
QA	quality assurance
RL	Richland Operations Office (DOE)
RLW	radioactive liquid waste
RLWS	radioactive liquid waste system
RPS	retention process sewer
RWP	radiation work permit
SSC	structures, systems, and components
TEDF	Treated Effluent Disposal Facility
TQ	threshold quantities
TQ _m	threshold quantities modified
TRU	transuranic
USQ	unreviewed safety question
WHC	Westinghouse Hanford Company

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1.0 INTRODUCTION AND SUMMARY

1.1 PURPOSE

This document establishes the interim safety basis (ISB) for the 340 Waste Handling Facility (340 Facility). An ISB is a documented safety basis that provides a justification for the continued operation of the facility until an upgraded final safety analysis report (FSAR) is prepared that complies with U.S. Department of Energy (DOE) Order 5480.23, *Nuclear Safety Analysis Reports*. The ISB for the 340 Facility documents the current design and operation of the facility. Due to the limited remaining active life for the core of the 340 complex (see sections 1.3 and 1.4), this ISB (now Rev. 1) will continue to serve in place of an upgraded FSAR, per provisions in WHC-CM-4-46, Chapter 2.0.

The 340 Facility ISB (ISB-003) is based on a facility walkdown and review of the design and operation of the facility, as described in the existing safety documentation. The safety documents reviewed, to develop the initial Rev. 0 and this Rev 1 of ISB-003, included the following:

- OSD-SW-153-00001, *Operating Specification Document for the 340 Waste Handling Facility* (WHC 1990) [Canceled]
- OSR-SW-152-00003, *Operating Limits for the 340 Waste Handling Facility* (WHC 1989) [Canceled]
- WHC-SD-RE-SAP-013, *Safety Analysis Report for Packaging, Railroad Liquid Waste Tank Cars* (Mercado 1993)
- WHC-SD-WM-TM-001, *Safety Assessment Document for the 340 Waste Handling Facility* (Berneski 1994) [Canceled]
- WHC-SD-WM-SEL-016, *340 Facility Safety Equipment List* (Berneski 1992; and Rev 2, Vogel 1994) [Superseded]
- WHC-SD-WM-FHA-011, Rev. 0, *340 Complex Fire Hazard Analysis*, (Roberts, 1995).
- WHC-SD-SQA-CSA-20379, Rev. 1, *CSER 94-012: Criticality Safety Evaluation Report for 340 Building* (Miller, 1996)

The safety assessment document for the 340 Facility, WHC-SD-WM-TM-001, has been determined to be outdated in its content. The facility description and hazard analysis applicable to the current facility status are addressed in ISB-003. WHC-SD-WM-ISB-003 supersedes WHC-SD-WM-TM-001 and the operational safety requirements document, OSR-SW-152-00003, for the 340 Facility.

The 340 Facility will comply with all applicable state and federal statutes, DOE Orders, rules, and regulations which establish safety constraints on the 340 Facility. The 340 Facility will comply with these regulations to ensure that all activities conducted at the facility proceed in a safe manner. Appendix A, Table A-1, contains a list of the applicable controls and safety requirements cross-referenced to the applicable DOE Orders, WHC Control Manuals, and 340 Facility Implementing Documentation.

1.2 BACKGROUND

The 340 Facility (Figures 1-1 and 1-2) is located in the 300 Area of the Hanford Site and provides the capability for receipt, temporary storage, and shipment of radioactive and mixed liquid wastes via the radioactive liquid waste system (RLWS). The RLWS is an underground piping system through which radioactive and mixed liquid wastes gravity drain from Pacific Northwest National Laboratory (Pacific Northwest) buildings into the 340 Building Vault Tanks. Pacific Northwest generates a majority of the radioactive and mixed liquid wastes in the 300 Area; however, infrequent transfers from Westinghouse Hanford Company (WHC) facilities also occur. As a result of operating and maintaining this system, some radioactive/mixed solid waste is generated during maintenance and repair of the facilities. The solid waste is packaged and temporarily stored before shipment to Solid Waste Disposal. The 340 Facility also accepts radioactive solid waste from other generators. The 340 Facility does not routinely handle solid transuranic (TRU) wastes and does not receive or store TRU waste from other generators.

The 340 Complex also manages the potentially radioactive, nonhazardous retention process sewer (RPS) liquid waste stream. The 307 Basins (Figure 1-1) serve as a holding/monitoring point for the RPS liquid which discharges to the Treated Effluent Disposal Facility located north of the 300 Area. Use of the process trenches for disposal of waste water has been discontinued. Building diverters in Pacific Northwest laboratories monitor the RPS, and in the event that the RPS does become radioactively contaminated, the building diverters shift the building discharges to the RLWS. The RPS basins are periodically sampled before discharge and are, as appropriate, drained to the process sewer or pumped to the RLWS.

The 307 Basins were evaluated separately as part of the RPS (Berneski 1995) which determined that this system falls below the threshold for consideration under the requirements of DOE Order 5480.23 (less than a Hazard Category 3 facility as defined in DOE-STD-1027, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*). This evaluation for this nonnuclear process meets the requirements of DOE Order 5481.1B, *Safety Analysis and Review System* and has been issued as a supporting document (Berneski 1995).

1.3 FACILITY STATUS

The 340 Facility continues its mission to provide temporary storage for radioactive and mixed liquid waste and serve as a staging area for low-level radioactive and mixed solid waste. Planning is currently underway to deactivate those portions of the 340 Facility associated with radioactive and mixed liquid waste storage (WHC 1996b). The 340 Facility is not a routine generator of solid TRU waste and does not require a facility-specific TRU waste certification plan. The facility does generate low-level waste and has an approved waste profile (per WHC 1995b). The 340 Facility no longer provides decontamination services to other facilities. Flammable quantities of liquids are not allowed in the RLWS, which eliminates the potential for a fire in the 340-A Building and the Vault Tanks. Rags containing solvents, oil, combustibles or flammables are collected in a drum located outside of the 340 Building.

1.4 FUTURE ACTIVITIES

Future projects that modify the 340 Facility will have a preliminary "safety analysis" completed before start-of-construction to document changes to the Facility Hazard Category and dose consequences from postulated accidents. This will ensure that the proposed modifications comply with current safety requirements and safety-related design criteria. Current plans call for the cessation of operations at 340 in the near future. Therefore, it is anticipated that no upgrade projects will be pursued, other than minor actions deemed necessary or prudent to place the facility systems and/or areas in a safe and stable condition such that cost effective surveillance and maintenance programs will prevent any unacceptable risk to the public or the environment until the facility can be ultimately dispositioned (WHC 1996b).

1.5 CONFIGURATION MANAGEMENT

The WHC configuration management program (WHC-CM-6-1, *Standard Engineering Practices*) addresses design changes and controls, with guidelines that cover changes to the facility documents (WHC-IP-1026, *Engineering Practices Guidelines*, WHC 1994a). The facility's cognizant engineers are responsible for identifying any additional documents, drawings, instructions, or procedures that are affected by a facility change. The documents requiring changes may include operating procedures, conduct of operations manual, and maintenance procedures. These changes require review and approval by Quality Assurance, Criticality safety, Environmental, and independent safety organizations as appropriate.

ISB-003 provides information relating to control of hazards at the 340 Facility (including design, engineering analysis, and administrative) from which the conclusion is made that current 340 Facility activities can be conducted safely. Changes to these descriptions will be updated at least annually via the engineering change procedure specified in WHC-CM-1-3, *Management Requirements and Procedures*. Also, WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, requires an annual update for safety analysis documentation.

1.6 SUMMARY OF SAFETY ANALYSIS AND SUPPORTING INFORMATION

The nature of the operations performed and the materials handled in this facility present potentials for nuclear accidents (e.g., exposure to direct radiation and radioactive contamination spread), as well as accidents of a more conventional nature (e.g., industrial accidents). Operation of the 340 Facility is managed as part of the WHC Liquid Effluent Services Department (300 Area Facility Function) within the Projects and Site Services Division.

The hazard analysis presented in ISB-003 establishes the 340 Facility Hazard Category as follows:

- RLWS Storage - Hazard Category 3, 340 Facility Vault Tanks and 340-A Building Tanks.
- Solid Waste Storage - Hazard Category 3, 340 Facility Decontamination Area and the 340-B Building.

The maximum radionuclide inventory found in the dose-consequence calculations and the guidelines of DOE-STD-1027-92 were used to determine the hazard category.

The 340 Facility inventory consists primarily of liquid and solid waste containing mixed fission products and other radionuclides. To remain classified as an isolated facility, per WHC-CM-4-29, *Nuclear Criticality Safety Manual*, the 340 Facility must maintain <177 fissile grams equivalent (FGE) of fissionable material. Administrative controls for inventory have been established through WHC-CM-4-29 and the 340 CSER (Miller, 1996).

The 340 Facility does not contain Safety Class or Safety Significant structures, systems, and components (SSC), per WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Chapter 9.0.

The hazards associated with the 340 Facility have been analyzed in a preliminary hazards analysis (PHA) format in Section 3.0. Annual frequency and severity categories are presented with each hazard. The principle types of hazards considered are industrial, high radiation, radiological contamination, and natural disaster. The bounding hazards were further evaluated for consequence and risk acceptance.

The worst-case hazards that presented vulnerabilities in design or operation were identified as the spray leak in the 340-B East and the solid waste fire in the 340-B West Building. As a result of the changing concentration and distribution of isotopes in the 340 Facility RLWS, sufficient inventory could allow an unmitigated spray release to exceed onsite/offsite dose limits or Hazard Category 2 thresholds. The RLWS inventory was simplified into curies of beta/gamma and alpha emitters. A worst-case beta/gamma inventory of 100% ^{154}Eu is assumed in a conservative approach because it has the highest onsite rem/Ci value. Similarly, ^{239}Pu has one of the highest onsite rem/Ci values and is assumed to be a worst-case alpha inventory. The tables in Section 3.0 assume a worst-case beta/gamma and alpha inventory of ^{90}Sr (^{90}Sr is more conservative for hazard category calculations than ^{154}Eu) and ^{239}Pu , respectively, for hazard category calculations. The calculated releases for the spray-leak, worst-case accident are within the risk-acceptance guidelines. The dose consequences are below the Safety Class and Safety Significant criteria. Operational restrictions of 66 Ci total alpha and 39 kCi total beta/gamma have been established for the vault tank to be pumped into the railroad tank car, based on the accident scenario and the inventory used in the dose calculations.

Similarly, an unmitigated solid waste fire in the 340-B West Building could exceed onsite/offsite dose limits or Hazard Category 2 thresholds with sufficient inventory. A total curie inventory of 10 Ci beta/gamma and 1.5 Ci alpha were used in the dose calculations in Section 3.0. Once again, ^{154}Eu and ^{239}Pu were used as worst-case beta/gamma and alpha inventories for the dose calculations, and ^{90}Sr and ^{239}Pu were used as the worst-case inventories for the hazard category calculations. The calculated releases for this worst-case accident are within the risk-acceptance guidelines. The dose consequences are below the Safety Class and Safety Significant criteria. Operational restrictions of 1.5 Ci total alpha and 10 Ci beta/gamma have been established for the solid waste based on the inventory used in the dose calculations.

1.7 CONCLUSIONS

The analysis in this document establishes that the 340 Facility is adequately designed and controlled to operate without undue risk to the health and safety of the onsite worker, the public, and the environment. A PHA (Section 3.0) identifies bounding hazards for further evaluation. The accident dose consequences show that possible releases, as a result of a RLWS spray leak in the 340-B East Building and a solid waste fire in the 340-B West Building, are below risk-acceptance guidelines based on the maximum inventories established herein. Operational restrictions in Section 3.0 were established to ensure safe operation. These controls identify an operating envelope in which the 340 Facility's interim safety is based.

In accordance with DOE-STD-1027-92, the 340 Facility RLWS, and Solid Waste Storage have been determined to be Hazard Category 3. Therefore, by providing a safety analysis based on the bounding source terms and the operations and design of the facility, it can be concluded that ISB-003 adequately defines the safe operating envelope. The safety analyses summarized in this document define the authorization basis for performing unreviewed safety question (USQ) screenings and evaluations in accordance with WHC procedures and DOE Order 5480.21, *Unreviewed Safety Questions*.

The conduct of operations for the 340 Facility, with respect to the institutional and safety controls, have been evaluated in this document. This evaluation compares facility-specific procedures to the WHC control manuals that implement the institutional and safety controls established by DOE Orders. Since ISB Rev. 0 was issued, the 340 procedures and administrative control documents have been upgraded to comply with the revisions (see Appendix A). Based on the results of the comparative evaluation, it can be concluded that the existing facility procedures adequately implement the WHC control manuals and have adequately addressed the 340 Facility conduct of operations.

Figure 1-1. 340 Waste Handling Complex Site Plan.

Figure 1-2. Aerial View of 340 Complex

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2.0 FACILITY DESCRIPTION

2.1 GENERAL

The 340 Facility supports Pacific Northwest operations through the receipt, storage, and shipment of radioactive liquid wastes generated during laboratory operations. The 340 Facility also occasionally receives liquid waste from WHC facilities in the 300 Area. Solid waste stored in the 340-B Building Storage Area comes from 340 Facility operations and maintenance activities. Other WHC 300 Area solid waste generators occasionally use the 340 Facility as a staging area for solid radioactive waste transfers.

The 340 Facility¹ consists of the following five buildings:

- 340 — control room, decontamination area, mechanical equipment room, change rooms, truck lock area, and an operator's office
- 340-A — above ground auxiliary RLWS tank storage
- 340-B East — railroad car loading station
- 340-B West — radioactive solid waste storage area (340-B East and 340-B West are one building)
- MO-036 — office trailer
- MO-741 — health physics technician (HPT) office and survey station.

The 300 Area RLWS, consisting of encased underground piping and ancillary equipment, connects the 340 Facility to individual Pacific Northwest buildings. The RLWS accepts radioactive liquids and mixed waste from the Pacific Northwest buildings. These liquids are gravity drained into the tanks within the 340 Building Vault. Transfers, if any, to the 340-A tanks require pumping. All 340 tanks (vault and above ground) and interconnecting piping have recently undergone and satisfactorily completed containment integrity checks (WHC 1996a).

2.2 PROCESS/OPERATION

The 340 Facility manages the RLWS. Radioactive waste is received via underground piping that connects the 324, 325, 326, 327, and 329 Buildings to the 340 Vault Tanks, or is transported to the facility in containers for addition to the 340 Vault Tanks. Containerized waste receipts outside the RLWS system enter the vault tanks either via the sump in the 340 decontamination area (see 2.3.1), or the drain (or pump TP-7) in the 340-B load-out facility (2.3.3). Recent examples of sources for containerized deliveries are lysimeter wastes and the 309 facility decon solutions. "Containers" may consist of anything from small carboys and 55-gallon drums to 5000 gallon tanker trucks.

¹As differentiated from the 340 "Complex", which includes the 307 basins and the RPS connecting system.

The RLWS equipment is constructed of stainless steel pipe and tanks. Buried steel pipe is encased in fiberglass-reinforced plastic pipe. Each section of the RLWS passes through a concrete valve box, which allows for the isolation of the flow. These valve boxes are equipped with a sump, and sump leak detector.

The facility accumulates and stores waste in two 57 kL (15,000 gal) below ground tanks. One tank is always online to receive waste, which allows the other tank to be isolated for transfer. The tanks, known as TK-1 and TK-2, are equipped with mechanical paddle agitators for mixing and centrifugal pumps for waste transfer. The liquid level in the tanks is recorded using a bubbler-type, liquid-level indicator. Each tank has two liquid-level alarm points: influent and high level. Should the tanks exceed the high-level point, they are equipped with an automatic function that transfers the contents of either tank to auxiliary storage, the six 30 kL (8,000 gal) above ground storage tanks located in the 340-A Building. In addition, TK-1 and TK-2 are connected by an overflow line. Should the transfer pump in one tank fail, the contents will overflow into the other tank.

Before transferring waste out of the 340 Facility, Operations schedules a rail tanker for delivery to the 340-B East Building. The 340-B East Building is a pre-engineered metal building with a high roll-up door and a rail spur leading into the east side of the building. The building is designed to handle the 76 kL rail tankers used on the Hanford Site. To prepare waste for shipment, the transfer tank is isolated from incoming waste and sampled. The tank contents are agitated to homogenize the waste before samples are taken. The samples are sent to a laboratory for analysis. The sample results dictate how much waste may be safely loaded into a rail tanker and shipped to the 200 Area.

A rail tanker is then received into the east side of the 340-B Building, which has its own ventilation system. The tanker is dose rated and surveyed for radioactive contamination and, if it's acceptable, the tanker is connected to the RLWS. Although valves in the 340-A and 340-B Buildings are manually operated, much of the loadout operation — position vault valves, pump actions, and liquid level indication alarms — takes place remotely in the 340 Building control room. The rail tanker is loaded and shipped to the 204-AR unloading facility located in the 200 East Area for ultimate transfer to the double-shell tanks.

Radioactive and mixed solid wastes are generated in the 340 Facility during the performance of routine operations, maintenance, and decontamination activities. Waste generated at the facility are typically low-dose rate waste, and are classified as low-level waste. The majority of the waste is packaged in 208 L (55-gal) drums and transported by truck to the 200 Area for burial or storage.

Internal waste transfers are done from the 340 Building control panel. Many of the transfers are automatic functions eliminating the need to establish valve line ups. Waste can be transferred between TK-1 and TK-2, from TK-1 or TK-2 to above ground auxiliary storage, and from above ground storage to TK-1 or TK-2.

2.3 BUILDINGS

2.3.1 340 Building

The 340 Building is an above ground structure housing the 340 Facility operator office, change rooms, control room, equipment decontamination room with a sample hood, mechanical equipment room, and truck lock. Below ground, the 340 Vault contains two RLWS 57 kL (15,000 gal) tanks and a valve pit containing valves and piping partitioned off from the main vault. The above grade structure is steel and sheet metal attached to a steel frame mounted on a concrete foundation.

The 340 Building is provided with a ventilation supply system (including evaporative cooling and electric heating), and an exhaust system that serves all of the rooms except the control and mechanical equipment rooms. The exhaust system consists of two-stage high-efficiency particulate air (HEPA) filters, exhaust fan, and a stack that is located above the rest rooms.

The decontamination area contains a radioactive liquid waste (RLW) sample hood and a large open work area in the room for decontamination. A steel grating over a shallow concrete trough services the open work area. The trough drains into a sump in the corner of the bay. Wash solutions used for decontamination and water rinse are pumped from the sump directly to a vault tank.

The control room and a cabinet located next to the stack contain effluent monitoring and control instrumentation for the RLWS loadout system, valve controls, the main electrical control panel, and dryer for the compressed air system. The control room has heating and cooling capabilities and is accessed only through an outside door.

The small mechanical equipment room south of the control room contains instrument air compressors for the bubbler system, air operated valves, and vacuum pumps for the stack monitors.

The 340 Building Vault walls are constructed of concrete, with concrete shielded cover blocks and access holes. A hatch is provided in the roof allowing entry for inspection and maintenance. The valve pit, accessible through a separate hatch, is located next to the vault and contains valves, piping and a sample/backup pump. Hatches to the vault and valve pit have been covered with locked penthouses. The 340 Building Vault and vault tanks are serviced by a common exhaust system, which discharges through a stage of dust stop filters, two-stage HEPA filters, and two exhaust fans located just east of the vault. The capability exists for the addition of activated charcoal adsorbent into the exhaust treatment train. The charcoal filters were used in the past to help control potential Iodine-131 releases associated with activities in the 327 Postirradiation Testing Laboratory.

2.3.2 340-A Building

The 340-A Building is constructed of steel panels attached to a steel frame mounted on a concrete foundation. The floor is set below grade level. The floor and lower portions of the walls are made of concrete. The floor contains a dry sump, which drains back to the 340 Building Vault Tanks. Six

30 kL (8,000 gal) stainless steel tanks are housed in the building to provide reserve capacity for RLW. There is no building ventilation and the tanks are ventilated through the vault ventilation system.

2.3.3 340-B Building

The east side of the 340-B Building houses a railroad car receiving and loadout station. The west side of the building has a 90-day solid mixed waste pad, and an area for radioactive solid waste, contained in steel drums and/or plywood or metal boxes. Other nonwaste items are also stored in the west side of 340-B Building. This building is constructed of steel panels mounted on a concrete foundation and is divided down the center by a concrete shielding wall extending out and around the south end of the building toward the east.

The railroad car loading station is in the east side of the building. The sump is located between the railroad tracks and drains to the 340 Building Vault Tanks. Flexible vent and fill lines are provided that are coupled with the railroad car. Water flushing equipment is provided to clean the exterior of the railroad cars. The sump drain line valve is interlocked with the liquid waste transfer pumps to prevent inadvertent pressurization of the drain line and back filling of the sump.

The east side of the 340-B Building is serviced by a ventilation system (located in the west side of the building) consisting of a HEPA filter, vent fan, and stack. This ventilation equipment is primarily operated when a railroad car is in the loading station and connections are being made or broken, or the loading operation is in progress. The west side of the building does not have a supply or exhaust ventilation system. Electric ceiling heaters are used for heating when required.

2.3.4 MO-036 Building

The MO-036 building is a double-wide trailer inside the 340 Facility fencing west of the 340-B building. This trailer provides offices for engineering and operations personnel.

2.3.5 MO-741 Building

The MO-741 building is a small single-room trailer south of MO-036. This trailer provides an office for Radiological Control personnel, and contains two personnel contamination monitors (PCM-1B).

2.4 RADIONUCLIDE AND HAZARDOUS MATERIAL INVENTORIES

The 340 Facility does not routinely handle or store hazardous chemicals within the buildings. However, hazardous material is present in the radioactive liquid waste. A data base developed over a recent 5-year period — 1989 through 1993 — for the 340 Facility recorded radionuclide and hazardous material concentrations for tank waste liquids before the waste was shipped from the 340 Facility via rail tank car to the 204-AR Unloading Facility in the 200 East Area. The data has been entered on a spreadsheet and the maximum value for each constituent was used. The radionuclide source term concentrations are shown in Table 2-1. Shipments made since this 5-year waste

summary was first prepared for the development of Rev. 0, have not exceeded Table 2-1 in terms of the maximum values depicted. These values are still considered valid for this Rev 1; and therefore continue to serve the purpose of demonstrating the conservatism of the bounding source term. The hazardous material source term is presented in Table 2-2.

2.4.1 340 Vault

The bounding source term for the 340 Building Vault Tanks assumes the sending tank contains its maximum 57 kL volume of a worst-case inventory. Because the RLW inventory is dependent on the work in Pacific Northwest laboratories, radionuclide concentrations may change. The worst-case inventory has been established based on the maximum inventory recorded in the past (Table 2-1). These historical values were increased to account for possible excursions, and these totals are shown in Table 2-3. Therefore, the facility inventory shown in Table 2-3 defines the bounding source term for liquid waste collected in a vault tank for transfer into a rail car. This bounding source term has been simplified to define total beta/gamma curies and total alpha curies in a full vault tank. The isotopic break-out depicted in Table 2-1 serves as the basis for substituting appropriate and realistic, worst-case nuclides for alpha or beta/gamma totals into the particular release scenarios and dose models used in various section 3.0 evaluations.

2.4.2 340 Building

The 340 Building inventory consists of radioactive and mixed solid waste and radioactive liquid waste in the decontamination area. The decontamination area in the 340 Building is a satellite accumulation area for solid waste, which is moved to the storage pad in the 340-B West Building. The sample sink and hood allow for processing samples from the vault tanks. Drains from the sample sink and hood return liquid to the sump. Decontamination solution drains through floor grating to trenches and then to the sump. The sump has a pump that transfers liquid waste back to the vault tanks.

2.4.3 340-A Building

The six cross-connected tanks in the 340-A Building are not currently used for waste storage. A heel of sludge exists in the portion of the tank below the piping connection to the tanks. An accumulation of fissile material (34 to 46 g) is estimated to be in the sludge. This range reflects both: 1) the results of grab samples of sludge; and, 2) an estimate based upon process knowledge of the insolubility of plutonium and the amounts of plutonium that passed through the tanks when they were in continuous use. Water has been pumped into the tanks and the samples taken to characterize the sludge indicate that the heel cannot be removed by filling and draining tank and will not contribute to the total fissile inventory during an accident scenario.

2.4.4 340-B Building

The west side of the 340-B Building contains solid radioactive and mixed waste storage areas separated from the loadout facility by a 30 cm (12 in.) thick concrete shield wall. Waste from the 340 Facility is collected and packaged where it occurs, then moved to the 340-B West Building for storage and shipment. Shipping records for solid waste generated in the 340 Facility

during the years 1989 through 1993 show that the maximum 208-L (55-gal) drum contained 3.08×10^{-3} Ci and the maximum plywood box contained 7.2×10^{-4} Ci.

Higher curie levels were selected for the solid waste storage areas to define the bounding inventory. These higher curie values will allow the facility to operate without exceeding the approved operating envelope. Solid waste storage area values selected and used in the accident analysis are 10 Ci beta/gamma and 1.5 Ci alpha as shown in Table 2-4. The accident analysis in Section 3.0 used these estimates of worst-case beta/gamma and alpha inventories for the onsite and offsite dose calculations.

The east side of 340-B is used for railroad tanker transfers and will contain RLW in the tanker during transfer operations. Occasionally a high-radiation, solid waste drum containing contaminated equipment (i.e., valve bodies, valve diaphragms, pump components, flanges, or sections of pipe) will be packaged in a shielded drum. Any such waste that would be considered a worker radiation exposure hazard is stored in the 340-B East Building to reduce exposure to workers.

Table 2-1. 340 Facility Radionuclide Inventory.

Item	Maximum Ci/L*
Total alpha	7.40 E-04
Total beta	2.77 E-02
⁵⁴ Mn	7.66 E-07
⁶⁰ Co	1.85 E-06
⁹⁰ Sr	1.07 E-03
⁹⁵ Zr	2.25 E-06
⁹⁵ Nb	4.01 E-06
⁹⁹ Tc	4.73 E-08
¹⁰⁶ Ru	4.96 E-05
¹²⁵ Sb	3.96 E-05
¹³⁴ Cs	6.87 E-05
¹³⁷ Cs	2.37 E-02
¹⁴⁴ Ce	3.15 E-04
¹⁵² Eu	4.49 E-03
¹⁵⁴ Eu	7.90 E-03
¹⁵⁵ Eu	1.90 E-03
¹⁸² Ta	1.14 E-05
²³⁴ U	1.50 E-07
²³⁵ U	1.88 E-09
²³⁶ U	1.23 E-08
²³⁸ U	5.98 E-08
²³⁸ Pu	2.72 E-04
^{239/240} Pu	5.81 E-05
²⁴⁰ Pu	7.85 E-05
²⁴¹ Pu	7.48 E-03
²⁴² Pu	2.35 E-07
²⁴¹ Am	6.26 E-04
^{243/244} Cm	1.67 E-06

*Based on rail car shipping concentrations, 1989 through 1993.

Table 2-2. 340 Facility Hazardous Material Inventory.

Item	Maximum mg/L*
Al ⁺³	3.20 E+03
As ⁺³	4.15 E+00
Ba ⁺²	1.14 E+01
HCO ₃ ⁻	5.38 E+02
Cd ⁺²	6.64 E+00
CO ₂	5.50 E+02
CO ₃ ⁼	2.91 E+01
Cl ⁻	3.40 E+03
Cr ⁺²	6.85 E+01
F ⁻	1.55 E+01
OH ⁻	4.25 E+02
Pb ⁺²	8.72 E+01
Hg ⁺²	1.25 E-01
NO ₃ ⁻	3.42 E+04
NO ₂ ⁻	3.01 E+03
PO ₄ ⁻³	7.27 E+03
Se ⁼	6.23 E+00
Ag ⁺¹	4.46 E+00
Na ⁺	2.07 E+03
SO ₄ ⁼	1.61 E+02
TOC	3.63 E+03

*Based on rail car shipping concentrations, 1989 through 1993.

TOC = total organic carbon.

Table 2-3. 340 Vault Tank Bounding Source Term.

Isotope	Facility Inventory in Ci/L ⁽¹⁾	Ci/Tank 57 kL (15,000 gal)
Beta/Gamma	6.90 E-01	3.93 E+04
Alpha	1.16 E-03	6.61 E+01

⁽¹⁾ As noted in Section 2.4.1, the historical maximum concentrations presented in Table 2-1 were further increased here (conservatively accounting for possible future excursions over past observances) to function as the bounding source term. Total alpha and beta/gamma values are presented because these gross parameters conform to the typical focus of both monitoring and laboratory screening analyses. In the next column these concentrations are in turn multiplied by the maximum vault tank capacity, 15,000 gallons.

Table 2-4. 340 Facility Solid Waste Bounding Source Term.⁽¹⁾

Isotope	Worst-case Inventory of Solid Waste Ci
Beta/Gamma	10.00 E+00
Alpha	1.50 E+00

⁽¹⁾ As noted in Section 2.4.4, "Shipping records for solid waste generated in the 340 Facility during the years 1989 through 1993 show that the maximum 208-L (55-gal) drum contained 3.08×10^{-3} Ci and the maximum plywood box contained 7.2×10^{-4} Ci. Higher curie levels were selected for the solid waste storage areas to define the bounding inventory. These higher curie values will allow the facility to operate without exceeding the approved operating envelope." Similar rationale to that given in the above Table 2-3 footnote explains use of gross, or total, radionuclide levels.

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3.0 INTERIM SAFETY BASIS EVALUATION

In order to limit risk from hazards and thereby conclude that the 340 Facility can be operated safely, the following sections reference existing safety analysis documents and provide information that identifies and evaluates hazards, identifies controls and/or mitigation systems, and identifies the necessary administrative controls and/or operational restrictions.

3.1 HAZARD ANALYSIS

This section summarizes the hazards of operating the 340 Facility using a PHA of the facility and its appurtenances. This section also evaluates the source terms — radiological and nonradiological — for the areas of the facility containing hazardous materials, determines the hazard categories for the areas within the facility, identifies the potential accident sequences based on the worst-case hazards from the PHA, estimates the potential consequences of the accidents, and provides a quantitative evaluation of the risk for the accidents.

3.1.1 Hazard Categorization

This section identifies the hazard category for each part of the 340 Facility using the bounding source term for that part of the facility. The hazards analysis categories for the 340 Facility are based on the "graded approach" and "facility segmentation" concepts of DOE-STD-1027-92. The "graded approach" ensures that the thoroughness of the documentation be graded or proportioned commensurate with the magnitude of the hazards, the complexity of the facility, and the stage or cycle of the facility. The "facility segmentation" concept in accordance with DOE-STD-1027-92 applies to inventories of hazardous materials where facility features preclude collocating the material and material interaction during a postulated accident (the *Fire Hazards Analysis* [Roberts 1995] also supports facility segmentation). There is a physical separation between buildings in the 340 Facility. Also, the 340-B Building has a concrete wall that separates the building into a 340-B East area and a 340-B West area. These physical separations and concrete wall provide barriers between the hazardous sources that prevent the interaction of hazardous materials during a postulated accident. The hazard categorization is based on radiological hazards in accordance with DOE-STD-1027-92.

3.1.1.1 Radioactive Liquid Waste System Hazard Category. The RLWS hazard category is established in the following subsections.

340 Vault Tanks — A spray release, while filling the railroad tank car from one of the 340 Vault Tanks, is the credible accident considered for hazard category determination. The C_i /threshold quantities modified (TQ_m)- C_i for the vault tanks, based on the modified Hazard Category 2 threshold quantities of one vault tank (57 kL) is shown in Table 3-1 (note discussion in Section 3.1.2). The total C_i/TQ_m - C_i of 2.66×10^{-02} is less than 1, placing the vault tanks within Hazard Category 3.

340-A Tanks — The 46 fissile grams in the 340-A Tanks, using the specific activity for ^{239}Pu of $6.2 \times 10^{-2} \text{ Ci/g}$ becomes $2.85 \text{ Ci } ^{239}\text{Pu}$, with a Hazard Category 2 threshold quantity (TQ) of $5.6 \times 10^1 \text{ Ci}$ giving a $2.85 \text{ Ci} / 5.6 \times 10^1 = 5.1 \times 10^{-2} \text{ Ci/TQ-Ci}$, which is less than 1, placing the 340-A Tanks in Hazard Category 3.

3.1.1.2 Solid Waste Area Hazards Category. A solid waste fire that would consume the entire inventory (Table 3-2) results in a total Ci/TQ-Ci of 2.72×10^{-02} , based on Hazard Category 2 threshold quantities per DOE-STD-1027-92, placing the solid waste in Hazard Category 3.

3.1.2 Hazard Categorization Methodology

If a facility contains greater than Hazard Category 2 TQ, as defined in DOE-STD-1027-92 and shows the potential for significant onsite consequences, the facility is defined as Hazard Category 2. Attachment 1 of DOE-STD-1027-92 notes that if the ratio of the quantity of each isotope to its Hazard Category 2 TQ is ≤ 1 and the sum of the ratios for each isotope in the facility is ≤ 1 , then the facility is Hazard Category 3. If the sum is greater than 1, the facility is defined as Hazard Category 2. The following equation defines how the sum of the ratios is calculated:

$$\text{Sum of ratios} = \frac{\sum_{i=1}^j \text{Inventory quantity of isotope}}{\text{Category 2 threshold quantity of isotope}}$$

3.1.2.1 Radioactive Liquid Waste System. The hazard categorization calculations for the 340 Vault Tanks (Table 3-1) are based on DOE-STD-1027-92, paragraph 3.1.2, and the spray-release accident described in Section 3.1.4.1 of this document. DOE-STD-1027-92 allows for modification of the threshold limit values by replacing the release fraction assumed in DOE-STD-1027-92 with the release fraction calculated for the worst-case unmitigated accident. The material at risk consists of the contents of one of the vault tanks (57 kL). The calculated respirable volume released in the spray is $5.11 \times 10^{-4} \text{ kL}$ (Appendix B). The release fraction is determined by dividing the respirable volume released by the material at risk ($5.11 \times 10^{-4} \text{ kL} / 57 \text{ kL} = 8.96 \times 10^{-6}$). The release fraction (8.96×10^{-6}) was divided by .001 (the release fraction assumed for liquids on page A-9, Item 4 of DOE-STD-1027-92) to give 8.96×10^{-3} . The Hazard Category 2 TQ values were divided by 8.96×10^{-3} to obtain the modified threshold values TQ_m . The modified threshold values TQ_m were used to calculate the Ci/TQ_m for ^{90}Sr and ^{239}Pu in Table 3-1. The sum of ratios of the Ci/TQ_m s, $2.66 \times 10^{-2} \text{ Ci}$, is less than 1.0 and places the RLWS in Hazard Category 3. Table 3-3 contains the plutonium equivalent curie (PE-Ci) calculations based on the alpha inventory in Table 2-1.

The 340-A Tanks were considered separately from the 340 Vault tanks because the immobility of the inventory precludes it from consideration in the vault tank accident scenario. However, it still contributes to the hazard category.

3.1.2.2 Solid Waste. The bounding radiological source term for the solid waste is shown in Table 2-4. The isotopes in Table 2-4 were used in an accident scenario that involved a solid waste fire that consumes the entire inventory. Dividing the curie inventory by the Hazard Category 2 TQ of DOE-STD-1027-92 results in a total Ci/TQ-Ci of 2.72×10^{-02} (Table 3-2). The Ci/TQ-Ci is less than 1, placing the solid waste in Hazard Category 3.

3.1.3 Preliminary Hazards Analysis

The 340 Facility PHA shown in Table 3-4 systematically lists the hazard/energy sources for the facility, identifies the potential accident and sequence of events leading up to the accident, and tabulates the target/potential consequences of the accident. Table 3-4 includes both engineered and administrative mitigating features, as applicable, for each potential accident. Table 3-4 also provides an estimate of the qualitative accident severity levels using the annual frequency and severity category descriptions in Table 3-5. From the longer list of accidents in Table 3-4, a small number of worst-case accidents were selected that represent accidents having the highest probability and greatest severity coupled with the highest dose consequences. These accidents are then evaluated for both onsite and offsite dose consequences. By demonstrating that the 340 Facility can be operated safely, assuming worst-case unmitigated releases from the highest severity/highest probability accidents, it can be concluded that the facility can also be operated safely assuming unmitigated accident releases of the other lower probability/lower severity accidents.

The worst-case accidents having the highest severity/highest probability that were selected for further evaluation in this section include:

- A spray release occurs upon failure of the pipe or pipe connection while pumping liquid into a railroad tank car (Table 3-4, II.A.5)
- A fire occurs in the 340-B West dry-waste storage area (Table 3-4, I.A.2.g).

3.1.3.1 Fire. A fire in one of the 340 Facility buildings could result in equipment and structure damage, and personnel injury. There is also a potential for radiological and chemical release based on inventory. Flammable quantities of liquids are not allowed in the RLWS, which eliminates the potential for a fire in the tanks in 340-A and the vault. The 340 Facility contains solid mixed waste in the 340 Building and the 340-B Building. The 340 Building has a fire detection and suppression system. The 340-B Building only has fire detection. The majority of the solid waste is stored in the 340-B West Building with some waste in the 340-B East Building. The amount of solid waste stored in the 340-B East Building is minimal and nonroutine. The release due to a solid waste fire in the 340 Building or 340-B East Building would be insignificant, compared to a solid waste fire in 340-B West Building.

3.1.3.2 Corrosion. The 340 Facility does not provide long-term storage of solid or liquid waste drums, eliminating the potential for containment failure, as a result of corrosion. There is a potential for corrosion in the RLWS pipelines, the 340 Vault Tanks, and the 340-A Tanks. However, the pipelines are encased, the vault tanks have a concrete vault, and the 340-A Tanks have a concrete sump draining to the vault tanks. Encasement, vault,

and sump leak detectors are also present. Corrosion presents an insignificant potential for hazard to the onsite/offsite person.

3.1.3.3 Potential Kinetic Energy. There is a potential for solid or liquid waste release as a result of drum/container impacts by heavy equipment, sharp/hard equipment, or by dropping. However, only low levels of waste are allowed and the effect of a spill would be local with a minimal airborne release. A helicopter or plane crash would also produce minimal airborne release and is considered extremely unlikely. The highest potential for an airborne release would be a pipe failure while pumping liquid waste to the tank car. This failure could produce a spray release and affect the onsite/offsite individual.

3.1.3.4 Natural Occurrences. Regarding natural forces criteria, early Hanford Site structures were designed for static, vertical live and dead loads, and have limited seismic resistance because the Site was classified as a low-intensity, low-frequency earthquake zone. Later, a classification was made to Zone 2B on the Uniform Building Code Seismic Risk Map, and currently the Site is considered an area of moderate to low seismicity (*Uniform Building Code*, UBC 1991). Some seismic resistance is inherent in structures because of design for winds (lateral forces), nonstructural elements (reserve strengths), stability requirements, limits on deflections, and safety factors included in design and working stress values for materials. Buried structures have considerable inherent earthquake resistance because they are constructed to support the backfill, and the backfill will restrict relative motions between the structures and ground during an earthquake.

The result of natural occurring events such as floods, earthquakes, wind and volcanic activity present only minor releases and are considered insignificant compared to the spray release of the RLWS inventory.

3.1.3.5 Stack Release. The 340 Vault and vault tanks are serviced by a common exhaust system discharging through a stage of dust stop filters, two stages of HEPA filters, and two exhaust fans. The capability exists for the addition of activated charcoal adsorbent into the exhaust treatment train. Filter change-out occurs on an as needed basis indicating that neither radionuclide buildup nor dust buildup on the filters is significant. A recent radiation measurement for the HEPA filter housing of 80 mrem/hr after more than 3 years of continuous operation further suggests that radiation buildup in the HEPA filters is moderate. Therefore, HEPA filter system degradation or failure is not a significant hazard and is bounded by the spray release accident. The charcoal filters were used in the past to help control potential I-131 releases associated with activities in the 327 Postirradiation Testing Laboratory.

3.1.3.6 Loss of Utilities. Loss of electrical utilities would result in the loss of stack fans, monitoring, transfer pump operation, tank level indication, and alarm capabilities. Although active ventilation and monitoring would be lost, passive ventilation through the HEPA filters would exist. Loss of transfer pump operations would only eliminate the potential for a spray leak. Loss of tank level indication and alarm capabilities would not affect the integrity of secondary containment. Also, waste handling operation would be curtailed. Therefore, there would be no significant safety related hazard to the onsite/offsite personnel.

Loss of electricity could result in a 340-A Building RLWS pipe rupture during freezing weather. The liquid waste would drain to the 340-A sump where the leak would be detected. The 340-A sump drains to vault tank 2 and thus, there would be no release.

Loss of process water would result in the loss of pump seal water, which could burn up the pumps when running. The failure of the pumps would not allow liquid transfers to take place. However, the pumps are interlocked to shut down on low seal water pressure. This is not a significant hazard to the onsite/offsite person.

3.1.3.7 Radiation. High-level radiation from RLWS inventory in the 340 Vault Tanks, the 340-A tanks, and 340-B East Building could result in high personnel exposure. Area radiation monitors provide warning on high radiation. Prior approval and notification of waste transfers are required, and access is restricted in high-radiation areas. High-level radiation from solid waste in either the 340 or 340-B West buildings is monitored by the Health Physics Technician (HPT). High-level radiation areas are controlled and present an insignificant hazard to the onsite/offsite person.

The 340 Facility maintains less than 177 FGE to maintain its status as an isolated facility per WHC-CM-4-29 and the 340 CSER (Miller, 1996). The 340 Facility administratively controls criticality concerns in accordance with WHC-CM-4-29 and DOE Order 5480.24, *Nuclear Criticality Safety*. Therefore, adequate criticality controls are maintained and additional controls are not necessary.

3.1.4 Accident Scenarios and Consequences

The types of operating hazards that could cause a significant release from the 340 Facility are limited. Table 3-6 contains a listing of the potential hazards for this facility, including a listing of the mitigating features and administrative controls used to ensure safe operation. Considering the preliminary hazards identified in Table 3-4 and the potential operating hazards in Table 3-6, a spray release in the 340-B East Building while pumping to a tank car and a solid waste fire in 340-B West Building are the worst-case potential accidents identified for further evaluation.

3.1.4.1 Spray Release from 340 Vault Tanks. A spray release while filling the railroad tank car from the 340 Vault Tanks is the most likely significant accident. Because the vault tanks are not under pressure and are underground, a spray release from the piping can only occur while the transfer pumps are operating. One tank must be valved to receive waste and automatic transfers from one tank to another do not occur while filling the tank car. Therefore, when one tank has been emptied, it is necessary to shut down the transfer pump and switch the valving to the other tank, making the maximum duration of a spray leak the time it takes to pump out one full tank. Also, because of administrative sampling requirements, typically only the contents of a single tank are transferred per railcar shipment.

Each of the vault tanks have a 57 kL (15,000 gal) maximum capacity, and the pump has a capacity of 380 L/min (100 gal/min) with a head of 16 m (53 ft). The maximum time a spray release can occur is 150 min (15,000 gal +

(53 ft). The maximum time a spray release can occur is 150 min (15,000 gal + 100 gal/min = 150 minutes). This time will be used for the spill ignoring the periodic leak inspections.

The pump head of 16 m (23 psi) and friction losses for the pipeline crack were used in a spreadsheet to calculate the total liquid released and the respirable liquid released using the equations in WHC-SD-GN-TI-30003 (WHC 1992), see Appendix B. No credit was taken for loss in head pressure from the pump to the tank car, about 4.5 m (15 ft), the building, or leak inspections. The spreadsheet calculations for a pipeline crack 7.62 cm (3 in.) long and 1.94×10^{-2} cm (7.65×10^{-3} in.) wide gives a 1.07 m^3 (275 gal) spray release, with a respirable liquid release of $5.11 \times 10^{-4} \text{ m}^3$ (0.132 gal). Using the bounding source term, as established in Section 2.4, the X/Q values from the *Hanford Environmental Radiation Dosimetry System Software System*, GENII (Napier et al. 1988), dose-consequence calculations (Appendix C and Table 3-7), and the respirable release from above, Table 3-8 shows the onsite and offsite dose estimates of 3.92 rem EDE and 3.30×10^{-01} rem EDE, respectively.

The corresponding release of chemicals for the spray-leak accident is shown in Appendix D. The release flow rate of $5.68 \times 10^{-8} \text{ m}^3/\text{s}$ was multiplied by the onsite X/Q, $4.21 \times 10^{-2} \text{ s/m}^3$ and offsite X/Q, $3.77 \times 10^{-3} \text{ s/m}^3$, and the highest hazardous material inventory (NO_x , $3.42 \times 10^4 \text{ mg/L}$) to obtain the release in mg/m^3 . The chemicals released in the spray are well below ERPG levels, per WHC-CM-4-46.

3.1.4.2 Fire Involving Solid Waste. The west side of the 340-B Building is both a 90-day solid mixed waste pad, and a radioactive waste storage area, separated from the loadout facility by a 30 cm (12") concrete shield wall. Waste from the 340 Facility is collected and packaged where it occurs, then moved to 340-B West Building for shipment. The solid waste stored on the 340 Building 90-day hazardous waste pad and the 340-B West Building 90-day solid mixed waste pad typically consists of cleaning materials, personal protective equipment and clothing, worn out equipment, material from cleanup activities, and tools that cannot be completely decontaminated and released.

Because the waste is solid and stored in boxes or drums the worst-case accident would be a fire, assuming sufficient combustible contents. Possible onsite and offsite releases were estimated, using an airborne-release fraction (ARF) of 5×10^{-4} from *Increment of Analysis: An Estimate Of Airborne Release Of Plutonium From Babcock and Wilcox Plant As A Result Of Severe Wind* (Mishima et al. 1978). The bounding source term established in Section 2.4, was used with the ARF to obtain onsite and offsite doses as shown in Table 3-9. The estimated total dose onsite is 3.24 rem EDE and the estimated total dose offsite is 2.72×10^{-01} rem EDE.

3.1.5 Risk Evaluation

Table 3-8 provides the dose consequence for a liquid spray release from the 340 Vault Tank while pumping to the railroad tanker. The conditions for the release are conservative in that no credit has been taken for the building enclosing the tanker, nor the loss in head pressure from the pump to the tanker; and it is estimated that an entire vault tank volume will be pumped without any awareness of the leak during this 2½ hour operation. The onsite

and offsite doses are based on a full tank (57 kL) of the worst-case source term (Table 3-8). Figure 3-1 shows a comparison of the total dose consequences to the risk-acceptance guidelines (*A Model for Estimating the Release Rate of Aerosol Droplets From Pressurized Liquid Leaks*, WHC 1992) for an Annual Frequency Category of 1.0×10^{-5} . Both the onsite and offsite doses are within the risk-acceptance guidelines.

The dose consequences for the worst-case solid waste fire in the 340-B West Building is shown in Table 3-9. Conservatism has also been applied here, by calculating the entire inventory of steel drums and fire retardant boxes to be consumed in the fire and taking no credit for the building. The onsite and offsite doses are based on the worst-case source term (Table 2-4). Figure 3-1 shows a comparison of the total dose consequences to the risk-acceptance guidelines for an Annual Frequency Category of 1.0×10^{-5} . Both the onsite and offsite doses are below the risk-acceptance guidelines.

The release fraction uncertainties can be obtained from DOE-HDBK-3010-94. This ISB document uses the bounding release fractions for the dose estimates. For a solid waste fire the bounding release fraction is $5 \text{ E-}04$ and the median release fraction is $8 \text{ E-}05$ (DOE-HDBK-3010-94, p. 5-1). The expected onsite and offsite doses, using the median release fraction, is, respectively, 0.518 rem and 0.0435 rem (verses the bounding values of 3.24 rem and 0.272 rem, respectively). The bounding values, therefore, are 6.25 times higher than the expected values and this difference represents the uncertainties for the consequences. The uncertainty for the frequency value, $1 \text{ E-}03$, is the range $1 \text{ E-}04$ to $1 \text{ E-}02$. The fire accident was judged to be an unlikely event with a frequency range of $1 \text{ E-}04$ to $1 \text{ E-}02$. The value $1 \text{ E-}03$ is in the middle and was chosen for Figure 3-1 to show the comparison to the guideline values.

The above calculations show that neither a spray release in 340-B East Building, nor a solid waste fire in 340-B West Building would exceed the 5 rem EDE onsite or the 0.5 rem EDE offsite limits. The 340 Facility continuously receives and transports waste and thus the inventory may change. To ensure that onsite/offsite limits are not exceeded during a spray-release incident, the RLWS inventory must be known to be within the bounding source term (see 3.2.2.3.2) before loadout operations are initiated. Also, the inventory of solid wastes must be controlled within the solid waste bounding source term (see 3.2.2.3.3).

3.2 HAZARD CONTROLS

This section describes the physical and administrative systems used for the control and/or mitigation of the 340 Facility accidents and events. There are no Safety Class nor Safety Significant systems in the 340 Facility.

3.2.1 Structures, Systems and Components (SSC)

3.2.1.1 340 Building. The 340 Building is an above ground structure of steel and sheet metal attached to a steel frame mounted on a concrete foundation. The 340 Vault is constructed of concrete with cover blocks, access holes, and hatches.

The 340 Building truck lock, control room, and decontamination room are protected with smoke and temperature detectors and automatic sprinklers. The smoke detectors and the sprinkler systems alarm locally and at the central dispatch in the 200 Area. Criteria, as established by the National Fire Protection Association Codes, were used for location of the above systems.

The 340 Building is provided with a ventilation supply system, an evaporative cooling system, an electric heating system, and an exhaust system servicing all of the rooms except the control and mechanical equipment rooms. The exhaust system consists of two-stage HEPA filters, an exhaust fan, and a stack that is located above the rest rooms. Airflow from the decontamination area hood, sink, and sump pass through an additional stage of HEPA filters before the two-stage HEPA filters.

The 340 Vault and Tanks are serviced by a common exhaust system, discharging through a stage of dust stop filters, two-stage HEPA filters, and two exhaust fans located just east of the vault. The capability exists for the addition of activated charcoal adsorbent into the exhaust treatment train. The charcoal filters were used in the past to help control potential I-131 releases associated with activities in the 327 Postirradiation Testing Laboratory. Some ventilation alarms are contained in panels near the stack. All other alarms signal in the control room.

A process radiation detector is located in Valve Box 9. It provides local alarms and remote alarms at the 340 Building Control Room Annunciator Panel and the 310 TEDF control room. The detector provides a means of monitoring for a change in the radiation level or movement of radioactive liquids and also provides an alarm on high radiation levels.

Vault tank high liquid-level alarms exist that aid in preventing tank overflow. There are also influent alarms that will alarm before the high-level alarms (variable-level alarms are normally slightly above the current level in the tank). In addition, overflow is prevented by a high-high set point that will automatically pump the waste to the 340-A Tanks. These alarm at the 340 control panel and remotely in 310 TEDF. Finally, there is an overflow leg between the two vault tanks so they will overflow to each other. In the event of a tank or piping leak, the concrete vault will temporarily contain up to 360 kL (94,000 gal) of liquid. The vault is equipped with a leak detector located at the sump and a sump pump.

There are also liquid-level alarms in the RLW lines at the 325 and 327 Buildings. They alarm locally and at the 310 TEDF, if water backs up in the RLW line.

3.2.1.2 340-A Building. The 340-A Building is constructed of steel panels attached to a steel frame mounted on a concrete foundation. The floor is set about 1 m below grade level. The floor and lower portions of the walls are made of concrete. The floor contains a dry sump that drains back to the 340 Vault Tanks. Six 30 kL (8,000 gal) stainless steel tanks are housed in the building to provide reserve capacity for RLW. They are valved to be used as one but also can be used singly. A leak detector is located in the trench to the sump. The tanks are ventilated through the vault ventilation system.

An area radiation monitor is located inside the west door, which is the

main door. It provides local alarms and remote alarms at the 340 Building Control Room Annunciator Panel and the 310 TEDF. The monitor provides a means for monitoring a change in the radiation level or movement of radioactive liquids and also provides an alarm on high radiation levels.

3.2.1.3 340-B Building. The 340-B Building is constructed of steel panels mounted on a concrete foundation. The building is divided down the center by a 30 cm (12 in.) thick concrete shielding wall.

The east side of the building is serviced by a ventilation system located in the west side of the building, consisting of a pre-filter, HEPA filter, exhaust fan, and stack; operated only when needed (see 2.3.3).

The 340-B Building is equipped with smoke detectors that alarm locally and at the central dispatch in the 200 Area. Installation locations were established by guidelines in the National Fire Protection Codes.

3.2.1.4 340 Facility Compliance with Codes, Standards, and Regulations. The core 340 Facility was built and commissioned for radioactive service in 1952, with several additions acquired over the years. The facility met the applicable codes, standards, and regulations at the time of construction. The facility has been, and continues to be upgraded to meet changing emission and regulatory requirements. The facility and operations are routinely audited to ensure compliance with the intent of meeting applicable codes, standards, and regulations. As part of the overall 300 Area upgrade, the RLWS has been renovated to improve environmental protection and to further reduce potential for personnel exposure. Although not required to mitigate, prevent, or control design base accidents, the systems listed in Table 3-10 provide enhanced safety in the operation under both routine and abnormal situations.

3.2.2 Administrative Controls/Operational Restrictions

3.2.2.1 Administrative Controls. The 340 Facility operations are conducted in accordance with various operational and administrative documents that establish formal programs to ensure compliance with applicable DOE Orders. Where necessary, instructions and procedures are prepared to translate the general requirements of DOE and WHC directives into specific guidance and limits to be observed by the operating staff.

3.2.2.2 General Westinghouse Hanford Company Administrative Controls. WHC policy and standard practices regarding specific facets of ongoing operational activities are set forth in manuals and procedures approved by the WHC President or designee. Several of the more significant documents that constitute part of the WHC system for administrative controls are included in the following:

- HSRCM-1, Rev. 2, *Hanford Site Radiological Control Manual*
- WHC-EP-0063, *Solid Waste Acceptance Criteria*, (WHC 1993)
- WHC-EP-0846, *Waste Specification System*, (WHC 1995b)
- WHC-IP-0263-340, *Building Emergency Plan*, (WHC 1995a)
- WHC-IP-1000, *300 Area Liquid Effluent Facilities Administration*
- WHC-CM-1, *Company Policies and Charters*
- WHC-CM-1-3, *Management Requirements and Procedures*
- WHC-CM-1-5, *Standard Operating Practices*

- WHC-CM-1-10, *Safety Manual*
- WHC-CM-1-11, *Industrial Hygiene Manual*
- WHC-CM-2-14, *Hazardous Materials Packing and Shipping*
- WHC-CM-4-1, *Fire Protection Program*
- WHC-CM-4-2, *Quality Assurance*
- WHC-CM-4-29, *Criticality Safety Procedure*
- WHC-CM-4-33, *Security*
- WHC-CM-4-34, *Nuclear Material Control Accountability*
- WHC-CM-4-41, *Fire Protection Program Manual*
- WHC-CM-4-43, *Emergency Management Procedures*
- WHC-CM-5-16, *Solid Waste Management*
- WHC-CM-6-1, *Standard Engineering Practices*
- WHC-CM-7-5, *Environmental Compliance*.

3.2.2.2.1 340 Facility Waste Management Facility Administrative Controls. Operation of the 340 Facility is conducted in accordance with operating, maintenance, and administrative procedures and programs approved by WHC management. These procedures and programs are incorporated into 340 Facility operating procedures and the *300 Area Liquid Effluent Facilities Administration Manual* (WHC 1994b). This manual is consistent with and implements the requirements of the documents listed above. Any modification that would change the facility status as a nuclear facility would be an unreviewed safety question and would be documented in subsequent revisions or supplements to this ISB.

Specific procedural and administrative controls are provided that cover:

- Building emergency preparedness and response procedures
- Equipment and process operating procedures
- Maintenance and inspection procedures
- Staff qualification and training programs — includes training for building personnel in the areas of criticality safety, radiation protection, industrial safety, job hazards, security, operating and emergency procedures.

These controls are implemented at the work stations (point of operation) by:

- Qualifications and demonstrated proficiency for job assignment
- The 340 Facility procedures and work packages that contain the task-specific Job Safety Analysis and Radiological Work Permits.

3.2.2.2.2 Audit Program. Adherence to established procedures and the adequacy of those procedures is verified continuously by a program of audits and inspections.

The audit program is accomplished by the following:

Self Audit — The manager of 340 Facility Operations is responsible for ensuring that audits and inspections of facility operations are done regularly

to identify and correct deficiencies. WHC-IP-1000, Section 1.8, "Management Assessment Program", establishes the basis for scheduling assessments.

Safety — Safety is responsible for conducting regular audits to verify the adequacy of the operational procedures, records, and conformance with operating limits.

Quality Assurance — The Quality Assurance department is responsible for periodic audits of quality systems to verify that facility operations are in compliance with WHC-CM-4-2.

3.2.2.3 Operational Restrictions. This section identifies the interim operational safety requirements (IOSR) for the 340 Facility. The IOSR are administrative controls that define limits to assure compliance within the classification of a Hazard Category 3 facility. These limits replace the previous operating limits.

3.2.2.3.1 340 Facility Maximum Fissile Limit.

Applicability — All storage, handling, or processing of radioactive waste in the 340-Complex.

Objective — To maintain a fissile materials inventory compliant with the classification of an isolated facility per WHC-CM-4-29 and the *CSER 94-012: Criticality Safety Evaluation Report for 340 Facility* (Miller, E.M., 1996) which supports the isolated facility classification. It should be noted the 340 CSER also documents that solid and liquid waste systems could be regarded as separate systems due to physical, isolating barriers. If the system were to be managed separately the solid waste system would be classified as "exempt".

Requirement — The ²³⁹Pu FGE equivalent quantities within the 340 Facility will be maintained at less than 177 FGE.

Surveillance — An inventory of the FGE within the 340 Facility will be maintained to demonstrate compliance with the requirement. The administrative program assigns responsibility and establishes programs for sampling and surveillances which verify adequate inventory accountability.

Basis — The facility criticality safety status as an isolated facility is in accordance with WHC-CM-4-29. The corresponding maximum fissile inventory value is based upon a fraction of the minimum critical mass (MCM). This MCM is in turn based upon 100% Pu 239 aqueous metal solution, optimum water moderation, full water reflection, optimum concentration (31g Pu/L) and spherical geometry. By contrast, the large, cylindrical 340 tanks contain much lower fissile concentrations, along with other chemical compounds which serve to absorb neutrons (e.g., chlorides, nitrates, and nitrites).

Recovery — In the event the requirement is not met, notification will be immediate and will include the 340 Facility manager and the manager of Criticality and Radiological Analysis. The cause of the event will be determined and a course of action to correct the problem will be implemented. A determination will be made if a continued classification as a Hazard Category 3 facility is valid.

Audit Point — Sample data used to determine FGE amounts and inventory lists of FGE amounts will be retained for a minimum of 15 months.

3.2.2.3.2 Radioactive Solid Waste Storage Limit.

Applicability — All storage, handling, or processing of solid radioactive waste in the 340-Complex subject to fire.

Objective — To prevent significant onsite and offsite dose consequences in the event of a fire by maintaining the solid radioactive materials inventory at a level validating the solid waste storage areas as Hazard Category 3.

Requirements — Dispersible radioactive materials packaged in solid waste in fire retardant boxes or drums will not exceed the following limits:

- Alpha emitters 1.5 Ci
- Beta-Gamma emitters 10 Ci.

Surveillance — An inventory of the radioactive materials present will be maintained that demonstrates compliance with the requirement.

Basis — The accident analysis for a fire involving radioactive waste materials (Section 3.0) with the above maximum inventory has shown that the resultant consequences, without credit for mitigating features, meets the criteria for a Hazard Category 3 facility. The analysis shows that the estimated fire consequences for a total solid waste inventory of 11.5 Ci would be 3.24 rem EDE onsite and 2.72×10^{-1} rem EDE offsite.

Recovery — In the event the requirement is not met, notification will be immediate and will include the 340 Facility manager. The cause of the event will be determined and a course of action to correct the problem will be implemented. A determination will be made if a continued classification as a Hazard Category 3 facility is valid.

In the event that the inventory is not maintained, the facility inventory of radioactive material will be immediately determined and corrective action taken to prevent reoccurrence

Audit Point — Storage/disposal records of inventory lists of radioactive materials will be retained for a minimum of 15 months.

3.2.2.3.3 340-B Railroad Tank Car Loadout Restrictions.

Applicability — 340 Facility RLWS transfer operations to 340-B East Building for railroad tanker loadout.

Objective — To prevent significant onsite and offsite consequences in the event of a spray leak by maintaining the liquid radioactive materials inventory at a level validating the vault tanks as Hazard Category 3.

Requirement — If the sending tank exceeds the following criteria, RLWS transfer operations to the 340-B East Building for railroad tanker loadout are prohibited until Engineering provides isotopic calculations that verify the

inventory to be transferred will not exceed the onsite/offsite doses and Hazard Category 3 Limits.

- Total Alpha 66 Ci
- Total Beta/Gamma 39 kCi.

Surveillance — Tank inventory data, by sample analysis and calculations, will demonstrate compliance with the requirement before transfer to the railroad tanker.

Basis — The accident analysis for a spray release (Section 3.0) of radioactive liquid waste from the vault tanks with the above maximum inventory has demonstrated that the resultant onsite and offsite consequences, without credit for mitigating features, classify the 340 Facility as Hazard Category 3. The spray-release accident analysis shows that the estimated release consequences from a full vault tank inventory of 1.07 m^3 released (the respirable release is $5.11 \times 10^{-4} \text{ m}^3$) is 3.92 rem EDE onsite dose and 3.30×10^{-1} rem EDE offsite.

Recovery — In the event the requirement is not met, transfer operations will cease, notification will be immediate, and will include the 340 Facility manager. Restrictions on quantity transferred or isotopic calculations from engineering are required for continuation of transfer operations. The cause of the event will be determined and a course of action to correct the problem will be implemented.

Audit Point — Vault tank sample data and waste transfer records/memo will be retained for a minimum of 15 months.

3.2.3 Institutional Safety Programs

3.2.3.1 As Low As Reasonably Achievable. In compliance with DOE Orders and to support radiation protection, WHC has established a company-wide ALARA program applicable to the pre-operational, operational, and post-operational phases of all projects and facilities. The program goal is to minimize human exposures (occupational and public) to radiological and nonradiological hazards and conditions ALARA, commensurate with sound economics and operating practices. The program focuses on those activities with significant risk because of the presence of radiation, toxic substances, or hazardous conditions.

The WHC ALARA program is established by WHC-CM-1-3, MRP 5.37, and is described in WHC-IP-1043, *WHC Occupational ALARA Program*. The WHC policy on radiation protection is described in WHC-CM-1-3 and HSRM-1.

Responsibility for ensuring implementation of ALARA practices and principles is assigned to the WHC ALARA Program Office within the Safety Function. An ALARA committee is responsible for coordinating administration of company-wide activities and facility teams are established to implement ALARA practices and principles on an operational level. ALARA surveillances are conducted periodically by the Radiological Engineering and the measures are implemented in day to day activities.

3.2.3.2 Operational Considerations. A number of administrative controls are in place ensuring safety during maintenance activities. In particular, WHC-CM-1-10, WKS-6, provides for pre-job planning, a job hazards analysis, and the dual function of providing a responsible review of the work scope and zone, as well as heightening operator awareness of personal safety.

Operations and maintenance activities within the 340 Facility will be governed by technical procedures that incorporate ALARA and safety concerns. Maintenance activities are covered by preventive maintenance procedures.

In addition to safety guidance provided in operation and maintenance procedures, activities that involve radiological exposure must be performed in compliance with the protective measures identified in HSRM-1. Entry into, and the work performed in any radiological area, is governed by the provisions of a radiological work permit (RWP) issued for that specific job or area. Radiological Control issues RWPs with the review and concurrence signature of Facility Operations management. The RWP must be followed by any person involved in the scope of operations described in the permit and only work specified in the RWP may be performed.

3.2.3.3 Area Radiation and Airborne Radioactivity Monitoring Instrumentation. Portable monitoring equipment may be used in support of the Radiation Protection Program developed for the 340 Facility operation to detect, record, and disseminate results of radiation and contamination surveys conducted in and around the facility. Monitoring may be performed before operations or maintenance activities involving surface contaminated areas.

Air sampling will be performed as required by the particular operations being conducted according to the criteria in HSRM-1.

3.2.3.4 Radiological Control Program. This section provides information on the WHC Radiological Control Program organization, procedures, equipment, instrumentation, and facilities.

3.2.3.4.1 Radiological Control Organizations. Radiological safety functions are part of the Emergency, Safety, and Quality Services organization that has the overall responsibility for the radiation protection program. The Radiological Control group and the Nuclear Safety group have been delegated principal responsibility for support and overview of the radiation protection and ALARA programs.

Radiological Control is responsible for the following:

- Day-to-day operational support
- Auditing and monitoring compliance with DOE Orders, Washington Administrative Codes, standards, and other pertinent requirements
- Maintaining a trained staff and equipment capable of responding to incidents involving control and containment of radioactive materials
- Maintaining a radiological control support service that provides the radiological measurements, surveys, and dosimetry program necessary to ensure radiological safety

- Administering a comprehensive program that ensures that ALARA practices and principles are applied to the control of radiological hazards
- Providing expert advice to assist all WHC organizations in effectively meeting their radiation protection program responsibilities.

Nuclear Safety performs an independent oversight role. Either this organization or the Facility Evaluation Board is responsible for conducting annual safety appraisals of each WHC nuclear facility to ensure compliance with DOE Order 5482.1B, *Environmental, Safety and Health Appraisal Program*. Examples of activities covered by this organization include readiness reviews, design reviews, audits and appraisals, facility inspections, and operational surveillance assessments.

HPTs are trained and certified in accordance with 10 CFR 835, *Occupational Radiation Protection*, Subpart J, and are responsible for the day-to-day field implementation of the radiation protection program.

3.2.3.4.2 Equipment, Instrumentation, and Facilities. The following sections provide information on the various radiological control-related equipment, instrumentation, and facilities available to support the radiation protection program for the 340 Facility. The design, installation, operation, and calibration of radiological control instrumentation will be in accordance with WHC-SD-GN-DGS-30011, *Radiological Design Guide*, HSRM-1, and WHC-IP-0718, *Health Physics Procedures Manual* (WHC 1991).

Air-Sampling Instruments — Stationary air-sampling instrumentation are in place in the 340 Building stack, the 340-B Loadout Facility stack, the decon stack and the vault and valve pits. Radiological Control may use portable air samplers. Gooseneck and high-volume grab samplers are used to provide long- and short-term sampling of areas that have the potential to exceed 10% of a DAC during certain job evolutions.

Personnel Survey Instruments — Semiportable rate meters and PCM-1Bs for monitoring personnel are available at the 340 Facility. Both scintillation and Geiger-Mueller detectors are available for use by 340 Facility personnel.

3.2.3.4.3 Procedures. WHC has compiled a number of documents that describe requirements and procedures relative to radiological and environmental protection. A brief overview of relevant documents and summaries of various radiological protection procedures applicable to 340 Facility activities are provided below.

- WHC-CM-4-14, *Applied Radiological Controls*, provides methods, routine practices, controls, exposure guides, supporting data, and other information developed to assist radiological control personnel in establishing and maintaining a uniform and sound radiation control program.
- WHC-CM-7-5, *Environmental Compliance Manual*, provides detailed standards for controlling the release of radioactive and nonradioactive materials to air, water, and land, environmental

surveillance criteria, and effluent sampling and monitoring program requirements.

Radiological Control Surveys — The methods, frequencies, and procedures for conducting radiation surveys are determined based on the characteristics of materials handled (i.e., form, element, isotope) and the radiological condition and type of operations conducted (i.e., dose rate, contamination level, or airborne potential).

Contamination Control — Bases and methods to control contamination are discussed in HSRM-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. The basic policy is to preclude contamination through facility design by including mechanical constraints such as air filtration and temporary maintenance enclosures.

Safety Training — Safety training will be provided to all employees who work at the 340 Facility. In addition to radiation protection training, the WHC Safety Training Program consists of courses in general safety awareness, nuclear safety, hazardous materials, and waste. Responsibility for providing this training is assigned to the Safety Training section of the Technical Training Organization. WHC-CM-2-15, *Training Administration Manual*, describes procedures for course development and maintenance, scheduling, instructor certification, training delivery, student evaluation, and maintenance of training records.

The Safety Training Program includes a multi-tiered radiation protection training program that provides a level of training commensurate with an individual's classification as a radiation worker/nonradiation worker, as well as the individual's specific work assignment. Requirements for radiation protection training are stated in HSRM-1 and are consistent with the requirements stated in DOE N 441.1 and 10 CFR 835.

Personnel Exposure Monitoring — WHC dosimetry program establishes requirements for measuring and recording personnel exposure. This program is described in Part 1 of the HSRM-1. A summary of these requirements is provided in this subsection.

WHC requires that all employees, visitors, and vendors be issued and use an assigned record dosimeter at all times, when in radiological areas within a facility. These dosimeters provide an official measurement of an individual's radiation exposure. All record dosimeters used at WHC are accredited by the DOE Laboratory Accreditation Program. In addition to the Hanford Standard multi-purpose dosimeters, radiation workers may be required to wear supplemental dosimetry to monitor highly-localized doses. These devices may include finger rings, pencils, electronic dosimeters, two-chip dosimeters, wrist dosimeters, or special beta-photon dosimeters.

Exposure to internally deposited radionuclides is assessed by in vitro (excreta analysis) or in vivo (whole-body or chest-count) bioassay measurements. A baseline bioassay determination of internal radionuclides is performed for employees, visitors, and vendors as a prerequisite to any work assignment that involves the potential for internal deposition of

radioactive material. Based on a review of the radionuclides and activity levels involved, the WHC Dosimetry Program determines the appropriate type of surveillance and establishes a routine internal exposure surveillance schedule.

As determined by Nuclear Safety, based on WHC-CM-4-29 and 340 CSER criteria, there is no need for criticality detection in the 340 Facility areas. However, nuclear accident dosimeters will be required to be posted at the 340 Facility regardless of criticality detection requirements for the 340 Facility, as other operations in the 300 Area will have sufficient fissile and fissionable material to require criticality detection systems and a criticality in those areas could affect personnel at the 340 Facility.

Occupational Radiation Exposure Records System — HSRCM-1 describes a system that maintains complete, accurate, and private personnel exposure data. The data include whole-body dose (neutron, beta, and gamma), extremity-dose (beta and gamma to fingers), and internal depositions. Hanford Site employees will have whole-body doses measured at a frequency dependent upon their work assignments as specified under Part 1 of the HSRCM-1.

Airborne Radioactivity Controls — Detailed methods and procedures for evaluating and controlling airborne radioactivity are discussed in WHC-SD-GN-DGS-30011. Radiological Control may employ portable instrumentation to evaluate airborne radioactivity concentrations. Alpha, beta, and gamma-emitters in air samples, as well as plutonium, noble gases, and iodine may be measured. Samples will be analyzed routinely, and the results may be reported to the Radiological Control, Facility Operations, Radiological Engineering, and ALARA organizations.

Airborne radioactivity concentrations will be controlled by using the design requirements stated in WHC-SD-GN-DGS-30011. Respiratory protection equipment may be required under special circumstances, as described in HSRCM-1.

3.3 SUMMARY

The 340 Facility RLWS and solid waste operations, with the controls outlined in this document, pose an acceptable risk to both the onsite and offsite individual. These operations maintain a radionuclide and chemical inventory without reliance on Safety Class or Safety Significant air-confinement barriers to reduce the amount of release to the onsite and offsite individual.

In accordance with DOE-STD-1027-92, the 340 Facility has been determined to be a Hazard Category 3 Facility. The credible accident scenarios, with a frequency greater than 10^{-6} per year, are an RLWS spray leak while pumping from the 340 Vault Tanks to the railroad tanker and a solid waste fire in 340-B West Building. Interim operational safety requirements have been developed to assure that the facility is maintained as a Hazard Category 3. Controlling the radioactive and hazardous material inventories ensures that potential onsite and offsite accident consequences are within the risk-acceptance guidelines.

Figure 3-1. Onsite and Offsite Radiological Risk Comparison to Guidelines.

*WHC-CM-4-46

7G96020306-01

[Note: 10 mSv = 1 rem.]

Table 3-1. 340 Vault Tank Hazard Category Calculations.¹

Isotope ²	Facility inventory (Ci/L) ³	Ci/tank 57 kL (15,000 gal)	Category 2 TQ (Ci)	Modified Category 2 TQ _m (Ci) ⁴	Ci/TQ _m (Ci) ^m
Beta/gamma	6.90 E-01	3.93 E+04	2.20 E+04	2.47 E+06	1.59 E-02
Alpha	1.16 E-03	6.61 E+01	5.60 E+01	6.18 E+03	1.07 E-02
			Sum of ratios	Total	2.66 E-02

¹Based on the bounding source term in Table 2-3 and the spray-release accident.
²For a worst-case inventory beta/gamma is taken as ⁹⁰Sr and alpha is taken as ²³⁹Pu.
³Simplified inventory based on total Ci/L inventory for beta/gamma and alpha emitters.
⁴The Category 2 threshold quantities were modified as shown in Chapter 3.0
 TQ = threshold quantities.
 TQ_m = threshold quantities modified.

Table 3-2. Hazard Categorization of 340 B Building Solid Radioactive Waste.

Isotope	Worst-case inventory of radioactive solid waste (Ci)	Category 2 TQ (Ci)	Total Ci/TQ (Ci)
Beta/gamma	10.00 E+00	2.20 E+04	4.55 E-04
Alpha	1.50 E+00	5.60 E+01	2.68 E-02
		Sum of ratios	2.72 E-02

NOTE: For a worst-case inventory beta/gamma is taken as ⁹⁰Sr and alpha is taken as ²³⁹Pu.
 TQ = threshold quantities.

Table 3-3. Calculation of Plutonium Equivalent Curie/Liter.¹

Isotope	(Ci/L)	Correction factor ²	PE (Ci/L)	Specific activity (Ci/g) ³	(g/L)	Fraction of total
²⁴¹ Am	6.26 E-04	1	6.262 E-04	3.42 E+00	2.08 E+01	0.1134108
²⁴⁰ Pu	7.85 E-05	1	7.85 E-05	2.27 E-01	3.93 E+01	0.2143256
²³⁹ Pu	5.81 E-05	1	5.81 E-05	6.20 E-02	1.06 E+02	0.5804136
²⁴² Pu	2.35 E-07	1/1.1	2.13 E-07	3.93 E-03	6.78 E+00	0.0370055
²³⁸ Pu	2.72 E-04	1/1.1	2.47 E-04	1.71 E+01	1.81 E+00	0.0098606
^{243/244} Cm	1.67 E-06	1/1.9	8.77 E-07	8.10 E+01	2.34 E-03	0.0000127
²⁴¹ Pu	7.48 E-03	1/52	1.44 E-04	1.03 E+02	8.24 E+00	0.0449712
Total			1.16 E-03			1.0

¹Based on Bounding Source Term (Table 2-1) and Appendix C of WHC-EP-0063-4.

²WHC-EP-0063-4, Table C-2.

³WHC-EP-0063-4, Table C-7.

Table 3-4. 340 Waste Handling Facility Preliminary Hazard Analysis. (6 sheets)

Hazard/ energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Annual probability	Severity
			Engineered	Administrative		
I. Chemistry						
A. Fire						
1. Range	None.	None.	Area around buildings is paved and/or graveled.	--	Incredible	IV
2. Building						
2a. 340	Fire could start in office area.	Fire and smoke damage, personnel injury.	Fire detection and suppression system.	--	Unlikely	III
2b. 340 Decontamination	Fire could start in or spread to stored dry waste.	Radiological/ Toxicological release could occur locally, onsite and offsite.	Fire detection and suppression system.	--	Unlikely	III
2c. 340 Control Room	Fire could start in wiring.	Radiological/ Toxicological contamination could occur locally.	Fire detection and suppression system.	--	Unlikely	III
2d. 340-A	Electrical fire could occur.	None.	Metal building, metal tanks, and piping. .	No flammable or combustible material stored in building.	Extremely Unlikely	III
2e. 340-B East Railroad Car Receiving	Fire could start in wiring.	Radiological/ Toxicological contamination could occur locally.	Metal building, metal tanks, and piping. Lighting and pumps only power source. Fire detection system.	No flammable or combustible material stored in building.	Extremely unlikely	III
2f. 340-B West Dry Waste Storage	Fire could start in stored waste.	Radiological/ Toxicological release could occur locally, onsite and offsite.	Fire Detection system.	--	Unlikely	III
3. Liquid Petroleum Gas						
3a. Fork lift or JLG manlift LPG tank	Tank damage causes leak. Resulting fire impacts stored waste.	Radiological/ Toxicological release could occur locally, onsite and offsite.	Design of fork lift and JLG protects tank from damage. Fire detection systems	Training of operators in proper handling techniques.	Anticipated	III
3b. LPG tank near 340 bldg. for auxiliary heater	Damage to LPG tank causes leak, resulting fire impacts stored waste.	Radiological/ Toxicological release could occur locally, onsite and offsite	Design of tank storage cage protects tank. Fire suppression system in 340.	Flammable material not stored or permitted near LPG tanks.	Anticipated	III

Table 3-4. 340 Waste Handling Facility Preliminary Hazard Analysis. (6 sheets)

Hazard/ energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Annual probability	Severity
			Engineered	Administrative		
1. Chemistry (Continued)						
3c. Any LPG tank.	External fire superheats tank resulting in BLEVE.	Radiological/ Toxicological release could occur locally, onsite and offsite.	(see A.3a & b) Also, LPG tanks have DOT mandated pressure relief valves.	Absence of fuel source for heating tank.	Incredible	II
B. Corrosion						
1. Corrosion fails drum/container						
1a. Dry Waste	Dry waste released to air.	Radiological/ Toxicological contamination could occur locally.	--	No long-term storage of waste drums.	Extremely unlikely	IV
1b. Liquid waste drums	Spill occurs.	Radiological/ Toxicological contamination could occur locally.	Area has gravel around building that reduces evaporation.	Incoming liquid dumped into 340 Vault Tanks in 340 decontamination sump.	Unlikely	III
2. Corrosion fails tanks or piping						
2a. 340 Vault Tanks	Corrosion in tank or piping allows release.	Release to ground could occur.	Tanks and most piping under ground. Pipes and tank double encased. Tank vault is concrete. Leak detection system.	--	Unlikely	III
2b. 340-A Tanks	Corrosion in tank or piping allows release.	Release to ground could occur.	Bottom of tanks and most piping underground. Pipes double encased. Concrete base and drains designed to divert leaks to the 340 Vault tanks. Leak detection system.	--	Unlikely	III
II. Potential/kinetic/energy						
A. Equipment						
1. Heavy equipment impacts drums/ containers	Drums or boxes ruptured.	Radiological/ Toxicological contamination could occur locally.	--	None used in area.	Extremely Unlikely	III
2. Sharp/hard equipment impacts drums/ containers	Drums or boxes ruptured.	Radiological/ Toxicological contamination could occur locally.	--	Only certified, experienced, operators, are allowed in facilities.	Unlikely	III

Table 3-4. 340 Waste Handling Facility Preliminary Hazard Analysis. (6 sheets)

Hazard/ energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Annual probability	Severity
			Engineered	Administrative		
II. Potential/Kinetic/Energy (Continued)						
3. Drum/container dropped	Container splits open.	Radiological/ Toxicological contamination could occur locally.	Drums lined with ten mil nylon reinforced plastic.	Stack height limited. Drums can take 3 m drop without failing.	Extremely Unlikely	III
4. Liquid waste drum dropped or damaged	Liquid spill to ground.	Ground contamination could occur.	Ground around building covered with gravel.	--	Unlikely	III
5. Pipe or pipe connection fails while pumping liquid waste to tankcar	Spray release could occur.	Radiological/ Toxicological release could occur locally, onsite and offsite.	HVAC system operating during pumpout - radiation alarms.	Piping inspected prior to connection. Leak check at start of pumping. Periodic inspections for leaks.	Extremely unlikely	III
6. Ventilation system, fails to maintain a vacuum in the vault/tanks.	Vault/tank pressurizes above atmospheric pressure.	Radiological/ Toxicological contamination could occur locally.	Ground around building covered with gravel.	Procedures provide recovery actions for operations.	Unlikely	III
7. Ventilation duct insulation deteriorates.	Internal ice buildup during freezing weather, vacuum not maintained.	Radiological/ Toxicological contamination could occur locally.	Ground around building covered with gravel.	Periodic inspection and maintenance or replace worn insulation	Unlikely	III
C. Helicopter/or plane crash	Crash into facility occurs.	Radiological/ Toxicological release could occur locally, onsite and offsite.	--	Flights over facility are rare.	Extremely unlikely	II
D. Transport Vehicle	Waste drums dropped while loading or unloading.	Radiological/ Toxicological contamination could occur locally.	--	Only certified, experienced, operators, are allowed in facilities. Drums can take 3 m drop without failing.	Unlikely	III
III. Natural occurrences						
A. Flood	The probable maximum flood could produce a river elevation of 116 m (382 ft) above msl which is 1.5 m (5 ft) below ground level at the 340 Building 118 m (387 ft). The floor level of the 340 Vault is at 111 m (365 ft) above msl.					
1. High water	High river flood covers area.	Overflow of vault tanks to river.	--	--	Extremely unlikely	III
2. Heavy rain (flash flood)	Heavy rain inundates area.	Overflow of vault tanks to river.	--	--	Unlikely	III

Table 3-4. 340 Waste Handling Facility Preliminary Hazard Analysis. (6 sheets)

Hazard/ energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Annual probability	Severity	
			Engineered	Administrative			
III. Natural occurrences (Continued)							
B. Seismic event	Strong earthquake collapses buildings ruptures tanks						
1. 340	Office area destroyed.	Property damage and personnel injury could occur.	--	--	Unlikely	IV	
2. 340 Decontamination	Sample and packaging area destroyed.	Minor release could occur.	--	--	Unlikely	III	
3. 340 Control Room	Instrument panel and Controls destroyed.	Minor release could occur.	--	--	Unlikely	III	
4. 340-A	Tanks ruptured concrete base cracked.	Ground release could occur.	--	--	Unlikely	III	
5a. 340-B railroad car receiving (empty)	Loading platform and pumping equipment damaged or destroyed.	Minor radiological/ toxicological release could occur locally.	--	--	Unlikely	III	
5b. 340-B railroad car receiving (car in place)	Loading platform and pumping equipment damaged or destroyed, railroad car damaged.	Radiological/ toxicological release could occur locally, onsite and offsite.	--	--	Incredible	II	
6. 340-B dry waste storage	Drums and boxes split open.	Radiological/ toxicological release could occur locally, onsite and offsite.	--	--	Extremely unlikely	III	
C. Wind							
1. Missile	Wind blown missile could penetrate building.	Property damage and personnel injury could occur. Minor release possible.	--	Area kept free of loose materials and trash.	Unlikely	III	
2. Pressure	Building could be destroyed.	Property damage and personnel injury could occur. Minor release possible.	UBC, Zone II, which provides for a wind loading of 98 2 kg/m ² (20 (lb/ft ²) 142 Km/h (88 m/hr)		--	Unlikely	III

Table 3-4. 340 Waste Handling Facility Preliminary Hazard Analysis. (6 sheets)

Hazard/ energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Annual probability	Severity
			Engineered	Administrative		
III. Natural occurrences (Continued)						
D. Volcanic Activity						
1. Ash buildup collapses building.	Building could be destroyed.	Property damage and personnel injury could occur. Minor release possible.	--	--	Unlikely	III
E. Lightening						
1. Lightening strikes building.	Electrical shorts and fire started.	Radiological/toxicological release could occur locally, onsite and offsite.	All buildings on grounding grid.	--	Extremely unlikely	III
IV. Stack Release						
A. HEPA filters	Fire or HEPA filter failure causes stack release.	Minor Radiological/toxicological release could occur.	DP gauge across filters.	Replacement on reaching set DP limit. Normal stack release complies with WMC-CM-7-5.	Extremely Unlikely	III
B. Charcoal filters	¹³¹ I release from 340 vault.	--	Charcoal filters. (not actively maintained)	Notification of 340 Facility prior to ¹³¹ I release to RLWS by labs.	--	--
V. Loss of Utilities						
A. Electrical	Storm or accident cuts off all electrical power.	Loss of stack flows and monitoring indication alarms and lights.	Emergency lighting.	Suspension of all waste handling operations.	Anticipated	IV
B. Process water	Loss of pump seal water.	Pump motor damaged by overheating.	Pump shutdown interlock.	--	Anticipated	IV
VI. Radiation						
A. Contamination	Marked radiation zones.	Persons working in zone could become contaminated.	Zones marked and/or isolated by rope fence.	ALARA rules are in effect. Personal Protective Equipment required.	Anticipated	III
B. Exposure	High-level radiation inventory	Radiation monitors, concrete cover blocks.	--	--	Anticipated	III
C. Criticality	Fissile materials are present.	Criticality could occur.	--	Facility compliance with WMC-CM-4-29.	Extremely unlikely	II

Table 3-4. 340 Waste Handling Facility Preliminary Hazard Analysis. (6 sheets)

Hazard/ energy source	Potential accident and sequence	Target/potential consequences	Mitigating features		Annual probability	Severity
			Engineered	Administrative		

ALARA = as low as reasonably achievable.

BLEVE = boiling liquid expanding vapor explosion

DOT = Department of Transportation

DP = differential pressure.

FHA = Federal Housing Administration.

HEPA = high-efficiency particulate air (filter).

HVAC = heating, ventilation, and air conditioning.

LPG = liquid petroleum gas.

msl = mean sea level.

UBC = Uniform Building Code.

Table 3-5. Probability Category Definition and Qualitative Accident Severity Levels.

Probability category definition			Qualitative accident severity levels	
Annual frequency category (AFC)	Category description	Nominal range of annual frequency	Severity category (SC)	Consequences to the public, workers, or environment
Anticipated (A)	An offnormal condition that individually may be expected to occur once or more during plant lifetime.	10^{-2} to 1	Category I	May cause deaths onsite or loss of the facility/operation, major injuries or illnesses offsite, radiation exposure to offsite individuals to individuals in excess of annual limits, or severe impact on the environment.
Unlikely (U)	Individually, condition is not expected to occur during the plant lifetime, but collectively, events in this category may occur several times.	10^{-4} to 10^{-2}	Category II	May cause severe injuries or severe occupational illnesses onsite, exposure to onsite individuals in excess of annual limits, major damage to a facility operation, minor illnesses or injury offsite, exposure to offsite individuals to radiation below annual limits, or major impact on the environment.
Extremely unlikely (EU)	Extremely low-probability conditions that are not expected during the plant lifetime, but that represent extreme or limiting cases of faults identified as possible. This category includes design basis accidents.	10^{-6} to 10^{-4}	Category III	May cause minor injury or minor occupational illness onsite, or exposure of onsite individuals to radiation below annual limits, negligible impact offsite, or minor impact on the environment.
Incredible (I)	Accidents for which no creditable scenario can be identified.	$<10^{-6}$	Category IV	Will not result in injury, occupational illness, exposure onsite or offsite, or result in a significant impact to the worker.

Table 3-6. Operating Hazards. (2 sheets)

Room location	Equipment	Hazardous material	Hazards							Mitigating features	Administrative controls
			Fire	Electric shock	Air borne	Noise	Surface contamination	Skin contamination	Whole body dose		
340 Building Vault	RLW vault tanks	RLW	--	X	X	--	X	X	X	Tanks below ground level, Concrete walls and .3 m 12" thick concrete shielded cover blocks. Access hatch, covered with penthouse.	Entry for maintenance and inspection only, PPE.
340 Building Vault	RLW agitators	RLW	--	X	X	X	X	X	X	Access through hole in cover block, covered by penthouse. Pumps controlled from control room.	Entry for maintenance and inspection only, PPE.
340 Building Vault	RLW pumps	RLW	--	X	X	X	X	X	X	Access through hole in cover block, covered by penthouse. Pumps controlled from control room.	Entry for maintenance and inspection only, PPE.
340 Building Vault, valve pit	RLW valves and piping	RLW	--	--	X	--	X	X	X	Access hatch, covered by penthouse.	Entry for maintenance and inspection only, PPE.
340 Building Vault, valve pit	Sample/backup pump	RLW	--	X	X	X	X	X	X		
340 Building	NaOH tank and pumps	--	--	--	--	--	--	--	--	Removed.	--
340 Building mechanical room	Air compressor, vacuum pump, MCC	Oil	X	X	--	X	--	--	--	Fire detection and suppression system.	Ear protection required.
340 Building decon room	Decon chemicals and equipment	Contamination, toxic chemicals	X	X	--	--	X	X	X	Steel grated trough drains to sump Fire detection and suppression system.	PPE as needed.
340 Building decon room	Sample hood	RLW, toxic chemicals	--	X	--	--	X	X	X	Steel grated trough drains to sump.	PPE as needed.
340 Building extension	Solid waste packaging and storage	Solid mixed waste	X	X	--	X	--	--	X	Fire detection and suppression system.	--

Table 3-6. Operating Hazards. (2 sheets)

Room location	Equipment	Hazardous material	Hazards							Mitigating features	Administrative controls
			Fire	Electric shock	Air borne	Noise	Surface contamination	Skin contamination	Whole body dose		
340 Building control room	--	--	X	X	--	--	--	--	--	Access through outside door. Fire detection and suppression system.	--
340-A Building	Storage tanks and valves	RLW	--	X	X	--	X	X	X	Bottom of tanks below ground. Dry sump drains to vault tanks.	Access tightly restricted, PPE.
340-B Building railroad car receiving	Tankcar loading	RLW	--	X	X	X	X	X	X	Shield wall, loading controlled from control room.	Access restricted, PPE.
340-B Building dry waste storage	208 L (55-gal) drums, and boxes	Solid mixed waste	X	X	X	--	X	X	X	Shield wall separates solid waste storage area from tankcar loadout. Fire detection system.	--
MO-037 trailer	Facility Office	--	X	X	--	--	--	--	--	Fire detection and suppression system.	--
MO-741 trailer	HPT office and survey station.	--	X	X	--	--	--	--	--	Fire detection and suppression system.	--

HPT = health physics technician.
 MCC = motor control center.
 PPE = personal protective equipment.
 RLW = radioactive liquid waste.

Table 3-7. Maximum Individual Dose Due to an Aerosol Release of 1 Curie of Each Isotope From the 340 Facility. (2 sheets)

Receptor	Onsite 100 m north	Offsite 345 m East	Onsite 100 m north	Offsite 345 m East	
X/Q	4.21 E-02	3.77 E-03	4.21 E-02	3.77 E-3	
Isotope	Annual Effective Dose Equivalent		Maximum Organ		Organ
³ H	1.30 E-03	1.16 E-04	1.60 E-03	1.43 E-04	Bone
¹⁴ C	2.90 E-02	2.60 E-03	3.70 E-02	3.31 E-03	R. Marrow
²² Na	1.20 E-01	1.07 E-02	1.80 E-01	1.61 E-02	Bone
⁵⁴ Mn	9.60 E-02	8.60 E-03	3.50 E-01	3.13 E-02	Lung
⁵⁷ Co	1.20 E-01	1.07 E-02	8.70 E-01	7.79 E-02	Lung
⁵⁹ Fe	1.80 E-01	1.61 E-02	7.30 E-01	6.54 E-02	Lung
⁶⁰ Co	2.80 E+00	2.51 E-01	1.80 E+01	1.61 E+00	Lung
⁶³ Ni	3.20 E-02	2.87 E-03	1.60 E-01	1.43 E-02	Lung
⁶⁵ Zn	2.60 E-01	2.33 E-02	1.10 E+00	9.85 E-02	Lung
⁷⁵ Se	1.20 E-01	1.07 E-02	2.90 E-01	2.60 E-02	Lung
⁷⁹ Se	1.30 E-01	1.16 E-02	5.10 E-01	4.57 E-02	Lung
⁸⁵ Sr	2.60 E-02	2.33 E-03	5.10 E-02	4.57 E-03	Bone
⁹⁰ Sr	2.80 E+00	2.51 E-01	3.40 E+01	3.04 E+00	Bone
⁹⁰ Y	1.20 E-01	1.07 E-02	5.00 E-01	4.48 E-02	Lung
⁹³ Zr	1.10 E+00	9.85 E-02	2.80 E+01	2.51 E+00	Bone
⁹⁵ Zr	2.20 E-01	1.97 E-02	1.20 E+00	1.07 E-01	Bone
⁹⁵ Nb	8.70 E-02	7.79 E-03	4.40 E-01	3.94 E-02	Lung
⁹⁹ Tc	1.30 E-01	1.16 E-02	8.80 E-01	7.88 E-02	Lung
¹⁰⁶ Ru	6.80 E+00	5.91 E-01	5.30 E+01	4.75 E+00	Lung
¹⁰⁹ Cd	1.60 E+00	1.43 E-01	2.10 E+01	1.88 E+00	Kidney
¹²⁵ Sb	1.80 E-01	1.61 E-02	1.20 E+00	1.07 E-01	Lung
¹³¹ I	4.30 E-01	3.85 E-02	1.40 E+01	1.25 E+00	Thyroid
¹³⁴ Cs	6.10 E-01	5.46 E-02	7.30 E-01	6.54 E-02	Small int
¹³⁷ Cs	4.30 E-01	3.85 E-02	4.70 E-01	4.21 E-02	Small int
¹⁴⁴ Ce	5.20 E+00	4.66 E-01	4.10 E+01	3.67 E+00	Lung
¹⁵¹ Sm	4.20 E-01	3.76 E-02	7.10 E+00	6.36 E-01	Bone
¹⁵² Eu	2.90 E+00	2.60 E-01	1.80 E+01	1.61 E+00	Liver
¹⁵⁴ Eu	3.90 E+00	3.49 E-01	2.70 E+01	2.42 E+00	Bone
¹⁵⁵ Eu	5.70 E-01	5.10 E-02	7.60 E+00	6.81 E-01	Bone
¹⁸² Ta	6.20 E-01	5.55 E-02	4.30 E+00	3.85 E-01	Lung
²³⁴ U	1.90 E+03	1.70 E+02	1.50 E+04	1.34 E+03	Lung
²³⁵ U	1.70 E+03	1.52 E+02	1.40 E+04	1.25 E+03	Lung
²³⁶ U	1.80 E+03	1.61 E+02	1.50 E+04	1.34 E+03	Lung
²³⁸ U	1.70 E+03	1.52 E+02	1.40 E+04	1.25 E+03	Lung
²³⁸ Pu	4.00 E+03	3.58 E+02	3.80 E+04	3.40 E+03	Bone

Table 3-7. Maximum Individual Dose Due to an Aerosol Release of 1 Curie of Each Isotope From the 340 Facility. (2 sheets)

Receptor	Onsite 100 m north	Offsite 345 m East	Onsite 100 m north	Offsite 345 m East	
X/Q	4.21 E-02	3.77 E-03	4.21 E-02	3.77 E-3	
Isotope	Annual Effective Dose Equivalent		Maximum Organ		Organ
²³⁸ Pu	4.30 E+03	3.85 E+02	4.40 E+04	3.94 E+03	Bone
²⁴⁰ Pu	4.20 E+03	3.76 E+02	4.40 E+04	3.94 E+03	Bone
²⁴¹ Pu	6.90 E+01	6.18 E+00	9.30 E+02	8.33 E+01	Bone
²⁴² Pu	4.10 E+03	3.67 E+02	4.00 E+04	3.58 E+03	Bone
²⁴¹ Am	6.20 E+03	5.55 E+02	1.10 E+05	9.85 E+03	Bone
²⁴³ Cm	4.30 E+03	3.85 E+02	7.60 E+04	6.81 E+03	Bone
²⁴⁴ Cm	3.50 E+03	3.13 E+02	6.10 E+04	5.46 E+03	Bone

Table 3-8. Dose Consequences for a Spray-Release Accident.^(a)

Isotope ^(b)	Ci/L	Ci released	rem/Ci Onsite	rem/Ci Offsite	rem Onsite	rem Offsite
Beta/Gamma	6.90 E-01	3.53 E-01	3.90 E+00	3.30 E-01	1.38 E+00	1.16 E-01
Alpha	1.16 E-03	5.93 E-04	4.30 E+03	3.60 E+02	2.55 E+00	2.13 E-01
Total	--	--	--	--	3.92 E+00	3.30 E-01

(a) For a 5.11 E-4 L release while pumping from the 340 Vault tank to a railroad tankcar.

(b) For a worst case inventory the Beta/Gamma distribution was modeled as ¹⁵⁴Eu and the Alpha was modeled as ²³⁹Pu.

Table 3-9. Dose Consequences When Burning the 340-B West Building Solid Wastes.

Isotope ^a	Total curies	Curies released	Onsite (rem/Ci)	Offsite (rem/Ci)	Onsite (rem)	Offsite (rem)
Beta/gamma	10.00 E+00	5.00 E-03	3.90 E+00	3.3 E-01	1.95 E-02	1.65 E-03
Alpha	1.50 E+00	7.50 E-04	4.30 E+03	3.60 E+02	3.23 E+00	2.70 E-01
Total					3.24 E+00	2.72 E-01

^aFor a worst-case release the beta/gamma is taken as ¹⁵⁴Eu and the alpha is taken as ²³⁹Pu.

Table 3-10. 340 Facility Safety Enhancement Systems.

Component/system	Provisions	Codes, standards, and regulations
Stack Sampler/Monitoring System		
340 Building Stack	Continuous isokinetic sampler/no monitor.	ANSI N 13.1-1982
340 Vault Stack	Continuous isokinetic sampler. Continuous monitoring of beta and alpha particulates.	ANSI N 13.1-1982
Personnel Protection	Process Radiation Detectors are installed in the 340 Valve Box 9 and in 340-A. These detectors are installed to give indication of changes in activity level or movement of radioactive liquids but also provide indication of high radiation levels.	DOE W 441.1, and 10 CFR 835
Facility Confinement/Containment Systems		
340 Building Stack	Two-stage HEPA filters, one fan (no backup).	WHC-CM-7-5
340 Vault Stack	Two stages HEPA filters, demister, two fans.	
340-B Building Stack	One stage HEPA filters, one fan (no backup).	
Fire Protection Systems		
340 Building	Smoke detectors, temperature detectors, and sprinkler systems-alarms locally and at the Hanford Fire Department Central Dispatch Center.	DOE Order 5480.7A
340-B Building	Smoke detectors - alarms locally and at the Hanford Fire Department Central Dispatch Center.	

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4.0 CONFIGURATION CONTROLS SYSTEM

The configuration control system for WHC is administered using procedures, standards and practices of WHC-CM-6-1, *Standard Engineering Practices*. This manual governs all engineering, development and project tasks that result in a documented design and/or deliverable engineered product. These engineering practices provide a graded approach to the principles of configuration management and design control to ensure that engineering tasks and deliverable engineered products produced from these tasks are identified, authorized, verified, changed, and documented by a controlled methodology, that is consistent with the importance of the activities to safety, health, environment, continuity of operations, and value. Drawing controls, operating, and maintenance procedure controls, USQ, procedures and quality assurance procedures all provide assurance that functional and physical characteristics of the facility are maintained within the safety basis and that the ISB-003 is maintained current.

4.1 DRAWING CONTROL

Engineering drawings initiated and approved by or for WHC are prepared in accordance with WHC-CM-6-1, EP-1.3, and WHC-IP-1026, *Engineering Practices Guidelines*, (WHC 1994a). This manual implements DOE Richland Operations Office (RL) Order 6430.1C, *Hanford Plant Standards*, Design Criteria, SDC-1.3, "Preparation and Control of Engineering and Fabrication Drawings." All released engineering drawings are stored in designated storage facilities. Before release, a designated reviewer ensures the drawing is in accordance with the above manuals. The approval process for drawings uses the engineering data transmittal form for recording approval signatures (Engineering Practice procedure EP-1.6, WHC-CM-6-1). Revision of approved drawings follow the procedures specified in EP-2.2, "Engineering Document Change Control." Approval of revised drawings use the engineering data transmittal form, as noted above.

4.2 PROCEDURE CONTROL

WHC maintains a policy that all operations are to be conducted in accordance with written procedures. The requirement for complying with procedures is stated in Appendix A of WHC-CM-1-3, MRP 4.16, "Standards of Conduct." Compliance with the detailed instructions in procedures is essential for safe and reliable operation. The procedures (maintenance and operating) will comply with the applicable requirements of DOE Orders 4330.4B and 5480.19, as stated in the requirements of WHC-CM-3-5, *Document Control and Records Management Manual*, Section 12.0, "Document Control," and Section 12.5, "Working Level Procedure Control," and WHC-CM-4-2, Section 6.0, "Document Control."

These procedures and policies apply to all facilities and organizations that require the use of procedures for guidance and control of day-to-day activities, including the 340 Facility. Each facility is responsible for controlling, maintaining, and modifying the procedures to achieve the highest standards of safety, efficiency, and excellence in conduct of operations.

The procedures are maintained current in procedure books that are readily available for the users. Outdated procedures are removed and replaced as procedure revisions are approved and issued. Management accepts the responsibility of assuring that personnel using the procedures are trained and qualified.

4.3 UNREVIEWED SAFETY QUESTIONS

The USQ process complies with DOE Order 5480.21 and is administered by WHC using WHC-CM-1-5, Section 7.3, "Identifying and Resolving Unreviewed Safety Questions." The safety evaluation process makes use of the methodology and risk-acceptance guidelines contained in WHC-CM-4-46. This process allows WHC to make physical and procedural changes and conduct tests and experiments without prior DOE approval, as long as the changes do not affect the safety basis of the facility or result in a change to a technical safety requirement or IOSR. Conversely, the USQ evaluation process starts when changes to the operations and facility, a discovery of new conditions, or a discovery of an error in the safety analysis affects the safety basis of the facility or results in changes to a technical safety requirement or IOSR.

The USQ process also ensures that discoveries representing conditions outside the safety basis or technical safety requirements are identified. This is to ensure that actions are taken to modify the conditions or to redefine the safety basis.

The USQ process applies to activities at all WHC-managed facilities (existing and new). The 340 Facility complies with the USQ process by evaluating proposed changes, tests, and experiments. If a USQ exists, a USQ safety evaluation will be performed and documented on the change. 340 Facility occurrences will be evaluated to determine if a discovery (potential USQ) might exist. If a discovery exists, the 340 Facility manager will be notified and actions will be taken to determine if the facility is in a safe (or safest) mode or state, based on the potential inadequacy or reduction in technical safety requirement margin. The appropriate RL Line manager will be notified when an occurrence is determined to be a discovery.

4.4 QUALITY ASSURANCE

The quality assurance program established by WHC for the design, construction, modification, and operation of the 340 Facility is consistent with the requirements of 10 CFR 830.120 *Quality Assurance*. The quality assurance program is administered using the requirements and instructions within WHC-CM-4-2 and WHC-SP-1131. It is WHC policy that the Quality Assurance program will be executed to provide adequate confidence that designs, construction, testing, and operations meet regulatory requirements and that the 340 Facility operations will be safe and efficient. The management plans and procedural controls necessary for safe operation and control will be documented, as required by DOE Orders. The Quality Assurance program applies to all activities that could effect safety and reliability at the 340 Facility. The Quality Assurance program also includes quality control. Included in the quality control are the Quality Assurance activities that provide control of the quality of the material, structure, component, or

system to predetermined requirements (including ISB requirements). Quality control provides verification that functional and physical characteristics of the facility are maintained within the safety envelope and that the ISB is maintained current.

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5.2 U.S. FEDERAL CODES AND DEPARTMENT OF ENERGY ORDERS/GUIDELINES

- 10 CFR 830.120, *Quality Assurance*, Code of Federal Regulations, as amended.
- 10 CFR 835, *Occupational Radiation Protection*, Code of Federal Regulations, as amended.
- DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, U.S. Department of Energy, Washington, D.C.
- 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.

- DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, U. S. Department of Energy, Washington, D.C.
- DOE Order 4330.4B, *Maintenance Management Program*, U. S. Department of Energy, Washington, D.C.
- DOE Order 5480.7A, *Fire Protection*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.10, *Radiological Control*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.21, *Unreviewed Safety Questions*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.23, *Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.
- DOE Order, 5480.24, *Nuclear Criticality Safety*, U.S. Department of Energy, Washington, D.C.
- DOE Order, 5481.1B, *Safety Analysis and Review System*, U.S. Department of Energy, Washington, D.C.
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- DOE Order 5820.2A, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.
- RL Order 6430.1C, *Hanford Plant Standards*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

5.3 WESTINGHOUSE HANFORD COMPANY CONTROLLED MANUALS

- HSRCM-1, *Hanford Site Radiological Control Manual*, Hanford Contractors Richland, Washington.
- WHC-CM-1, *Company Policies and Charters*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-1-3, *Management Requirements and Procedures*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-1-10, *Safety Manual*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-1-11, *Industrial Hygiene Manual*, Westinghouse Hanford Company, Richland, Washington.

- WHC-CM-2-14, *Hazardous Material Packaging and Shipping*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-3-5, *Document Control and Records Management*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-1, *Fire Protection Program*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-2, *Quality Assurance*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-29, *Nuclear Criticality Safety*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-33, *Security*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-41, *Fire Protection Program*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-43, *Emergency Management Procedures*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-46, *Nonreactor Facility Safety Analysis*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-6-1, *Standard Engineering Practices*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-7-5, *Environmental Compliance*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SP-1131, Rev. 1, *WHC Quality Assurance Program and Implementation Plan*, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A
CONDUCT OF OPERATIONS COMPARATIVE
EVALUATION

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Table A-1. Identification of DOE Orders, WHC Control Manuals, and 340 Facility Implementing Documentation. (8 sheets)

Institutional control or safety requirement	Federal Codes and DOE Orders and titles	Applicable WHC controlled manuals	340 Facility implementing document(s)
Radiation Protection	<p>10 CFR Part 835 <i>Occupational Radiation Protection</i></p> <p>5400.5, <i>Radiation Protection of the Public and the Environment</i></p> <p>5480.4, <i>Environmental Protection, Safety, and Health Protection Standards</i></p> <p>N 441.1, <i>Radiological Protection for DOE Activities</i></p>	<p>WHC-CM-1-3, <i>Management Requirements and Procedures</i></p> <p>HSRCM-1, Rev. 2, <i>Hanford Site Radiological Control Manual</i></p> <p>WHC-CM-7-5, <i>Environmental Compliance</i></p> <p>WHC-IP-1043, <i>WHC Occupational Alara Program</i></p>	<p>WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i>, Section 1.11 "Radiological Protection Program" will address radiation protection within the 340 Facility. Personnel shall be aware of their own exposure levels and take appropriate action to minimize exposures (such as time, distance and shielding).</p> <p>WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i>, Section 2.2, "Shift Routines and Operating Practices" requires that all operators verify important parameters using a checklist, especially those pertaining to safety, to ensure continuity of operations in a safe and effective manner.</p>
ALARA	<p>10 CFR Part 835 <i>Occupational Radiation Protection</i></p>	<p>HSRCM-1, <i>Hanford Site Radiological Control Manual</i></p> <p>WHC-IP-1043, <i>WHC Occupational Alara Program</i></p>	<p>WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i>, Section 1.11, "Radiological Protection Program," requires that specific ALARA goals are prepared. The facility goals implement WHC-IP-1043 by establishing a facility ALARA team and defining the responsibilities of this team.</p>

Table A-1. Identification of DOE Orders, WHC Control Manuals, and 340 Facility Implementing Documentation. (8 sheets)

Institutional control or safety requirement	Federal Codes and DOE Orders and titles	Applicable WHC controlled manuals	340 Facility implementing document(s)
Occupational Safety	5483.1A, <i>Occupational Safety and Health Program for DOE Contractor Employees at Government-owned Contractor-operated Facilities</i>	WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-1-10, <i>Safety Manual</i> WHC-CM-1-11, <i>Industrial Hygiene Manual</i> WHC-CM-4-2, <i>Quality Assurance Manual</i> WHC-CM-4-40, <i>Industrial Hygiene Manual</i>	WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i> , Section 2.2, "Shift Routine and Operating Practices," requires personnel to adhere to the requirements of WHC-CM-1-10. The facility Safety Improvement Plan requires that all work be performed safely and further requires that management take action should safety concerns be identified.
Fire Protection, Fire Protection Programs	5480.7A, <i>Fire Protection</i>	WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-4-41, <i>Fire Protection Program Manual</i>	WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i> , Section 2.2, "Shift Routine and Operating Practices," will require that all work be performed safely. The facility is classified as a "Low Fire Load" facility. Operator training, the presence of smoke detectors and fire sprinkler systems, together with periodic inspections by the fire department comply with WHC-CM-4-41.
Industrial Safety	None Identified (see Occupational Safety)		

Table A-1. Identification of DOE Orders, WHC Control Manuals, and 340 Facility Implementing Documentation. (8 sheets)

Institutional control or safety requirement	Federal Codes and DOE Orders and titles	Applicable WHC controlled manuals	340 Facility implementing document(s)
Industrial Hygiene	5480.10, <i>Contractor Industrial Hygiene Program</i>	WHC-CM-1, <i>Company Policies and Charters</i> WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-1-10, <i>Safety Manual</i> WHC-CM-1-11, <i>Industrial Hygiene Manual</i> WHC-CM-4-40, <i>Industrial Hygiene Manual</i>	WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i> , Section 1.11, "Hazard Communication", contains facility specific requirements for maintaining an inventory of all hazardous materials.
Criticality Safety	5480.24, <i>Nuclear Criticality Safety</i>	WHC-CM-4-29, <i>Nuclear Criticality Safety Manual</i>	WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i> , Section 3.10, "340 Facility Criticality Safety Program" provides limited facility-specific implementation for the requirements of WHC-CM-4-29. The 340 Facility is administratively classified as an "Isolated Facility," i.e., the fissile material inventory is limited to no more than one-third of a minimum critical mass; therefore, a nuclear criticality is not an issue.

Table A-1. Identification of DOE Orders, WHC Control Manuals, and
340 Facility Implementing Documentation. (8 sheets)

Institutional control or safety requirement	Federal Codes and DOE Orders and titles	Applicable WHC controlled manuals	340 Facility implementing document(s)
Training for Nuclear Facilities	5480.20A, <i>Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-reactor Nuclear Facilities</i>	WHC-CM-2-15, <i>Training Standards</i>	WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i> , Section 1.2, "Training Program Description" describes the training requirements and responsibilities to comply with DOE 5480.20A and represents a graded application of the requirements that apply to the liquid waste disposal facilities.
Radioactive Waste Management	5820.2A, <i>Radioactive Waste Management</i>	WHC-CM-1, <i>Company Policies and Charters</i> WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-2-14, <i>Hazardous Material Packaging and Shipping</i> WHC-CM-4-29, <i>Nuclear Criticality</i> WHC-CM-7-5, <i>Environmental Compliance</i>	All radioactive waste operations are conducted in accordance with WHC-EP-0063, <i>Hanford Site Radioactive Waste Acceptance Criteria</i> , and with applicable operating procedures.

Table A-1. Identification of DOE Orders, WHC Control Manuals, and 340 Facility Implementing Documentation. (8 sheets)

Institutional control or safety requirement	Federal Codes and DOE Orders and titles	Applicable WHC controlled manuals	340 Facility implementing document(s)
Occurrence Reporting	232.1, <i>Occurrence Reporting and Processing of Operations Information</i>	WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-1-4, <i>Corrective Actions Management Manual</i> WHC-CM-1-5, <i>Standard Operating Practices</i>	WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i> , Section 1.9 "Occurrence Reporting," will identify the occurrence reporting process in accordance with WHC-CM-1-5. This section will ensure prompt release to the public of occurrence reports, implementing the requirements of DOE Order 232.1.
Quality Assurance	10 CFR 830.120, <i>Quality Assurance</i>	WHC-CM-1, <i>Company Policies and Charters</i> WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-3-5, <i>Document Control and Records Management Manual</i> WHC-CM-4-2, <i>Quality Assurance Manual</i> WHC-SP-1131, Rev. 1, <i>WHC Quality Assurance Program and Implementation Plan</i>	WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i> , Section 1.4, "Quality Assurance Program Plan," provides guidance for implementation of the 19 elements defined by WHC-CM-4-2, QR 1.0 through QR 19.0.

Table A-1. Identification of DOE Orders, WHC Control Manuals, and
340 Facility Implementing Documentation. (8 sheets)

Institutional control or safety requirement	Federal Codes and DOE Orders and titles	Applicable WHC controlled manuals	340 Facility implementing document(s)
Configuration Management	<p>4330.4B, <i>Maintenance Management Program</i></p> <p>5480.21, <i>Unreviewed Safety Questions</i></p> <p>5480.22, <i>Technical Safety Requirements</i></p> <p>5480.23, <i>Nuclear Safety Analysis Reports</i></p> <p>5481.1B, <i>Safety Analysis and Review System</i></p>	<p>WHC-CM-1-3, <i>Management Requirements and Procedures</i></p> <p>WHC-CM-1-5, <i>Standard Operating Practices</i></p> <p>WHC-CM-4-2, <i>Quality Assurance Manual</i></p> <p>WHC-CM-4-46, <i>Nonreactor Facility Safety Analysis Manual</i></p> <p>WHC-CM-6-1, <i>Standard Engineering Practices</i></p>	<p>WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i>, Section 3.1, "Operations Procedures," establishes the methods for management of operating procedures.</p> <p>Section 1.5, "340 Facility Unreview Safety Question Process and Administration of the Plant Review Committee" established the facility-specific requirements for the USQ process.</p> <p>All other configuration control will be conducted in accordance with WHC-CM-6-1 and WHC-CM-4-2.</p>
Conduct of Operations	<p>5480.19, <i>Conduct of Operations Requirements for DOE Facilities</i></p>	<p>WHC-CM-1, <i>Company Policies and Charters</i></p> <p>WHC-CM-1-5, <i>Standard Operating Practices</i></p> <p>WHC-CM-3-5, <i>Document Control and Records Management Manual</i></p>	<p>WHC-IP-1000, <i>300 Area Liquid Effluent Facilities Administration</i>, contains many sections regulating conduct of operations at the 340 Facility. Section 2.1, "Operations Organization and Administration," includes an implementation matrix for DOE Order 5480.19.</p>

Table A-1. Identification of DOE Orders, WHC Control Manuals, and 340 Facility Implementing Documentation. (8 sheets)

Institutional control or safety requirement	Federal Codes and DOE Orders and titles	Applicable WHC controlled manuals	340 Facility implementing document(s)
Emergency Planning	5500.2B, <i>Emergency Categories, Classes, and Notification and Reporting Requirements</i> 5500.3A, <i>Planning and Preparedness for Operational Emergencies</i>	WHC-CM-1, <i>Company Policies and Charters</i> WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-4-43, <i>Emergency Management Procedures</i>	The building emergency plan is contained in WHC-IP-0263-340, <i>Building Emergency Plan, 340 Waste Handling Facility</i> . This document has been prepared in accordance with WHC-CM-4-43.
Environmental Protection	5400.1, <i>General Environmental Protection Program</i> 5400.5, <i>Radiation Protection of the Public and the Environment</i> 5480.4, <i>Environmental Protection, Safety, and Health Protection Standards</i> 5484.1, <i>Environmental Protection, Safety, and Health Protection Information Reporting Requirements</i>	WHC-CM-1, <i>Company Policies and Charters</i> WHC-CM-1-3, <i>Management Requirements and Procedures</i> WHC-CM-1-4, <i>Corrective Action Management Manual</i> WHC-CM-4-2, <i>Quality Assurance Manual</i> WHC-CM-7-5, <i>Environmental Compliance Manual</i>	ISB-003 addresses environmental monitoring within the 340 Facility and specifies periodic formal and informal audits to assure conformance to limits and safe practices. Compliance with environmental protection is implemented through WHC-CM-7-5. Tracking of corrective actions is implemented through WHC-CM-1-4.

REFERENCES

U.S. FEDERAL CODES AND DEPARTMENT OF ENERGY ORDERS

- 10 CFR 830.120, *Quality Assurance*, Code of Federal Regulations, as amended.
- 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.
- DOE Order 4330.4B, *Maintenance Management Program*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5400.1, *General Environmental Protection Program*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.7, *Fire Protection*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.10, *Contractor Industrial Hygiene Program*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.11, *Radiation Protection for Occupational Workers*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.20A, *Personnel Selection, qualification, Training, and Staffing Requirements at DOE Reactor and Non-reactor Nuclear Facilities*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.21, *Unreviewed Safety Questions*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.22, *Technical Safety Requirements*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.23, *Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5480.24, *Nuclear Criticality Safety*, U.S. Department of Energy, Washington, D.C.
- DOE Order 5483.1A, *Occupational Safety and Health Program for DOE Contractor Employees at Government-owned Contractor-operated Facilities*,

U.S. Department of Energy, Washington, D.C.

DOE Order 5484.1, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, U.S. Department of Energy, Washington, D.C.

DOE Order 5500.2B, *Emergency Categories, Classes, and Notification and Reporting Requirements*, U.S. Department of Energy, Washington, D.C.

DOE Order 5500.3A, *Planning and Preparedness for Operational Emergencies*, U.S. Department of Energy, Washington, D.C.

DOE Order 5820.2A, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

N 441.1, *Radiological Protection for DOE Activities*, U.S. Department of Energy, Washington, D.C.

WESTINGHOUSE CONTROLLED MANUALS

HSRCM-1, *Hanford Site Radiological Control Manual*, Hanford Contractors Richland, Washington.

WHC-CM-1, *Company Policies and Charters*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-1-3, *Management Requirements and Procedures*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-1-4, *Corrective Actions Management Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-1-5, *Standard Operating Practices*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-1-10, *Safety Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-1-11, *Industrial Hygiene Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-2-14, *Hazardous Material Packaging and Shipping*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-2-15, *Training Administration Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-3-5, *Document Control and Records Management Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-2, *Quality Assurance Manual*, Westinghouse Hanford Company, Richland, Washington.

- WHC-CM-4-5, *Quality Assurance Qualifications and Instructions*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-29, *Nuclear Criticality Safety Manual*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-40, *Industrial Hygiene Manual*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-41, *Fire Protection Program Manual*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-6-1, *Standard Engineering Practices*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-7-5, *Environmental Compliance Manual*, Westinghouse Hanford Company, Richland, Washington.
- WHC-IP-1043, *WHC Occupational Alara Program*, Westinghouse Hanford Company, Richland, Washington.
- WHC-IP-1000, *300 Area Liquid Effluent Facilities Administration*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SP-1131, Rev. 1, *WHC Quality Assurance Program and Implementation Plan*, Westinghouse Hanford Company, Richland, Washington.

APPENDIX B
CALCULATION OF SPRAY RELEASE

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CALCULATION OF SPRAY RELEASE

Calculation of the spray release from the Vault Tank piping used equations from WHC-SD-GN-TI-30003 and WHC-SD-GN-SWD-20007. The calculations were done on a spreadsheet iterating first to find the Reynolds number and then to find the slit width giving the highest respirable flow. The Reynolds number 3230 indicates a critical flow. Subscripts were changed in some of the equations for consistency.

The following variable constants define the system.

Velocity Coefficient	$C_v =$	8.20 E-01	-		
Resistance Coefficient	$K_v =$	4.87 E-01	-		
Absolute Surface Roughness	$\epsilon =$	4.57 E-05	m	0.00015	ft
	Slit depth	1.10 E-02	m	0.433	in
	ΔP	1.59 E+05	N/m ²	23	psi
	$\rho =$	1.04 E+03	kg/m ³	64.9	lb/ft ³
Velocity	$U_1 = C_v \sqrt{2 \frac{\Delta P}{\rho_1}} =$	1.75 E+01	m/s	57.41	ft/s
	Viscosity $\mu =$	1.00 E-03	Pa/s	1	centipoise
	Kinematic Viscosity $\nu_L = \mu/\rho =$	9.62 E-07	m ² /s	3.01 E-6	ft ² /s
	slit length $l =$	7.62 E-02	m	3	in

The respirable portion was calculated using Saunter Mean Diameter

$$SMD = \frac{500 d_p^{1.2} \nu_L^{0.2}}{U_L}$$

and the Rosin-Rammler drop size distribution

$$Q = 1 - e^{-(D_r/X)^q}$$

SMD using the Rosin Rammler drop size distribution

$$\frac{SMD}{X} = [\Gamma(1 - \frac{1}{q})]^{-1}$$

Where: Γ denotes the gamma function

To calculate the Saunter Mean Diameter (SMD) and drop size distribution the following variable constants were assumed. The value of q and the corresponding value of SMD/X were taken from Page 3 of WHC-SD-GN-TI-30003

Respirable drop size	$D_r =$	20	μm	7.87 E-4	in
A fitting Constant	$q =$	2.4			
Based on q	SMD/X =	0.65415			

The calculation sequence giving the equations in the sequence used and the final result follows.

slit width $w =$	1.943 E-04	m	7.65 E-03	in
Equivalent diameter $2*w = d_e =$	3.89 E-04	m	1.53 E-2	in
depth/ $d_e =$	2.83 E+01			
$\epsilon/d_e =$	1.18 E-01			
Estimated Reynolds number $Re =$	3.25 E+03			
$\frac{2}{\sqrt{f_d}} = -2 \log_{10} \left(\frac{\epsilon/d_e}{3.7} + \frac{2.51}{Re \sqrt{f_d}} \right)$ estimated $f_d =$	1.16 E-01			
$\epsilon/d_e/3.7 =$	3.18 E-02			
$2.51/Re * f^{1/2} =$	2.27 E-03			
$-2 * \log(\epsilon/d_e/3.7 + 2.51/Re * f^{1/2}) =$	2.94 E+00			
$f_d =$	1.16 E-01			
$K_f =$	3.28 E+00			
$K + 1 = K_f + K_v + 1 =$	4.77 E+00			
Liquid jet velocity $U_L = \sqrt{\frac{2 \Delta P}{\rho (K + 1)}} =$	8.00 E+00	m/s	62.2	ft/s
Reynolds number $Re = \frac{D_o U_L \rho}{\mu} =$	3.23 E+03			
$SMD = \frac{500 d_o^{1.2} v_L^{0.2}}{U_L} =$	3.16 E+02	μm	1.24 E-2	in
$Q = 1 - e^{-\left(\frac{Re}{SMD} \right)^{0.5}} =$	4.79 E-04			
Total spray flow rate $= W_c = C_v A U_L =$	1.18 E-04	m ³ /s	3.12 E-2	gal/s
Release flow rate $= W_o = Q W_c =$	5.68 E-08	m ³ /s	1.58 E-5	gal/s
Total22 volume released $= 150 \text{ min} * 60 \text{ s} * W_o =$	1.07 E+00	kL	2.75 E+02	gal
Volume released $= 150 \text{ min} * 60 \text{ s} * W_o =$	5.11 E-04	kL	1.32 E-01	gal

APPENDIX C
GENII DOSE CONSEQUENCE CALCULATION
FOR THE 340 FACILITY

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Westinghouse
Hanford Company

WHC-SD-WM-ISB-003 REV 1

Internal
Memo

From: Criticality & Radiological Analyses LVN-8D150-94-013
Phone: 376-9710 H4-64
Date: September 19, 1994
Subject: GENII DOSE CONSEQUENCE CALCULATION FOR THE 340 FACILITY

To: D. J. Johnson H4-70

cc: J. S. Davis H4-64
J. P. Estrellado, Jr. H4-70
B. E. Hey H4-64
J. C. Van Keuren H4-64
J. W. Daughtry H4-64
LVN File/LB

As requested, radiological dose consequence calculations for the 340 facility have been completed. Doses were calculated for a release of 1 Ci of the isotopes specified by the customer. The computer codes used in this analysis were GENII version 1.485 and GXQ Version 3.1. The results are reported in the attachment.

If you have any questions, please call me on 376-9710.

Loc V. Nguyen
Engineer

siw

Attachment

Concurrence:
J. W. Daughtry, Manager
Criticality & Radiological Analyses

9-20-94
Date

GENII DOSE CONSEQUENCE CALCULATION FOR THE 340 FACILITY

L. V. Nguyen
September 20, 1994

PURPOSE

Potential maximum individual dose consequences to the onsite 100 meter and site boundary receptors from the postulated accident involving the 340 facility radioactive inventory have been calculated. The accident was evaluated as a ground-level release.

SOURCE TERMS

The source terms were 1 Ci of each isotope as specified by the customer in Appendix A. The release was assumed to be in the form of oxide.

METHODOLOGIES AND ASSUMPTIONS

Acute maximum individual ground level release 99.5 percentile dispersion factors (X/Q) were generated using GXQ Version 3.1 (B. E. Hey, 1993) for 16 onsite 100-meter and site boundary locations. In addition, the onsite 100-meter and site boundary overall average 95 percentile X/Qs were determined using GXQ to compare with the maximum sector individual X/Q. The higher X/Q will be used for dose calculations (NRC Regulatory Guide 1.145).

RECEPTOR DESCRIPTION

- Onsite: For the ground level releases, the receptor is normally 100 m in the worst direction (WHC-CM-4-46). Doses calculated for the onsite receptor include inhalation and submersion. The onsite maximum individual X/Q at 100 meters was calculated for 16 sectors. The maximum onsite individual for acute ground level release from the 340 Facility was calculated to be located at 100 meters north, with an acute 99.5 percentile X/Q of 4.21 E-02 s/m^3 . The 100 meter X/Q for all 16 sectors are listed in Table 1. The asterisk in Table 1 identifies the worst onsite X/Q.
- Site Boundary: The site boundary receptor is located at the site boundary in the worst direction. Where the site is bounded by the Columbia River, the site boundary is taken to be at the nearer bank of the river for maximum individual doses. This receptor is assumed to stay at this location for the duration of the accident. Doses calculated include inhalation and submersion. The maximum offsite individual 99.5 percentile X/Q for an acute ground level release from the 340 Facility is 3.77 E-03 s/m^3 (345 meters E). The asterisk in Table 2 identifies the worst site boundary X/Q.

X

CODE DOCUMENTATION

- GENII version 1.485 (12/3/90)
- GENII Default Parameter Values (28-Mar-90 RAP)
- Radionuclide Master Library (7/23/93 PDR)
- PNL Food Transfer Factor Library (7/19/93)
- External Dose Factor Library (8-May-90-RAP)
- Internal Dose Increments, PNL Solubilities, (7/23/93 PDR)
- Joint Frequency Data: 300 Area, 10 m, Pasquill A-G (1983-1991 Average)
- GXQ Version 3.1 (1993)

A typical GENII and GXQ input files are attached as Appendix B and C.

RESULTS

The resulting effective dose equivalents (EDE) and limiting organ doses for onsite and offsite receptors calculated by GENII with 99.5 percentile meteorology are shown in Tables 3 and 4. Inhalation doses were 50-year committed doses based on an acute uptake. Submersion doses were calculated using a semi-infinite cloud model.

Any external dose due to plume submersion was included in both the EDE and organ dose for GENII calculations. Building wake and plume meander were not taken into account as requested by the customer.

NOTE: *Please, be aware of the fact that the new joint frequency data, and NRC Regulatory Guide 1.145 (Ref. 4) atmospheric dispersion coefficient (X/Q) methods were applied for dose calculations. These changes may affect consistency with previous X/Qs and dose consequences. This document is based on the best available information at this time.*

Note: When using the unit release consequences presented in this document, note that (a) release fractions considering only respirable size particles may not be appropriate for determining source term ratios, (b) scaling of unit release consequences may not be appropriate for changes other than source term quantity, and (c) the technical peer review for unit release consequences does not cover consequences scaled from the unit release consequences. Scaled consequences must also be reviewed by Radiological & Toxicological Analysis or their designees, as required in SA&E Work Procedure 6-2 (WHC-CM-6-32). In general, the HEDOP review of the original analysis is sufficient.

Table 1: Acute 99.5 Percentile X/Qs in 16 Sectors, and 95 Percentile Overall Average X/Q for 100 Meters, all for Ground Level Releases.

Sector	Dispersion Factors X/Q (s/m^3)
S	3.18 E-02
SSW	1.16 E-02
SW	4.39 E-03
WSW	3.88 E-03
W	1.51 E-02
WNW	2.90 E-02
NW	3.28 E-02
NNW	3.29 E-02
N	4.21 E-02 *
NNE	2.89 E-02
NE	2.93 E-02
ENE	1.60 E-02
E	3.16 E-02
ESE	2.99 E-02
SE	3.16 E-02
SSE	3.23 E-02
OVERALL 95 PERCENTILE X/Q	3.44 E-02

Table 2: Acute 99.5 Percentile X/Qs at Site Boundary Locations for Ground Level Release from 340 Facility.

Sector	Distance (m)	Dispersion Factors X/Q (s/m^3)
S	6475	4.25 E-05
SSW	2590	5.36 E-05
SW	3515	1.32 E-05
WSW	3515	1.01 E-05
W	6575	1.88 E-05
WNW	28675	6.02 E-06
NW	49025	3.54 E-06
NNW	51800	3.33 E-06
N	17020	1.65 E-05
NNE	505	1.83 E-03
NE	505	1.85 E-03
ENE	345	1.90 E-03
E	345	3.77 E-03 *
ESE	345	3.58 E-03
SE	535	1.81 E-03
SSE	830	8.89 E-04
Overall sector 95 Percentile		1.51 E-03

Table 3. Maximum Individual Doses for Onsite 100
Meter Receptor Due to an Aerosol Release
of 1 Ci of Each Isotope from 340 Facility

Radionuclide	External Dose (rem)	Annual Effective Dose Equivalent (rem)
MN 54	7.0 E-03	9.6 E-02
CO 60	2.1 E-02	9.6 E+00
SR 90	1.7 E-06	2.8 E+00
Y 90	6.1 E-05	1.2 E-01
ZR 95	6.3 E-03	2.2 E-01
NB 95	7.0 E-03	8.7 E-02
TC 99	3.2 E-07	1.3 E-01
RU 106	2.0 E-03	6.6 E+00
SB 125	4.0 E-03	1.8 E-01
CS 134	1.4 E-02	6.1 E-01
CS 137	4.7 E-03	4.3 E-01
CE 144	1.2 E-04	5.2 E+00
EU 152	1.0 E-02	2.9 E+00
EU 154	1.0 E-02	3.9 E+00
EU 155	3.5 E-04	5.7 E-01
TA 182	1.1 E-02	6.2 E-01
U 234	1.7 E-06	1.9 E+03
U 235	0.0 E+00	1.7 E+03
U 236	1.3 E-06	1.8 E+03
PU 238	1.3 E-06	4.0 E+03
U 238	1.2 E-06	1.7 E+03
PU 239	8.8 E-07	4.3 E+03
PU 240	1.3 E-06	4.2 E+03
AM 241	9.0 E-05	6.2 E+03
PU 241	3.1 E-12	6.9 E+01
CM 242	1.3 E-06	2.4 E+02
PU 242	0.0 E+00	4.1 E+03

Table 4. Maximum Individual Doses Calculated for Site Boundary Receptor at 345 m E, Due to An Aerosol Release of 1 Ci of Each Isotope from 340 Facility

Radionuclide	External Dose (rem)	Annual Effective Dose Equivalent (rem)
HN 54	6.5 E-04	8.3 E-03
CO 60	1.9 E-03	2.4 E-01
SR 90	1.6 E-07	2.4 E-01
Y 90	5.6 E-06	1.0 E-02
ZR 95	5.8 E-04	1.9 E-02
NB 95	6.5 E-04	7.5 E-03
TC 99	2.9 E-08	1.1 E-02
RU 106	1.8 E-04	5.6 E-01
SB 125	3.7 E-04	1.6 E-02
CS 134	1.3 E-03	5.2 E-02
CS 137	4.4 E-04	3.6 E-02
CE 144	1.1 E-05	4.5 E-01
EU 152	9.2 E-04	2.5 E-01
EU 154	9.4 E-04	3.3 E-01
EU 155	3.2 E-05	4.9 E-02
TA 182	1.0 E-03	5.3 E-02
U 234	1.6 E-07	1.6 E-02
U 235	0.0 E+00	1.5 E-02
U 236	1.2 E-07	1.5 E-02
U 238	1.1 E-07	1.4 E-02
PU 239	8.1 E-08	3.6 E-02
PU 240	1.2 E-07	3.6 E-02
AM 241	2.9 E-13	5.9 E-00
PU 241	8.3 E-06	5.3 E-02
CM 242	1.2 E-07	2.0 E-01
PU 242	0.0 E+00	3.5 E-02

REFERENCES

Napier, B. A., et al., 1988, *GENII - The Hanford Environmental Radiation Dosimetry Software System*, PNL-6484, Pacific Northwest Laboratory, Richland, Washington.

Hey, B. E., 1993, *GXQ Program Users' Guide*, WHC-SD-GN-SWD-30002, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Westinghouse Hanford Company, Richland, Washington.

U.S. Nuclear Regulatory Commission, November 1982, *Atmospheric Dispersion Models For Potential Accident Consequence Assessments At Nuclear Power Plants*, Regulatory Guide 1.145, Revision 1, Office Of Nuclear Regulatory Research.

APPENDIX A

CC: MAIL FROM D. J. JOHNSON TO J. C. VAN KEUREN

DATE: September 14, 1994

340 Vault tanks expected isotopes	
Isotopes	ci
^{54}Mn	1.0
^{60}Co	1.0
^{90}Sr	1.0
^{95}Zr	1.0
^{95}Nb	1.0
^{99}Tc	1.0
^{106}Ru	1.0
^{125}Sb	1.0
^{134}Cs	1.0
^{137}Cs	1.0
^{144}Ce	1.0
^{152}Eu	1.0
^{154}Eu	1.0
^{155}Eu	1.0
^{182}Ta	1.0
^{234}U	1.0
^{235}U	1.0
^{236}U	1.0
^{238}U	1.0
^{238}Pu	1.0
$^{239}/^{240}\text{Pu}$	1.0
^{240}Pu	1.0
^{241}Pu	1.0
^{242}Pu	1.0
^{241}Am	1.0
$^{242}/^{243}\text{Cm}$	1.0

APPENDIX B
SAMPLE GENII INPUT DECK

ONSITE 100 METERS ACUTE GROUND LEVEL INDIVIDUAL RELEASE

Program GENII Input File ##### 8 Jul 88 ####
 Title: ACUTE ONSITE INDIVIDUAL DOSES FOR X/Q OF 4.21 E-02 RELEASE
 \SAMPL\G-AIR.AC

OPTIONS----- Default -----
 F Near-field scenario? (Far-field) NEAR-FIELD: narrowly-focused
 F Population dose? (Individual) release, single site
 T Acute release? (Chronic) FAR-FIELD: wide-scale release,
 Maximum Individual data set used multiple sites
 Complete Complete
 TRANSPORT OPTIONS----- Section EXPOSURE PATHWAY OPTIONS----- Section
 T Air Transport 1 F Finite plume, external 5
 F Surface Water Transport 2 T Infinite plume, external 5
 F Biotic Transport (near-field) 3,4 F Ground, external 5
 F Waste Form Degradation (near) 3,4 F Recreation, external 5
 T Inhalation uptake 5,6
 REPORT OPTIONS-----
 T Report AEDE only F Drinking water ingestion 7,8
 T Report by radionuclide F Aquatic foods ingestion 7,8
 T Report by exposure pathway F Terrestrial foods ingestion 7,9
 F Debug report on screen F Animal product ingestion 7,10
 F Inadvertent soil ingestion

INVENTORY

- 4 Inventory input activity units: (1-pCi 2-uCi 3-mCi 4-Ci 5-Bq)
 0 Surface soil source units (1- m2 2- m3 3- kg)
 Equilibrium question goes here

Use when	Release Terms-- transport selected			Basic Concentrations-- near-field scenario, optionally				
	Air	Surface	Buried	Air	Surface	Deep	Ground	Surface
Release Radio- nuclide	/yr	Water /yr	Waste /m3	/m3	Soil /unit	Soil /m3	Water /L	Water /L
MN54	1.0							
CO60	1.0							
AM241	1.0							
CS137	1.0							
CS134	1.0							
CE144	1.0							
CM242	1.0							
EU152	1.0							
EU154	1.0							
EU155	1.0							
SR90	1.0							
Y 90	1.0							
ZR95	1.0							
NB95	1.0							
TC99	1.0							
RU106	1.0							

SB125 1.0
 TA182 1.0
 U 234 1.0
 U 235 1.0
 U 236 1.0
 U 238 1.0
 PU238 1.0
 PU239 1.0
 PU240 1.0
 PU241 1.0
 PU242 1.0

-----Derived Concentrations-----				
Use when	measured values are known			
Release	Terres.	Animal	Drink	Aquatic
Radio-	Plant	Product	Water	Food
nuclide	/kg	/kg	/L	/kg

TIME #####

1 Intake ends after (yr)
 50 Dose calc. ends after (yr)
 0 Release ends after (yr)
 0 No. of years of air deposition prior to the intake period
 0 No. of years of irrigation water deposition prior to the intake period

FAR-FIELD SCENARIOS (IF POPULATION DOSE) #####

0 Definition option: 1-Use population grid in file POP.IN
 0 2-Use total entered on this line

NEAR-FIELD SCENARIOS #####

Prior to the beginning of the intake period: (yr)
 0 When was the inventory disposed? (Package degradation starts)
 0 When was LOIC? (Biotic transport starts)
 0 Fraction of roots in upper soil (top 15 cm)
 0 Fraction of roots in deep soil
 0 Manual redistribution: deep soil/surface soil dilution factor
 0 Source area for external dose modification factor (m2)

TRANSPORT #####

-----AIR TRANSPORT-----		-----SECTION 1-----	
	0-Calculate PM	0	Release type (0-3)
1	Option: 1-Use chi/Q or PM value	F	Stack release (T/F)
	2-Select MI dist & dir	0	Stack height (m)
	3-Specify MI dist & dir	0	Stack flow (m3/sec)
4.21E-2	Chi/Q or PM value	0	Stack radius (m)
0	MI sector index (1-5)	0	Effluent temp. (C)
0	MI distance from release point (m)	0	Building x-section (m2)
T	Use if data, (T/F) else chi/Q grid	0	Building height (m)


```

=====SURFACE WATER TRANSPORT=====SECTION 2=====
0 Mixing ratio model: 0-use value, 1-river, 2-lake
0 Mixing ratio, dimensionless
0 Average river flow rate for: MIXFLG=0 (m3/s), MIXFLG=1,2 (m/s),
0 Transit time to irrigation withdrawal location (hr)
0 If mixing ratio model > 0:
0 Rate of effluent discharge to receiving water body (m3/s)
0 Longshore distance from release point to usage location (m)
0 Offshore distance to the water intake (m)
0 Average water depth in surface water body (m)
0 Average river width (m), MIXFLG=1 only
0 Depth of effluent discharge point to surface water (m), lake only

=====WASTE FORM AVAILABILITY=====SECTION 3=====
0 Waste form/package half life, (yr)
0 Waste thickness, (m)
0 Depth of soil overburden, m

=====BIOTIC TRANSPORT OF BURIED SOURCE=====SECTION 4=====
T Consider during inventory decay/buildup period (T/F)?
T Consider during intake period (T/F)?
0 Pre-Intake site condition..... 1-Arid non agricultural
                                   2-Humid non agricultural
                                   3-Agricultural

```

EXPOSURE #####

```

=====EXTERNAL EXPOSURE=====SECTION 5=====
Exposure time: Residential irrigation:
0 Plume (hr) T Consider: (T/F)
0 Soil contamination (hr) 0 Source: 1-ground water
0 Swimming (hr) 0 2-surface water
0 Boating (hr) 0 Application rate (in/yr)
0 Shoreline activities (hr) 0 Duration (mo/yr)
0 Shoreline type: (1-river, 2-lake, 3-ocean, 4-tidal basin)
0 Transit time for release to reach aquatic recreation (hr)
1.0 Average fraction of time submersed in acute cloud (hr/person hr)

```

```

=====INHALATION=====SECTION 6=====
8766.0 Hours of exposure to contamination per year
0 0-No resus- 1-Use Mass Loading 2-Use Anspaugh model
0 pension Mass loading factor (g/m3) Top soil available (cm)

```

```

=====INGESTION POPULATION=====SECTION 7=====
0 Atmospheric production definition (select option):
0 0-Use food-weighted chi/Q, (food-sec/m3), enter value on this
line
    1-Use population-weighted chi/Q
    2-Use uniform production
    3-Use chi/Q and production grids (PRODUCTION will be overridden)
0 Population ingesting aquatic foods, 0 defaults to total (person)
0 Population ingesting drinking water, 0 defaults to total (person)
F Consider dose from food exported out of region (default=F)

```

Note below: S* or Source: 0-none, 1-ground water, 2-surface water
3-Derived concentration entered above

---- AQUATIC FOODS / DRINKING WATER INGESTION-----SECTION 8----

F Salt water? (default is fresh)

USE ? T/F	FOOD TYPE	TRAN- SIT hr	PROD- UCTION kg/yr	-CONSUMPTION- HOLDUP da	RATE kg/yr	DRINKING WATER	
F	FISH	0.00	0.0E+00	0.00	0.0	0	Source (see above)
F	MOLLUS	0.00	0.0E+00	0.00	0.0	T	Treatment? T/F
F	CRUSTA	0.00	0.0E+00	0.00	0.0	0	Holdup/transit(da)
F	PLANTS	0.00	0.0E+00	0.00	0.0	0	Consumption (L/yr)

-----TERRESTRIAL FOOD INGESTION-----SECTION 9-----

USE ? T/F	FOOD TYPE	GROW TIME da	--IRRIGATION-- S RATE * in/yr	TIME mo/yr	YIELD kg/m2	PROD- UCTION kg/yr	--CONSUMPTION-- HOLDUP da	RATE kg/yr
F	LEAF V	0.00	0	0.0	0.0	0.0E+00	0.0	0.0
F	ROOT V	0.00	0	0.0	0.0	0.0E+00	0.0	0.0
F	FRUIT	0.00	0	0.0	0.0	0.0E+00	0.0	0.0
F	GRAIN	0.00	0	0.0	0.0	0.0E+00	0.0	0.0

-----ANIMAL PRODUCTION CONSUMPTION-----SECTION 10-----

USE ? T/F	FOOD TYPE	---HUMAN--- CONSUMPTION RATE kg/yr	HOLDUP da	TOTAL PROD- UCTION kg/yr	DRINK WATER CONTAM FRACT.	DIET FRAC- TION	GROW TIME da	---STORED FEED--- --IRRIGATION-- S RATE * in/yr	TIME mo/yr	YIELD kg/m3	STOR- AGE da
F	BEEF	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
F	POULTR	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
F	MILK	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
F	EGG	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
	BEEF					0.00	0.0	0	0.0	0.00	0.0
	MILK					0.00	0.0	0	0.0	0.00	0.0

#####

APPENDIX C

SAMPLE ONSITE 100 METERS GXQ INPUT DECK

ONSITE 100 METER 99.5 PERCENTILE X/Q

 GXQ Version 3.1 B
 June 8, 1993

General Purpose Atmospheric Dispersion Code
 Produced by Radiological & Toxicological Analysis
 Westinghouse Hanford Company

Users Guide documented in WHC-SD-GN-SWD-3002 Rev. 0.
 Validation documented in WHC-SD-GN-SWD-3003 Rev. 0.
 Code Custodian is Brit E. Key, WHC, ext. 6-2921.

Run Date = 2/ 1/1994
 Run Time = 10:44 24.03

```

INPUT ECHO:
Input title line
c GXQ Ver. 3.1B Input File
c mode
  1

c
c MODE CHOICE:
c mode = 1 then X/Q based on Hanford site specific meteorology
c mode = 2 then X/Q based on atmospheric stability class and wind speed
c mode = 3 then X/Q plot file is created
c
c LOGICAL CHOICES:
c ifox inorm icdf ichk isite ipop icon
  T   F   F   F   F   F   F
c ifox = t then joint frequency used to compute frequency to exceed X/Q
c      = f then joint frequency used to compute annual average X/Q
c inorm = t then joint frequency data is normalized (as in GENII)
c      = f then joint frequency data is un-normalized
c icdf  = t then cumulative distribution file created (CDF.OUT)
c      = f then no cumulative distribution file created
c ichk  = t then X/Q parameter print option turned on
c      = f then no parameter print
c isite = t then X/Q based on joint frequency data for all 16 sectors
c      = f then X/Q based on joint frequency data of individual sectors
c ipop  = t then X/Q is population weighted
c      = f then no population weighting
c icon  = t then X/Q is air concentration
c      = f then X/Q is integrated exposure
c
c MODEL CHOICES:
c idep iwake ipm irise igrav iwash iflow iwind
  0    0    0    0    0    0    0
c idep = 1 then plume depletion model turned on (Chamberlain model)
c iwake = 1 then NRC RG 1.145 building wake model turned on
c      = 2 then MACCS virtual distance building wake model turned on
c ipm   = 1 then NRC RG 1.145 plume meander model turned on
c      = 2 then 5th Power Law plume meander model turned on
c      = 3 then sector average model turned on
c irise = 1 then momentum/buoyancy plume rise model turned on, buoyancy
c        rise based on sensible heat emission
c      = 2 then momentum/buoyancy plume rise model turned on, buoyancy
c        rise based on initial plume density
c igrav = 1 then gravitational settling model turned on
c iwash = 1 then stack downwash model turned on
c iflow = 1 then sigmas adjusted for volume flow rate
c iwind = 1 then wind speed corrected for plume height
  
```

```

c      = 0 to turn any of the above models off
c
c  PARAMETER INPUT:
c  stack      wind      frequency
c  release    speed     to
c  height     height    exceed    scaling
c  (m)        (m)       (m)       factor
c  0.00000E+00 1.00000E+01 1.00000E+03 5.00000E-01 1.00000E+00
c
c  building   building  release    deposition  gravitational
c  width      height    duration  velocity   settling
c  (m)        (m)       (hr)     (m/s)      velocity
c  1.52400E+01 7.80000E+00 2.00000E+00 1.00000E-03 1.00000E-03
c
c  initial    initial   sensible
c  plume      plume     heat
c  plume      flow      stack      emission
c  density    rate       diameter  rate
c  (g/cc)     (m3/s)     (m)      (cal/s)
c  1.22000E-03 0.00000E+00 5.00000E+00 4.18000E+05

```

```

c  RECEPTOR DEPENDENT DATA
c  FOR MODE make RECEPTOR DEPENDENT DATA
c  1 (site specific) sector distance z-height
c  2 (by class & wind speed) class windspeed distance offset z-height
c  3 (create plot file) class windspeed xmax imax ymax jmax xqmin power

```

```

c  RECEPTOR PARAMETER DESCRIPTION:
c  sector = 0, 1, 2... (all, S, SW, etc.)
c  distance = meters
c  class = 1, 2, 3, 4, 5, 6, 7 (P-G stability class A, B, C, D, E, F, G)
c  windspeed = m/s
c  offset = meters offset from plume centerline
c  xmax = maximum distance to plot or calculate to (m)
c  imax = distance intervals
c  ymax = maximum offset to plot (m)
c  jmax = offset intervals
c  xqmin = minimum scaled X/Q to calculate
c  power = exponent in power function step size

```

MODE:

Site specific X/Q calculated

LOGICAL CHOICES:

Joint frequency used to calculate X/Q based on
frequency of exceedance.
No normalization of joint frequency.
X/Q calculated for single sector.
Output is atmospheric dispersion coefficient.

MODELS SELECTED:

WARNING/ERROR MESSAGES:

WARNING #3 - Scaled X/Q units (shown as s/m³ or 1/m³
below) do not reflect the user specified
scaling factor.

JOINT FREQUENCY DATA:

300 AREA - 10 M - Pasquill A - G (1983 - 1991 Average)
Created 8/26/92 KR

Input title line

RECEPT	SECT.	TOTAL	AVERAGE	INDIVIDUAL	ATM.	WIND
		SCALED	SCALED			
<div style="text-align: center;">17</div>						

SECTOR	DISTANCE (m)	HEIGHT (m)	FREQ. (%)	POPULATION	X/Q (s/m3)	X/Q (s/m3)	STAB. CLASS	SPEED (m/s)
S	100	0	11.55	1	3.18E-02	3.18E-02	F	.89
SSW	100	0	5.07	1	1.16E-02	1.16E-02	F	2.65
SV	100	0	2.39	1	4.39E-03	4.39E-03	F	7.15
WSW	100	0	1.82	1	3.88E-03	3.88E-03	C	.89
W	100	0	4.20	1	1.51E-02	1.51E-02	E	.89
WNW	100	0	6.49	1	2.90E-02	2.90E-02	G	2.65
NW	100	0	8.60	1	3.28E-02	3.28E-02	F	.89
NNW	100	0	5.97	1	3.29E-02	3.29E-02	F	.89
N	100	0	8.76	1	4.21E-02	4.21E-02	F	.89
NNE	100	0	8.50	1	2.89E-02	2.89E-02	G	2.65
NE	100	0	9.64	1	2.93E-02	2.93E-02	G	2.65
ENE	100	0	6.13	1	1.60E-02	1.60E-02	G	4.70
E	100	0	4.55	1	3.16E-02	3.16E-02	F	.89
ESE	100	0	2.86	1	2.99E-02	2.99E-02	G	2.65
SE	100	0	5.20	1	3.16E-02	3.16E-02	F	.89
SSE	100	0	7.95	1	3.23E-02	3.23E-02	F	.89

Execution Time = 0 hr 0 min 5.60 sec

Stop - Program terminated.

OFFSITE RECEPTORS 99.5 PERCENTILE X/Q

GXQ Version 3.1 B
June 8, 1993

General Purpose Atmospheric Dispersion Code
Produced by Radiological & Toxicological Analysis
Westinghouse Hanford Company

Users Guide documented in WMC-SD-GN-SWD-3002 Rev. 0.
Validation documented in WMC-SD-GN-SWD-3003 Rev. 0.
Code Custodian is Brit E. Hey, WMC, ext. 6-2921.

Run Date = 9/14/1994
Run Time = 14:24 44.26

INPUT ECHO:

GXQ test input file
c GXQ Ver. 3.1 Input File
c mode
1

c

c MODE CHOICE:

c mode = 1 then X/Q based on Hanford site specific meteorology
c mode = 2 then X/Q based on atmospheric stability class and wind speed
c mode = 3 then X/Q plot file is created

c

c LOGICAL CHOICES:

c ifox inorm icdf ichk isite ipop icon
T F F F F F F F

c ifox = t then joint frequency used to compute frequency to exceed X/Q
c = f then joint frequency used to compute annual average X/Q
c inorm = t then joint frequency data is normalized (as in GENII)
c = f then joint frequency data is un-normalized
c icdf = t then cumulative distribution file created (CDF.OUT)
c = f then no cumulative distribution file created
c ichk = t then X/Q parameter print option turned on
c = f then no parameter print
c isite = t then X/Q based on joint frequency data for all 16 sectors
c = f then X/Q based on joint frequency data of individual sectors
c ipop = t then X/Q is population weighted
c = f then no population weighting
c icon = t then X/Q is air concentration
c = f then X/Q is integrated exposure

c

c MODEL CHOICES:

c idep iwake ipm irise igrav iwash iflow iwind
0 0 0 0 0 0 0 0 0

c idep = 1 then plume depletion model turned on (Chamberlain model)
c iwake = 1 then NRC RG 1.145 building wake model turned on
c = 2 then MACCS virtual distance building wake model turned on
c ipm = 1 then NRC RG 1.145 plume meander model turned on
c = 2 then 5th Power Law plume meander model turned on
c = 3 then sector average model turned on
c irise = 1 then momentum/buoyancy plume rise model turned on, buoyancy
c rise based on sensible heat emission
c = 2 then momentum/buoyancy plume rise model turned on, buoyancy
c rise based on initial plume density
c igrav = 1 then gravitational settling model turned on
c iwash = 1 then stack downwash model turned on
c iflow = 1 then sigmas adjusted for volume flow rate
c iwind = 1 then wind speed corrected for plume height
c = 0 to turn any of the above models off
c

```

c PARAMETER INPUT:
c stack      wind      frequency
c release    speed     to
c height     height    exceed    scaling
c (m)        (m)       (m)       factor
c 0.00000E+00 1.00000E+00 1.00000E+03 5.00000E-01 1.00000E+00
c
c building   building   release    deposition
c width      height     duration  velocity
c (m)        (m)       (hr)     (m/s)
c 0.00000E+00 0.00000E+00 1.00000E+00 1.00000E-03 1.00000E-03
c
c initial    initial    sensible
c plume      plume      heat
c density    flow       emission
c (g/cc)     rate       diameter
c 1.22000E-03 1.00000E+00 1.00000E+00 4.18000E+05

```

```

c RECEPTOR DEPENDENT DATA
c FOR MODE make RECEPTOR DEPENDENT DATA
c 1 (site specific) sector distance z-height
c 2 (by class & wind speed) class windspeed distance offset z-height
c 3 (create plot file) class windspeed xmax imax ymax jmax xqmin power

```

```

c RECEPTOR PARAMETER DESCRIPTION:
c sector = 0, 1, 2... (all, S, SSW, etc.)
c distance = meters
c class = 1, 2, 3, 4, 5, 6, 7 (P-G stability class A, B, C, D, E, F, G)
c windspeed = m/s
c offset = meters offset from plume centerline
c xmax = maximum distance to plot or calculate to (m)
c imax = distance intervals
c ymax = maximum offset to plot (m)
c jmax = offset intervals
c xqmin = minimum scaled X/Q to calculate
c power = exponent in power function step size

```

MODE:

Site specific X/Q calculated

LOGICAL CHOICES:

Joint frequency used to calculate X/Q based on frequency of exceedance.

No normalization of joint frequency.

X/Q calculated for single sector.

Output is atmospheric dispersion coefficient.

MODELS SELECTED:

WARNING/ERROR MESSAGES:

WARNING #3 - Scaled X/Q units (shown as s/m³ or 1/m³ below) do not reflect the user specified scaling factor.

JOINT FREQUENCY DATA:

300 AREA - 10 M - Pasquill A - G (1983 - 1991 Average)

Created 8/26/92 KR

GXQ test input file

SECTOR	DISTANCE (m)	RECEPT HEIGHT (m)	SECT. FREQ. (%)	POPULATION	TOTAL POPULATION	AVERAGE INDIVIDUAL	ATM. STAB. CLASS	WIND SPEED (m/s)
					SCALED X/Q (s/m3)	SCALED X/Q (s/m3)		
S	6475	0	11.55	1	4.25E-05	4.25E-05	F	.89
SSW	2590	0	5.07	1	5.36E-05	5.36E-05	F	2.65
SW	3515	0	2.39	1	1.32E-05	1.32E-05	F	7.15
WSW	3515	0	1.82	1	1.01E-05	1.01E-05	E	4.70
W	6575	0	4.20	1	1.88E-05	1.88E-05	E	.89
WNW	28675	0	6.49	1	6.02E-06	6.02E-06	G	2.65
NW	49025	0	8.60	1	3.54E-06	3.54E-06	F	.89
NNW	51800	0	5.97	1	3.33E-06	3.33E-06	F	.89
N	17020	0	8.76	1	1.65E-05	1.65E-05	F	.89
NNE	505	0	8.50	1	1.83E-03	1.83E-03	G	2.65
NE	505	0	9.64	1	1.85E-03	1.85E-03	G	2.65
ENE	345	0	6.13	1	1.90E-03	1.90E-03	G	4.70
E	345	0	4.55	1	3.77E-03	3.77E-03	G	2.65
ESE	345	0	2.86	1	3.58E-03	3.58E-03	G	2.65
SE	535	0	5.20	1	1.81E-03	1.81E-03	F	.89
SSE	830	0	7.95	1	8.89E-04	8.89E-04	F	.89

Execution Time = 0 hr 0 min 5.66 sec
 Stop - Program terminated.

CHECKLIST FOR PEER REVIEW

Document Reviewed: Loc V. Nguyen, "GENII DOSE CONSEQUENCE CALCULATION FOR THE 340 FACILITY," July 14, 1994.

Scope of Review: Entire Document

Yes	No	NA	
☒	☐	☐	* Previous reviews complete and cover analysis, up to scope of this review, with no gaps.
☒	☐	☐	Problem completely defined.
☒	☐	☐	Accident scenarios developed in a clear and logical manner.
☒	☐	☐	Necessary assumptions explicitly stated and supported.
☒	☐	☐	Computer codes and data files documented.
☒	☐	☐	Data used in calculations explicitly stated in document.
☒	☐	☐	Data checked for consistency with original source information as applicable.
☒	☐	☐	Mathematical derivations checked including dimensional consistency of results.
☒	☐	☐	Models appropriate and used within range of validity or use outside range of established validity justified.
☒	☐	☐	Hand calculations checked for errors. Spreadsheet results should be treated exactly the same as hand calculations.
☒	☐	☐	Software input correct and consistent with document reviewed.
☒	☐	☐	Software output consistent with input and with results reported in document reviewed.
☐	☐	☒	Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references.
☐	☐	☒	Safety margins consistent with good engineering practices.
☐	☐	☒	Conclusions consistent with analytical results and applicable limits.
☒	☐	☐	Results and conclusions address all points required in the problem statement.
☐	☐	☒	Format consistent with appropriate NRC Regulatory Guide or other standards
☐	☒	*	Review calculations, comments, and/or notes are attached.
☒	☐	☐	Document approved. <i>Brit E. Hen</i> 10/15/94
			<i>Brit E. Hen</i> 7/14/94
Reviewer (Printed Name and Signature)			Date

* Any calculations, comments, or notes generated as part of this review should be signed, dated and attached to this checklist. Such material should be labeled and recorded in such a manner as to be intelligible to a technically qualified third party.

☒ ☐ ☐ Analysis entered into analysis database

Loc V. Nguyen *Loc Nguyen* July 14, 1994
(Printed Name and Signature) Date

HEDOP REVIEW CHECKLIST
for
Radiological and Nonradiological Release Calculations

Loc V. Nguyen, "GENII DOSE CONSEQUENCE CALCULATION FOR THE 340 FACILITY,"
September 14, 1994. *Memo, L.V. Nguyen to D.J. Johnson*

Submitted by: L. V. Nguyen.

Date Submitted: September 14, 1994

Scope of Review: Entire Document

YES NO* N/A

☒	☐	☐	1. A detailed technical review and approval of the environmental transport and dose calculation portion of the analysis has been performed and documented.
☐	☐	☒	2. Detailed technical review(s) and approval(s) of scenario and release determinations have been performed and documented.
☒	☐	☐	3. HEDOP-approved code(s) were used.
☒	☐	☐	4. Receptor locations were selected according to HEDOP recommendations.
☒	☐	☐	5. All applicable environmental pathways and code options were included and are appropriate for the calculations.
☒	☐	☐	6. Hanford site data were used.
☐	☐	☒	7. Model adjustments external to the computer program were justified and performed correctly.
☒	☐	☐	8. The analysis is consistent with HEDOP recommendations.
☐	☐	☒	9. Supporting notes, calculations, comments, comment resolutions, or other information is attached. (Use the "Page 1 of X" page numbering format and sign and date each added page.)
☒	☐	☐	10. Approval is granted on behalf of the Hanford Environmental Dose Overview Panel.

* All "NO" responses must be explained and use of nonstandard methods justified.

Janet S. Davis Janet S. Davis 9/16/94
HEDOP-Approved Reviewer (Printed Name and Signature) Date

COMMENTS (add additional signed and dated pages if necessary):

3. GENII (HEDOP-approved) was used. GXA (not HEDOP-approved) was used to calculate X/Qs because GENII does not calculate X/Qs in accordance with NRC Reg. 23 Guide 1.145.
6. Hanford site joint frequency meteorology data were used in GXA.

APPENDIX D
HAZARDOUS MATERIAL RELEASE ESTIMATES

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HAZARDOUS MATERIAL RELEASE ESTIMATES

A review of the RLWS Disposal Approval Requests prepared by PNL identified the types of hazardous chemicals received at the 340 Facility. A majority of the waste, over 93%, is water. The chemicals appearing most frequently in the waste are:

Nitric Acid
 Sodium Hydroxide
 Sodium Nitrate
 UltimaGold (solvent Di-isopropyl-nathalene)
 Optifluor (solvent alkylbenzene)
 Sodium Phosphate
 Potassium Persulfate
 Sodium Carbonate
 Potassium Nitrate
 Potassium Hydroxide
 Hydrochloric Acid
 Sulfuric Acid
 Ammonium Hydroxide
 Oxalic Acid
 Dimethylsulfoxide

PNL uses sodium hydroxide to neutralize nitric acid forming sodium nitrate, the predominate contaminant. This agrees with the 340 Facility Vault Tank sample data shown in Table 2-2.

Using nitrate as the worst-case chemical, the estimated spray release airborne concentrations become:

$$\text{Spray Release (mg/m}^3\text{)} = V \text{ (m}^3\text{/s)} \times X/Q \text{ (s/m}^3\text{)} \times \text{source (mg/m}^3\text{)}$$

where

$$\begin{array}{lll} V & = 5.68 \times 10^{-8} \text{ m}^3/\text{s} & \text{Appendix B} \\ X/Q \text{ onsite} & = 4.21 \times 10^{-2} \text{ s/m}^3 & \text{Appendix C} \\ X/Q \text{ offsite} & = 3.77 \times 10^{-3} \text{ s/m}^3 & \text{Appendix C} \\ \text{source} & = 3.42 \times 10^7 \text{ mg/m}^3 & 3.42 \times 10^4 \text{ mg/L in Table 2-2} \end{array}$$

Assuming the source to be NaNO_3 the source value becomes:

$$3.42 \times 10^7 \times \frac{85 \text{ g NaNO}_3}{65 \text{ g NO}_3} = 4.47 \times 10^7 \text{ mg/m}^3$$

Estimated onsite release concentration:

$$0.11 \text{ mg/m}^3 = 5.68 \times 10^{-8} \text{ m}^3/\text{s} \times 4.21 \times 10^{-2} \text{ s/m}^3 \times 4.47 \times 10^7 \text{ mg/m}^3$$

Estimated offsite release concentration:

$$9.6 \times 10^{-3} \text{ mg/m}^3 = 5.68 \times 10^{-8} \text{ m}^3/\text{s} \times 3.77 \times 10^{-3} \text{ s/m}^3 \times 4.47 \times 10^7 \text{ mg/m}^3$$

The Hanford Emergency Response Planning Guidelines for chemicals are intended for use in performing site safety classification, hazard evaluations, and emergency preparedness planning (WHC-CM-4-46, Appendix D). The risk-acceptance guidelines for onsite exposure recommends using the ERPG-2 to ERPG-3 values over the frequency range of 1 to 10^{-6} . For offsite, risk-acceptance guidelines recommend using ERPG-1 to ERPG-2 values over the frequency range of 1 to 10^{-6} . The most restrictive range is ERPG-1 to ERPG-2. ERPG values do not exist for every chemical and WHC-CM-4-46 recommends using threshold limit value - time weighted average (TLV-TWA) values when no ERPG values can be found. Neither ERPG nor TLV-TWA values could be found for NaNO_3 , using the Hanford information computer listing of ERPG values, the National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards or the American Conference of Governmental Industrial Hygienists pocket guide for Threshold Limit Values and Biological Exposure Indices. However, using the ERPG limits for a more hazardous chemical provides a greater degree of conservatism and further reduces the risk of adverse effects on the general population. The chemical received at the 340 Facility that presents a potential hazard to personnel, the environment, and the public is sodium hydroxide. The PNL facilities adjust the radioactive liquid waste to a pH of 10, using sodium hydroxide to reduce corrosion of the stainless steel. The ERPG (Hanford Info) sodium hydroxide values for the comparison are:

Sodium Hydroxide Onsite (mg/m^3)	ERPG-2 40	to	ERPG-3 100	Estimated Value 0.11
Sodium Hydroxide Offsite (mg/m^3)	ERPG-1 2	to	ERPG-2 40	Estimated Value 0.0096

These values show that comparing the chemical having the highest concentration with the chemical that is a potential hazard for 340 Facility personnel gives values far below the Emergency Response Planning Guidelines. Based on this comparison, releases for the other hazardous chemicals are expected to be well within the risk-acceptance guidelines.