11.4 SOLID WASTE MANAGEMENT SYSTEM

The Solid Waste Management System (SWMS) is designed to control, collect, handle, process, package, and temporarily store prior to offsite shipping, the wet waste sludges generated by the Liquid Waste Management System, the Reactor Water Cleanup System, Fuel Pool Cleanup System, the Condensate Demineralizer System, and the Condensate Filtration System. Contaminated solids such as HEPA, cartridge filters, rags, paper, clothing, tools, and equipment are also disposed of in the SWMS. The SWMS processes wet and dry solid waste materials. Process and Instrumentation Diagrams for the SWMS are presented on Dwgs. M-166, Sh. 1, M-166, Sh. 2, M-167, Sh. 1 and M-167, Sh. 2. A flow diagram for the SWMS is given on Figure 11.4-3.

The operation of the SWMS is conducted in accordance with the Process Control Program (PCP). The PCP provides administrative control, guidance and records for the processing, packaging, transportation, and disposal of radioactive solid waste. This procedure describes the envelope within which processing and packaging of radioactive waste materials is accomplished to provide reasonable assurance of compliance with low-level radwaste regulations and requirements. The PCP is applicable to Susquehanna SES installed systems and portable systems and equipment provided by vendors for processing, packaging, transportation, and disposal of applicable waste forms.

11.4.1 DESIGN BASES

The objectives and criteria which form the bases for the design of the SWMS are as follows:

a. The SWMS system is capable of receiving, processing, solidifying or dewatering the solid radioactive waste inputs as shown in Tables 11.4-1 and 11.4-2 for permanent offsite disposal. The SWMS is designed to package radioactive solid wastes for offsite shipment and burial in accordance with the requirements of applicable NRC and DOT regulations including 10CFR71 and 49CFR170 through 178. This results in radiation exposures to individuals and the general population within the limits of 10CFR20 and 50.

b. The SWMS has no nuclear safety related functions as a design basis.

c. Connections for mobile radwaste processing systems are available to support additional demands on the SWMS, to provide flexibility in radwaste processing, and to accommodate new technology. Mobile radwaste processing systems are subjected to the same performance objectives as the permanently installed systems and are approved for use in accordance with applicable SSES programs and procedures.

d. Mobile dewatering processing equipment, utilized to treat and package wet wastes, meet the requirements of ETSB 11-3, Revision 2 (Reference 11.4-1).

e. The SWMS is designed to minimize the volume of dewatered, solidified or compacted waste for offsite shipment and burial. There is no liquid plant discharge from the SWMS.

f. Redundant and backup equipment, alternate routes, and interconnections are designed into the system to provide for operational occurrences such as refueling, abnormal leak rates, decontamination activities, SWMS equipment down time, maintenance and repair. Table 11.4-3 shows the design parameters of the SWMS equipment.

g. Equipment locations, room designs, drainage, ventilation, and design features of components are consistent with those shown in Section 11.2 and are provided to reduce maintenance, equipment down time, leakage, gaseous releases of radioactive materials to the building atmosphere, or to otherwise improve the system operations.

h. The seismic and quality group classifications of the SWMS components, piping, and structures are listed in Section 3.2.

i. Remote controls and viewing systems are used to keep exposure to the personnel as low as reasonably achievable (ALARA).

j. Storage space for approximately three weeks' volume of solidified or dewatered waste from each unit is provided in the radwaste building. At expected generation rates, four (or more) additional years of storage capacity are available in the Low Level Radioactive Waste Holding Facility, as described in Section 11.6.

k. Dry Active Waste (DAW) can be stored in the Low Level Radioactive Waste Holding Facility as described in Section 11.6.

l. The expected radionuclide activity concentrations in the SWMS process equipment are based on reactor water radioactivity concentrations corresponding to fuel defects that result in 50,000 μCi/sec noble gas release rate for one reactor unit after a 30 minute delay. The design basis radionuclide activity concentrations in the SWMS process equipment are based on reactor water radioactivity concentrations corresponding to fuel defects that result in 100,000 μCi/sec noble gas release rate for one reactor unit after a 30 minute delay.

m. The expected and design inventories of individual radionuclides in components containing significant amounts of radioactive material are shown in Tables 11.4-5, 11.4-6, and 11.4-7.

11.4.2 SYSTEM DESCRIPTION

11.4.2.1 General

The Solid Waste Management System consists of two processing streams: 1) the wet solid waste process stream is utilized for the collection, processing, and dewatering or solidification of wet solids such as filter material slurries and spent resins, and 2) the dry solid waste process stream collects and packages dry solids such as contaminated filter media, clothing, equipment, tools, paper, and plastic sheeting.

Except for condensate demineralizer regeneration waste surge tanks, condensate filters, and backwash receiving tanks in the turbine building and the RWCU and fuel pool backwash receiving tanks in the reactor buildings, all SWMS equipment serves both reactor units and is located in the radwaste building.

11.4.2.2 Wet Solid Wastes

The wet solid waste processing is shown on Dwgs. M-166, Sh. 1, M-166, Sh. 2, M-167, Sh. 1, and M-167, Sh. 2. Wet solid waste is normally dewatered to meet applicable free standing water requirements. Alternatively, these wastes may be solidified if the need should arise. As shown on the flow diagram (Figure 11.4-3) and detailed in Table 11.4-4 some of the waste inputs are collectively processed due to their expected similar characteristics. Only spent resins from the RWCU system are expected to be of the HSA-type with the remainder of the wet solid waste categorized as low specific activity, as defined in 10CFR71.

Spent Resins

The spent ion exchange resin from the radwaste demineralizer is periodically sluiced to the spent resin tank for radioactive decay, settling, and storage until transferred to the mobile processing system. As an alternate process, the spent resin may be pumped from the spent resin tank to the liquid radwaste filters for dewatering and then transferred to a waste container.

Sufficient capacity is provided in the spent resin tank for several batches of radwaste demineralizer resins or one batch of condensate demineralizer resins of either reactor unit. The vent and overflow nozzles of the spent resin tank are equipped with 30 mesh screens to minimize spread of particulate contamination to the radwaste tank vent system. A spray nozzle with spherical pattern located in the tank center allows remote internal washdown. A manhole and external ladder provide access to the tank interior.

Associated with the spent resin tank is the spent resin transfer pump, which is of the progressing cavity (Moyno) type. This pump is normally used as a decant pump to the spent resin tank and then to transfer the spent resin to the mobile processing system for dewatering and disposal. The decanted water is pumped to the liquid radwaste collection tanks of the LWMS. The spent resin transfer pump may also be used for dewatering of the spent resin directly through the liquid radwaste filters. In this case, liquid radwaste collection tank water is added to the spent resin tank to dilute the spent resin to a pumpable slurry, with condensate transfer water also being available as a backup water source. The spent resin transfer pump is used to mix the tank contents by recirculating tank fluid through internal tank piping and fittings located near the bottom of the tank. After the resins are in suspension, a portion of the spent resin transfer pump discharge is directed to either one of the two radwaste filters for removal and dewatering of the resins from the slurry at a flow rate of 50 to 100 gpm. The spent resin transfer pump is sized to provide continuous recirculation of the tank contents during tank pumpout to keep the resin in the tank in suspension.

The spent resin transfer pump and associated valves are separated from the spent resin tank by a shield wall to permit maintenance access.

When dewatering using the liquid radwaste filters, the amount of spent bead resins being dewatered at one time is expected to be limited by the space between the filter screen plates rather than by the differential pressure across the filter screens. A demineralizer resin bed must therefore be dewatered in several batches.

The resin dewatering and/or discharge cycle of the filter in the dewatering mode is identical to the one described in Subsection 11.2.2.2 for the liquid radwaste filtering mode.

Condensate Demineralizer Waste

A twin set of interconnected conical bottom tanks is located close to each condensate demineralizer resin cleaning system in the turbine building. The corrosion product-containing waste stream is continuously recirculated through tank internal mixing nozzles and a 35 gpm partial flow is discharged to the waste sludge phase separator by one of two redundant in-line pumps. This inlet flow rate to the waste sludge phase separator allows continuous settling of the suspended solids. The supernatant overflows into an internal standpipe and is transferred by the waste sludge phase separator decant pump to the liquid radwaste collection tanks.

The waste sludge phase separator also receives drainage from the radwaste filter vessels prior to and following filter discharge cycles.

A mode selector switch also allows isolation of the waste sludge phase separator for extended settling periods. This mode may be used with resin fines carry-over in the condensate resin cleaning waste inflow. Although a flowpath exists from the fuel pool backwash receiving tank to the waste sludge phase separator, fuel pool demineralizer backwash is normally processed through a RWCU phase separator to maintain the low and high activity wastes segregation. Interlocks are also provided to prevent fuel pool filter demineralizer backwash into the phase separator when in the continuous decant mode in order to minimize the slow settling powdered ion exchange resin from entering the standpipe.

The elevation of the decant nozzle on the phase separator allows collection of approximately 500 gallons of sludge on the slanted bottom.

Before sludge is transferred to either the mobile processing system or the liquid radwaste filter by the waste sludge discharge mixing pump, it is diluted in a phase separator volume of water to a pumpable concentration. Internal mixing is accomplished through recirculated supernatant.

Automatic flushing of slurry carrying lines and mechanical seals of slurry pumps is provided.

Because of the pressure drop and volume limitations of the liquid radwaste filters, several dewatering batches may be necessary for one phase separator sludge load when dewatering with these filters. The resin dewatering and/or discharge cycle of the filter in the dewatering mode is identical to the one described in Subsection 11.2.2.2 for the liquid radwaste filtering mode.

Reactor Water Cleanup Filter Demineralizer and Fuel Pool Demineralizer Backwash Slurries

A RWCU backwash receiving tank is close to the reactor water cleanup filter demineralizer system of each reactor unit in the reactor buildings. One batch of exhausted powdered ion exchange resins from a RWCU filter demineralizer can be collected in each tank.

Exhausted powdered ion exchange resins from the fuel pool filter demineralizers of both reactor units are backwashed into a common fuel pool backwash receiving tank in the reactor building of Unit 1. One batch of exhausted fuel pool filter demineralizer resins can be collected in the backwash receiving tank.

Compressed air at a flow rate of approximately 75 scfm is injected through a diffuser at the tank bottom for approximately 30 minutes to agitate the slurry before and while the tank is gravity drained to one of two reactor water cleanup phase separators in the radwaste building.

The sludge holding capacity of one RWCU phase separator allows collection of one years' backwash sludges from both units RWCU demineralizers (total of four) and from the fuel pool demineralizers (three) at normal frequency. Sufficient settling time for the suspended solids in each backwash slurry batch is allowed before the supernatant is transferred by the reactor water cleanup decant pump to the radwaste collection tanks.

Alternating at approximately one year intervals, each RWCU phase separator is first in the sludge collecting and then in the isolated mode to allow radioactive decay of isotopes with short half-lives.

This provision reduces operator exposures in subsequent processing steps and facilitates handling and shielding for offsite disposal. The sludge holding capacity on the slanted bottom of each RWCU phase separator is 750 gallons. Additional decant nozzles are provided for adjustment of the phase separation height.

Before the sludge is transferred to either the mobile processing system or to the liquid radwaste filter by the reactor water cleanup sludge discharge mixing pump, it is diluted in a phase separator volume of water to a pumpable concentration. Internal mixing is provided by recirculated tank fluids driven through nozzles. Automatic flushing of slurry carrying lines and mechanical seals of slurry pumps is provided.

Condensate Filtration System Waste

Condensate filters are installed directly downstream of the steam packing exhauster (SPE) condenser. The purpose of the condensate filters is to remove iron from the condensate to mitigate dose effects of Hydrogen Water Chemistry and extend the life of the deep bed demineralizers. The filtration subsystem consists of equal size vessels designed to remove the suspended solids (mainly fine iron particles) prior to entering the demineralizer vessel resin beds.

All condensate filter vessels are normally in service at one time except for periodic backwashing. Particles accumulate on the filter elements causing an increasing resistance to flow. At a predetermined flow resistance (filter vessel pressure drop) or radiation level, the vessel will be taken out of service and backwashed. The backwash slurry is drained to the backwash receiving tank and from there pumped to the Waste Sludge Phase Separator (WSPS).

The filter elements in each filter vessel are periodically replaced (every 2 to 4 years) due to accumulated solids and reduced backwash efficiency. Filter element replacement entails removing the filter bundle from the vessel, placing it into a canister, sealing the canister and transporting it to a staging area where the dirty elements are removed from the tube sheets. Prior to placement in the canister, filter bundles are backwashed and drained of water. Dropping of a bundle during transfer could result in localized contamination but will not result in airborne or liquid activity release to the environment.

In order to improve the precipitation and filterability of the iron oxide particles contained in the CFS backwash, two chemical feed systems are installed.

A CPS Polymer Injection System is installed in the Unit 1 Turbine Building on elevation 656’ near the caustic storage tank 1T161. It utilizes one pump for each Unit. Each pumping unit is controlled by its respective CFS PLC to assure proper coordination of polymer addition with the slurry transfers from the BWRT. The injection point is located in the CFS backwash transfer line from the BWRTs to the WSPS. This system is the primary means of coagulating the fine iron oxide particles producing a larger agglomerate of particles (or floc) that can be effectively processed by the WSPS and liquid radwaste filters.

A Chemical Injection System is installed in the Radwaste Building at elevation 646' in the southeast corner of the WSPS room. It utilizes two redundant pumps. Control of the unit is from a local station and is entirely manual except that the injection pump is interlocked with a timer to trip after a preselected operating interval. The chemical injection point is into the WSPS via the Waste Sludge Discharge Mixing pump suction line. This will allow the addition of caustic (for pH control) or a second polyelectrolyte (polymer) directly to the WSPS batch during mixing, if required.

<u>LRW Filter Waste</u>

The dewatered mixture is packaged in disposable radwaste containers for offsite burial. A waste mixing tank beneath each radwaste filter receives, by gravity flow, the dewatered waste discharged from the filtering and dewatering process. While operating the mechanical agitator in the tank, the remainder of the mixing tank volume is then filled with condensate to produce a pumpable slurry for processing.

Two redundant process trains are provided in three separately shielded rooms. Each train consists of a mixing tank with conical bottom, agitator, internal decontamination spray nozzles, heat tracing, level detector, temperature sensor, the associated process feed pump, associated piping, valves, and instrumentation. Process feed pump discharge branch lines permit transfer of wastes between the two mixing tanks.

<u>Wet Radwaste Dewatering, Solidification, and Packaging</u>

Solids discharged from the waste mixing tanks, spent resin tank, RWCU phase separators and waste sludge phase separator are dewatered for offsite shipment. Due to the infrequent need to solidify, solidification equipment is not normally maintained onsite. When solidification is necessary, the process is either performed onsite or the waste is transported to a suitable solidification facility offsite.

Mobile radwaste processing systems may be used to package wet solid radwaste materials for offsite disposal in accordance with applicable burial site requirements (e.g. high integrity containers). Multiple filled waste container storage compartments may be used as waste container processing cubicles in conjunction with a mobile radwaste processing system. To provide radiation shielding for operating personnel, two steel compartment lids with waste container access ports are available as waste container processing shields in substitution for the standard compartment lids. Also, four composite lead/steel compartment lids with waste container access ports are available as waste container processing shields for lower level radiation dose rate waste containers. Branch lines from the spent resin tank, phase separators, and waste mixing tanks, as well as a return line to each phase separator, are provided at the radwaste building monitoring room near the truck loading area for hookup of mobile radwaste processing equipment. Branch lines to/from the Liquid Waste Management System are also provided in this room for the liquid radwaste collection tanks, sample tanks, and chemical waste tank for interfacing with mobile radwaste processing systems. A branch line from the phase separator sludge discharge pumps, a return line to the liquid radwaste collection tanks, and a vent line are provided to the radwaste building truck loading area for hookup of a mobile radwaste dewatering and/or solidification processing system.

Samples of waste from the RWCU phase separator, waste sludge phase separators or the spent resin tank are taken for chemical and radiological analysis to assure compliance with applicable

10CFR61 requirements. Typically, samples of waste from the waste sludge phase separators or the spent resin tank are taken directly from the waste containers after transfer to the mobile processing system, while the RWCU phase separator waste is sampled from a drain line in the tank after recirculating to ensure adequate mixing.

Mobile Radwaste Processing System

Wet waste is dewatered in a mobile radwaste processing system installed in the radwaste processing area located in the radwaste building. Waste can be pumped directly to this system from the spent resin tank, the phase separators, or from the waste mixing tanks. Excess water is returned to a phase separator.

This processing system is designed to handle powdered and bead type ion exchange resins and other filter media by removing excess water utilizing a two step process: filling and dewatering to meet gross or decanted dewatering requirements, wet waste processor requirements, or disposal site criteria. The waste container is filled from the plant's waste tanks using excess water to keep the resin in a slurry and recirculating the waste tank to maintain a homogeneous mixture. As the waste container is being filled, it is dewatered so that the available space in the container is filled with waste to the maximum extent possible. The excess water is pumped out of the container using a positive displacement diaphragm pump. The waste media is then transferred through the fillhead assembly to the dewatering container. During transfer of the waste media, the dewatering pump is energized to return the filtered slurry water back to the client's waste system. At the predetermined setpoint, the level detection system will close the inlet waste valve to prevent overfilling the container and the dewatering pump will continue to run to reduce the level of slurry water in the container. This cycle is repeated until the correct volume of waste is in the container and the slurry water is removed to meet applicable shipping or disposal site criteria.

Waste Transfer System - consists of a high pressure flexible hose, a 1-1/2" air-operated ball valve at the plant radwaste system interface, a manual-operated ball valve on the fillhead, and a portable radiation monitor on the waste transfer piping to provide quantitative radiation levels during transfer and flushing.

Fillhead - provides the connections between the waste transfer system and waste container. Connections to the piping skid provide for the removal of excess water from the container. A connection to the blower skid provides for incoming dry, hot air for the drying process. The electronics enclosure on the fillhead contains a remote video camera, a pressure switch, electrical connections for level indications, and an air supply for cooling.

Piping Skid - contains hose connections for processing either powdered or bead type resins, and an air-driven diaphragm pump to remove the collected water from the processing container

Control Panel - provides a central location to operate equipment and indication of processing parameters (level, temperature, valve position, and fillhead position) and alarms.

Remote Video System - a TV camera mounted in the electronics section of the fillhead provides a secondary level indication during resin transfer operations. A dimmer control for the video light is provided on the control panel.

Radwaste Building Crane

A remotely controlled bridge crane is provided in the solid waste handling area of the radwaste building. It is used for loading of empty waste containers onto the rail dolly, transferring filled containers from the rail dolly into temporary storage compartments and onto a shielded truck for offsite disposal, for disassembling the radwaste filters, and for general use.

The lifting deck on the crane is suspended by four independent cables reeved by two cable drums. This minimizes swaying during lifting and unbalancing of the load should one cable fail. An installed hook on the lifting deck engages the waste containers and storage compartment lids. This allows crane operation from the radio control system, or from the backup stationary control pendant, located in normally accessible areas. A selector switch is provided near the crane that is accessible from the floor to allow the use of either pendant or radio control. The crane uses a positioning system for the bridge and trolley positions provided by positioning lasers and displays on a display screen (mounted near the crane camera monitors), for when the lifting deck center reaches the container loading, pickup, storage compartment, and truck loading positions. A standard 25 ton crane hook can be mounted on the lifting deck for general use of the radwaste building crane.

The crane bridge and trolley travels are interlocked with the lifting deck elevation to prevent interference with shield walls and the container loading and pickup shaft walls.

Closed circuit TV camera on the crane lifting cameras on the crane bridge, the lifting deck, and in the truck bay transmit images of the relative crane position to monitors on the console to assist in remote operation of the crane when handling filled waste containers or compartment lids. Target marks on the container and compartment lids facilitate positioning of the lifting deck. Proper engagement of the grappling device is indicated by a light on the Panel View control console and the backup each pendant. A slack cable indication light is provided on the control console only.

The trolley and bridge speeds are stepped from 5 to 50 ft per minute white the hoist speed is controllable in 10 increments from 1.5 to 15 ft per minute. A speed selector switch is provided on the two radio transmitters and the backup pendant station that, when selected, will reduce the maximum speeds on all crane motions. The hoist motor adjustable frequency drive (AFD) control provides dynamic braking of the hoist. Two additional, independent solenoid operated holding brakes are provided.

Waste Container Storage and Offsite Disposal

Filled waste containers are separately stored in covered concrete compartments for radioactive decay prior to offsite disposal.

The number of compartments in the Radwaste Building allows storage of approximately six weeks anticipated dewatered waste volume for normal operation of one reactor unit considering refueling. The storage capacity consists of twelve shielded compartments for liners up to 200 cubic feet. Each compartment will contain one liner. Shielding of the storage compartments reduces the radiation in the adjacent crane control area to less than 2.5 mR/hr. Sufficient lifting height is provided to place a large waste container into a top entry shield cask on a truck.

Additional storage capacity for packaged dewatered or solidified waste is provided in the Low Level Radioactive Waste Holding Facility as described in Section 11.6.

11.4.2.3 Dry Solid Waste

The dry solid waste consists of contaminated air filter media, miscellaneous paper, rags, plastic sheeting, etc. from contaminated areas; contaminated clothing, tools and equipment parts that cannot be effectively decontaminated, mechanical cartridge filters and solid laboratory wastes and other similar materials. Dry Solid Waste is also called Dry Active Waste (DAW).

Depending upon the activity level, the physical size, and the material, different handling and packaging procedures for dry solid wastes are used. Except for irradiated reactor internals, the dry solid waste is expected to allow temporarily unshielded handling without exceeding the dose limits of 10CFR20. Generally, the dry solid wastes are shipped to an offsite waste processor for volume reduction prior to offsite disposal. If off-site disposal is not practicable, dry solid wastes packaged for burial may be temporarily stored at the Low Level Radioactive Waste Holding Facility (LLRWHF). Dry Solid Wastes may also be packaged for transportation and stored in the LLRWHF until enough is accumulated to permit economical transportation.

Contaminated Protective Clothing and Other Launderable Material

Contaminated laundry consists of multiple use materials such as protective clothing, cloth, or nylon bags, rags, tarps, and mop heads. The volume of dry solid waste is minimized by washing and reusing the contaminated laundry to the extent practical or utilizing disposable protective garments, rags, tarps and mop heads that are segregated for processing at an off-site facility. The contaminated laundry and disposable materials are collected from the areas where it was generated and moved to the on-site laundry handling facility or waste segregation area. Disposable protective garments, rags, tarps and mop heads that do not meet the release criteria are rejected and become a dry solid waste.

The on-site laundry handling facility is a temporary (double wide trailer) structure attached to the Unit 2 Turbine Building. The facility is connected into the Turbine Building wet pipe fire protection system, encompassing all sections of the facility except for any attached transport containers. Ventilation includes a recirculating filtered HVAC system which does not exhaust to the outside. The facility and any attached transport containers are part of a Radiological Controlled Area and are routinely monitored for dose rates and contamination.

The laundry handling facility is used to receive, store, package (into DOT acceptable transport containers) and ship contaminated laundry to a vendor for decontamination. The vendor cleans, monitors for contamination, and returns the laundered items to the laundry handling facility at SSES where it is off loaded into storage areas within the facility. The facility can store up to 5,600 cubic feet of laundry items. Laundry rejected by the vendor as being beyond repair or too contaminated is off loaded from the transport containers and conveyed to a dry solid waste collection area. Approximately 5 to 10 percent of all decontaminated laundry is rejected and becomes a dry solid waste.

Irradiated Reactor Internals

Irradiated reactor internals being replaced are removed from the RPV underwater and stored for radioactive decay in the fuel pool. Subsection 9.1.4.2 describes reactor vessel and in-vessel servicing equipment used for handling reactor components.

An estimated average of 7 percent (14) of the control rod blades are removed from one reactor annually (during the refueling outage - 24 month cycle) and are stored on hangers on the fuel pool walls or in racks interspersed with the spent fuel racks. Offsite shipping is done in suitable containers.

Approximately 50 percent (22) of the power range monitor detectors are replaced in one reactor annually (during the refueling outage - 24 month cycle). The replacement procedure is described in Subsection 9.1.4.2. Spent in-core detectors and dry tubes are transferred on a refueling platform auxiliary hoist or on the LPRM bender underwater to the spent fuel pool.

A pneumatically operated cutting tool supplied with the nuclear steam supply system allows remote cutting of the in-core detectors and dry tubes on the work table in the fuel pool or in the fuel pool to cask pit transfer canal area. The cut in-core monitors and dry tubes and other small sized reactor internals are shipped offsite in suitable containers and/or shielded casks that can be loaded underwater.

A trolley mounted disposal cask with an internal cable drum is supplied with the nuclear steam supply system for spent source and intermediate range neutron monitor detector cables and the traversing in-core probe (TIP) wires.

Offgas System HEPA Filter Elements

The outlet HEPA filter element of the ambient temperature charcoal offgas system is housed in a pressure vessel at the outlet of each unit's system. The annual number of disposed HEPA filter elements from the offgas system is shown in Table 11.4-2. The size of the individual filter elements allows for disposal in approved container with a 55 gallon drum size opening.

Miscellaneous Contaminated Dry Solid Waste

Administrative procedures provide for frequent radiation monitoring and periodic replacement of the ventilation and laundry drain system filter media to limit the dose to maintenance personnel during handling to as low as reasonably achievable (ALARA). Redundant filter trains further allow shutdown of one train for decay of the radioactive isotopes in the filter media before replacement. Portable charcoal removal and loading systems are employed for packaging exhausted charcoal beds in 55 gallon drums.

Pre-filter and HEPA filter elements are manually retrieved from the filter housings and wrapped in dust-tight plastic bags.

Dry solid wastes are collected and processed by various means. They may be packaged in approved containers for direct disposal or for transportation to vendor facilities for volume reduction prior to disposal. Some waste may be compressed into 55-gallon drums by a hydraulic compactor with a vent hood. A fan on the compactor keeps the 55-gallon drum at a slight vacuum with discharge through a HEPA filter to the building ventilation duct.

The averaged annual volumes of unprocessed dry solid waste is shown in Table 11.4-2. The average annual volume of charcoal waste is derived from the bed depth, number of test canisters provided, and required test frequency per NRC Regulatory Guide 1.52. These volumes may be up to six times higher for any given year due to removal of the longest time exposed test canister. The average annual volume of prefilter, HEPA, laundry drain cartridge filter and other miscellaneous waste is estimated from previous plant experience.

Volumes of miscellaneous dry solid wastes may vary widely depending on the housekeeping in the plant, number and type of modifications in progress and other factors. Vendor volume reduction services reduce the waste volume by a factor of three to one hundred, depending on the nature of the waste and the process used. The total generated volume of these wastes is expected to average between 10,000 and 20,000 cubic feet per year. The total disposal volume of this waste is expected to average between 2,000 and 8,000 cubic feet per year.

11.4.3 REFERENCES

11.4-1 USNRC Branch Technical Position ETSB 11-3, Revision 2

11.4-2 Topical Report DW-11118-01-NP

TABLE 11.4-1

INPUTS TO THE SOLID RADWASTE COLLECTION SYSTEM FOR BOTH UNITS

SOURCE(7)	WASTE TYPE(8)	EXPECTED AVERAGE BATCH SIZE AND FREQUENCY(5) (FT^3/DAY)	MAXIMUM EXPECTED YEARLY VOLUME (FT^3)	EXPECTED YEARLY VOLUME (FT^3)(6)	NOTES
Spent Resin Tank					
Radwaste Demineralizer	Dewatered spent ion exchange bead resin	160/69	1010	850	1
Condensate Demineralizers	Dewatered spent ion exchange bead resin	300/77.5	3813	1413	2,3
Waste Mixing Tanks					
LRW Filters Backwash	Dewater powdered resin including crud	8/4.2	750	650	4,6
Waste Sludge Phase Separator					
Condensate Filters	Dewatered corrosion product crud with polyelectrolyte	1.0/7	52	52	10
LRW Filters Drain	Dewatered powdered resin including crud	1.0/4.2	100	85	4,6
RWCU Phase Separators					
RWCU Filter/Demineralizers	Dewatered spent powdered resin including crud	2.7/5.25	240	200	4,6
Fuel Pool Filter/Demineralizers	Dewatered spent powdered resin including crud	5.0/120	30	15	4,6

TABLE 11.4-1

INPUTS TO THE SOLID RADWASTE COLLECTION SYSTEM FOR BOTH UNITS

NOTES:

1) The Maximum Expected Yearly Volume includes an extra demineralizer at about 160 cubic feet above the Expected Yearly Volume.

2) Condensate demineralizer resin is not disposed on a regular frequency. A complete replacement of 16 beds is expected every 3.8 years on a unit operating condensate filtration. One additional bed is expected to be replaced each refueling outage. With a refueling outage every two years for the station, 18.8 beds will be replaced every four years for the station.

3) The Maximum Expected Yearly Volume includes an extra complete condensate demineralizer bed changeout on one unit as a result of a significant condenser tube leak. This includes 8 beds at 300 cubic feet per bed or 2400 ft^3.

4) The Maximum Expected Yearly Volumes are based on the maximum volumes disposed at SSES for the last five years 1992-1996 from the Susquehanna Cumulative Waste Processed Data Log.

5) The Expected Aver Batch Size and Frequency (ft^3/year) is based on the Expected Yearly Volume (ft^3).

6) The Expected Yearly Volume (ft^3) is based on the average disposal volumes for the last five years 1992-1996 from the Susquehanna Cumulative Waste Processed Data Log.

7) There is wet waste volume buried that is not reflected as a source to the solid radwaste collection system, therefore was not included specifically in this table. This waste is from the mobile liquid processing system used for treating chemical liquid waste. The waste is transferred directly from the mobile system to a HIC within the vendor supplied equipment system. In 1996, about 60 ft^3 of charcoal was disposed of from the mobile processing system. Bead resin may also be used in the mobile processing system.

8) The volumes presented in this table are only the wet solids portion of the total input slurry volumes therefore the waste types are all dewatered as stated. Since solidification is no longer performed, the dewatered volumes in the table represent the burial volumes less the packaging efficiency.

9) The Maximum Expected Yearly Volume and Expected Yearly Volume are based on the known iron input. The values are the same since the iron volume removed in year is not dependent on frequency.

TABLE 11.4-2

DRY SOLID WASTE AMOUNT FROM GAS, LAUNDRY DRAIN FILTERS, AND MAINTENANCE ACTIVITIES

SOURCE	EQUIPMENT NOS.	WASTE TYPE	SIZE (INCHES)	EXPECTED NUMBER/ WEIGHT OF FILTER UNITS PER YEAR	EXPECTED ANNUAL VOLUME UNCOMPACTED (FT^3)
Offgas Treatment System					
HEPA (Outlet)	1F-302/2F-302	Glass fiber, steel frame	12 dia. x 12	2	1
Control Structure Emergency O.A. Supply Filters					
Pre	0F-123A,B	Glass fiber, frameless	24x24x12	12	48
HEPA	0F-124A,B	Glass fiber, steel frame	24x24x12	12	48
Adsorption	0F-125A,B	Activ. Charcoal, 30 lb/ft^3	2336 lb	78	
HEPA	0F-126A,B	Glass fiber, steel frame	24x24x12	12	48
Reactor Bldg, Zones I and II Equipment Compartm. Exhaust Filters					
Pre	1F-254A,B/2F-254A,B	Same as above	24x24x12	64	256
HEPA	1F-255A,B/2F-255A,B		24x24x12	64	
Adsorption	1F-257A,B/2F-257A,B			29,336 lb	978
HEPA	1F-258A,B/2F-258A,B		24x24x12	64	256
Reactor Bldg. Zone III Exhaust Filters					
Pre	1F-215A,B/2F-215A,B	Same as above	24x24x12	16	64
HEPA	1F-216A,B/2F-216A,B		24x24x12	16	64
Adsorption	1F-217A,B/2F-217A,B			8180 lb	273
HEPA	1F-218A,B/2F-218A,B		24x24x12	16	64

TABLE 11.4-2

DRY SOLID WASTE AMOUNT FROM GAS, LAUNDRY DRAIN FILTERS, AND MAINTENANCE ACTIVITIES

SOURCE	EQUIPMENT NOS.	WASTE TYPE	SIZE (INCHES)	EXPECTED NUMBER/ WEIGHT OF FILTER UNITS PER YEAR	EXPECTED ANNUAL VOLUME UNCOMPACTED (FT^3)
Turbine Bldg. Exhaust Filters					
Pre	1F-156A,B/2F-156A,B	Same as above	24x24x12	84	336
HEPA	1F-157A,B/2F-257A,B		24x24x12	84	336
Adsorption	1F-158A,B/2F-258A,B			40,888 lb	1370
Control Structure Rad. Chem. Lab., Sample & Decon. Shower Room Filters					
Pre	0F-136/0F-139/0F-133/0F-142	Same as above	24x24x12	8	32
HEPA	0F-140/0F-137/0F-134/0F-143		24x24x12	8	32
Adsorption	0F-141/0F-138/0F-135/0F-144			20 trays 1400 lb	47
Radwaste Bldg. Exhaust Filters					
Pre	0F-354A,B	Glass fiber, frameless	24x24x12	60	240
HEPA	0F-355A,B	Glass fiber, steel frame	24x24x12	60	240
Hydraulic Compactor Exhaust Filter					
Radwaste Tank Vent Filters					
Pre	0F-357	Glass fiber, frameless	24x24x12	1	4
HEPA	0F-358	Glass fiber, steel frame	24x24x12	1	4
Adsorption	0F-359	Activ. charcoal, 30 lb/ft^3		1 tray 210 lb	7

TABLE 11.4-2

DRY SOLID WASTE AMOUNT FROM GAS, LAUNDRY DRAIN FILTERS, AND MAINTENANCE ACTIVITIES

SOURCE	EQUIPMENT NOS.	WASTE TYPE	SIZE (INCHES)	EXPECTED NUMBER/ WEIGHT OF FILTER UNITS PER YEAR	EXPECTED ANNUAL VOLUME UNCOMPACTED (FT^3)
Port. Charcoal Removal and Loading System Filters					
for Vent. Systems					
Pre	0S-512	Glass fiber, steel frame	24x24x12	2	8
HEPA		Glass fiber, steel frame	24x24x12	2	8
for Standby Gas					
Treatment System	0S-110,0S-111				
Pre		Cloth bag	24x24x12	2	8
HEPA		Glass fiber, steel frame	24x24x12	2	8
Standby Gas Treatment System Filters					
Pre	0F-172A,B	Glass fiber, frameless	24x24x12	18	72
HEPA	0F-170A,B	Glass fiber, steel frame	24x24x12	18	72
Adsorption	0F-169A,B	Activ. Charcoal, 28 lb/ft^3	13,840 lb	494	
HEPA	0F-171A,B	Glass fiber, steel frame	24x24x12	18	72
Reactor Bldg. Backwash Tank Exhaust Filters					
for RWCU System	1F-211/2F-211		12x12x12	2	2
for Fuel Pool Clean-up System	0F-211		24x24x12	1	4

TABLE 11.4-2

DRY SOLID WASTE AMOUNT FROM GAS, LAUNDRY DRAIN FILTERS, AND MAINTENANCE ACTIVITIES

SOURCE	EQUIPMENT NOS.	WASTE TYPE	SIZE (INCHES)	EXPECTED NUMBER/ WEIGHT OF FILTER UNITS PER YEAR	EXPECTED ANNUAL VOLUME UNCOMPACTED (FT^3)
Hydraulic Compactor Dust Hood Vent Filter					
Pre	0F-308	Glass fiber, plywood frame	12x12x2	12	2
HEPA		Glass fiber, plywood frame	12x12x12	12	12
Laundry Drain Processing					
Cartridge	0F-313A,B	Epoxy impreg. cellulose fiber steel frame	7 dia.x18-3/16	150	60
Condensate Filters	1F-135A-G 2F-135A-G	Plastic Fiber, plastic frame-polyprophylene or equivalent	2 5/8" ODx1.1Dx10"L cartridges. equivalent effective length = 50"	2028	400
Mechanical/cartridge filters from under-water vacuum operations, CRD's & CRD Liftpumps and other non-permanent liquid filtration systems					900
Metal (debris, piping, supports, etc. from modification and maintenance activities)				---	3000
Disposable/Consumable Material (plastic, tape, cardboard, paper, trash, protective clothing, laydown material, tarps, etc.)				---	8000

TABLE 11.4-3

SOLID WASTE MANAGEMENT SYSTEM COMPONENT DESCRIPTION

A. PUMPS	EQUIPMENT NUMBERS	TYPE	QUANTITY	MATERIAL	CAPACITY EACH, gpm	TDH ft	USAGE FACTOR NORMAL	DRIVER hp	DESIGN PRESSURE/TEMP psig/°F
SOLID RADWASTE COLLECTION									
Spent Resin Transfer	OP-320	Prog. Cavity (Moyno)	1	SS	200	354	0.076	60	150/140
RW Cleanup Phase Sep. Decant	OP-336	Horiz. Centr.	1	SS	50	155	0.0047	10	150/155
RW Cleanup Phase Sep. Sludge Disch.	OP-334	Horiz. Centr.	1	SS	200	272	0.00067	30	150/155
Waste Sludge Phase Sep. Decant	OP-331	Horiz. Centr.	1	SS	50	155	0.49	10	150/155
Waste Sludge Phase Sep. Disch.	OP-332	Horiz. Centr.	1	SS	200	272	0.013	30	150/155
Cond. Demin Regen. Waste Transfer	1P-106A,B	Inline Centr.	2	SS	85	53	0.0	3	150/105
Cond. Demin. Regen. Waste Transfer	2P-106A,B	Inline Centr.	2	SS	85	150	0.0	10	150/105
CFS BWRT Transfer	1P-2P-191	Centrifugal	2	316 SS	120	145	0.0341	7.5	150/125
U1/U2 Polymer Injection	OP-176A/B	Pos Displ	2	Cast Iron	11 gph @100 psi	350 psi max	0.0334	1/3	135/105
WSPS Chemical Injection	OP-347A/B	Pos Displ	2	Cast Iron	11 gph @100 psi	350 psi max	0.012	1/3	135/105
RADWASTE SOLIDIFICATION									
Process Feed	OP-304A,B	Prog. Cavity (Moyno)	2	SS/BUNA N	20	(Setp. 3 psig)	0.00023	2	125/180
Mixing	OP-307A,B	Prog. Cavity (Moyno)	2	SS/BUNA N 32	32	(Setp. 3 psig)	0.0	3	125/180
Sodium Silicate	OP-309	Prog. Cavity (Moyno)	1	CS/BUNA N	2.9	(Setp. 180 psig)	0.0	1/2	125/105
Cement Feed *	OS-305	Rotary Valve	1	C.I.	110 lb/min.		0.0	1	
RWSS Sample Pump	OP-306	Prog. Cavity	1	SS	30	150 psi	0.0065	10	180/140

* COMPONENT ISOLATED FROM THE RWSS AND NO LONGER SERVES ANY RWSS FUNCTIONS.

TABLE 11.4-3

SOLID WASTE MANAGEMENT SYSTEM COMPONENT DESCRIPTION

B. TANKS	**EQUIPMENT NUMBERS**	**TYPE**	**QUANTITY**	**MATERIAL**	**LIVE/NOMINAL CAPACITY, EACH gal.**	**DESIGN PRESSURE/TEMP. psig/□F**
SOLID RADWASTE COLLECTION						
Spent Resin	OT-324	Vert. Cyl.	1	SS	6200/7500	Atmos./200
RW Cleanup Backw. Receiving	1T-225	Vert. Cyl.	1	SS	2450/3000	Atmos./200
RW Cleanup Backw. Receiving	2T-225	Vert. Cyl.	1	SS	2450/3000	Atmos./200
Fuel Pool Backw. Receiving	OT-203	Vert. Cyl.	1	SS	1900/2500	Atmos./200
CFS Backw. Receiving	1T-187	Horiz. Cyl.	1	SS	9243/10920 (Max.)	Atmos./150
CFS Backw. Receiving	2T-187	Horiz. Cyl.	1	SS	9243/10920 (Max.)	Atmos./150
CFS Polymer Injection	0T-137	Vert. Cyl.	1	SS	250	Atmos./100
CFS Chemical Injection	0T-361	Vert. Cyl.	1	SS	100	Atmos./100
Cond. Demin. Regen. Waste Surge	1T-106A,B	Vert. Cyl.	2	CS	2800/3390	Atmos./105
Cond. Demin. regen. Waste Surge	2T-106A,B	Vert. Cyl.	2	CS	2800/3300	Atmos./105
RW Cleanup Phase Separator	OT-318A,B	Vert. Cyl.	2	SS	3100 Supern./898 Sludge/7400	Atmos./200
Waste Sludge Phase Separator	OT-331	Vert. Cyl.	1	SS	7330 Supern./898 Sludge/10780	Atmos./200
RADWASTE SOLIDIFICATION						
Waste Mixing	OT-307A,B	Vert. Cyl.	2	SS	700/750	Atmos./200
Cement Silo	OT-306	Vert. Cyl.	1	CS	3950/4325	Atmos./100
Sodium Silicate	OT-309	Vert. Cyl.	1	CS	1150/1270	Atmos./200
HSA Waste Container			As Required	CS	Up to 100 ft^3	Per DOT 7A
LSA Waste Container			As Required	CS	Up to 200 ft^3	Atmos. 250

C. MISC. EQUIPMENT	**EQUIPMENT NUMBERS**	**TYPE**	**QUANTITY**	**MATERIAL**	**CAPACITY**	**hp**	
Radwaste Building Crane	OH-301	Bridge & Trolley	1	CS	25 tons 48 ft. 2 in. lift 166 ft. 2 in. runway 34 ft. 2 in. span	Hoist Motor: 30 Bridge Motor: 3 Trolley Motor: 1.5 Grab Motor: 0.25 Trans T1: 1500VA Trans T2: 500VA Trans T3: 1500VA	
Waste Compactor	OS-313	Vert. Hydr. Piston	1	CS/SS	10 tons 14-1/2 in. Stroke	5	
Waste Container - Transfer Cart.	OS-315	Rail, Cable	1	CS	15 tons 63.75 ft. Travel	1	
Waste Container Storage Compartments						n/a	
Large	-	(Top Entry)	12	Concr.	For 6 ft. Cyl. Cont.		
Small	-	(With Lid)	4	Concr.	For 4x4 ft. Cyl. Cont. (if required)	n/a	

TABLE 11.4-4

SOLID WASTE MANAGEMENT SYSTEM FLOWS
(Refer to Figure 11.4-3)

No.	Stream (Note 4)	Averaged Number and Frequency of Batch (Notes 1 and 2)	Total Volume/ Batch (gallon)	Solids Volume/ Batch (ft^3)	Flowrate (gpm)	Maximum Expected Number and Frequency of Batch (Note 3)	Notes
1a	To Spent Resin Tank (From Radwaste Demin	1/69 days	2000	160	100	58 days	Total Volume is 1 demin and 40 gpm of sluice water for 20 minutes
1b	To Spent Resin Tank (From Cond Demins)	77.5 days	3800	300	150	29 days	Total Volume is 150 gpm for 25 minute transfer.
2	To Mobile Processing System (From Spent Resin Tank)	48 days	8000	300	10-50	23 days	Total Volume is one tank and 30 gpm sluice water for 60 minutes
3a	To Waste Sludge Phase Separator (CFS Backwash Receiving Tank)	14/21 days	5,056	1.0	35	5/7 day	Total Volume is from Table 11.2-2.
3b	To Waste Sludge Phase Separator (From LRW Filters Drain)	1/4.2 days	500	1.0	By gravity	1/3.7 days	Total Volume is from Table 11.2-2.

TABLE 11.4-4

SOLID WASTE MANAGEMENT SYSTEM FLOWS
(Refer to Figure 11.4-3)

No.	Stream (Note 4)	Averaged Number and Frequency of Batch (Notes 1 and 2)	Total Volume/ Batch (gallon)	Solids Volume/ Batch (ft^3)	Flowrate (gpm)	Maximum Expected Number and Frequency of Batch (Note 3)	Notes
4	To Mobile Processing System(From Waste Sludge Phase Separator)	1/426 days	9550	160	10-50	1/384 days	Total Volume is tank live capacity including 700 gallons of flush water
5	To RWCU Phase Sep. (From Fuel Pool Backwash Tank)	1/120 days	1450	5.0	By gravity	1/60 days	Total Volume is from Table 11.2-2.
6	To RWCU Phase Sep. (From RWCU Backwash Tanks)	1/4.5 days	1470	2.7	By gravity	1/4.1 days	Total Volume is from Table 11.2-2.
7	To Mobile Processing System (From RWCU Phase Separator)	1/340 days	6300	200	10-50	1/270 days	Total Volume is tank live capacity including 440 gallons of flush water.
8	To Waste Mixing Tanks(From Radwaste Filters Backwash)	1/4.2 days	210	8.0	By gravity	1/3.9 days	Total Volume is 30 % of waste mixing tank live capacity

TABLE 11.4-4

SOLID WASTE MANAGEMENT SYSTEM FLOWS
(Refer to Figure 11.4-3)

No.	Stream (Note 4)	Averaged Number and Frequency of Batch (Notes 1 and 2)	Total Volume/ Batch (gallon)	Solids Volume/ Batch (ft^3)	Flowrate (gpm)	Maximum Expected Number and Frequency of Batch (Note 3)	Notes
9	To Mobile Processing System (From Waste Mixing Tanks)	1/8.4 days	560	16	10-50	1/7.8 days	Total Volume is80 % of waste mixing tank live capacity
10	Large Waste Container For Disposal (From Mobile Processing System)	1/28 days	---	175	---	1/13 days	Container disposal volume (size) is about 200 ft3.
11	Medium Waste Container For Disposal (From Mobile Processing System)	1/70 days	---	150	---	1/61 days	Container disposal volume (size) is about 174 ft3.
12	Small Waste Container For Disposal (From Mobile Processing System)	1/170 days	---	100	---	1/135 days	Container disposal volume (size) is about 132 ft3.
13	To Vendor Processing(DAW from Cargo Containers)	---	---	Various cargo container sizes	---	---	About 17,000 ft3/year DAW shipped to vendors per Table 11.4-2

TABLE 11.4-4

SOLID WASTE MANAGEMENT SYSTEM FLOWS
(Refer to Figure 11.4-3)

No.	Stream (Note 4)	Averaged Number and Frequency of Batch (Notes 1 and 2)	Total Volume/ Batch (gallon)	Solids Volume/ Batch (ft^3)	Flowrate (gpm)	Maximum Expected Number and Frequency of Batch (Note 3)	Notes

NOTES:

1) Batch Frequencies are from total number of equipment.

2) The Averaged Number and Frequency of Batch is based on the Expected Yearly Volume (ft3) from Table 11.4-1.

3) The Max. Expected Number and Frequency of Batch is based on the Max Expected Yearly Volume (ft3) from Table 11.4-1.

4) A stream is not included specifically in this table because it is not part of the solid waste management system. This stream is for solid waste disposal from the mobile liquid processing system used for treating chemical liquid waste. The waste is transferred directly from the mobile system to a HIC within the vendor supplied equipment system. The Large Waste Container is typically used for this waste stream. In 1996, about 60 ft3 of charcoal was disposed of from the mobile processing system. Bead resin may also be used in the mobile processing system.

5) The container disposal volumes in the notes and corresponding Solids Volume/Batch (gallon) reflect present processing vendor sizes. These container sizes are considered typical, and may vary some between vendors.

6) The Large Waste Container is typically used for disposal of bead resin from the radwaste demineralizer and condensate demineralizers transferred to the spent resin tank. The Medium Waste Container is typically used for disposal of powdered resin, bead resin fines, and crud from the LRW filters transferred to the waste mixing tanks and WSPS. The Small Waste Container is typically used for disposal of powdered resin and crud from the RWCU Filter/Demineralizers and Fuel Pool Filter/Demineralizers transferred to the RWCU phase separators.

TABLE 11.4-5

EXPECTED INVENTORIES OF RADIOACTIVE MATERIALS IN COMPONENTS OF THE SOLID WASTE MANAGEMENT SYSTEM[(2)]

ISOTOPE	FP F/D BACKWASH RECEIVING TANK (CURIES)	RWCU F/D BACKWASH RECEIVING TANK (CURIES)	RWCU PHASE SEPARATOR (CURIES)	CFS BACKWASH RECEIVING TANK (CURIES)	LIQUID RADWASTE FILTER (DRAIN) 1/9 ACTIVITY (CURIES)	WASTE SLUDGE PHASE SEPARATOR (CURIES)	LIQUID RADWASTE FILTER 8/9 ACTIVITY (CURIES)	WASTE MIXING TANK (CURIES)	SPENT RESIN TANK (CURIES)	CFS FILTER (CURIES)
Na-24	4.93E-01[(1)]	4.83E+00	2.03E+01	1.22E+00	9.30E-02	1.31E+00	7.44E-01	7.44E-01	-	1.22E+00
P-32	2.14E-01	1.65E+00	9.05E+00	1.15E+00	4.05E-02	1.19E+00	3.24E-01	1.09E-01	-	1.15E+00
Cr-51	1.07E+01	6.61E+01	5.22E+02	7.59E+01	2.35E+00	7.82E+01	1.88E+01	3.56E+00	-	7.59E+01
Mn-54	2.57E-01	1.06E+00	3.86E+01	7.10E+00	1.90E-01	7.29E+00	1.52E+00	4.57E-02	-	7.10E+00
Mn-56	4.52E-01	4.37E+00	1.84E+01	1.11E+00	8.54E-02	1.20E+00	6.84E-01	6.84E-01	-	1.11E+01
Fe-55	3.89E+00	1.55E+01	7.19E+02	1.38E+02	3.63E+00	1.41E+02	2.90E+01	6.57E-01	-	1.38E+02
Fe-59	6.98E-02	3.75E-01	4.16E+00	6.44E-01	1.90E-02	6.63E-01	1.52E-01	1.86E-02	-	6.44E-01
Co-58	5.61E-01	2.72E+00	4.31E+01	7.02E+00	1.98E-01	7.22E+00	1.58E+00	1.27E-01	-	7.02E+00
Co-60	1.58E+00	6.23E+00	3.07E+02	5.93E+01	1.56E+00	6.08E+01	1.24E+01	2.63E-01	-	5.93E+01
Ni-65	2.65E-03	2.56E-02	1.08E-01	6.51E-03	5.00E-04	7.01E-03	4.00E-03	4.00E-03	-	6.51E-03
Cu-64	1.25E+00	1.22E+01	5.13E+01	3.10E+00	2.37E-01	3.33E+00	1.89E+00	1.89E+00	-	3.10E+00
Zn-65	7.18E-01	3.01E+00	1.00E+02	1.82E+01	4.87E-01	1.86E+01	3.89E+00	1.30E-01	-	1.82E+01
Sr-90	2.80E-02	1.09E-01	5.68E+00	-	-	-	-	-	2.45E-01	-
Y-93	1.33E-01	1.31E+00	5.51E+00	-	-	-	-	-	6.30E-02	-
Nb-98	1.19E-05	0.0	2.40E-05	-	-	-	-	-	1.42E-18	-
I-134	2.31E-01	2.15E+00	9.06E+00	-	-	-	-	-	4.25E+00	-
Cs-134	1.15E-01	4.63E-01	2.07E+01	-	-	-	-	-	6.03E-01	-
Cs-136	7.91E-02	6.31E-01	3.34E+00	-	-	-	-	-	3.82E-02	-
Cs-138	-	-	-	-	-	-	-	-	3.48E-02	
Ba-139	5.03E-02	4.79E-01	2.02E+00	5.79E-02	4.37E-03	6.23E-02	3.49E-02	3.48E-02	2.34E-02	5.79E-02
W-187	2.32E-02	2.28E-01	9.59E-01	2.24E-01	1.71E-02	2.41E-01	1.37E-01	1.37E-01	-	2.24E-01
Zn-69m	9.04E-02	8.85E+01	3.72E+00	2.24E-01	1.71E-02	2.41E-01	1.37E-01	1.37E-01	-	2.24E-01
Zn-69	9.04E-02	8.88E+01	3.73E+00	-	-	-	-	-	-	
Br-83	3.01E-02	2.90E-01	1.22E+00	-	-	-	-	-	4.51E-01	-
Sr-89	2.47E-01	1.28E+00	1.56E+01	-	-	-	-	-	2.34E-01	-
Y-89m	3.70E-05	1.93E-04	2.35E-03	-	-	-	-	-	2.74E-05	-
Sr-92	9.46E-02	9.16E-01	3.85E+00	-	-	-	-	-	4.45E-02	-
Y-92	1.68E-01	1.64E+00	6.90E+00	-	-	-	-	-	7.93E-02	-
Ru-103	4.40E-02	2.44E-01	2.46E+00	-	-	-	-	-	2.86E-02	-

TABLE 11.4-5

EXPECTED INVENTORIES OF RADIOACTIVE MATERIALS IN COMPONENTS OF THE SOLID WASTE MANAGEMENT SYSTEM[(2)]

ISOTOPE	FP F/D BACKWASH RECEIVING TANK (CURIES)	RWCU F/D BACKWASH RECEIVING TANK (CURIES)	RWCU PHASE SEPARATOR (CURIES)	CFS BACKWASH RECEIVING TANK (CURIES)	LIQUID RADWASTE FILTER (DRAIN) 1/9 ACTIVITY (CURIES)	WASTE SLUDGE PHASE SEPARATOR (CURIES)	LIQUID RADWASTE FILTER 8/9 ACTIVITY (CURIES)	WASTE MIXING TANK (CURIES)	SPENT RESIN TANK (CURIES)	CFS FILTER (CURIES)
Rh-103m	4.40E-02	2.44E-01	2.46E+00	-	-	-	-	-	2.86E-02	-
Ru-106	1.12E-02	4.56E-02	1.75E+00	-	-	-	-	-	3.74E-02	-
Rh-106	1.12E-02	4.56E-02	1.75E+00	-	-	-	-	-	3.74E-02	-
Te-132	2.51E-03	2.46E-02	1.04E-01	-	-	-	-	-	1.19E-03	-
I-132	2.96E-01	2.85E+00	1.20E+01	-	-	-	-	-	4.39E+00	-
Cs-137	7.95E-02	3.12E-01	1.62E+01	-	-	-	-	-	7.04E-01	-
Ba-137m	7.48E-02	2.94E-01	1.53E+01	-	-	-	-	-	6.63E-01	-
Ba-140	3.86E-01	3.10E+00	1.62E+01	-	-	-	-	-	1.86E-01	-
La-140	3.85E-01	2.99E+00	1.62E+01	-	-	-	-	-	1.86E-01	-
La-142	2.87E-02	2.74E-01	1.15E+00	-	-	-	-	-	1.34E-02	-
Ce-143	3.20E-03	3.14E-02	1.32E-01	-	-	-	-	-	1.52E-03	-
Pr-143	4.36E-02	3.44E-01	1.85E+00	-	-	-	-	-	2.12E-02	-
Nd-147	2.51E-03	2.11E-02	1.04E-01	-	-	-	-	-	1.20E-03	-
Pm-147	1.07E-04	2.95E-04	2.38E-02	-	-	-	-	-	7.76E-04	-
Np-239	1.26E+00	1.25E+01	5.25E+01	-	-	-	-	-	6.01E-01	-
Pu-239	7.16E-06	2.62E-05	1.54E-03	-	-	-	-	-	6.89E-05	-
Sr-91	1.25E-01	1.23E+00	5.17E+00	-	-	-	-	-	5.92E-02	-
Y-91m	7.21E-02	7.08E-01	2.98E+00	-	-	-	-	-	3.41E-02	-
Y-91	1.77E-01	8.90E-01	1.22E+01	-	-	-	-	-	1.44E-01	-
Zr-95	2.17E-02	1.07E-01	1.57E+00	-	-	-	-	-	1.86E-02	-
Nb-95m	1.61E-04	7.05E-04	1.22E-02	-	-	-	-	-	1.45E-04	-
Nb-95	2.79E-02	1.22E-01	2.40E+00	-	-	-	-	-	2.88E-02	-
Mo-99	4.24E-01	4.16E+00	1.75E+01	-	-	-	-	-	2.01E-01	-
Tc-99m	7.71E-01	7.55E+00	3.17E+01	-	-	-	-	-	3.64E-01	-
Tc-99	5.37E-07	2.01E-06	1.14E-04	-	-	-	-	-	5.09E-06	-
Ru-105	3.03E-02	2.95E-01	1.24E+00	-	-	-	-	-	1.43E-02	-
Rh-105m	6.36E-03	6.21E-02	2.61E-01	-	-	-	-	-	3.00E-03	-
Rh-105	3.03E-02	2.98E-01	1.25E+00	-	-	-	-	-	1.43E-02	-
Te-129m	8.03E-02	4.67E-01	4.20E+00	-	-	-	-	-	4.87E-02	-

TABLE 11.4-5

EXPECTED INVENTORIES OF RADIOACTIVE MATERIALS IN COMPONENTS OF THE SOLID WASTE MANAGEMENT SYSTEM(2)

ISOTOPE	FP F/D BACKWASH RECEIVING TANK (CURIES)	RWCU F/D BACKWASH RECEIVING TANK (CURIES)	RWCU PHASE SEPARATOR (CURIES)	CFS BACKWASH RECEIVING TANK (CURIES)	LIQUID RADWASTE FILTER (DRAIN) 1/9 ACTIVITY (CURIES)	WASTE SLUDGE PHASE SEPARATOR (CURIES)	LIQUID RADWASTE FILTER 8/9 ACTIVITY (CURIES)	WASTE MIXING TANK (CURIES)	SPENT RESIN TANK (CURIES)	CFS FILTER (CURIES)
Te-129	5.04E-02	2.93E-01	1.27E+00	-	-	-	-	-	3.06E-02	-
I-129	4.64E-10	9.32E-10	6.37E-08	-	-	-	-	-	8.31E-09	-
Te-131m	1.94E-02	1.90E-01	8.01E-01	-	-	-	-	-	9.17E-03	-
Te-131	2.15E-03	2.12E-02	8.91E-02	-	-	-	-	-	1.02E-03	-
I-131	1.11E+00	1.01E+01	4.60E+01	-	-	-	-	-	1.35E+01	-
I-133	1.68E+00	1.66E+01	6.94E+01	-	-	-	-	-	2.06E+01	-
I-135	5.87E-01	5.73E+00	2.41E+01	-	-	-	-	-	7.74E+00	-
Ce-141	5.90E-02	3.47E-01	3.05E+00	-	-	-	-	-	3.53E-02	-
Ce-144	1.08E-02	4.53E-02	1.60E+00	-	-	-	-	-	3.00E-02	-
Pr-144m	1.56E-04	6.47E-04	2.90E-03	-	-	-	-	-	4.29E-04	-
Pr-144	1.08E-02	4.52E-02	2.03E-01	-	-	-	-	-	3.00E-02	-
Rb-87	-	-	-	-	-	-	-	-	4.91E-13	-
Rb-88	-	-	-	-	-	-	-	-	8.33E-03	-
Rb-89	-	-	-	-	-	-	-	-	5.11E-02	-
Cs-135	-	-	-	-	-	-	-	-	1.10E-08	-
TOTAL	2.96E+01	2.02E+02	2.28E+03	3.13E+02	8.92E+00	3.22E+02	7.13E+01	8.55E+00	5.60E+01	3.13E+02

NOTES:

(1) 4.93E-01 = 4.93×10^{-1}

(2) Noble gases are not included in tank inventories because they are assumed to escape from solution and are continuously vented to the Radwaste Building ventilation system.

TABLE 11.4-6

DESIGN INVENTORIES OF RADIOACTIVE MATERIALS IN COMPONENTS OF THE SOLID WASTE MANAGEMENT SYSTEM (Curies) [2]

ISOTOPE	FP F/D BACKWASH RECEIVING TANK (CURIES)	RWCU F/D BACKWASH RECEIVING TANK (CURIES)	RWCU PHASE SEPARATOR (CURIES)	CFS BACKWASH RECEIVING TANK (CURIES)	LIQUID RADWASTE FILTER (DRAIN) 1/9 ACTIVITY (CURIES)	WASTE SLUDGE PHASE SEPARATOR (CURIES)	LIQUID RADWASTE FILTER 8/9 ACTIVITY (CURIES)	WASTE MIXING TANK (CURIES)	SPENT RESIN TANK (CURIES)	CFS FILTER (CURIES)
Na-24	2.57E-02[1]	1.57E+00	6.33E+00	2.49E-01	3.15E-02	2.80E-01	2.52E-01	2.52E-01	2.73E-01	2.49E-01
P-32	5.69E-03	2.76E-01	1.45E+00	1.20E-01	7.06E-03	1.27E-01	5.65E-02	1.89E-02	6.22E-02	1.20E-01
Cr-51	2.38E-01	9.20E+00	7.01E+01	6.60E+00	3.40E-01	6.94E+00	2.72E+00	5.16E-01	2.92E+00	6.60E+00
Mn-54	3.91E-02	1.01E-00	3.65E+01	4.20E+00	1.88E-01	4.39E+00	1.50E+00	4.53E-02	7.17E-01	4.20E+00
Mn-56	1.10E-01	6.68E+00	2.69E+01	1.06E+00	1.36E-01	1.19E+00	1.08E+00	1.08E+00	1.17E+00	1.06E+00
Fe-59	4.98E-02	1.67E+00	1.80E+01	1.80E+00	8.74E-02	1.88E+00	6.99E-01	8.58E-02	6.83E-01	1.80E+00
Co-58	3.74E+00	1.13E+02	1.75E+03	1.83E+02	8.58E+00	1.91E+02	6.86E+01	5.48E+00	5,72E+01	1.83E+02
Co-60	5.26E-01	1.30E+01	6.36E+02	7.64E+01	3.37E+00	7.97E+01	2.70E+01	5.71E-01	1.02E+01	7.64E+01
Ni-65	6.45E-04	3.92E-02	1.58E-01	6.20E-03	7.92E-04	6.99E-03	6.34E-03	6.34E-03	6.86E-03	6.20E-03
Zn-65	1.91E-03	5.02E-02	1.65E+00	1.88E-01	8.45E-03	1.96E-01	6.76E-02	2.26E-03	3.45E-02	1.88E-01
Br-84	1.22E-02	7.12E-01	2.87E+00	-	-	-	-	-	1.30E-01	-
Sr-90	2.45E-01	6.01E+00	3.09E+02	-	-	-	-	-	4.77E+00	-
Tc-101	2.83E-02	1.54E+00	6.22E+00	-	-	-	-	-	3.00E-01	-
I-134	1.79E-01	1.07E+01	4.32E+01	-	-	-	-	-	1.90E+00	-
Cs-134	1.65E-01	4.13E+00	1.83E+02	-	-	-	-	-	3.14E+00	-
Cs-136	2.90E-02	1.45E+00	7.35E+00	-	-	-	-	-	3.14E-01	-
Cs-138	8.70E-02	5.07E+00	2.05E+01	-	-	-	-	-	9.25E-01	-
Ba-139	1.89E-01	1.14E+01	4.60E+01	-	-	-	-	-	2.01E-00	-
Zn-69m	3.52E-04	2.16E-02	8.71E-02	3.41E-03	4.33E-04	3.84E-03	3.46E-03	3.46E-03	3.74E-03	3.41E-03
Zn-69	3.52E-04	2.16E-02	8.71E-02	3.41E-03	4.32E-04	3.85E-03	3.45E-03	3.45E-03	3.74E-03	3.41E-03
Br-83	3.06E-02	1.86E+00	7.50E+00	-	-	-	-	-	3.26E+01	-
Sr-89	2.04E+00	6.65E+01	7.88E+02	-	-	-	-	-	2.89E+01	-
Y-89m	3.05E-04	9.97E-03	1.18E-01	-	-	-	-	-	4.34E-03	-
Sr-92	2.55E-01	1.55E+01	6.25E+01	-	-	-	-	-	2.70E+00	-
Y-92	2.55E-01	1.55E+01	6.29E+01	-	-	-	-	-	2.70E+00	-
Ru-103	1.11E-02	3.86E-01	3.78E+00	-	-	-	-	-	1.48E-01	-
Rh-103m	1.11E-02	3.86E-01	3.78E+00	-	-	-	-	-	1.49E-01	-
Ru-106	2.58E-03	6.61E-02	2.51E+00	-	-	-	-	-	4.77E-02	-
Rh-106	2.58E-03	6.61E-02	2.51E+00	-	-	-	-	-	4.77E-02	-
Ag-110m	5.74E-02	1.51E+00	5.00E+01	5.70E+00	2.56E-01	5.95E+00	2.05E+00	6.79E-02	1.04E+00	5.70E+00
Ag-110	7.64E-04	2.00E-02	6.65E-01	7.57E-02	3.41E-03	7.92E-02	2.73E-02	9.02E-04	1.38E-02	7.57E-02
Te-129m	2.15E-02	7.80E-01	6.80E+00	-	-	-	-	-	2.75E-01	-

TABLE 11.4-6

DESIGN INVENTORIES OF RADIOACTIVE MATERIALS IN COMPONENTS OF THE SOLID WASTE MANAGEMENT SYSTEM (Curies) (2)

ISOTOPE	FP F/D BACKWASH RECEIVING TANK (CURIES)	RWCU F/D BACKWASH RECEIVING TANK (CURIES)	RWCU PHASE SEPARATOR (CURIES)	CFS BACKWASH RECEIVING TANK (CURIES)	LIQUID RADWASTE FILTER (DRAIN) 1/9 ACTIVITY (CURIES)	WASTE SLUDGE PHASE SEPARATOR (CURIES)	LIQUID RADWASTE FILTER 8/9 ACTIVITY (CURIES)	WASTE MIXING TANK (CURIES)	SPENT RESIN TANK (CURIES)	CFS FILTER (CURIES)
Te-129	1.35E-02	4.90E-01	4.27E+00	-	-	-	-	-	1.73E-01	-
Te-132	3.28E+00	2.01E+02	8.12E+02	-	-	-	-	-	3.48E+01	-
I-132	3.51E+00	2.15E+02	8.68E+02	-	-	-	-	-	3.73E+01	-
I-131	2.14E+00	1.22E+02	5.32E+02	-	-	-	-	-	2.27E+01	-
Cs-137	2.55E-01	6.27E+00	3.23E+02	-	-	-	-	-	4.97E+00	-
Ba-137m	2.41E-01	5.93E+00	3.06E+02	-	-	-	-	-	4.71E+00	-
Ba-140	2.31E+00	1.16E+02	5.83E+02	-	-	-	-	-	2.51E+01	-
La-140	2.31E+00	1.12E+02	5.84E+02	-	-	-	-	-	2.51E+01	-
Ba-142	2.59E-02	1.36E+00	5.49E+00	-	-	-	-	-	2.75E-01	-
La-142	2.59E-02	1.59E+00	6.41E+00	-	-	-	-	-	2.75E-01	-
Ce-143	9.83E-04	6.05E-02	2.44E-01	-	-	-	-	-	1.05E-02	-
Pr-143	1.12E-02	5.54E-01	2.86E+00	-	-	-	-	-	1.22E-01	-
Nd-147	3.12E-03	1.64E-01	7.79E-01	-	-	-	-	-	3.34E-02	-
Pm-147	1.32E-04	2.30E-03	1.84E-01	-	-	-	-	-	2.83E-03	-
W-187	6.10E-02	3.74E+00	1.51E+01	5.95E-01	7.46E-02	6.70E-01	5.97E-01	5.95E-01	6.48E-01	5.95E-01
Re-187	1.82E-13	4.33E-12	2.36E-10	2.87E-11	1.26E-12	2.99E-11	1.01E-11	1.64E-13	3.58E-12	2.87E-11
Np-239	1.15E+01	7.10E+02	2.86E+03	-	-	-	-	-	1.23E+02	-
Pu-239	6.52E-05	1.49E-03	8.76E-02	-	-	-	-	-	1.30E-03	-
Br-85	6.93E-04	2.37E-02	9.62E-02	-	-	-	-	-	7.36E-03	-
Sr-91	5.59E-01	3.42E+01	1.38E+02	-	-	-	-	-	5.92E+00	-
Y-91m	3.21E-01	1.97E+01	7.94E+01	-	-	-	-	-	3.40E+00	-
Y-91	3.24E-01	1.01E+01	1.37E+02	-	-	-	-	-	5.17E+00	-
Zr-95	2.89E-02	8.94E-01	1.28E+01	-	-	-	-	-	4.33E-01	-
Nb-95m	2.14E-04	5.89E-03	9.96E-02	-	-	-	-	-	3.32E-03	-
Nb-95	3.83E-02	1.06E+00	2.00E+01	-	-	-	-	-	6.25E-01	-
Zr-97	4.63E-04	2.83E-02	1.14E-01	-	-	-	-	-	4.91E-03	-
Nb-97m	4.38E-04	2.68E-02	1.08E-01	-	-	-	-	-	4.65E-03	-
Nb-97	4.63E-04	2.83E-02	1.14E-01	-	-	-	-	-	4.91E-03	-
Mo-99	1.24E+00	7.60E+01	3.07E+02	-	-	-	-	-	1.32E+01	-
Tc-99m	2.53E+00	1.55E+02	6.25E+02	-	-	-	-	-	2.69E+01	-
Tc-99	1.74E-06	4.07E-05	2.27E-03	-	-	-	-	-	3.44E-05	-
I-133	1.58E+00	9.69E+01	3.91E+02	-	-	-	-	-	1.68E+01	-

TABLE 11.4-6

DESIGN INVENTORIES OF RADIOACTIVE MATERIALS IN COMPONENTS OF THE SOLID WASTE MANAGEMENT SYSTEM (Curies) (2)

ISOTOPE	FP F/D BACKWASH RECEIVING TANK (CURIES)	RWCU F/D BACKWASH RECEIVING TANK (CURIES)	RWCU PHASE SEPARATOR (CURIES)	CFS BACKWASH RECEIVING TANK (CURIES)	LIQUID RADWASTE FILTER (DRAIN) 1/9 ACTIVITY (CURIES)	WASTE SLUDGE PHASE SEPARATOR (CURIES)	LIQUID RADWASTE FILTER 8/9 ACTIVITY (CURIES)	WASTE MIXING TANK (CURIES)	SPENT RESIN TANK (CURIES)	CFS FILTER (CURIES)
I-135	7.34E-01	4.49E+01	1.81E+02	-	-	-	-	-	7.80E+00	-
Ba-141	4.42E-02	2.48E+00	1.00E+01	-	-	-	-	-	4.70E-01	-
La-141	4.42E-02	2.71E+00	1.09E+01	-	-	-	-	-	4.70E-01	-
Ce-141	5.55E-02	2.03E+00	1.74E+01	-	-	-	-	-	7.06E-01	-
Ce-144	3.38E-02	8.83E-01	3.08E+01	-	-	-	-	-	6.20E-01	-
Pr-144m	4.84E-04	1.26E-02	5.14E-02	-	-	-	-	-	4.80E-03	-
Pr-144	3.38E-02	8.83E-01	3.60E+00	-	-	-	-	-	3.36E-01	-
Rb-88	-	-	-	-	-	-	-	-		-
Rb-89	-	-	-	-	-	-	-	-		-
Cs-139	-	-	-	-	-	-	-	-		-
Rb-90	-	-	-	-	-	-	-	-		-
Y-90	-	-	-	-	-	-	-	-		-
Rb-92	-	-	-	-	-	-	-	-		-
Rb-93	-	-	-	-	-	-	-	-		-
Sr-93	-	-	-	-	-	-	-	-		-
Y-93	-	-	-	-	-	-	-	-		-
Rb-94	-	-	-	-	-	-	-	-		-
Sr-94	-	-	-	-	-	-	-	-		-
Y-94	-	-	-	-	-	-	-	-		-
Cs-140	-	-	-	-	-	-	-	-		-
Cs-142	-	-	-	-	-	-	-	-		-
TOTAL	4.17E+01	2.23E+03	1.30E+04	2.80E+02	1.31E+01	2.93E+02	1.05E+02	8.74E+00	4.85E+02	2.80E+02

<u>NOTES</u>: (1) 2.57E-02 = 2.57×10^{-2}

(2) Noble gases are not included in tank inventories because they are assumed to escape from solution and are continuously vented to the Radwaste Building ventilation system.

TABLE 11.4-9

EXPECTED INVENTORIES OF RADIOACTIVE MATERIALS IN WASTE SHIPPING CASKS[1,2]

ISOTOPE	LARGE CONTAINER 200 FT^3 (SHIPPING)/ 175 FT^3 (RESIN)		MEDIUM CONTAINER 174 FT^3 (SHIPPING)/ 150 FT^3 (RESIN)		SMALL CONTAINER 132 FT^3 (SHIPPING)/ 100 FT^3 (RESIN)	VERY SMALL CONTAINER 51 FT^3 (SHIPPING)/ 39 FT^3 (RESIN)
	CONDENSATE DEMIN. RESIN (175/300 FT^3) (CURIES)	RADWASTE DEMIN. RESIN (175/160 FT^3) (CURIES)	WASTE MIXING TANK (150/16 FT^3) (CURIES)	WASTE SLUDGE PHASE SEPARATOR (150/164 FT^3) (CURIES)	RWCU PHASE SEPARATOR (100/155.4 FT^3) (CURIES)	RWCU PHASE SEPARATOR (39/155.4 FT^3) (CURIES)
Na-24	-	9.17E-01[1]	6.97E+00	1.20E+00	1.31E+01	5.09E+00
P-32	-	3.94E-01	1.02E-00	1.09E+00	5.82E+00	2.27E+00
Cr-51	-	1.95E+01	3.34E+01	7.15E+01	3.36E+02	1.31E+02
Mn-54	-	4.43E-01	4.28E-01	6.67E+00	2.48E+01	9.69E+00
Mn-56	-	8.40E-01	6.41E+00	1.10E+00	1.18E+01	4.62E+00
Fe-55	-	6.66E+00	6.16E+00	1.29E+02	4.63E+02	1.80E+02
Fe-59	-	1.26E-01	1.74E-01	6.06E-01	2.68E+00	1.04E+00
Co-58	-	9.93E-01	1.19E+00	6.60E+00	2.77E+01	1.08E+01
Co-60	-	2.69E+00	2.47E+00	5.56E+01	1.98E+02	7.70E+01
Ni-65	-	4.92E-03	3.75E-02	6.41E-03	6.95E-02	2.71E-02
Cu-64	-	2.33E+00	1.77E+01	3.05E+00	3.30E+01	1.29E+01
Zn-65	-	1.24E+00	1.22E+00	1.70E+01	6.44E+01	2.51E+01
Sr-90	1.43E-01	4.76E-02	-	-	3.66E+00	1.43E+00
Y-93	3.67E-02	2.48E-01	-	-	3.55E+00	1.38E+00
Nb-98	8.31E-19	2.22E-05	-	-	1.54E-05	6.02E-06
I-134	2.48E+00	4.30E-01	-	-	5.83E+00	2.27E+00
Cs-134	3.52E-01	1.98E-01	-	-	1.33E+01	5.19E+00
Cs-136	2.23E-02	1.47E-01	-	-	2.15E+00	8.38E-01
Cs-138	2.03E-02	-	-	-	-	-
Ba-139	1.37E-02	9.38E-02	-	-	1.30E+00	5.07E-01
W-187	0.00E+00	4.31E-02	3.27E-01	5.70E-02	6.17E-01	2.41E-01
Zn-69m	0.00E+00	1.68E-01	1.28E+00	2.20E-01	2.39E+00	9.34E-01
Zn-69	0.00E+00	1.68E-01	1.28E+00	2.20E-01	2.40E+00	9.36E-01
Br-83	2.63E-01	5.60E-02	-	-	7.85E-01	3.06E-01
Sr-89	1.37E-01	4.41E-01	-	-	1.00E+01	3.92E+00
Y-89m	1.60E-05	6.62E-05	-	-	1.51E-03	5.90E-04
Sr-92	2.59E-02	1.77E-01	-	-	2.48E+00	9.66E-01
Y-92	4.62E-02	3.13E-01	-	-	4.44E+00	1.73E+00

TABLE 11.4-9

EXPECTED INVENTORIES OF RADIOACTIVE MATERIALS IN WASTE SHIPPING CASKS[1,2]

ISOTOPE	LARGE CONTAINER 200 FT^3 (SHIPPING)/ 175 FT^3 (RESIN)		MEDIUM CONTAINER 174 FT^3 (SHIPPING)/ 150 FT^3 (RESIN)		SMALL CONTAINER 132 FT^3 (SHIPPING)/ 100 FT^3 (RESIN)	VERY SMALL CONTAINER 51 FT^3 (SHIPPING)/ 39 FT^3 (RESIN)
	CONDENSATE DEMIN. RESIN (175/300 FT^3) (CURIES)	RADWASTE DEMIN. RESIN (175/160 FT^3) (CURIES)	WASTE MIXING TANK (150/16 FT^3) (CURIES)	WASTE SLUDGE PHASE SEPARATOR (150/164 FT^3) (CURIES)	RWCU PHASE SEPARATOR (100/155.4 FT^3) (CURIES)	RWCU PHASE SEPARATOR (39/155.4 FT^3) (CURIES)
Ru-103	1.67E-02	7.90E-02	-	-	1.58E+00	6.17E-01
Rh-103m	1.67E-02	7.90E-02	-	-	1.58E+00	6.17E-01
Ru-106	2.18E-02	1.91E-02	-	-	1.13E+00	4.39E-01
Rh-106	2.18E-02	1.91E-02	-	-	1.13E+00	4.39E-01
Te-132	6.93E-04	4.68E-03	-	-	6.69E-02	2.61E-02
I-132	2.56E+00	5.49E-01	-	-	7.72E+00	3.01E+00
Cs-137	4.11E-01	1.36E-01	-	-	1.04E+01	4.07E+00
Ba-137m	3.87E-01	1.28E-01	-	-	9.85E+00	3.84E+00
Ba-140	1.09E-01	7.13E-01	-	-	1.04E+01	4.07E+00
La-140	1.09E-01	7.11E-01	-	-	1.04E+01	4.07E+00
La-142	7.79E-03	5.33E-02	-	-	7.40E-01	2.89E-01
Ce-143	8.84E-04	5.95E-03	-	-	8.49E-02	3.31E-02
Pr-143	1.23E-02	8.07E-02	-	-	1.19E+00	4.64E-01
Nd-147	6.98E-04	4.64E-03	-	-	6.69E-02	2.61E-02
Pm-147	4.53E-04	1.78E-04	-	-	1.53E-02	5.97E-03
Np-239	3.50E-01	2.36E+00	-	-	3.38E+01	1.32E+01
Pu-239	4.02E-05	1.23E-05	-	-	9.91E-04	3.86E-04
Sr-91	3.46E-02	2.34E-01	-	-	3.33E+00	1.30E+00
Y-91m	1.99E-02	1.35E-01	-	-	1.92E+00	7.48E-01
Y-91	8.42E-02	3.16E-01	-	-	7.85E+00	3.06E+00
Zr-95	1.09E-02	3.86E-02	-	-	1.01E+00	3.94E-01
Nb-95m	8.46E-05	2.84E-04	-	-	7.85E-03	3.06E-03
Nb-95	1.68E-02	4.90E-02	-	-	1.54E+00	6.02E-01
Mo-99	1.17E-01	7.90E-01	-	-	1.13E+01	4.39E+00
Tc-99m	2.12E-01	1.43E+00	-	-	2.04E+01	7.96E+00
Tc-99	2.97E-06	9.14E-07	-	-	7.34E-05	2.86E-05
Ru-105	8.32E-03	5.64E-02	-	-	7.98E-01	3.11E-01
Rh-105m	1.75E-03	1.18E-02	-	-	1.68E-01	6.55E-02

TABLE 11.4-9

EXPECTED INVENTORIES OF RADIOACTIVE MATERIALS IN WASTE SHIPPING CASKS[1,2]

ISOTOPE	LARGE CONTAINER 200 FT^3 (SHIPPING)/ 175 FT^3 (RESIN)		MEDIUM CONTAINER 174 FT^3 (SHIPPING)/ 150 FT^3 (RESIN)		SMALL CONTAINER 132 FT^3 (SHIPPING)/ 100 FT^3 (RESIN)	VERY SMALL CONTAINER 51 FT^3 (SHIPPING)/ 39 FT^3 (RESIN)
	CONDENSATE DEMIN. RESIN (175/300 FT^3) (CURIES)	RADWASTE DEMIN. RESIN (175/160 FT^3) (CURIES)	WASTE MIXING TANK (150/16 FT^3) (CURIES)	WASTE SLUDGE PHASE SEPARATOR (150/164 FT^3) (CURIES)	RWCU PHASE SEPARATOR (100/155.4 FT^3) (CURIES)	RWCU PHASE SEPARATOR (39/155.4 FT^3) (CURIES)
Rh-105	8.37E-03	5.64E-02	-	-	8.04E-01	3.14E-01
Te-129m	2.84E-02	1.45E-01	-	-	2.70E+00	1.05E+00
Te-129	1.79E-02	9.14E-02	-	-	8.17E-01	3.19E-01
I-129	4.85E-09	7.45E-10	-	-	4.10E-08	1.60E-08
Te-131m	5.35E-03	3.61E-02	-	-	5.15E-01	2.01E-01
Te-131	5.94E-04	4.00E-03	-	-	5.73E-02	2.24E-02
I-131	7.90E+00	2.06E+00	-	-	2.96E+01	1.15E+01
I-133	1.20E+01	3.12E+00	-	-	4.47E+01	1.74E+01
I-135	4.52E+00	1.09E+00	-	-	1.55E+01	6.05E+00
Ce-141	2.06E-02	1.07E-01	-	-	1.96E+00	7.65E-01
Ce-144	1.75E-02	1.88E-02	-	-	1.03E+00	4.02E-01
Pr-144m	2.50E-04	2.69E-04	-	-	1.87E-03	7.28E-04
Pr-144	1.75E-02	1.88E-02	-	-	1.31E-01	5.09E-02
Rb-87	2.86E-13	-	-	-	-	-
Rb-88	4.86E-03	-	-	-	-	-
Rb-89	2.98E-02	-	-	-	-	-
Cs-135	6.42E-09	-	-	-	-	-
TOTAL	3.27E+01	5.34E+01	8.01E+01	2.94E+02	1.47E+03	5.73E+02

NOTES:

1. Container volumes are based on disposal volumes; the volume in parentheses is the actual radwaste volume.
2. Cask inventories given above, are estimates for immediately after filling. Actual shipping inventories will include additional decay time.
3. 8.41E-01 = 8.41×10^{-1}

TABLE 11.4-10

DESIGN INVENTORIES OF RADIOACTIVE MATERIALS IN WASTE SHIPPING CASKS[1,2]

ISOTOPE	LARGE CONTAINER 200 FT^3 (SHIPPING) / 175 FT^3 (RESIN)		MEDIUM CONTAINER 74 FT^3 (SHIPPING) / 150 FT^3 (RESIN)		SMALL CONTAINER 132 FT^3 (SHIPPING) / 100 FT^3 (RESIN)	VERY SMALL CONTAINER 51 FT^3 (SHIPPING) / 39 FT^3 (RESIN)
	CONDENSATE DEMINERALIZER RESIN (175/300 FT^3) (CURIES)	RADWASTE DEMINERALIZER RESIN (175/320 FT^3) (CURIES)	WASTE MIXING TANK (150/16 FT^3) (CURIES)	WASTE SLUDGE PHASE SEPARATOR (150/164 FT^3) (CURIES)	RWCU PHASE SEPARATOR (100/155.4 FT^3) (CURIES)	RWCU PHASE SEPARATOR (39/155.4 FT^3) (CURIES)
Na-24	-	1.49E-01[3]	2.36E+00	2.56E-01	4.07E+00	1.59E+00
P-32	-	3.40E-02	1.77E-01	1.16E-01	9.34E-01	3.64E-01
Cr-51	-	1.59E+00	4.84E+00	6.35E+00	4.51E+01	1.76E+01
Mn-54	-	3.92E-01	4.25E-01	4.02E+00	2.35E+01	9.16E+00
Mn-56	-	6.39E-01	1.02E+01	1.09E+00	1.73E+01	6.76E+00
Fe-59	-	3.74E-01	8.04E-01	1.72E+00	1.16E+01	4.52E+00
Co-58	-	3.13E+01	5.14E+01	1.75E+02	1.13E+03	4.40E+02
Co-60	-	5.55E+00	5.35E+00	7.29E+01	4.09E+02	1.60E+02
Ni-65	-	3.75E-03	5.94E-02	6.39E-03	1.02E-01	3.97E-02
Zn-65	-	1.89E-02	2.12E-02	1.79E-01	1.06E+00	4.14E-01
Br-84	5.55E-01	7.10E-02	-	-	1.85E+00	7.21E-01
Sr-90	4.91E+00	2.61E+00	-	-	1.99E+02	7.76E+01
Tc-101	2.76E-02	1.64E-01	-	-	4.00E+00	1.56E+00
I-134	7.53E+00	1.04E+00	-	-	2.78E+01	1.08E+01
Cs-134	1.96E+00	1.71E+00	-	-	1.18E+02	4.60E+01
Cs-136	3.19E-02	1.72E-01	-	-	4.73E+00	1.85E+00
Cs-138	1.32E-01	5.06E-01	-	-	1.32E+01	5.13E+00
Ba-139	3.34E-01	1.10E+00	-	-	2.96E+01	1.15E+01
Zn-69m	-	2.05E-03	3.25E-02	3.51E-03	5.61E-02	2.19E-02
Zn-69	-	2.05E-03	3.24E-02	3.52E-03	5.61E-02	2.19E-02
Br-83	1.04E+00	1.78E-01	-	-	4.83E+00	1.88E+00
Sr-89	3.52E+00	1.58E+01	-	-	5.07E+02	1.98E+02
Y-89m	5.18E-04	2.37E-03	-	-	7.60E-02	2.96E-02
Sr-92	3.47E-01	1.48E+00	-	-	4.02E+01	1.57E+01
Y-92	3.50E-01	1.48E+00	-	-	4.05E+01	1.58E+01
Ru-103	1.65E-02	8.12E-02	-	-	2.43E+00	9.49E-01

TABLE 11.4-10

DESIGN INVENTORIES OF RADIOACTIVE MATERIALS IN WASTE SHIPPING CASKS[1,2]

ISOTOPE	LARGE CONTAINER 200 FT^3 (SHIPPING) / 175 FT^3 (RESIN)		MEDIUM CONTAINER 74 FT^3 (SHIPPING) / 150 FT^3 (RESIN)		SMALL CONTAINER 132 FT^3 (SHIPPING) / 100 FT^3 (RESIN)	VERY SMALL CONTAINER 51 FT^3 (SHIPPING) / 39 FT^3 (RESIN)
	CONDENSATE DEMINERALIZER RESIN (175/300 FT^3) (CURIES)	RADWASTE DEMINERALIZER RESIN (175/320 FT^3) (CURIES)	WASTE MIXING TANK (150/16 FT^3) (CURIES)	WASTE SLUDGE PHASE SEPARATOR (150/164 FT^3) (CURIES)	RWCU PHASE SEPARATOR (100/155.4 FT^3) (CURIES)	RWCU PHASE SEPARATOR (39/155.4 FT^3) (CURIES)
Rh-103m	1.65E-02	8.12E-02	-	-	2.43E+00	9.49E-01
Ru-106	1.98E-02	2.61E-02	-	-	1.62E+00	6.30E-01
Rh-106	1.98E-02	2.61E-02	-	-	1.62E+00	6.30E-01
Ag-110m	-	5.68E-01	6.37E-01	5.44E+00	3.22E+01	1.26E+01
Ag-110	-	7.57E-03	8.46E-03	7.24E-02	4.28E-01	1.67E-01
Te-129m	2.96E-02	1.51E-01	-	-	4.38E+00	1.71E+00
Te-129	1.86E-02	9.47E-02	-	-	2.75E+00	1.07E-00
Te-132	3.53E+00	1.90E+01	-	-	5.22E+02	2.04E+02
I-132	1.37E+01	2.04E+01	-	-	5.59E+02	2.18E+02
I-131	6.00E+01	1.24E+01	-	-	3.42E+02	1.33E+02
Cs-137	5.13E+00	2.72E+00	-	-	2.08E+02	8.11E+01
Ba-137m	4.85E+00	2.57E+00	-	-	1.97E+02	7.67E+01
Ba-140	2.68E+00	1.37E+01	-	-	3.75E+02	1.46E+02
La-140	2.68E+00	1.37E+01	-	-	3.76E+02	1.47E+02
Ba-142	3.55E-02	1.50E-01	-	-	3.53E+00	1.38E+00
La-142	4.04E-02	1.50E-01	-	-	4.13E+00	1.61E+00
Ce-143	1.06E-03	5.74E-03	-	-	1.57E-01	6.12E-02
Pr-143	1.24E-02	6.69E-02	-	-	1.84E+00	7.17E-01
Nd-147	3.39E-03	1.83E-02	-	-	5.01E-01	1.95E-01
Pm-147	2.20E-03	1.54E-03	-	-	1.18E-01	4.61E-02
W-187	-	3.55E-01	5.58E+00	6.13E+01	9.71E+00	3.79E+00
Re-187	-	1.96E-12	1.54E-12	2.73E-11	1.52E-10	5.93E-11
Np-239	1.25E+01	6.72E+01	-	-	1.84E+03	7.19E+02
Pu-239	1.42E-03	7.12E-04	-	-	5.58E-02	2.18E-02
Br-85	3.21E-02	4.03E-03	-	-	6.19E-02	2.41E-02
Sr-91	6.05E-01	3.24E+00	-	-	8.88E+01	3.46E+01

TABLE 11.4-10

DESIGN INVENTORIES OF RADIOACTIVE MATERIALS IN WASTE SHIPPING CASKS[1,2]

ISOTOPE	LARGE CONTAINER 200 FT^3 (SHIPPING) / 175 FT^3 (RESIN)		MEDIUM CONTAINER 74 FT^3 (SHIPPING) / 150 FT^3 (RESIN)		SMALL CONTAINER 132 FT^3 (SHIPPING) / 100 FT^3 (RESIN)	VERY SMALL CONTAINER 51 FT^3 (SHIPPING) / 39 FT^3 (RESIN)
	CONDENSATE DEMINERALIZER RESIN (175/300 FT^3) (CURIES)	RADWASTE DEMINERALIZER RESIN (175/320 FT^3) (CURIES)	WASTE MIXING TANK (150/16 FT^3) (CURIES)	WASTE SLUDGE PHASE SEPARATOR (150/164 FT^3) (CURIES)	RWCU PHASE SEPARATOR (100/155.4 FT^3) (CURIES)	RWCU PHASE SEPARATOR (39/155.4 FT^3) (CURIES)
Y-91m	3.48E+01	1.86E+00	-	-	5.11E+01	1.99E+01
Y-91	6.06E+01	2.83E+00	-	-	8.79E+01	3.43E+01
Zr-95	5.67E-02	2.73E-01	-	-	8.23E+00	3.21E+00
Nb-95m	4.42E-04	1.815E-03	-	-	6.41E-02	2.50E-02
Nb-95	8.91E-02	3.42E-01	-	-	1.29E+01	5.02E+00
Zr-97	4.79E-04	2.68E-03	-	-	7.34E-02	2.86E-02
Nb-97m	4.71E-04	2.54E-03	-	-	6.96E-02	2.71E-02
Nb-97	4.97E-04	2.68E-03	-	-	7.34E-02	2.86E-02
Mo-99	1.33E+00	7.20E+00	-	-	1.97E+02	7.70E+01
Tc-99m	2.73E+00	1.47E+01	-	-	4.02E+02	1.57E+02
Tc-99	3.74E-05	1.88E-05	-	-	1.46E-03	5.71E-04
I-133	4.42E+01	9.18E+00	-	-	2.51E+02	9.81E+01
I-135	2.21E+01	4.27E+00	-	-	1.17E+02	4.54E+01
Ba-141	4.84E-02	2.57E-01	-	-	6.44E+00	2.51E+00
La-141	5.23E-02	2.57E-01	-	-	7.03E+00	2.74E+00
Ce-141	8.03E-02	3.86E-01	-	-	1.12E+01	4.36E+00
Ce-144	2.14E-01	3.39E-01	-	-	1.98E+01	7.73E+00
Pr-144m	3.05E-03	2.62E-03	-	-	3.31E-02	1.29E-02
Pr-144	2.14E-01	1.84E-01	-	-	2.32E+00	9.04E-01
Rb-88	9.01E-03	-	-	-	-	-
Rb-89	5.94E-02	-	-	-	-	-
Cs-139	1.15E-01	-	-	-	-	-
Rb-90	7.02E-02	-	-	-	-	-
Y-90	1.12E-02	-	-	-	-	-
Rb-92	4.06E-10	-	-	-	-	-
Rb-93	6.56E-09	-	-	-	-	-

TABLE 11.4-10

DESIGN INVENTORIES OF RADIOACTIVE MATERIALS IN WASTE SHIPPING CASKS[1,2]

ISOTOPE	LARGE CONTAINER 200 FT^3 (SHIPPING) / 175 FT^3 (RESIN)		MEDIUM CONTAINER 74 FT^3 (SHIPPING) / 150 FT^3 (RESIN)		SMALL CONTAINER 132 FT^3 (SHIPPING) / 100 FT^3 (RESIN)	VERY SMALL CONTAINER 51 FT^3 (SHIPPING) / 39 FT^3 (RESIN)
	CONDENSATE DEMINERALIZER RESIN (175/300 FT^3) (CURIES)	RADWASTE DEMINERALIZER RESIN (175/320 FT^3) (CURIES)	WASTE MIXING TANK (150/16 FT^3) (CURIES)	WASTE SLUDGE PHASE SEPARATOR (150/164 FT^3) (CURIES)	RWCU PHASE SEPARATOR (100/155.4 FT^3) (CURIES)	RWCU PHASE SEPARATOR (39/155.4 FT^3) (CURIES)
Sr-93	1.40E-02	-	-	-	-	-
Y-93	1.68E-02	-	-	-	-	-
Rb-94	3.82E-18	-	-	-	-	-
Sr-94	1.90E-04	-	-	-	-	-
Y-94	5.78E-04	-	-	-	-	-
Cs-140	3.88E-02	-	-	-	-	-
Cs-142	1.71E-22	-	-	-	-	-
TOTAL	1.99E+02	2.65E+02	8.19E+01	2.67E+02	8.38E+03	3.27E+03

<u>NOTES</u>:

1. Container volumes are based on disposal volumes; the volume in parentheses is the actual radwaste volume.
2. Cask inventories given above, are estimates for immediately after filling. Actual shipping inventories will include additional decay time.
3. 1.55E-01 = 1.55×10^{-1}

THIS FIGURE HAS BEEN
REPLACED BY DWG.
M-166, Sh. 1

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure 11.4-1-1 replaced by dwg.
M-166, Sh. 1

FIGURE 11.4-1-1, Rev. 56

AutoCAD Figure 11_4_1_1.doc

THIS FIGURE HAS BEEN
REPLACED BY DWG.
M-166, Sh. 2

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Figure 11.4-1-2 replaced by dwg.
M-166, Sh. 2

FIGURE 11.4-1-2, Rev. 56

AutoCAD Figure 11_4_1_2.doc

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M-167, Sh. 1

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure 11.4-2-1 replaced by dwg. M-167, Sh. 1 FIGURE 11.4-2-1, Rev. 55

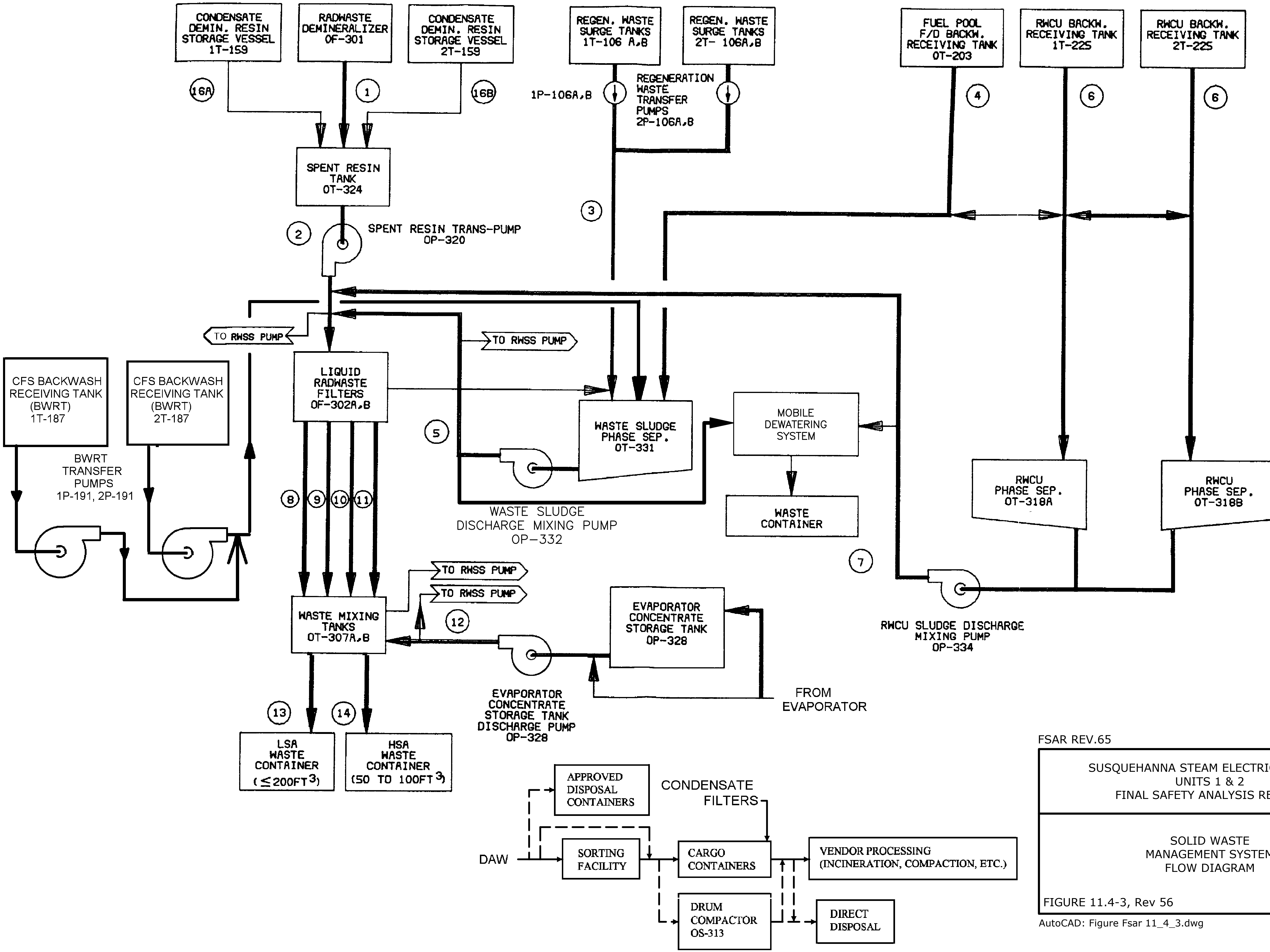
AutoCAD Figure 11_4_2_1.doc

THIS FIGURE HAS BEEN
REPLACED BY DWG.
M-167, Sh. 2

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure 11.4-2-2 replaced by dwg. M-167, Sh. 2 FIGURE 11.4-2-2, Rev. 55

AutoCAD Figure 11_4_2_2.doc



FSAR REV.65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

SOLID WASTE
MANAGEMENT SYSTEM
FLOW DIAGRAM

FIGURE 11.4-3, Rev 56

AutoCAD: Figure Fsar 11_4_3.dwg