## 11.4 SOLID WASTE MANAGEMENT SYSTEM

Low-level solid radioactive wastes are processed, packaged and stored for subsequent shipment and offsite burial by the Solid Waste Management System (SWMS). Wastes include spent ion exchange resin, used filter cartridges and miscellaneous refuse.

### 11.4.1 DESIGN BASES

The design bases of the SWMS are as follows:

→(DRN 00-1045, R11-A; 01-223, R11-B)

a) Provide for receipt and interim storage of spent resins.

←(DRN 00-1045, R11-A; 01-223, R11-B)

b) Provide for holdup capacity for normally radioactive spent resin to allow decay of short-lived radionuclides.

c) Provide for receipt and water content adjustment (dewatering and/or dilution) of radioactive wastes such as spent resins.

→(DRN 99-1696, R11-A)

d) Provide remote means for transferring used filter cartridges from their respective filters to the Solidification area. Appropriate lifting grabs and remote handling tools will be used during filter transfer.

←(DRN 99-1696, R11-A)

e) Provide means to compact Low Specific Activity (LSA) solid waste such as contaminated clothing, rags, paper, laboratory equipment and supply items.

f) Provide means for encapsulation and solidification of wastes in large volume disposable liners for subsequent shipment and offsite burial.

→(DRN 02-109, R12)

g) Prevent the release of significant quantities of radioactive materials. The overall exposure to the public and operating personnel will be kept within the requirements of 10CFR20, Appendix B, and 10CFR50, Appendix I.

←(DRN 02-109, R12)

h) Disposal and transportation of wastes from the SWMS, including the shipping containers, will satisfy the requirements of 1OCFR20, 10CFR71, 10CFR61, and 49CFR.

i) The in-plant SWMS is housed in the Reactor Auxiliary Building which meets the seismic criteria of Regulatory Guide 1.143.

j) Components of the in-plant SWMS are classified "NNS" at Waterford 3 (Regulatory Guide 1.26-Quality Group "D"). Further discussion of the conformance of the SWMS with Regulatory Guide 1.143 and Branch Technical Position ETSB 11-3 can be found in Table 11.4-10.

k) The SWMS meets the QA requirements of Regulatory Guide 1.143.

## 11.4.2 SWMS DESCRIPTION

→(DRN 01-233)

The SWMS is shown schematically on Figures 11.2-2 and 11.4-5. Layout drawings are in Section 1.2.

→(DRN 99-2361, R11)

The SWMS is comprised of the portable solidification system and/or dewatering system, the spent resin handling system, filter handling, and the dry active waste handling system.

←(DRN 99-2361, R11; 01-223, R11-B)

The buildings, systems and facilities described in this subsection are designed and constructed such that handling waste containers and operating equipment of the SWMS can be done with the least possible personnel exposure in accordance with the ALARA criteria of Regulatory Guides 8.8 and 8.10. In addition, plant procedures specify particular practices for waste handling and monitoring for the various systems and storage areas that also adhere to the ALARA requirements of Regulatory Guide 8.8 and 8.10. Volumes of input to, and volumes and activities of output from the SWMS during normal operations can be found in Tables 11.4-4 through 11.4-9.

Descriptions of the SWMS sub-systems are provided in subsequent sections.

## 11.4.3 IN-PLANT SOLIDIFICATION SYSTEM DESCRIPTION

→(DRN 01-233)

The in-plant solidification system has been isolated from interfacing systems. The system consists of a waste storage tank with a concentrate feed pump, a dewatering tank with a process pump, a sodium silicate storage tank with a process pump, a cement silo with screw conveyors and a process mixing pump. The system was isolated because of design and ALARA concerns. The components are itemized in Table 11.4-1. Schematic details of the system are shown in Figure 11.4-5.

The in-plant solidification system has been replaced by the vendor solidification system described in Section 11.4.4.
→(DRN 99-2361, R11; 00-1045, R11-A)
←(DRN 99-2361, R11; 00-1045, R11-A, DRN 01-223, R11-B)

→(DRN 01-223, R11-B)
←(DRN 01-223, R11-B)
→(DRN 99-2361, R11)

## 11.4.4 PORTABLE SOLIDIFICATION AND DEWATERING SYSTEMS

Waterford will utilize a portable solidification or dewatering system to provide for plant solidification or dewatering requirements. This solidification or dewatering system may be housed in a weatherproof structure with curbing and a sump which may be pumped to the LWMS. An overhead bridge crane is provided for lifting requirements up to 10 tons. This structure is located on the west side of the RAB adjacent to the original in-plant solidification area (see Figure 11.4-1).

The portable systems are operated as specified to comply with the respective process control programs.

### 11.4.4.1 Equipment Description

Major components may include: solidification media storage, fillhead assembly, pump and valve skid(s), control panel and liner shielding. Connections between the in-plant system and portable system equipment are by reinforced flexible hoses. The waste concentrates storage and handling portion of the in-plant SWMS and the spent resin handling system, is utilized to supply waste feed to the portable system. These parts of the in-plant SWMS are situated with appropriate shielding, remote sampling, separation of components and accessibility to reduce leakage and facilitate maintenance and operation in accordance with Regulatory Guide 1.143 and BTP ETSB 11-3.

The operation of the portable system is relatively simple. Operation is performed in compliance with the Process Control Program (PCP).

Radwaste if solidified will be performed in appropriate sized containers. The size of a container depends on its shield thickness and one radwaste activity to meet DOT shipping dose rate requirements.
←(DRN 99-2361, R11)

11.4.4.2 System Operations and Controls

→(DRN 99-2361, R11)

A predetermined amount of spent resin is pumped into the container through the fillhead assembly if required. If dewatering is required, it can be done at the same time as the container is being filled. Solidification media, if needed, is added to the container after waste fill is completed. The media is added to the waste in accordance with the portable equipment procedure. The container can then be put into interim storage or shipped offsite for processing or to a burial ground, as desired.

The basic equipment set-up in the Solidification Building may be used to process spent resins into containers and associated preparations for storage and shipment to a burial facility including the dewatering operation to meet the criteria of the intended burial facility. The equipment may be used to dewater the radioactive material for shipment to another facility for preparation for storage or disposal.

←(DRN 99-2361, R11)

All pumps, valves and associated controls are part of the vendor equipment and are maintained by the vendor.

11.4.5 SPENT RESIN HANDLING SYSTEM DESCRIPTION

The purpose of the Spent Resin Transfer System (SRTS) is to provide the following services:

a) Collect and store spent radioactive ion exchanger resin from the various process demineralizers.

→(DRN 99-2361, R11)

b) Transfer resins to the portable solidification and/or dewatering system.

←(DRN 99-2361, R11)

The SRTS has the following modes of operation:

a) Spent resin tank fill

b) Spent resin tank dewatering

c) Spent resin tank water addition

d) Resin mixing by recirculation

→(DRN 99-2361, R11)

e) Resin transfer to the portable solidification and/or dewatering system

←(DRN 99-2361, R11)

f) System flushing

The SRTS consists of the following components: One spent resin tank, one spent resin transfer pump, one spent resin dewatering pump, two spent resin strainers, and associated valves, piping and controls.

→(DRN 99-2361, R11)

Spent ion exchanger resin from the waste condensate ion exchanger, boric acid condensate ion exchangers, preconcentration ion exchangers, fuel pool demineralizers, and purification ion exchangers may be sluiced to the spent resin tank. The blowdown demineralizers may be sluiced to the spent resin tank. When resin transfer is completed, the system may be flushed to remove residual resin from the piping system.

←(DRN 99-2361, R11)

11.4.5.1 Component Description and Location

The major components used within the SRTS are:

a) Spent Resin Tank - quantity: one

b) Spent Resin Transfer Pump - quantity: one

c) Spent Resin Dewatering Pump - quantity: one

d) Piping and Valves

e) Strainers - quantity: two

f) Resin Sampling Valve - quantity: one
→(DRN 01-458, R11-A)
g) Delete
←(DRN 01-458, R11-A)

General Description of Each Major Component:

a) Spent Resin Tank

The spent resin tank, fabricated of Type 304 stainless steel, is located in the southwest quadrant of the Reactor Auxiliary Building on EL. -35-00 ft MSL. The tank is located in a shielded cubicle. The spent resin storage tank has a capacity of 3,200 gallons (427 cu ft).

b) Spent Resin Transfer Pump

An open impeller centrifugal type pump with double mechanical seal draws suction from the spent resin tank. The pump is located in a shielded area in the southwest quadrant of the Reactor Auxiliary Building just south of the spent resin tank room on EL. -35.00 ft MSL.

The pump has a capacity of 230 gpm and is powered by a 20 hp electric motor.

c) Spent Resin Dewatering Pump

A centrifugal type pump that draws suction from the spent resin tank. The pump is located in a shielded area in the southwest quadrant of the Reactor Auxiliary Building just south of the spent resin tank on EL. -35.00 ft MSL.

The pump has a capacity of 50 gpm and is powered by a 5 hp electric motor.

d) Piping and Valves

The SRTS piping is fabricated of austenitic stainless steel, Type 304, and is designed in accordance with ANSI B31.1. All piping containing slurry is run utilizing five inch diameter bends, lateral type fittings on branch connections, butt welding and is run in shielded areas and chases to the maximum extent possible.

The process valves are plug type valves with ultra high molecular weight polyethylene seats. Valves with air operators are provided with limit switches and fail safe provisions where required.

e) Strainers

Two stainless steel "Y" type resin strainers sized at 60 mesh prevent resin fines from entering the waste system and the sump system during system drainage and dewatering operations, respectively. The strainer at the dewatering line can be backwashed.

f) Resin Sampling Valve

The valve is an Isolok liquid/slurry sampler which can extract a 10 cc sample slurry from the recirculation/transfer pipe by operating the manual cycle control switch.

g) Sight Glass

A sight glass is located at the inlet header of the spent resin tank to verify resin flow into the tank.

11.4.5.2 Design Basis

The SRTS is designed in accordance with the following:

a) Provide holdup capacity for normally radioactive spent resin to allow decay of short-lived isotopes.

b) Provide for receiving and adjusting water content in the spent resin tank.

→(DRN 99-2361, R11)

c) Provide a means to transport resins to the portable solidification or dewatering system using a recirculation loop concept.

←(DRN 99-2361, R11)

→(DRN 02-109, R12; 03-2065. R14)

d) Prevent the release of significant quantities of radioactive materials. The overall exposure to the public and operating personnel will be kept within the requirements of 10CFR20, Appendix B, and 10CFR50, Appendix I.

←(DRN 02-109, R12; 03-2065, R14)

e) The SRTS is located entirely in the seismic Category I Reactor Auxiliary Building. The SRTS components are not safety-related and are not designed to seismic Category I requirements.

f) Provide a means for system flush after a resin transfer operation.

g) Provide a means for resin slurry sampling.

The spent resin tank is provided with level indication and alarms for high level and low-level conditions. Level alarms alert operators when tanks are nearly full or empty. Appropriate control devices shut off the resin transfer pump on low-low level and prevent overfilling of the spent resin storage tank by closing the inlet valve on high-high tank level.

The SRTS sizing is based on the following:

Recirculation loop piping is a minimum of three inch I.D. in order to minimize the potential for plugging.

Resin slurry velocity is approximately 10 ft/sec. Higher than normal velocity helps insure that resin will remain in suspension during pumping.

→(DRN 99-2361, R11)

Resin slurry feed rate to the portable solidification or dewatering system is 30 gpm.

←(DRN 99-2361, R11)

The SRTS is located in the Reactor Auxiliary Building which is designed to seismic Category I. Therefore, uncontrolled release to the environment would not occur as a result of a seismic event. The design and fabrication codes, seismic category, and classification meet the requirements of Regulatory Guides 1.26 (Rev 1), 1.29 (Rev 1) and 1.143 (Rev 1).

To reduce radioactive releases to the building atmosphere, the following design features have been incorporated into the system design:

a) Venting of the spent resin tank is to the vent gas collection header.

b) The spent resin tank overflow is provided with a loop seal to prevent the escape of radioactive gas.

c) Zero stem leakage valves are used on the process lines.

### 11.4.5.3 Instrumentation and Control

The control panel for monitoring and controlling the SRTS is located at the solid radwaste area of EL +21.00 ft MSL. A mimic graphic panel with control switches, indicating lights, alarms and analog or digital readout provides information to the operator.

The SRTS has a programmable controller (PC) located in the control panel at EL. +21.00 ft. MSL in the RAB. A local instrument rack containing, system transmitters is located at EL. -35.00 ft MSL in the RAB just outside the spent resin tank/pump cubicles.

Water level - The water level is monitored by a differential pressure instrument. A transmitter sends a signal to the control panel, which will isolate the tank at high-high tank level or trip the pump at low-low tank level.

Pump differential pressure - Transfer pump differential pressure is monitored by a differential pressure transmitter for pump protection. The pump is tripped automatically at high differential pressure (dead headed) and low differential pressure (cavitation).

Transfer pump seal water pressure - The double mechanical seal is protected by a pressure transmitter. Low pressure signals lack of water in the mechanical seal and will trip the pump automatically.

$\Delta$P across dewatering strainer - High pressure signals that the strainer is clogged and will actuate an alarm.

Programmable controller - A programmable controller having 2K expandable to 8K RAM memory, automatic sequencing, monitoring and alarm. Communication between local instruments and the control panel is via a remote I/O system. A CRT and keyboard or personal computer (PC) may be used to reprogram the automatic sequence and setpoints.

### 11.4.6 RADIOACTIVE FILTER HANDLING

→(DRN 99-2361, R11)

Filter(s) may be replaced using a bottom loading filter transfer shield when radiation levels dictate remote handling. After remotely removing bolts on the head of the filter, the filter is lifted into the filter transfer shield and the shield is closed.

At the solidification area, the bottom of the shield is removed. An overhead crane is used to lift the transfer shield containing the filter into position over a container and the filter is lowered into the container. The container, after closure, is appropriately stored or buried at a licensed burial site.

### 11.4.7 DRY ACTIVE WASTE HANDLING

→(DRN 99-1696, R11-A)

The bulk dry waste material is collected in containers as it is generated in the CCA. The waste is surveyed for radiation prior to transportation to a licensed volume reduction facility. Plant procedures provide guidelines for monitoring the dry waste for materials that could cause chemical reactions or spontaneous combustion.

←(DRN 99-2361, R11)

A licensed volume reduction facility is used to volume reduce radioactive waste such as contaminated clothing, rags, paper, low activity filters, activated charcoal and HEPA filters from plant ventilation systems, and miscellaneous contaminated material generated by maintenance and operations of the facility.

←(DRN 99-1696, R11-A)
→(DRN 99-1050, R11)

An onsite box compactor utilizing hydraulic pressure or a licensed volume reduction facility may be used to volume reduce radioactive waste such as contaminated clothing, rags, paper, low activity filters, activated charcoal and HEPA filters from plant ventilation systems, and miscellaneous contaminated material generated by maintenance and operations of the facility.

→(DRN 99-1696, R11-A)
←(DRN 99-1050, R11; 99-1696, R11-A)

### 11.4.8 SOLIDIFICATION BUILDING

→(DRN 99-2361, R11)

The function of the Solidification Building (SB) is to provide shelter for the portable equipment and to supply the necessary service requirements and waste delivery for this equipment. In addition to service provided to this facility (air, water, electric power), a 10 ton overhead crane is provided to handle the portable equipment and containers.

←(DRN 99-2361, R11)

The bridge crane has adequate travel over the interior area of the Solidification Building.

→(DRN 99-2361, R11)

The waste solidification (and/or resin dewatering) operation has provisions for the use of shielded containers. Waste is supplied to the container by flexible hoses connected to waste transfer lines routed from inside the RAB out to the SB. Support equipment for the portable system is mounted on skids. The SB will supply space for equipment required for solidification and dewatering (See Figure 11.4-2).

←(DRN 99-2361, R11)

The SB is a pre-engineered, prefabricated sheet metal building with interior dimensions of 40' wide by 55' long with a 30' high eave. The building is located on the concrete truck platform on the west side of the RAB, between the RAB main access doors and the solidification area doors at elevation +21 ft. (See Figure 11.4-1).

→(DRN 99-2361, R11)

The design of the SB satisfies the applicable requirements of Regulatory Guide 1.143, NUREG-0800 BTP-ETSB 11-3 and the applicable ACI and AISC Codes and Standards. The BTP, which specifies minimum requirements for portable solid waste systems, calls for equipment to be located on concrete pads with curbs and drainage provisions for containing radioactive spills. To manage radwaste spills, a sump is provided in the SB. If desired, liquids may be transferred to the plant radwaste systems.

←(DRN 99-2361, R11)

→(DRN 99-1050, R11; 99-1696, R11-A)

## 11.4.9 DELETED

←(DRN 99-1050, R11; 99-1696, R11-A)

→(DRN 99-1050, R11; 99-1696, R11-A)
←(DRN 99-1050, R11; 99-1696, R11-A)

## 11.4.10 STORAGE FACILITIES

→(DRN 99-2361, R11)
The solidified waste storage facility shown on the general arrangement drawing, G135, is presently used for the portable demineralizer skid. This storage capacity has been replaced by the outdoor storage area shown on Figure 11.4-7.

### 11.4.10.1 Solidified Waste Per Design Basis to Waterford SES No. 3

Due to revised operating philosophy and a re-evaluation of radwaste generation rates, the outside interim storage area provides sufficient space for over two months of shielded storage for wastes which may be stored before shipment.
←(DRN 99-2361, R11)

### 11.4.10.2 Values of Waste Given by the NRC (FSAR Question 321.22)

The pre-licensing waste generation values provided by the NRC are not reflective of actual waste generation volumes experienced by commercial reactors operating with similar systems and philosophies as Waterford SES No. 3. Sufficient storage capacity is provided to accommodate the waste outputs which are illustrated in Table 11.4-2.

### 11.4.10.3 Dry Waste Storage

→(DRN 99-1050, R11; 99-1696, R11-A)
Storage of dry miscellaneous waste is discussed in Subsection 11.4.10.4.
←(DRN 99-1050, R11; 99-1696, R11-A)

### 11.4.10.4 Solid Waste Storage

→(DRN 99-2361, R11; 99-1696, R11-A)
To provide for temporary storage of solid wastes prior to shipment, storage areas will be designated by the Radiation Protection Group. One designated storage area that may be used to store wastes is located west of the Turbine Building and south of the Solidification Building. This area is inside the Plant Controlled Area and can be accessed by trucks and mobile heavy lifting equipment. See Figure 11.4-7 for location.
←(DRN 99-2361, R11; 99-1696, R11-A)

→(DRN 99-2361, R11)
Waste including, but not limited to, solidified concentrates, spent filter and waste resins, may be placed in disposable and/or storage containers. Waste ready for shipment and requiring shielding may be stored in this interim waste storage area.

→(DRN 01-458, R11-A; 03-2065, R14)
The decision whether or not to store waste shielded or unshielded will be made by the Radiation Protection Group as necessary in accordance with 49CFR Parts 171-177, 10CFR Part 20, and plant technical specifications. Shielding will be provided as necessary.
←(DRN 99-2361, R11; 01-458, R11-A)

Plant procedures contain provisions for periodic radiological surveys of stored waste to ensure that radiation levels are below the limits of 10CFR20.
←(DRN 03-2065, R14)

→(DRN 99-2361, R11)
The concrete Onsite Storage Container (OSC) design incorporates a high strength liner for additional leakage protection and provisions for sampling and collecting any liquid found in the OSC cavity. If needed, plant procedures will be developed to provide for sampling and analysis of any residual water found in OSC prior to shipment and prior to dispositioning the water. The onsite storage containers have a tube extending to the bottom of the inner cavity of the OSC's which allows sampling and removal of water with a portable pump.

The radwaste storage area can accommodate OSC's without stacking containers. Should circumstances dictate, additional onsite storage containers may be procured to provide additional shielded storage capacity. Plant procedures provide requirements to not only survey for external radiation and contamination but also to periodically inspect waste containers to ensure that no container deterioration is occurring during temporary storage.
←(DRN 99-2361, R11)

As a precaution against approaching severe weather such as a hurricane, unshielded loaded waste containers that have not been placed in an OSC and could be damaged by high winds will be anchored to protect them from damage or moved into a protected location. The OSC's themselves can withstand winds in excess of 650 mph without tipping, and as such do not require anchoring.

Analyses determining wind loading factors on liners, drums and boxes determine the need for additional restraints.

### 11.4.10.5 Low Level Radwaste Storage Facility

→(DRN 99-2361, R11)
The LLRWSF is located outside the Protection Area west of the fire water storage tanks approximately at plant coordinates N3815 and W4351 (centerline). The facility is a 80 ft. wide by 140 ft. long by 50 ft. tall steel frame building with metal siding and designed to support a 20 ton traveling crane. The size of the facility was established based upon the total number of radioactive material containers, size of the concrete vault, and requirements for inspection aisles. The LLRWSF has the capacity to store sixty 8 ft. x 20 ft. x 8 ft. high Sea/Land containers and 32 HICs. In general, the inspection aisles are 3 ft. wide.

The facility contains four concrete cubicles to store HICs. Each cubicle is 16 ft. x 16 ft. x 16 ft. with 2 ft. thick concrete walls and topped with 1 ft. thick removable concrete panels. Each cubicle has the capacity to hold eight HICs, i.e. four stacked two high. The entire facility is surrounded by a 1 ft. thick by 16 ft. high concrete shield wall, except at the openings for the 3 ft. x 7 ft. personnel door and the 14 ft. x 16 ft. roll-up door.
←(DRN 99-2361, R11)

The LLRWSF will be equipped with a natural convection ventilation system consisting of a building ridge vent, two supply fans and louvers mounted in the building walls. The system is of sufficient capacity to moderate inside temperatures for worker comfort and safety. There is no freeze protection in the facility.

The LLRWSF will be provided with 480 volt electrical power to supply power for the interior and exterior lighting, the overhead traveling bridge crane, supply fans, and receptacles throughout the facility. Weatherproof distribution panels will be mounted to the exterior of the LLRWSF per the request of the Waterford 3 insurers, American Nuclear Insurers and Nuclear Mutual Limited. Lightning protection will also be provided and the building grounding will be tied into the plant grounding system.

➔(DRN 99-2361, R11)
The LLRWSF is considered a storage occupancy with a fire loading classification of low hazard (NFPA-101 Section 4-2.2.2) since it will be unoccupied except during the movement of radioactive material and all radioactive material will be stored in noncombustible containers or within a concrete vault. In order to reduce the number of openings in the surrounding 16 ft. conrete wall for shielding purposes, only one personnel door will be installed on the south end of the west wall and one roll-up door will be installed in one south wall. Per NFPA 101 "Life Safety Code", Capter 29-2.4.1, Exception No. 1, for low hazard storage occupancies only a single means of egress is required from any story or section; therefore, one exit is acceptable, Furthermore, since the LLRWSF will be unoccupied, no potable water will be required.

In addition, the LLRWSF will be contained within a 7 ft. (approximately) fence to provide security as well as restricting general access to the facility.

➔(LBDCR 13-009, R307)
Refer to Figure 1.2-2 for the location of the LLRWSB. This building is also referred to as the Low Level Radwaste Storage Facility (LLRWSF).

Refer to Figure 11.4-8 for the layout of the interior of the Low Level Radwaste Building/Facility.
🡐(LBDCR 13-009, R307)
➔(LBDCR 13-010, R307)

### 11.4.10.6 Original Steam Generator Storage Facility (OSGSF)

As part of the change out of the steam generators and reactor vessel closure head (RVCH) performed during RF18, the Original Steam Generators (OSGs) and Original RVCH (ORVCH) including Original Control Element Drive Mechanisms (OCEDMs) were placed in an onsite constructed Original Steam Generator Storage Facility (OSGSF). The OSGSF meets the requirements for temporary storage of the OSGs and ORVCH until site decommissioning consistent with 10 CFR 20.1301 and 40 CFR 190. The OSGSF is designed to be used as a non-occupied facility for the temporary storage of these large components and no radwaste storage other than the OSGs and ORVCH is permitted within the facility.

The OSGSF is a non-safety-related structure that functions only for the purpose of storing contaminated components prior to decommissioning of the facility. It is also located well away from any safety-related SSCs to avoid any potential secondary impacts. The concrete shielding design of the building meets the radiological requirements of 10 CFR 190 and 10 CFR 20.

The design and construction of the OSGSF ensures that the storage of the OSGs, ORVCH and OCEDMs until plant decommissioning is physically secure, environmentally safe, and compliant with applicable standards and regulatory guidance.

The location of the OSGSF is depicted in Figure 1.2-2.
🡐(LBDCR 13-010, R307)
➔(LBDCR 14-007, R308)

### 11.4.10.7 Entrapment Area

The entrapment area is located in the Owner Controlled Area west of the helicopter pad. It is an 80 foot by 180 foot fenced area with two access gates, one on each end. This area is located well away from any safety related System, Structure or Component (SSCs).

The entrapment area is non-safety-related that functions only for the purpose of temporary storage of radioactive material after receipt and prior to shipment. It also houses empty packages that were used to ship and store radioactive material prior to use. These packages are empty by the Department of Transportation (DOT) definition. Radioactive material in the entrapment area is stored in appropriate containers and is maintained consistent with radioactive material stored in outside areas. No more than 50 millicuries of activity is stored in the area at any one time that is not material staged for shipment or temporarily stored post receipt. The material could be slightly contaminated and stored on a short term basis. Shipments are packaged in accordance with DOT regulations and prepared as a DOT shipment.

11.4.10.8 Independent Spent Fuel Storage Installation (ISFSI)

An Independent Spent Fuel Storage Installation (ISFSI) has been established which is located directly south of the four fire water storage tanks as reflected in Figure 1.2-2. The ISFSI concrete pad has a capacity for 72 vertical spent fuel storage casks. The details including description of this installation are incorporated into section 9.1.5, Fuel Dry Cask Storage. The 10 CFR 72.212 Evaluation Report for Independent Spent Fuel Storage Installation Utilizing the Holtec, International HI-STORM 100 Cask System (Docket 72-075) contains the detailed description of environmental and ALARA impacts from both design basis accidents and normal operations.

The ISFSI has been separately licensed by the Nuclear Regulatory Commission under docket number 72-1014, Holtec report number HI-2002444. Final Safety Analysis Report for the HI-STORM 100 Cask System has been issued for that docket number.

The Certificate of Compliance (Certificate Number 1014) for the spent fuel storage casks is licensed under Title 10 of the Code of Federal Regulations, Part 72, "Licensing Requirements for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (10 CFR Part 72). The certificate is issued to Holtec International in accordance with 10 CFR 72.238. The Certificate of Compliance is conditional upon fulfilling the requirements of 10 CFR Part 72 and contains the associated Technical Specifications and Design Features

← (LBDCR 14-007, R308)

11.4.11 RADIOACTIVE MATERIAL PACKAGING

Packaging containers will be of type and size appropriate for the radioactive material to be packaged for shipment. The packages will be shielded as appropriate to meet the applicable transportation regulations. In cases where the material is packaged for shipment to a burial site, the material will be packaged to meet the disposal site’s requirements.

←(DRN 99-2361, R11)

### 11.4.11.1 Waste Container Failure

In the unlikely event of waste container failure after final packaging during storage or prior to shipment, plant procedures provide instructions on handling, repackaging and/or reprocessing of the waste.

Typical handling of a failure would be as follows. The liner or drum would be temporarily sealed and, if necessary, moved to an area affording maximum protection against spillage, spread of contamination and minimizing personnel radiation exposure. If the waste material is dewatered resin, the contents can be transferred to a new container, if required. Several options are available to resolve the container problem including repairing the waste container, placing the damaged waste container and contents into a larger liner or repackaging the waste in a different container. Loose concrete solids can be recast by the addition of fresh cement mixtures.

In case of a unique failure not anticipated in plant procedures, the failed container would be handled on a case by case basis; Waterford Engineering and Technical personnel would evaluate the situation and determine the best course of action based on the specific conditions. In no case would the method of resolution fail to meet shipping and burial criteria.

## 11.4.12 RADIOACTIVE MATERIAL SHIPPING

→(DRN 99-2361, R11)

Radioactive material will be shipped in accordance with applicable regulations. Shipments of radioactive waste destined for licensed burial sites will be shipped to meet the disposal site's requirements.

←(DRN 99-2361, R11)

TABLE 11.4-1 Revision 14 (12/05)

SOLID WASTE MANAGEMENT SYSTEM COMPONENT SUMMARY DATA

| Tanks | Quantity | Code | Design Capacity | Design Pressure psig | Design Temp. F | Operating Pressure psig | Normal Operating Temp. F | Material |
|---|---|---|---|---|---|---|---|---|
| →(DRN 03-2065, R14) Spent Resin Tank | 1 | ASME Section VIII Div. I (1973) | 3200 gal | Atm | 200 | Atm | 100 | SA 240 Type 304 |
| ←(DRN 03-2065, R14) →(DRN 01-223, R11-B) *Dewatering Tank – T1 | 1 | | | | | | | |
| *Waste Concentrate Storage Tank - T3 | 1 | | | | | | | |
| *Cement Silo - T2 | 1 | | | | | | | |
| *Sodium Silicate Tank - T4 | 1 | | | | | | | |

| Pumps | Quantity | Standards | Type | Design Pressure psig | Design Temp. F | Design Flow gpm | Material | Seal Type | Motor HP | Motor Voltage Phase/Hz |
|---|---|---|---|---|---|---|---|---|---|---|
| *Waste Concentrate Storage Tank Metering Pump - P3 | 1 | | | | | | | | | |
| *Dewatering Tank Metering Pump - P1 | 1 | | | | | | | | | |
| *Process Mixing Pump - P2 | 1 | | | | | | | | | |
| *Sodium Silicate Pump - P4 | 1 | | | | | | | | | |
| Spent Resin Transfer Pump | 1 | Manufacturer's Standard | Horizontal Centrifugal | 100 | 180 | 230 | SS 316 | Mech. | 20 | 460/3/60 |
| Spent Resin Dewatering Pump | 1 | Manufacturer's Standard | Horizontal Centrifugal | 100 | 180 | 50 | SS 316 | Mech | 5 | 460/3/60 |

* Inactivated by ER-W3-98-0868-00-00.
←(DRN 01-223, R11-B)

TABLE 11.4-2 Revision 11-A (02/02)

SOLID WASTE MANAGEMENT PROCESS DATA

| Type of Waste | System Requirements<br>Output of Solidified Waste $Ft^3/Yr$ | Process Flow Rate gpm | Solidification System Capabilities<br>Systems Output $Ft^3/Yr$ | Fraction of Process Capacity Used | Remarks |
|---|---|---|---|---|---|
| →(DRN 00-1045) | | | | | |
| Spent Resins<br>Solidified Liquid Waste | 588 See Note 1<br>13,000 See Note 2 | 5* | 49,439 | 27% | * 2/3 of System Design Flow Rate (using 7.5 gpm Pump) |
| Dry waste | 10,000 | ** | 23,520 | 42% | ** Based on filling one 96 $ft^3$ dry waste box per day and 245 work days per year. |

Note 1: The volume of spent resins expected annually is based on the sum of spent resins reported in semi-annual nuclear power plant reports through 1979 and information provided in Combustion Engineering Letter C-CE-3850.

Note 2: Based on a solidified mixture of liquid waste and cement in the ratio of 1.85:1.00.
←(DRN 00-1045)

TABLE 11.4-3 Revision 11-A (02/02)

SOLID WASTE MANAGEMENT STORAGE CAPACITY

| Type of Waste | Ft $^3$/Year | Number of 195 Ft$^3$ Liners/Yr | Number of Liner* Spaces Allocated For Storage | Number of Months Storage |
|---|---|---|---|---|
| →(DRN 00-1045) (see Table 11.4-2) | | | | |
| Spent Resin | 588 | 3 | 1 | 4 |
| Solidified Liquid Waste | 13,000 | 68 | 14 | 2.5 |
| ←(DRN 00-1045) Dry Waste | 10,000 | 105** | 76 | 8.7 |

* Available shielded storage area = 391 ft$^2$ for 9-195 ft$^3$ liners plus 6-195 ft$^3$ liners stored in the interim solid waste storage area.

** Number of 96 ft$^3$ boxes/yr.

TABLE 11.4-4 Revision 11-A (02/02)

QUANTITIES OF INPUT DURING NORMAL OPERATIONS INCLUDING ANTICIPATION OPERATIONAL OCCURENCES TO SOLID WASTE MANAGEMENT SYSTEM

| Type of Waste | Form | Quantity (ft$^3$/yr) |
|---|---|---|
| Spent Resins | | |
| CVCS | Dewatered | 108 |
| Boron Management System | Dewatered | 72 |
| Fuel Pool System | Dewatered | 72 |
| Waste Management System | Dewatered | 1000 |
| Blowdown System | Dewatered | 0* |
| →(DRN 00-1045) | | |
| ←(DRN 00-1045) | | |
| Filters | | |
| Spent Filter Cartridges | Single Element Cartridges | 30 |
| Oil Separator Filter Cartridges | 10 Cartridges | 10 |
| Compressible Solids | Plastic, Rags, Paper, etc. | 20,000 *** |

* Assumes no primary to secondary leak
** Assumes operating demineralizers on the WMS
*** Reflects volume prior to compacting

TABLE 11.4-5 Revision 11-A (02/02)

QUANTITIES OF OUTPUT DURING NORMAL OPERATIONS INCLUDING ANTICIPATED OPERATIONAL OCCURENCES FROM SOLID WASTE MANAGEMENT SYSTEM

| Type of Waste | Form | Quantity ($ft^3$/yr) |
|---|---|---|
| Spent Resins | Dewatered | 1252 |
| →(DRN 00-1045)<br>←(DRN 00-1045) | | |
| Filters | Dry, Dewatered | 30 |
| Compressible Solids | Compressed in boxes (Compaction Factor = 4) | 5000 (1) |

(1) does not include non-compactable waste

TABLE 11.4-6 WAS DELETED

TABLE 11.4-7 Revision 14 (12/05)

→(DRN 03-2065, R14)

ANNUAL ACTIVITIES (CURIES/YEAR) OF SPENT RESIN INPUT TO THE SPENT RESIN TANK DURING NORMAL OPERATIONS INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES**

←(DRN 03-2065, R14)

| Nuclide | Activity | Nuclide | Activity |
|---|---|---|---|

Seurity-Related Information
Figure Withheld Under 10 CFR 2.390

* ( ) Denotes power of 10

** Includes purification, deborating, preconcentrator, boric acid condensate, fuel pool purification, waste condensate and steam generator blowdown ion exchangers.

TABLE 11.4-8

ANNUAL ACTIVITIES (CURIES/YEAR) OF SPENT FILTER CARTRIDGES INPUT TO THE SOLID WASTE MANAGEMENT SYSTEM DURING NORMAL OPERATIONS INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES

| Nuclide | Activity | Nuclide | Activity |
|---|---|---|---|

Seurity-Related Information
Figure Withheld Under 10 CFR 2.390

*() Denotes power of 10

** Negligible compared with other nuclides activities listed in this table.

*** Includes purification filter, pre-concentrator filter, fuel pool purification filter, waste filter, laundry filter, and oil separator filter.

TABLE 11.4-9 (Sheet 1 of 3) Revision 11-A (02/02)

→ (DRN 99-2361)

BASIS FOR ACTIVITIES PROVIDED IN TABLES 11.4-7 THROUGH 11.4-8

← (DRN 99-2361)

a) General

1) Activities are based on Reactor Coolant System activities provided in Table 11.1-3.

2) Filters and ion exchangers are assumed to be on the process line 292 days (plant capacity factor of .8) unless otherwise noted.

→(DRN 00-1045)

3) Deleted

←(DRN 00-1045)

4) Each ion exchanger resin bed contains 36 cu. ft. of resin.

5) Ion exchanger DF's used for buildup on resins as upstream decontamination factors.

| Nuclide | Purification I-X | Pool Purification, Waste Condensate and Lithium I-X | Deborating and Boric Acid Condensate I-X | Pre-concentrator I-X |
|---|---|---|---|---|
| Cs, Rb | 2 | 10 | 1 | 100 |
| I | 10 | 10 | 10 | 10 |
| Other Anions | 10 | 10 | 10 | 10 |
| Other Cations | 10 | 10 | 1 | 10 |
| Crud | 10 | 10 | 10 | 10 |
| Noble gases, tritium | 1 | 1 | 1 | 1 |

6) Filter DF's are 10 for crud and unity for all other nuclides.

7) Letdown is assumed to be 40 gpm.

8) Waste to the Boron Management System includes the following:

| Source | Volume | Fraction of RCS Activity |
|---|---|---|
| From CVCS | 734,000 gpy | 1.0 |
| Reactor Drain Tank | 200 gpd | 1.0 |
| Equipment Drain Tank | 50 gpd | 0.1 |

→(DRN 99-2361, R11)

BASIS FOR ACTIVITIES PROVIDED IN TABLES 11.4-7 THROUGH 11.4-8

←(DRN 99-2361, R11)

→(DRN 00-1045, R11-A)

b) Deleted

1) Deleted

2) Deleted

3) Deleted

4) Deleted

←(DRN 00-1045, R11-A)

c) Spent Resin

→(DRN 99-2361, R11)

1) The purification ion exchanger A (CVCS) dominates the amount of activity that enters the spent resin tank. Credit is taken for the upstream DF of the purification filter.

→(DRN 03-2065, R14)

2) Purification ion exchanger B (CVCS)

←(DRN 99-2361, R11; 03-2065, R14)

(a) The lithium removal ion exchanger is assumed to be on-line 20 percent of the time. (40 gpm) (.2) = 8 gpm average.

(b) Credit is taken for upstream DF by the purification filter and purification ion exchanger.

→(DRN 99-2361, R11)

3) Purification ion exchanger C (CVCS)

←(DRN 99-2361, R11)

(a) The deborating ion exchanger is assumed to be on-line at the end of the core cycle when the boron concentration reaches 30 ppm.

(b) Credit is taken for upstream DF by the purification filter and purification ion exchanger.

4) Pre-Concentrator ion exchanger (BMS)

(a) Waste processed through this ion exchanger (see a.8).

(b) Credit is taken for upstream DF by the purification filter and purification ion exchanger.

5) Fuel pool purification ion exchanger (FPS)

(a) The fuel pool water is processed through the ion exchanger at 150 gpm.

(b) The volume of the spent fuel pool is 312,000 gallons.

(c) The volume of the refueling cavity pool is 470,000 gallons.

→ (DRN 99-2361)

BASIS FOR ACTIVITIES PROVIDED IN TABLES 11.4-7 THROUGH 11.4-8

← (DRN 99-2361)

6) Boric acid condensate ion exchanger (BMS) and waste condensate ion exchangers

(a) These ion exchangers are located downstream of the distillate of the concentrators. Their contribution to total resin activity is negligible compared to the previously listed ion exchangers.

7) Blowdown ion exchangers

(a) Based on primary-to-secondary leakage of 100 pounds per day and one regenerative batch being radioactive. 260 cu. ft./yr of radioactive resin is being collected from steam generator blowdown ion exchangers.

d) Spent Filter Cartridges

1) Purification filter (CVCS)

(a) The activity that builds up on the purification filters predominates over the other filters.

(b) The purification filter is assumed to be changed four times per year.

2) Fuel pool purification filter (FPS)

See c.5.

3) Waste filter (WMS)

(a) Waste quantities and activities processed through this filter are the same as in b.1.

(b) Credit for decay is taken for the time required to fill one 4,000 gallon waste tank.

4) Laundry filter (WMS)

(a) The activity built up on this filter is negligible when compared to other filters in the system.

5) Pre-Concentrator filter (BMS)

(a) Waste processed through this filter (see a.8).

(b) Credit is taken for upstream DF by the purification filter.

6) Oil separator filter (WMS)

See d.3.

TABLE 11.4-10 (Sheet 1 of 2) Revision 11-B (06/02)

COMPARISON OF WATERFORD 3 DESIGN CRITERIA WITH REGULATORY GUIDE 1.143, "DESIGN GUIDANCE FOR RADIOACTIVE WASTE MMAGEMENT SYSTEMS STRUCTURES, AND COMPONENTS INSTALLED IN LIGHT-WATERCOOLED NUCLEAR POWER PLANTS", OCTOBER 1979, AND BRANCH TECHNICAL POSITION ETSB 11-3, "DESIGN GUIDANCE FOR SOLID RADIOACTIVE WASTE MANAGEMENT SYSTEMS INSTALLED IN LIGHT-WATER-COOLED NUCLEAR POWER REACTOR PLANTS"

→(DRN 00-1045)

A) Waterford 3 Solid Waste Management System (SWMS) conforms to Regulatory Guide 1.143 as follows:

←(DRN 00-1045)

1) Design and Fabrication

→(DRN 01-223)

The spent resin tank is designed and fabricated in accordance with ASME VIII, Division I, 1973. All piping and valves are designed and fabricated in accordance with ANSI B31.1-1973. All pumps are designed and fabricated in accordance with manufacturer's standards.

←(DRN 01-223)

2) Materials

All materials in the SWMS are selected in accordance with ASTM or ASME Section II, 1974.

3) Welder Qualifications and Procedures

All welder qualifications and procedures are in accordance with ASME Section IX, 1974.

4) Inspection and Testing

All liquid penetrant testing has been performed in accordance with and meets the acceptance standards of ASME Section VIII, Division 1, Appendix 8. All visual inspection has been performed in accordance with Article 9 of ASME Section V. All piping assemblies have been hydrostatically tested for 30 minutes at the following pressures:

(a) All service and decontamination piping 150 psig

(b) All skid mounted and instrument process piping 50 psig

All pipe joint welds two in. and under are of the butt weld or socket weld type. All pipe joint welds greater than two in. are of the butt weld type.

The Reactor Auxiliary Building is designed seismic Category 1. The seismic system analysis for seismic Category I is given in Section 3.7.

The SWMS components adhere to the Quality Assurance Program outlined in ANSI N45.2-1971.

Testing provisions are incorporated to enable periodic evaluation of the operability of the SWMS.

→(DRN 00-1045)

B) Waterford 3 SWMS conforms to ETSB 11-3 in the following ways:

Waterford 3 does not normally solidify waste but, if desired, the following process may be used.

←(DRN 00-1045)

The hydraulic press, which is used for compacting solid wastes, has a ventilated exhaust hood with filters and exhaust fan to control the release of airborne dusts.

The SWMS casts liquid and solid radioactive wastes into solid immobile form by mixing a predetermined amount of waste and an acceptable solidification agent meeting the requirements of 10CFR61. The amounts of waste and solidification agent are determined by the use of an approved process control program with established predetermined parameters, and are controlled by instrumentation during the solidification process.

Assurance that the process is run within the predetermined process parameters, used to assure complete solidification, is established by the use of approved process control program procedures.

→(DRN 01-223

The SWMS storage facilities have sufficient capacity to accommodate approximately two months solidified waste at normal generation rate. The spent resin tank has sufficient capacity for one year holdup of resins. The SWMS storage facilities have sufficient capacity for at least one full shipment.

←(DRN 01-223)

All lines and tanks containing evaporator concentrates are heat traced, as well as having flushing connections.

Solidification agents are stored in low radiation areas with provisions for sampling.

All vents are above tank overflows therefore no liquid or solid overflows can enter the Plant Ventilation System.

→(LBDCR 13-009, R307)

Table 11.4-11 (Sheet 1 of 7) Revision 307 (07/13)

ANTICIPATED WASTE FOR STORAGE IN THE
LOW LEVEL RADWASTE FACILITY

| TYPE OF WASTE | $FT^3$ |
|---|---|
| DRY ACTIVE WASTE | 76,800 |
| PLANT BEAD RESIN | 2,808 |
| LIQUID WASTE MANAGEMENT BEAD RESIN | 2,808 |
| FILTERS<br>CLASS A<br>CLASS B | <br>190<br>60 |
| SECONDARY BLOWDOWN BEAD RESIN | 2,000 |
| CONDENSATE POLISHER POWDER RESIN | 1,520 |

←(LBDCR 13-009, R307)

→(LBDCR 13-009, R307)

Table 11.4-11 (Sheet 2 of 7) Revision 307 (07/13)

Anticipated Waste for Storage in the
Low Level Radioactive Waste Storage Facility

**Dry Active Waste**

| **Nuclide** | **Activity** | **Curies / Cubic Foot** |
|---|---|---|
| | **Curies** | |
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Security-Related Information
Text Withheld Under 10 CFR 2.390

→(LBDCR 13-009, R307)

Table 11.4-11 (Sheet 3 of 7) Revision 307 (07/13)

Anticipated Waste for Storage in the
Low Level Radioactive Waste Storage Facility

**Plant Bead Resin**

| Nuclide | Activity | Curies / Cubic Foot |
|---|---|---|
| | Curies | |
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Security-Related Information
Text Withheld Under 10 CFR 2.390

→(LBDCR 13-009, R307)

Table 11.4-11 (Sheet 4 of 7) Revision 307 (07/13)

Anticipated Waste for Storage in the
Low Level Radioactive Waste Storage Facility

**Liquid Waste Management Bead Resin**

| Nuclide | Activity | Curies / Cubic Foot |
|---|---|---|
| | Curies | |
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Security-Related Information
Text Withheld Under 10 CFR 2.390

→(LBDCR 13-009, R307)

Table 11.4-11 (Sheet 5 of 7) Revision 307 (07/13)

Anticipated Waste for Storage in the
Low Level Radioactive Waste Storage Facility

**Plant Filters, Class A & B**

| Nuclide | Activity | Curies / Cubic Foot |
|---|---|---|
| | Curies | |
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Security-Related Information
Text Withheld Under 10 CFR 2.390

→(LBDCR 13-009, R307)

Table 11.4-11 (Sheet 6 of 7) Revision 307 (07/13)

Anticipated Waste for Storage in the
Low Level Radioactive Waste Storage Facility

**Secondary Blowdown Bead Resin**

| **Nuclide** | **Activity** | **Curies / Cubic Foot** |
|---|---|---|
| | **Curies** | |
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Security-Related Information
Text Withheld Under 10 CFR 2.390

→(LBDCR 13-009, R307)

Table 11.4-11 (Sheet 7 of 7) Revision 307 (07/13)

Anticipated Waste for Storage in the
Low Level Radioactive Waste Storage Facility

**Condensate Polisher Powder Resin**

| Nuclide | Activity | Curies / Cubic Foot |
|---|---|---|
| | Curies | |
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Security-Related Information
Text Withheld Under 10 CFR 2.390

→ LBDCR 14-007, R308)

Table 11.4-12 (Sheet 1 of 2) Revision 309 (06/16)

Waterford 3 Original Steam Generator Storage Facility Radioactive Isotope Inventory

Old Steam Generators

| Isotope | Calculated Activity [Ci] | Isotope | Calculated Activity [Ci] | Isotope | Calculated Activity [Ci] |
|---|---|---|---|---|---|
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←(LBDCR 14-007, R308)
→ LBDCR 15-018, R309)

Note:

Quantity of Isotopes identified in Table 11.4-12 above are estimates only and not intended to be used for calculating actual quantity of material stored.
←(LBDCR 15-018, R309)

Security-Related Information
Text Withheld Under 10 CFR 2.390

→(LBDCR 14-007, R308)

Table 11.4-12 (Sheet 2 of 2) Revision 309 (06/16)

Waterford 3 Original Steam Generator Storage Facility Radioactive Isotope Inventory

Reactor Head

| Isotope | Smear (Ci) | Head (Ci) | Isotope | Smear (Ci) | Head (Ci) |
|---|---|---|---|---|---|
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←(LBDCR 14-007, R308)
→(LBDCR 15-018, R309)

Note:

Quantity of Isotopes identified in Table 11.4-12 above are estimates only and not intended to be used for calculating actual quantity of material stored.
←(LBDCR 15-018, R309)

Security-Related Information
Text Withheld Under 10 CFR 2.390