12.2 Radiation Sources

This section describes the key component sources of radioactivity present in the U.S. EPR, in accordance with Section 12 of the NUREG-0800 SRP (Reference 1), that are used as input to:

- Perform shield design calculations (see Section 12.3.2).
- Design the ventilation systems.
- Determine radwaste classifications for systems and components in accordance with Regulatory Guide 1.143.

Source terms are presented here for both contained and airborne sources of radioactivity.

12.2.1 Contained Sources

The U.S. EPR component source terms for contained sources are based on the shielding design basis primary coolant source term described in Section 11.1.2, Table 11.1-2, which is based on U.S. EPR specific design inputs and a conservative 0.25 percent failed fuel fraction. Plan scale drawings of each floor of the plant, showing the location of these contained sources, are included in the radiation zone maps (see Section 12.3.2.3).

12.2.1.1 Reactor Core

During normal operation, radiation within the containment consists of neutrons and gamma radiation emanating from the reactor core. The model dimensions for the reactor vessel are shown in Table 12.2-1—Reactor Vessel Model Dimensions (cm). Table 12.2-2—Neutron and Gamma Fluxes at Primary Shield Concrete lists neutron and gamma multigroup fluxes at the inside surface of the primary shield concrete, core midplane elevation. These fluxes are further reduced by shielding provided by the reactor vessel and reactor internals. See Section 12.3.1.1 for features that reduce neutron and gamma streaming in the service area of the Containment Building.

The spent fuel gamma ray source strengths, as a function of time after shutdown, are presented in Table 12.2-3. The spectra are based on the radionuclide mix containing the bounding core inventory for each individual radionuclide of importance for the following core parameters:

- Power level: 4612 MW_t.
- U-235 fuel enrichment: 2 to 5 $^w/_o$.
- Fuel burn-up: 5 to 62 GWD/MTU.

- Core loading: 129 MTU (metric tons of uranium).

The 18-group spectral structure corresponds to that of ORIGEN-2, and the tabulation includes 18 decay times covering the interval from 5 minutes to approximately 23 years.

12.2.1.2 Reactor Coolant System

Sources of radiation in the RCS are fission products released from fuel cladding defects and activated corrosion products. Each of these radiological sources is continuously transported through most of the RCS; the pressurizer and its associated surge line do not normally experience large continuous flows. These sources are listed in Table 11.1-2, and their bases are described in Section 11.1.

During operation, nitrogen-16 is the largest source of radioactivity in the RCPs, SGs, and reactor coolant piping, and consequently has the most impact on shielding design in the Reactor Building. The determination of the nitrogen-16 concentration is described in Section 11.1.2.3. Because of the short half-life of nitrogen-16 (7.11 s) and reactor coolant transport times, nitrogen-16 activity in the RCS varies considerably by location. Table 12.2-4—Nitrogen-16 Concentration Along Reactor Coolant Loop and Figure 12.2-1—Nitrogen-16 Concentration Along Reactor Coolant Loop present bounding values of nitrogen-16 concentrations as a function of transport time within the RCS.

The radiation sources originating within the pressurizer consist of the reactor coolant source term without the nitrogen-16 contribution. The pressurizer source term spectrum is shown in Table 12.2-5—Photon Spectra for Pressurizer.

During plant operation, radioactive corrosion products deposit on the inner surface of pipes and components and build up a layer of contamination. This build-up of contamination is a continuous process, which is mainly dependent on physical and chemical conditions of the RCS in the different states of the reactor (full power, shutdown, and startup). Bounding values of fixed corrosion products for the U.S. EPR are presented in Table 12.2-6—Corrosion Product Deposits on the Main Coolant Loops for selected radionuclides based upon operating reactor data for plants with low-cobalt alloys. This information is used for shielding requirements during shutdown and inservice inspection.

12.2.1.3 Chemical and Volume Control System

The chemical and volume control system (CVCS) extracts reactor coolant from the RCS for purification, degassing, and treatment. The extracted reactor coolant is then re-injected into the primary coolant system. The CVCS operates continuously when the reactor is operating. The CVCS components are located outside of containment. The volume control tank (VCT), located in the Fuel Building, is the largest radiological source in the CVCS. During normal operation, both purified and unpurified nondegasified reactor coolant flows continuously through the VCT. Within the VCT, reactor water is partly degasified because of the gas phase above the water level. The gas phase of the VCT is connected to the purge gas circuit of the gaseous waste processing system. For surge gas, the degasified noble gas is transferred to the gaseous waste processing system. Figure 12.2-2—Simplified Flow Diagram for Volume Control Tank shows a simplified flow diagram for this process, with flow rates, for the VCT.

The CVCS source term activity is based on the shielding design basis primary source term for the RCS described in Section 11.1. Nitrogen-16 reactor coolant activity is not significant for this system because the half-life of nitrogen-16 is significantly less than the transport time required for CVCS water to exit the reactor containment. The activity inventories for the liquid and gaseous phase of the CVCS VCT are provided in Table 12.2-33—Activity Inventory for Water Phase of Volume Control Tank and Table 12.2-34—Activity Inventory for Gas Phase of Volume Control Tank. The CVCS VCT liquid and gaseous photon spectra are provided in Table 12.2-7—Photon Spectra for Water Phase of Volume Control Tank and Table 12.2-8—Photon Spectra for Gas Phase of Volume Control Tank.

12.2.1.4 Primary Coolant Purification System

The following functions are performed by the primary coolant purification system (CPS):

- Maintain the reactor coolant water quality in accordance with the water specifications.
- Remove suspended and dissolved fission and activation products from the reactor coolant.
- Remove the surplus of lithium-7 which builds up because of the nuclear reaction: $^{10}B(n,\alpha)^{7}Li$.
- Maintain cesium activity at acceptable levels.

The system consists of three parallel coolant filters, followed by two parallel mixed-bed ion exchangers, which are followed by two parallel resin traps. These components are located in the Nuclear Auxiliary Building. The normal flow path is from the CVCS letdown, through the filter and ion exchanger, to the CVCS upstream of the high pressure charging pumps for return to the RCS. The filters and mixed-bed ion exchangers represent the largest radiological source for this system.

Similar to the CVCS, the CPS source term activity is based on the shielding design basis primary source term for the RCS described in Section 11.1. Nitrogen-16 reactor coolant activity is not significant for this system because the half-life of nitrogen-16 is significantly less than the transport time required for CPS water to exit the Reactor Building. Table 12.2-9—CPS Design Input includes the values used to determine the source term for this system.

The components of interest in the primary coolant purification system are the primary coolant filter, demineralizer, and the resin waste tanks in which the coolant purification resins are stored to allow for decay prior to processing within the solid waste system. The activity inventory for the coolant purification system cartridge filters is provided in Table 12.2-11—Activity Inventory for the Coolant Purification System Cartridge Filter, with the photon spectra provided in Table 12.2-36—Photon Spectra for the Coolant Purification System Cartridge Filter. The activity inventory for the mixed bed demineralizer is provided in Table 12.2-35—Activity Inventory for the Coolant Purification System (CPS1) Mixed Bed Demineralizer, with the photon spectra provided in Table 12.2-10—Photon Spectra for the Coolant Purification System (CPS1) Mixed Bed Demineralizer. The activity inventory of the resin waste tank is provided in Table 12.2-37—Activity Inventory for Resin Waste Tank, with the photon spectra provided in Table 12.2-38—Photon Spectra for Resin Waste Tank. Table 12.2-31—Radioactivity Content of Resin Waste Tank provides the total curie content in the resin waste tank that constitutes an input to the solid waste management system.

12.2.1.5 Primary Coolant Degasification System

The primary coolant degasification system (CDS) reduces the noble gas in the primary coolant before shutdown. The degasified noble gas is transferred to the gaseous waste processing system. A simplified flow diagram for the degasifier, with flow rates, is shown in Figure 12.2-2—Simplified Flow Diagram for Volume Control Tank. The degasifier constitutes the largest radiological source for this system.

The degasifier includes both a liquid and a gaseous source. The liquid source consists of reactor coolant that has been purified (filtered and demineralized). The gaseous source consists of noble gas and iodines. The CDS source term activity is based on the shielding design basis primary source term for the RCS described in Section 11.1. Nitrogen-16 reactor coolant activity is not significant for this system because the half-life of nitrogen-16 is significantly less than the transport time required for CDS water to exit the containment. The liquid and gaseous activity inventories for the CDS are provided in Table 12.2-39—Activity Inventory for Water Phase of Degasifier and Table 12.2-40—Activity Inventory for Gas Phase of Degasifier. The CDS photon spectra are provided in Table 12.2-12—Photon Spectra for Water Phase of Degasifier and Table 12.2-13—Photon Spectra for Gas Phase of Degasifier.

12.2.1.6 Secondary Coolant System

Under normal operating conditions, insignificant radioactivity is present within the steam and power conversion system. SG tube defects cause the introduction of reactor coolant into the secondary coolant system. The resulting radionuclide concentrations in the secondary coolant depend upon the primary-to-secondary leak rate, the nuclide decay constant, and the SG blowdown rate. A design basis secondary coolant source resulting from a defined SG tube leak is presented and described in Sections 11.1 and 15.0.3.6. For shielding and dose assessment purposes, the steam and power conversion system is assumed to be nonradioactive.

12.2.1.6.1 Steam Generator Blowdown Demineralizing System (GDA)

The steam generator blowdown demineralizing system (GDA) is downstream of the steam generator blowdown system and purifies the blowdown using mechanical filtration and ion exchange. The system helps to control and maintain the steam generator secondary water quality by removing blowdown impurities. The blowdown process fluid passes through a backwashable cartridge filter, then a cation demineralizer, and finally a mixed bed demineralizer. The activity inventories for the steam generator blowdown system are provided in Table 12.2-41—Activity Inventory for Steam Generator Blowdown Mixed Bed Demineralizer and Table 12.2-43—Activity Inventory for Steam Generator Blowdown Cation Demineralizer. The corresponding photon spectra are provided in Table 12.2-42—Photon Spectra for Steam Generator Blowdown Mixed Bed Demineralizer and Table 12.2-44—Photon Spectra for Steam Generator Blowdown Cation Demineralizer. Table 12.2-32—Radioactivity Content of Steam Generator Blowdown Mixed Bed Demineralizer and Table 12.2-45—Radioactivity Content of Steam Generator Blowdown Cation Demineralizer provides curie contents. The activity for the cartridge filter is bounded by the activity on the cation demineralizer.

12.2.1.7 Component Cooling Water and Essential Service Water Systems

Under normal operating conditions, the component cooling water system and essential service water system work together to transfer heat from safety-related systems and operational cooling loads to the heat sink. Heat transfer between components and systems occurs via heat exchangers. For shielding and dose assessment purposes, the component cooling water and essential service water systems are assumed to be nonradioactive.

12.2.1.8 Fuel Pool Cooling and Purification System

Radioactive impurities in the fuel pool water or in the fuel pool cooling system result from:

- Release of fission products from breaches in fuel rod cladding.

- Release of activated corrosion products located on the surfaces of fuel rods stored in the fuel pool.
- Intermixing of minimal amounts of reactor coolant with fuel pool water via the transfer channel during fuel assembly transfer.

The fuel pool cooling and purification system (FPCPS) uses mechanical filters and mixed-bed demineralizers, which are operated continuously to remove impurities. The mechanical prefilters, upstream of the mixed bed demineralizer, are used to trap undissolved corrosion products, preventing them from entering the mixed bed demineralizer. The activity on the mechanical pre-filter and post-filters is bounded by the activity on the mixed bed demineralizer. The activity inventory for the FPCPS mixed bed demineralizer is given in Table 12.2-46—Activity Inventory for FPCPS Mixed Bed Demineralizer, and the photon spectra is given in Table 12.2-14—Photon Spectra for FPCPS Mixed Bed Demineralizer. The activity inventory for the spent fuel pool (SFP) water and fuel building air is given in Table 12.2-47—SFP Water and Fuel Building Airborne Activity Inventory. The photon spectra for the SFP water and fuel building air are given in Table 12.2-48—Photon Spectra for SFP Water and Fuel Building Air. A one-year operation period was selected for determining shielding adequacy.

12.2.1.9 Liquid Waste Management System

The radiation sources in the liquid waste storage system (LWSS) and in the liquid waste processing system (LWPS) include fission and activation products present in the reactor coolant. The activity inventories for the liquid waste management system (LWMS) components are given in Table 12.2-49—Activity Inventory for Group I Liquid Waste Storage Tanks and Sludge Tank, Table 12.2-50—Activity Inventory for Liquid Waste Processing System Evaporator and Evaporator Column – Liquid Phase, Table 12.2-51—Activity Inventory for Liquid Waste Concentrate Tank, and Table 12.2-53—Activity Inventory for Liquid Waste Monitoring Tanks and Distillate Tank. The photon spectra for the liquid waste systems are given in Table 12.2-15—Photon Spectra for Group I Liquid Waste Storage Tanks and Sludge Tank, Table 12.2-16—Photon Spectra for Liquid Waste Processing System Evaporator and Evaporator Column – Liquid Phase, Table 12.2-52—Photon Spectra for Liquid Waste Concentrate Tank, and Table 12.2-54—Photon Spectra for Liquid Waste Monitoring Tanks and Distillate Tank. The total activity content for the components are given in Table 12.2-24—Radioactivity Content of Group I Liquid Waste Storage Tanks, Table 12.2-25—Radioactivity Content of Liquid Waste Processing System Evaporator, Table 12.2-26—Radioactivity Content of Liquid Waste Concentrate Tank, and Table 12.2-27—Radioactivity Content of Liquid Waste Monitoring Tanks.

12.2.1.10 Gaseous Waste Processing System

Radioactive fission product gases that are generated in the reactor core are released into the reactor coolant through the fuel rod cladding and are transported to auxiliary systems within the plant. These gases are collected and processed by the gaseous waste processing system (GWPS). The activity inventories for the components of the gaseous waste processing system (GWPS) are given in Table 12.2-55—Activity Inventory for Charcoal Holdup System, and Table 12.2-56—Activity Inventory for Purge Gas Circuit. The photon spectra for the components of the GWPS are given in Table 12.2-17—Photon Spectra for Purge Gas Circuit and Charcoal Holdup System. Table 12.2-28—Radioactivity Content of Purge Gas Circuit, and Table 12.2-29—Radioactivity Content of Charcoal Holdup Beds provide total curie contents for these components of the GWPS.

12.2.1.11 Solid Waste Management System

During operation, solid radioactive waste is generated from processes such as maintenance, repair, exchange of components, decontamination, and cleaning. The U.S. EPR layout physically separates radioactive waste collection, processing, handling, and storage. This arrangement minimizes the dose contribution from activities in which the operator is not immediately involved. To further minimize exposure, operators use remote control equipment to move solid radioactive wastes into and out of storage.

The wastes associated with this system range in activity from relatively low activity materials to high activity spent resins and filter cartridges. The activity inventories for the components of the solid waste management system are given in Table 12.2-57—Activity Inventory for Concentrate Buffer Tank and Waste Drum. The photon spectra for the components of the solid waste management system are given in Table 12.2-58—Photon Spectra for Concentrate Buffer Tank and Waste Drum. The resin proportioning tank uses the same activity concentration as the resin waste tank as provided in Tables 12.2-37 and 12.2-38. The condensate collection tank uses the same activity concentration as the concentrate tank as provided in Tables 12.2-51 and 12.2-52. Table 12.2-30—Radioactivity Content of Concentrate Buffer Tank provides the total curie content for the concentrate buffer tank.

12.2.1.12 Post-LOCA ESF Filters

The radiation shielding source terms for the ESF filters post-LOCA are listed in Table 12.2-18—Photon Spectra for ESF Filters Post-LOCA.

12.2.1.13 Miscellaneous Sources

A combined license (COL) applicant that references the U.S. EPR design certification will provide site-specific information for required radiation sources containing byproduct, source, and special nuclear material that may warrant shielding design considerations. This site-specific information will include a listing of isotope, quantity, form, and use of all sources in this latter category that exceed 100 millicuries.

12.2.1.14 Safety Injection System

The U.S. EPR safety injection system (SIS) source strengths at various times following a loss of coolant accident (LOCA) are presented in Table 12.2-21. The tabulated spectra are based on the following:

1. A radionuclide mix at the time of the postulated LOCA containing the bounding core inventory for each individual radionuclide of importance for the following core parameters:

Power level:	4612 MW_t
U-235 fuel enrichment:	2 to $5^w/_o$
Fuel burn-up:	5 to 62 GWD/MTU
Core loading:	129 MTU (metric tons of uranium)

2. Core release fractions as defined in RG 1.183 for the alternative source term methodology.
3. Instantaneous transfer from the core of all released halogens and other particulates directly into the post-LOCA liquids in the in-containment refueling water storage tank (IRWST), which is the supply source for the SIS (i.e., combined gap and early in-vessel releases to the IRWST at t=0 hr, a conservative assumption).
4. Instantaneous evolution of all noble gases generated within the IRWST from halogen decay directly to the containment atmosphere.
5. 17 decay times spanning the range from 0 hours to 1 year.

12.2.1.15 Normal Residual Heat Removal System

The normal residual heat removal (RHR) system source strength is presented in Table 12.2-22 for a series of decay times after shutdown. The tabulated spectra are based on the following:

1. The initial (un-decayed) RCS coolant inventory is assumed to correspond to the design-basis source term listed in Table 11.1-2.
2. No dilution credit is considered for the extra coolant injected into the RCS to compensate for the coolant volume reduction induced by the cool-down.
3. The RCS coolant is assumed to be degasified prior to shutdown. Specifically, the noble gas concentrations in the RHR piping are assumed to correspond to 1 percent of those during operation.

4. The coolant density is assumed to be 1 g/cc during the entire cool-down process by the RHR.

5. The time array for the post-shutdown decay is assumed to include the following time steps: 3, 6, 9, 12, 15 and 18 hours. The typical time for RHR cool-down startup (based on a cool-down rate of 90°F per hour and coolant temperature reduction from 594°F at full power to 250°F) is about 4 hours.

12.2.1.16 Aeroball Measurement System

Each Aeroball is 1.7 mm in diameter and the typical composition of each Aeroball is:

weight % Cr-50 in Aeroball: 14.5

weight % Fe-56 in Aeroball: 83.36

weight % V-51 in Aeroball: 1.54

weight % C-12 in Aeroball: 0.6

The neutron capture reactions include:

$$ {}^{51}_{23}V \xrightarrow{(n,\gamma)} {}^{52}_{23}V \xrightarrow[3.76\,\text{min}]{\beta,\gamma} {}^{52}_{24}Cr \qquad (\gamma = 1434.1\,keV) $$

$$ {}^{50}_{24}Cr \xrightarrow{(n,\gamma)} {}^{51}_{24}Cr \xrightarrow[27.7\,day]{\varepsilon,\gamma} {}^{51}_{23}V \quad (\gamma = 320.1\,keV) $$

$$ {}^{56}_{26}Fe \xrightarrow{n} {}^{57}_{26}Fe $$

$$ {}^{12}_{6}C \xrightarrow{n} {}^{13}_{6}C $$

$$ {}^{55}_{25}Mn \xrightarrow{(n.\gamma)} {}^{56}_{25}Mn \xrightarrow[2.578\,hr]{\beta,\gamma} {}^{56}_{26}Fe \quad (\gamma = 846.8,\ 1810.8,\ 2113.1\,keV) $$

The V-52 activity decays away after 45 minutes. The Mn-56 activity decays away after 24 hours.

The content of the alloy elements with their tolerances are specified in detail and verified after fabrication by chemical analysis. During commissioning, two ball stacks will be activated so that they reach saturation. Their activity will then be measured to establish time dependence and decay constants of the material components.

The bounding total activity for the Aeroballs was established by considering 34 consecutive irradiation cycles with each cycle consisting of a 4 minute irradiation followed by a 10 minute decay period after the irradiation. The conservative action of applying this minimal 10 minute decay time between irradiations 34 consecutive times will bound all conceivable future use of this system. Note that the typical decay period between irradiations is expected to be 14 days. Table 12.2-23 presents the total activity of the Aeroballs as a function of decay time after the application of these 34 irradiation cycles.

12.2.1.17 Coolant Supply and Storage

The coolant supply and storage system provides fluid supply and storage support functions for the reactor coolant system. It acts through integration with the chemical and volume control system (CVCS) and the reactor boron and water makeup system (RBWMS) to adjust RCS boron concentrations as required for power variation control, plant startup or shutdown, and to compensate for fuel burn-up through the addition of demineralized water. The components that are of radiological interest in the coolant supply and storage system are the coolant storage tanks (CST), which are located in the nuclear auxiliary building (UKA). The activity inventories for the water and gas phase of the coolant storage tank are provided in Table 12.2-59—Activity Inventory for Water Phase of Coolant Storage Tank, and Table 12.2-61—Activity Inventory for Gas Phase of Coolant Storage Tank. The associated photon spectra for the water and gas phase of the coolant storage tank are provided in Table 12.2-60—Photon Spectra for Water Phase of Coolant Storage Tank, and Table 12.2-62—Photon Spectra for Gas Phase of Coolant Storage Tank.

12.2.1.18 Coolant Treatment System

The coolant treatment system processes reactor coolant that has been discharged to the coolant supply and storage system during plant operations. Borated water (reactor coolant) is supplied from the coolant supply and storage system to the boric acid column by means of evaporator feed pumps. Prior to entering the boric acid column, the borated water is purified by the coolant purification system (CPS). The components that are of radiological interest in the coolant treatment system are the mixed-bed demineralizer for the CPS, the recuperative boric acid cooler, the electrical pre-heater, and the vapor compressor. The activity inventory and the photon spectra for the mixed bed demineralizer are provided in Table 12.2-63—Activity Inventory for Coolant Purification System (CPS2) Mixed Bed Demineralizer, and Table 12.2-64—Photon Spectra for Coolant Purification System (CPS2) Mixed Bed Demineralizer. The activity inventory and the photon spectra for the vapor compressor are provided in Table 12.2-65—Activity Inventory for Coolant Treatment System Vapor Compressor, and Table 12.2-66—Photon Spectra for Coolant Treatment System Vapor Compressor. The activity inventory and the photon spectra for the recuperative boric acid cooler and the electrical pre-heater are provided in Table 12.2-67—Activity Inventory for Coolant Treatment System Recuperative Boric Acid Cooler and Electrical Pre-Heater, and Table 12.2-68—Photon Spectra for Coolant Treatment System Recuperative Boric Acid Cooler and Electrical Pre-Heater.

12.2.1.19 Reactor Boron and Makeup Water System

The reactor boron and water makeup system (RBWMS) provides the boric acid for the initial filling and makeup of the reactor coolant system (RCS), extra borating system (EBS), fuel building pools, and other systems and components containing borated water. The components that are of radiological interest in the reactor boron and makeup water system are the boric acid storage tanks. The activity inventory and the photon spectra for the boric acid storage tanks are provided in Table 12.2-69—Activity Inventory for the Boric Acid Storage Tanks, and Table 12.2-70—Photon Spectra for the Boric Acid Storage Tanks.

12.2.2 Airborne Radioactive Material Sources

Airborne radioactive material sources in the plant are considered in the design of the ventilation systems. Airborne radioactivity is monitored inside the plant, as described in Section 12.3.4, and in process equipment and effluents, as described in Section 11.5.

12.2.2.1 Normal Operations

Airborne radioactivity concentrations can occur in the Reactor Building, both during power operation (coolant leakage) and refueling (evaporation of the refueling pool). The normal airborne radioactivity concentrations within the Containment Building are based on continuous RCS leakage into the equipment area of the Reactor Building and activation of naturally-occurring argon in the Reactor Building air that is exposed to high neutron flux level, with subsequent leakage to the service area. The assumptions and parameters listed in Table 12.2-19—Parameters and Assumptions for Calculating Airborne Radioactive Concentrations were used to evaluate the airborne radionuclide concentrations in the Reactor Building.

The spent fuel pool water contains radionuclides from defects in spent fuel and corrosion products released from fuel assemblies. The evaporation of the spent fuel pool water then leads to airborne radioactivity concentrations in the Fuel Building, both during power operation and refueling. The airborne radioactivity in the Fuel Building is primarily because of tritium, since the continuous operation of the FPCPS effectively removes other isotopes from the pool. The assumptions and parameters listed in Table 12.2-19 were used to evaluate the airborne radionuclide concentrations in the Fuel Building. The concentrations in the Reactor and Fuel Buildings are listed in Table 12.2-20—Airborne Radioactivity Concentrations.

Equipment leakage is the primary source of airborne radioactivity concentrations within the Safeguard Building, Nuclear Auxiliary Building and Radioactive Waste Processing Building. This equipment is located in normally unoccupied areas. The ventilation systems in the Safeguard Building, Nuclear Auxiliary Building and Radioactive Waste Processing Building are designed so that the airflow is from regions of lower potential for contamination to those with higher potential for contamination, and then exhausted from the building. As a result, negligible airborne radioactivity concentrations are expected in those areas of the Safeguard Building, Nuclear Auxiliary Building and Radioactive Waste Processing Building which are normally occupied.

As discussed in Section 12.2.1.6, components within the Turbine Building are considered to be nonradioactive under normal operating conditions (no primary-to-secondary leaks). Thus, airborne radioactivity concentrations in the Turbine Building are also expected to be negligible.

12.2.3 References

1. NUREG-0800, "U.S. NRC Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, March 2007.

2. NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors PWR-GALE Code," Revision 1, U.S. Nuclear Regulatory Commission, April 1985.

Table 12.2-1—Reactor Vessel Model Dimensions (cm)

Zone	R min	R max	Z min	Z max
Lower Plenum	118.338	243.5	0	30
Lower Support Plate	118.338	188.34	30	71.5
Lower End Fitting	118.338	188.34	71.5	79.5
Lower Gas Plenum	118.338	188.34	79.5	93.2
Core	118.338	188.34	93.2	513
Upper Gas Plenum	118.338	188.34	513	534.5
Upper End Fitting	118.338	188.34	534.5	554
Upper Internals	118.338	188.34	554	560
Upper Plenum	118.338	208	560	601.5
HR Support Plate	118.338	216.25	30	71.5
Heavy Reflector	118.338	208.3	71.5	554
Water	188.34	208.3	554	560
Core Barrel	208	214.5	71.5	601.5
Downcomer	214.5	243.5	30/71.5	601.5
RPV Liner	243.5	244.3	0	601.5
RPV	244.3	269.25	0	601.5
Air	269.25	307.5	0	601.5
Concrete	307.5	337.5	0	601.5

Table 12.2-2—Neutron and Gamma Fluxes at Primary Shield Concrete

Energy	Flux (n/cm^2-s)
≥1 MeV	1.51E+08
≥0.1 MeV	2.08E+09
≤0.414 eV	8.55E+08
Total neutron flux	6.00E+09
Total gamma flux (photon/cm^2-s)	1.96E+09

Table 12.2-3—Full-Core Bounding Photon Spectra at 4612 MW_t
Sheet 1 of 3

Energy (MeV)	Photon Spectra (MeV/sec) as a Function of Shutdown Time (hrs)					
	0.0833 (5 min)	1	2	5	10	20
0.01	1.76E+18	1.44E+18	1.36E+18	1.30E+18	1.22E+18	1.08E+18
0.025	4.15E+17	3.22E+17	2.92E+17	2.59E+17	2.34E+17	2.03E+17
0.0375	1.11E+18	7.58E+17	6.93E+17	6.49E+17	6.15E+17	5.61E+17
0.0575	5.26E+17	4.76E+17	4.71E+17	4.57E+17	4.36E+17	3.98E+17
0.085	7.54E+18	3.65E+18	2.81E+18	2.52E+18	2.36E+18	2.12E+18
0.125	1.16E+19	1.10E+19	1.07E+19	1.03E+19	9.70E+18	8.70E+18
0.225	2.24E+19	1.73E+19	1.62E+19	1.50E+19	1.39E+19	1.19E+19
0.375	2.19E+19	9.79E+18	7.41E+18	6.00E+18	5.36E+18	4.75E+18
0.575	6.41E+19	4.64E+19	4.11E+19	3.49E+19	3.05E+19	2.54E+19
0.85	1.06E+20	6.95E+19	5.66E+19	4.28E+19	3.71E+19	3.24E+19
1.25	8.23E+19	4.35E+19	3.18E+19	2.04E+19	1.39E+19	9.21E+18
1.75	4.5E+19	2.94E+19	2.50E+19	2.01E+19	1.76E+19	1.59E+19
2.25	3.13E+19	1.59E+19	1.06E+19	5.12E+18	2.73E+18	1.90E+18
2.75	1.45E+19	6.98E+18	4.25E+18	1.70E+18	9.75E+17	8.64E+17
3.5	7.09E+18	2.24E+18	1.27E+18	3.27E+17	4.87E+16	1.05E+16
5	2.28E+18	4.07E+16	2.71E+16	1.20E+16	3.52E+15	3.07E+14
7	3.77E+10	3.77E+10	3.77E+10	3.77E+10	3.77E+10	3.77E+10
9.5	5.88E+09	5.88E+09	5.88E+09	5.88E+09	5.88E+09	5.88E+09
Total	4.20E+20	2.59E+20	2.11E+20	1.62E+20	1.37E+20	1.15E+20

Table 12.2-3—Full-Core Bounding Photon Spectra at 4612 MW_t
Sheet 2 of 3

Energy (MeV)	Photon Spectra (MeV/sec) as a Function of Shutdown Time (hrs)					
	50 (2.08 days)	100 (4.17 days)	200 (8.33 days)	500 (20.8 days)	1000 (41.7 days)	2000 (83.3 days)
0.01	7.64E+17	4.34E+17	1.52E+17	1.89E+16	5.35E+15	2.53E+15
0.025	1.55E+17	1.14E+17	7.08E+16	3.10E+16	1.54E+16	6.90E+15
0.0375	4.41E+17	3.23E+17	2.11E+17	1.05E+17	5.99E+16	3.62E+16
0.0575	3.09E+17	2.14E+17	1.17E+17	3.11E+16	6.45E+15	1.98E+15
0.085	1.58E+18	1.00E+18	4.51E+17	9.84E+16	2.91E+16	1.42E+16
0.125	6.31E+18	3.81E+18	1.63E+18	5.40E+17	3.36E+17	1.81E+17
0.225	7.94E+18	4.45E+18	1.59E+18	1.91E+17	4.37E+16	1.27E+16
0.375	3.77E+18	2.80E+18	1.80E+18	7.12E+17	2.11E+17	4.61E+16
0.575	1.85E+19	1.44E+19	1.12E+19	7.83E+18	5.81E+18	4.16E+18
0.85	2.66E+19	2.26E+19	1.90E+19	1.50E+19	1.22E+19	8.77E+18
1.25	5.77E+18	4.19E+18	2.81E+18	1.47E+18	8.13E+17	4.76E+17
1.75	1.46E+19	1.34E+19	1.09E+19	5.58E+18	1.85E+18	2.38E+17
2.25	1.62E+18	1.42E+18	1.14E+18	6.60E+17	3.14E+17	1.29E+17
2.75	8.32E+17	7.66E+17	6.23E+17	3.19E+17	1.04E+17	1.25E+16
3.5	9.02E+15	8.35E+15	6.88E+15	3.69E+15	1.44E+15	4.50E+14
5	4.35E+11	2.33E+11	2.33E+11	2.32E+11	2.30E+11	2.26E+11
7	3.77E+10	3.76E+10	3.76E+10	3.74E+10	3.70E+10	3.65E+10
9.5	5.88E+09	5.87E+09	5.86E+09	5.83E+09	5.78E+09	5.69E+09
Total	8.92E+19	6.99E+19	5.16E+19	3.26E+19	2.18E+19	1.41E+19

Table 12.2-3—Full-Core Bounding Photon Spectra at 4612 MW_t
Sheet 3 of 3

Energy (MeV)	Photon Spectra (MeV/sec) as a Function of Shutdown Time (hrs)					
	5.0E+03 (0.57 yrs)	1.0E+04 (1.14 yrs)	2.0E+04 (2.28 yrs)	5.0E+04 (5.7 yrs)	1.0E+05 (11.4 yrs)	2.0E+05 (22.8 yrs)
0.01	1.49E+15	1.04E+15	7.36E+14	5.50E+14	4.53E+14	3.40E+14
0.025	2.68E+15	1.87E+15	1.36E+15	5.78E+14	1.47E+14	2.18E+13
0.0375	2.12E+16	1.41E+16	7.67E+15	3.41E+15	2.32E+15	1.48E+15
0.0575	1.15E+15	9.02E+14	7.14E+14	5.61E+14	5.11E+14	5.28E+14
0.085	9.96E+15	6.74E+15	3.55E+15	1.28E+15	5.69E+14	1.50E+14
0.125	6.99E+16	4.10E+16	1.92E+16	5.93E+15	3.24E+15	1.23E+15
0.225	5.31E+15	3.89E+15	3.19E+15	2.04E+15	1.12E+15	4.46E+14
0.375	2.21E+16	1.75E+16	1.25E+16	5.09E+15	1.35E+15	1.64E+14
0.575	2.80E+18	2.19E+18	1.53E+18	7.39E+17	4.37E+17	3.04E+17
0.85	3.66E+18	1.55E+18	9.00E+17	3.00E+17	6.11E+16	9.72E+15
1.25	3.52E+17	2.77E+17	1.88E+17	8.57E+16	4.01E+16	1.46E+16
1.75	3.21E+16	2.02E+16	9.85E+15	2.92E+15	1.53E+15	6.07E+14
2.25	7.32E+16	4.45E+16	1.67E+16	9.19E+14	9.48E+12	1.87E+11
2.75	1.42E+15	9.49E+14	4.32E+14	4.11E+13	1.00E+12	1.31E+11
3.5	2.67E+14	1.80E+14	8.25E+13	8.09E+12	3.83E+11	1.50E+11
5	2.17E+11	2.08E+11	1.97E+11	1.72E+11	1.39E+11	9.16E+10
7	3.51E+10	3.36E+10	3.17E+10	2.78E+10	2.25E+10	1.48E+10
9.5	5.47E+09	5.24E+09	4.95E+09	4.34E+09	3.51E+09	2.31E+09
Total	7.05E+18	4.17E+18	2.70E+18	1.15E+18	5.49E+17	3.34E+17

Table 12.2-4—Nitrogen-16 Concentration Along Reactor Coolant Loop

Time (s)	Location	N-16 Concentration (Ci/g)
0	---	1.80E-04
1.3585	Active Fuel Region Inlet	1.58E-04
2.373	Active Fuel Region Outlet	3.98E-04
4	SG Inlet Nozzle Diffuser	3.40E-04
6	---	2.80E-04
8	---	2.30E-04
9.92	RCP Outlet	1.80E-04

Table 12.2-5—Photon Spectra for Pressurizer

Energy (MeV)	Photon Spectra (MeV/s-m^3)
0.01	7.18E+08
0.025	9.21E+08
0.0375	3.67E+10
0.0575	2.00E+07
0.085	7.42E+10
0.125	2.58E+08
0.225	2.59E+10
0.375	1.08E+10
0.575	4.08E+10
0.85	3.79E+10
1.25	4.30E+10
1.75	2.97E+10
2.25	4.41E+10
2.75	9.52E+09
3.5	1.43E+09
5	4.50E+08
7	6.77E-04
9.5	1.06E-04
Total	3.56E+11

Note:

1. The above photon spectrum is associated with a reactor coolant density of 0.699 g/cm^3.

Table 12.2-6—Corrosion Product Deposits on the Main Coolant Loops

Nuclide	Hot Leg/Cold Leg (μCi/cm^2)	SGs (μCi/cm^2)
Mn-54	1.1E+00	3.5E-01
Co-58	1.4E+01	7.0E+00
Co-60	2.6E+00	1.4E+00
Fe-59	5.4E-01	3.2E-01

Table 12.2-7—Photon Spectra for Water Phase of Volume Control Tank

Photon Energy (MeV)	Photon Spectra ($MeV/s\text{-}m^3$)
0.01	3.64E+06
0.025	2.84E+07
0.0375	2.57E+07
0.0575	1.69E+07
0.085	3.49E+07
0.125	1.53E+08
0.225	7.66E+08
0.375	4.52E+09
0.575	2.18E+10
0.85	1.88E+10
1.25	2.14E+10
1.75	1.67E+10
2.25	2.16E+09
2.75	3.97E+09
3.5	6.62E+08
5	2.26E+08
7	4.37E-04
9.5	6.83E-05
Total	9.12E+10

Note:

1. VCT contains both purified and unpurified reactor coolant and is based on a 13 gpm flow rate of unpurified reactor coolant and a 16 gpm flow rate of purified reactor coolant with an accumulation period of 1 year and no post-accumulation radioactive decay.

Table 12.2-8—Photon Spectra for Gas Phase of Volume Control Tank

Photon Energy (MeV)	Photon Spectra (MeV/s-m^3)
0.01	2.56E+09
0.025	3.14E+09
0.0375	1.36E+11
0.0575	5.43E+04
0.085	2.75E+11
0.125	3.30E+07
0.225	7.35E+10
0.375	5.95E+09
0.575	7.90E+09
0.85	1.62E+10
1.25	8.77E+09
1.75	3.51E+10
2.25	8.41E+10
2.75	8.94E+09
3.5	1.25E+09
5	3.96E+08
7	0.00E+00
9.5	0.00E+00
Total	6.59E+11

Note:

1. Activity concentration in VCT is the same as that contained in the purge gas circuit, accounting for pressure differential.

Table 12.2-9—CPS Design Input

Parameter	Value
RCS letdown flow rate for purification	79,366 lb/hr (10 kg/s)
Coolant filter decontamination factor for corrosion products	1.1
Coolant filter efficiency for corrosion products	0.091
Mixed-bed filter decontamination factors, based on NUREG-0017 (Reference 2)	Iodine, Bromine: 100 Cesium, Rubidium: 2 Tritium, Noble Gases: 1 Others: 50
Mixed bed filter efficiencies, based on NUREG-0017 (Reference 2)	Iodine, Bromine: 0.99 Cesium, Rubidium: 0.50 Tritium, Noble Gases: 0 Others: 0.98

Table 12.2-10—Photon Spectra for the Coolant Purification System (CPS1) Mixed Bed Demineralizer

Energy (MeV)	Photon Spectra at End of One Year Operation (MeV/sec-m^3)
0.01	5.10E+10
0.025	2.31E+11
0.038	9.30E+11
0.058	8.90E+10
0.085	3.33E+11
0.125	8.45E+11
0.225	3.93E+12
0.375	4.24E+13
0.575	5.10E+14
0.85	3.41E+14
1.25	5.30E+13
1.75	2.70E+12
2.25	4.85E+11
2.75	1.49E+12
3.5	9.90E+09
5	1.29E+09
7	1.13E+02
9.5	1.76E+01
Total	9.55E+14

Note:

1. Activity based on a purification flow rate of 79,366 lb/hr and an accumulation period of 1 year with no post-accumulation radioactive decay.

Table 12.2-11—Activity Inventory for the Coolant Purification System Cartridge Filter

Nuclide	Activity (Ci/m^3)
Na-24	3.89E+01
Cr-51	9.34E+01
Mn-54	2.93E+02
Fe-55	2.85E+02
Fe-59	1.43E+01
Co-58	3.36E+02
Co-60	1.36E+02
Zn-65	8.49E+01
W-187	3.01E+00

Note:

1. Activity based on a purification flow rate of 79,366 lb/hr and an accumulation period of 1 year with no post-accumulation radioactive decay.

Table 12.2-12—Photon Spectra for Water Phase of Degasifier

Photon Energy (MeV)	Photon Spectra (MeV/s-m^3)
0.01	4.77E+05
0.025	1.02E+06
0.0375	1.02E+07
0.0575	8.31E+06
0.085	5.99E+06
0.125	1.75E+07
0.225	1.23E+08
0.375	3.52E+08
0.575	4.02E+09
0.85	6.02E+09
1.25	8.44E+09
1.75	7.09E+09
2.25	1.75E+09
2.75	2.19E+09
3.5	5.18E+08
5	2.27E+08
7	1.91E-05
9.5	2.99E-06
Total	3.08E+10

Note:

1. Activity based on a degasification flow rate of 158,730 lb/hr (20 kg/sec).

Table 12.2-13—Photon Spectra for Gas Phase of Degasifier

Photon Energy (MeV)	Photon Spectra ($MeV/s\text{-}m^3$)
0.01	7.24E+08
0.025	8.87E+08
0.0375	3.73E+10
0.0575	1.19E+05
0.085	7.55E+10
0.125	1.31E+07
0.225	2.49E+10
0.375	3.37E+09
0.575	4.33E+09
0.85	4.70E+09
1.25	3.09E+09
1.75	7.91E+09
2.25	3.95E+10
2.75	3.53E+09
3.5	2.66E+08
5	1.27E+07
7	0.00E+00
9.5	0.00E+00
Total	2.06E+11

Note:

1. Activity based on equilibrium conditions for a degasification flow rate into the purge gas circuit of 158,730 lb/hr (20 kg/sec) and a removal rate equal to the surge gas flow rate to the delay beds of 0.0765 lb/sec, accounting for pressure and temperature differential.

Table 12.2-14—Photon Spectra for FPCPS Mixed Bed Demineralizer

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	1.24E+08
0.025	8.33E+07
0.0375	9.43E+08
0.0575	8.17E+07
0.085	1.28E+08
0.125	2.42E+08
0.225	1.62E+09
0.375	1.33E+10
0.575	6.80E+11
0.85	5.63E+11
1.25	8.87E+10
1.75	4.30E+08
2.25	5.13E+07
2.75	8.50E+07
3.5	1.74E+05
5	9.70E+02
7	1.48E+00
9.5	2.31E-01
Total	1.35E+12

Note:

1. Activity based on a 1 year accumulation period and no post-accumulation radioactive decay.

Table 12.2-15—Photon Spectra for Group I Liquid Waste Storage Tanks and Sludge Tank

Photon Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	5.47E+06
0.025	4.30E+07
0.0375	3.25E+07
0.0575	2.12E+07
0.085	5.65E+07
0.125	2.76E+08
0.225	8.08E+08
0.375	7.02E+09
0.575	1.50E+10
0.85	9.32E+09
1.25	6.05E+09
1.75	1.14E+09
2.25	2.14E+08
2.75	7.01E+08
3.5	6.63E+06
5	1.30E+06
7	9.53E-04
9.5	1.49E-04
Total	4.07E+10

Note:

1. Activity based on a continuous flow of undecayed RCS coolant at a flow rate of 2.6 gpm and a total tank volume of 18,500 gallons with decay during processing and no decay thereafter. Noble gases not used in the shielding analyses as they are processed through gaseous waste processing system.

Table 12.2-16—Photon Spectra for Liquid Waste Processing System Evaporator and Evaporator Column – Liquid Phase

Energy (MeV)	Photon Spectra (MeV/sec-m^3)(1)(2)(3)
0.01	1.09E+08
0.025	6.53E+08
0.0375	1.88E+09
0.0575	4.11E+08
0.085	1.04E+09
0.125	2.62E+09
0.225	1.26E+10
0.375	1.22E+11
0.575	9.59E+11
0.85	6.76E+11
1.25	1.19E+11
1.75	2.64E+09
2.25	5.93E+08
2.75	2.46E+09
3.5	2.57E+06
5	3.11E+04
7	1.17E-01
9.5	1.82E-02
Total	1.90E+12

Notes:

1. Liquid waste processing system activity based on 18 batches of Group I liquid waste being processed within 160 days. Combined liquid volume for the evaporator (3.94 m^3) and the evaporator column (4.92 m^3) is approximately 9 m^3.

2. Credit is taken for buildup and decay during the fill time of the liquid waste tanks of approximately 237 hrs at 1.3 gpm (16 batches) and approximately 119 hrs at 2.6 gpm (2 batches) and the process time of approximately 18 hours per batch during the entire 160-day processing period and no decay thereafter.

3. Steam spectra is 1/10,000 of liquid distributed over 18 m^3 combined gaseous volume for evaporator (7.87 m^3) and the evaporator column (9.84 m^3).

Table 12.2-17—Photon Spectra for Purge Gas Circuit and Charcoal Holdup System

Photon Energy (MeV)	Photon Spectra (MeV/s-m^3)	
	Purge Gas Circuit[1]	Charcoal Holdup System[2]
0.01	6.92E+08	2.27E+10
0.03	8.49E+08	2.84E+10
0.04	3.68E+10	1.22E+12
0.06	1.47E+04	3.21E+05
0.09	7.44E+10	2.46E+12
0.13	8.92E+06	2.73E+08
0.23	1.98E+10	5.79E+11
0.38	1.61E+09	4.16E+10
0.58	2.13E+09	9.73E+10
0.85	4.36E+09	1.23E+11
1.25	2.37E+09	9.16E+10
1.75	9.48E+09	2.76E+11
2.25	2.27E+10	5.82E+11
2.75	2.41E+09	6.95E+10
3.50	3.36E+08	1.06E+10
5.00	1.07E+08	3.47E+09
7.00	0.00E+00	0.00E+00
9.50	0.00E+00	0.00E+00
Total	1.78E+11	5.61E+12

Note:

1. Activity based on equilibrium conditions for a degasification flow rate into the purge gas circuit of 158,730 lb/hr (20 kg/sec) and a removal rate equal to the surge gas flow rate to the delay beds of 0.0765 lb/sec.

2. Activity based on a degasification flow rate of 158,730 lb/hr (20 kg/sec) to the purge gas circuit and instant transfer of the noble gases to the charcoal holdup beds with a holdup (decay) period of 40 hours for kryptons and 27.7 days for xenons.

Table 12.2-18—Photon Spectra for ESF Filters Post-LOCA
Sheet 1 of 2

Photon Energy (MeV)	Photon Spectra (MeV/s) at Various Times (hr) Post-LOCA						
	1	2	8	24	96	720	8766
Annulus Ventilation							
0.01	1.21E+10	9.43E+10	5.17E+11	7.37E+11	4.57E+11	6.44E+10	1.68E+10
0.025	1.54E+11	9.90E+11	4.96E+12	7.33E+12	5.20E+12	5.75E+11	9.72E+10
0.0375	7.90E+10	4.45E+11	2.26E+12	3.51E+12	3.02E+12	1.22E+12	8.10E+11
0.0575	5.83E+10	3.82E+11	2.12E+12	3.21E+12	2.36E+12	3.24E+11	1.71E+08
0.085	1.39E+11	7.05E+11	3.29E+12	5.10E+12	4.22E+12	5.72E+11	2.63E+09
0.125	5.19E+11	1.87E+12	5.34E+12	7.34E+12	3.83E+12	2.72E+11	2.17E+10
0.225	4.10E+12	2.11E+13	8.67E+13	1.11E+14	7.48E+13	6.80E+12	1.03E+11
0.375	1.80E+13	8.41E+13	3.80E+14	5.62E+14	4.81E+14	6.20E+13	7.96E+11
0.575	1.22E+14	5.25E+14	1.73E+15	1.91E+15	1.06E+15	7.17E+14	5.43E+14
0.85	1.44E+14	5.01E+14	9.68E+14	1.10E+15	8.92E+14	5.90E+14	3.96E+14
1.25	1.73E+14	5.59E+14	1.23E+15	6.82E+14	2.69E+14	9.38E+13	3.87E+13
1.75	5.94E+13	2.22E+14	4.42E+14	2.19E+14	2.07E+14	6.58E+13	2.93E+10
2.25	2.46E+13	5.49E+13	6.81E+13	2.98E+13	9.26E+12	9.94E+11	3.89E+10
2.75	1.41E+13	2.41E+13	3.75E+12	5.41E+12	1.22E+13	3.94E+12	2.64E+09
3.5	3.24E+12	5.72E+12	6.97E+11	6.80E+10	1.26E+11	4.21E+10	5.07E+08
5	4.09E+11	1.05E+12	2.67E+11	5.52E+09	4.57E+04	4.63E+04	4.22E+04
7	7.45E+01	6.43E+02	3.89E+03	6.56E+03	7.37E+03	7.48E+03	6.80E+03
9.5	1.16E+01	1.00E+02	6.07E+02	1.02E+03	1.15E+03	1.17E+03	1.06E+03
Safeguard Building (Controlled Area)							
0.01	9.78E+06	1.31E+08	1.10E+10	7.77E+10	2.74E+11	1.45E+11	2.36E+08
0.025	4.91E+08	6.57E+09	5.60E+11	3.94E+12	1.38E+13	5.95E+12	6.42E+09
0.0375	1.26E+08	1.68E+09	1.45E+11	1.02E+12	3.54E+12	1.43E+12	1.19E+09
0.0575	7.75E+07	1.59E+09	1.63E+11	1.14E+12	3.48E+12	1.03E+11	4.50E-20
0.085	4.05E+08	4.07E+09	2.92E+11	2.18E+12	9.60E+12	7.59E+12	1.67E+05
0.125	1.30E+09	8.17E+09	2.10E+11	1.24E+12	2.87E+12	9.51E+10	1.06E+08
0.225	1.25E+10	1.38E+11	9.46E+12	5.59E+13	1.84E+14	6.78E+13	1.42E+09
0.375	6.46E+10	6.23E+11	4.53E+13	3.16E+14	1.36E+15	1.08E+15	8.57E+07
0.575	3.90E+11	3.43E+12	1.67E+14	7.46E+14	9.77E+14	2.01E+14	3.31E+10
0.85	4.80E+11	3.21E+12	7.17E+13	2.78E+14	5.74E+14	6.21E+13	5.57E+09
1.25	3.80E+11	3.28E+12	1.35E+14	2.78E+14	1.85E+14	5.22E+12	3.59E+09

Table 12.2-18—Photon Spectra for ESF Filters Post-LOCA
Sheet 2 of 2

Photon Energy (MeV)	Photon Spectra (MeV/s) at Various Times (hr) Post-LOCA						
	1	2	8	24	96	720	8766
1.75	1.63E+11	1.34E+12	5.11E+13	8.01E+13	2.00E+13	5.65E+11	2.47E-19
2.25	2.86E+10	2.31E+11	8.53E+12	1.73E+13	2.03E+13	5.79E+11	2.53E-19
2.75	1.75E+09	8.06E+09	4.96E+10	1.91E+11	5.81E+11	1.72E+10	7.51E-21
3.5	5.50E+09	1.58E+10	5.37E+08	3.49E+00	2.58E-40	0.00E+00	0.00E+00
5	1.23E+08	3.52E+08	1.20E+07	7.78E-02	5.75E-42	0.00E+00	0.00E+00
7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Main Control Room (Intake and Recirculation Filters)							
0.01	1.22E+05	8.76E+05	4.79E+06	5.19E+06	3.25E+06	6.19E+05	1.10E+05
0.025	1.93E+06	9.57E+06	4.74E+07	5.58E+07	4.88E+07	1.40E+07	6.14E+05
0.0375	1.28E+06	4.65E+06	2.17E+07	2.61E+07	2.39E+07	1.07E+07	5.33E+06
0.0575	8.56E+05	3.84E+06	1.98E+07	2.25E+07	1.55E+07	2.13E+06	1.08E+03
0.085	2.21E+06	7.48E+06	3.37E+07	4.50E+07	5.52E+07	2.24E+07	1.66E+04
0.125	8.52E+06	2.10E+07	4.92E+07	5.06E+07	2.46E+07	1.72E+06	1.37E+05
0.225	6.57E+07	2.23E+08	8.53E+08	8.68E+08	7.24E+08	2.03E+08	6.60E+05
0.375	3.38E+08	9.62E+08	4.03E+09	5.28E+09	7.06E+09	3.04E+09	5.03E+06
0.575	2.31E+09	6.02E+09	1.78E+10	1.61E+10	8.47E+09	5.16E+09	3.59E+09
0.85	2.83E+09	8.76E+09	1.63E+10	8.45E+09	6.25E+09	4.01E+09	2.62E+09
1.25	3.56E+09	8.08E+09	1.35E+10	5.81E+09	1.90E+09	6.19E+08	2.55E+08
1.75	1.69E+09	1.26E+10	2.55E+10	2.03E+09	1.33E+09	4.15E+08	1.84E+05
2.25	5.49E+08	1.10E+09	9.38E+08	2.58E+08	6.14E+07	6.28E+06	2.46E+05
2.75	4.01E+08	2.03E+09	3.17E+09	6.59E+07	7.81E+07	2.48E+07	1.67E+04
3.5	9.27E+07	5.70E+08	1.01E+09	9.59E+06	8.10E+05	2.65E+05	3.20E+03
5	1.90E+07	2.07E+08	4.03E+08	3.68E+06	3.25E-01	2.92E-01	2.66E-01
7	6.16E-04	5.83E-03	3.57E-02	4.52E-02	4.72E-02	4.72E-02	4.29E-02
9.5	9.61E-05	9.09E-04	5.57E-03	7.04E-03	7.37E-03	7.36E-03	6.69E-03

Table 12.2-19—Parameters and Assumptions for Calculating Airborne Radioactive Concentrations

Parameter/Assumption	Value
Containment Building	
Reactor coolant leakage rate	1 gpm (continuous), in equipment area
Time used to estimate airborne concentration	24 hours
Containment free air volume	5.68E+05 ft^3 Equipment area 2.25E+06 ft^3 Service area 2.82E+06 ft^3 Total
Flashing fraction	43.8%
Fuel defects	0.25%
Reactor coolant tritium concentration	1 μCi/gm
Normal operation purge flow rate	3210 (initiated after equilibrium conditions have been achieved) Service area purged via equipment area
Primary containment configuration	Isolated equipment area, with 1% per day leakage rate to service area
Equipment area filtered recirculation flow and filtration efficiencies (continuous)	4100 cfm 90% for all nuclides except noble gases and N-16
Fuel Building	
Spent fuel pool evaporation rate	1 gpm
Fuel Building air volume	2.11E+05 ft^3
Ventilation flow through area	35,450 cfm
Fuel Building air release rate	241.9 per day

Table 12.2-20—Airborne Radioactivity Concentrations

Nuclide	Reactor Building Concentration – Service Area (µCi/ml)	Fuel Building Concentration (µCi/ml)	10 CFR 20, Appendix B Inhalation DAC (µCi/ml)
H-3	9.26E-07	2.67E-06	2E-05
Ar-41	< 3.0E-06	N/A	3E-06
Br-83	1.27E-14	1.07E-22	3E-05
Kr-83m	7.13E-14	2.13E-21	1E-02
Kr-85m	1.11E-10	5.28E-16	2E-05
Kr-85	5.65E-03	1.96E-08	1E-04
Kr-87	4.37E-16	1.60E-31	5E-06
Kr-88	9.41E-12	2.98E-19	2E-06
Rb-88	1.05E-11	3.06E-19	3E-05
I-129	4.37E-14	4.87E-17	4E-09
I-130	4.33E-11	2.74E-13	3E-07
I-131	4.04E-08	5.72E-10	2E-08
I-132	1.08E-13	1.27E-10	3E-06
I-133	3.33E-09	5.83E-11	1E-07
I-134	1.24E-19	7.03E-41	2E-05
I-135	1.03E-10	4.96E-14	7E-07
Xe-131m	2.83E-05	1.27E-09	4E-04
Xe-133	1.05E-06	6.30E-10	1E-04
Xe-133	4.91E-04	7.54E-08	1E-04
Xe-135m	1.65E-11	1.37E-14	9E-06
Xe-135	1.97E-08	2.11E-11	1E-05
Cs-134	1.48E-07	7.44E-10	4E-08
Cs-136	4.87E-09	1.43E-10	3E-07
Cs-137	1.01E-07	2.85E-10	6E-08

Table 12.2-21—Post-LOCA Photon Spectra for Waterborne Sources
Sheet 1 of 3

Energy (MeV)	Photon Spectra (MeV/sec-m^3) as a Function of Post-LOCA Time (hrs)					
	0	0.1	0.2	0.5	1	2
0.01	9.75E+11	8.02E+11	7.22E+11	6.20E+11	5.58E+11	5.16E+11
0.025	1.23E+13	8.28E+12	7.13E+12	6.13E+12	5.46E+12	4.78E+12
0.0375	6.91E+12	4.71E+12	3.99E+12	3.36E+12	2.96E+12	2.54E+12
0.0575	1.87E+12	1.84E+12	1.83E+12	1.82E+12	1.81E+12	1.80E+12
0.085	8.61E+12	7.84E+12	7.20E+12	5.83E+12	4.53E+12	3.40E+12
0.125	3.38E+13	3.14E+13	2.98E+13	2.54E+13	1.85E+13	1.03E+13
0.225	3.12E+14	1.97E+14	1.77E+14	1.50E+14	1.25E+14	1.00E+14
0.375	8.16E+14	5.73E+14	5.48E+14	4.92E+14	4.31E+14	3.68E+14
0.575	3.72E+15	3.62E+15	3.54E+15	3.27E+15	2.85E+15	2.29E+15
0.85	6.89E+15	5.81E+15	5.38E+15	4.55E+15	3.56E+15	2.34E+15
1.25	8.05E+15	6.64E+15	6.41E+15	5.46E+15	4.02E+15	2.46E+15
1.75	2.03E+15	1.87E+15	1.85E+15	1.79E+15	1.63E+15	1.29E+15
2.25	1.54E+15	1.23E+15	1.15E+15	9.10E+14	5.78E+14	2.51E+14
2.75	1.08E+15	7.77E+14	7.22E+14	5.62E+14	3.57E+14	1.58E+14
3.5	1.10E+15	4.49E+14	2.54E+14	1.43E+14	8.75E+13	4.16E+13
5	1.24E+15	3.06E+14	7.57E+13	1.57E+13	1.39E+13	1.08E+13
7	3.18E+03	3.18E+03	3.18E+03	3.18E+03	3.18E+03	3.18E+03
9.5	4.95E+02	4.95E+02	4.95E+02	4.96E+02	4.96E+02	4.96E+02
Total	2.68E+16	2.15E+16	2.02E+16	1.74E+16	1.37E+16	9.33E+15

Table 12.2-21—Post-LOCA Photon Spectra for Waterborne Sources
Sheet 2 of 3

Energy (MeV)	Photon Spectra (MeV/sec-m^3) as a Function of Post-LOCA Time (hrs)					
	5	10	20	24	50	100
0.01	4.72E+11	4.32E+11	3.85E+11	3.70E+11	2.94E+11	2.00E+11
0.025	4.21E+12	3.94E+12	3.62E+12	3.52E+12	2.95E+12	2.16E+12
0.0375	2.07E+12	1.85E+12	1.71E+12	1.68E+12	1.51E+12	1.26E+12
0.0575	1.76E+12	1.71E+12	1.60E+12	1.56E+12	1.33E+12	1.00E+12
0.085	2.75E+12	2.63E+12	2.49E+12	2.44E+12	2.17E+12	1.76E+12
0.125	5.21E+12	4.33E+12	3.75E+12	3.58E+12	2.68E+12	1.61E+12
0.225	7.71E+13	6.57E+13	5.53E+13	5.27E+13	4.24E+13	3.08E+13
0.375	3.15E+14	2.93E+14	2.71E+14	2.64E+14	2.36E+14	1.98E+14
0.575	1.64E+15	1.27E+15	9.82E+14	9.08E+14	6.22E+14	4.39E+14
0.85	1.11E+15	7.20E+14	5.53E+14	5.26E+14	4.39E+14	3.73E+14
1.25	1.33E+15	8.22E+14	4.05E+14	3.27E+14	1.60E+14	1.13E+14
1.75	7.26E+14	3.56E+14	1.36E+14	1.06E+14	7.40E+13	8.88E+13
2.25	8.26E+13	4.45E+13	1.87E+13	1.43E+13	5.85E+12	3.98E+12
2.75	4.28E+13	1.31E+13	3.26E+12	2.94E+12	4.03E+12	5.20E+12
3.5	1.32E+13	3.75E+12	3.45E+11	1.47E+11	4.16E+10	5.40E+10
5	5.03E+12	1.48E+12	1.29E+11	4.85E+10	8.49E+07	2.01E+04
7	3.18E+03	3.18E+03	3.18E+03	3.18E+03	3.17E+03	3.17E+03
9.5	4.96E+02	4.95E+02	4.95E+02	4.95E+02	4.95E+02	4.95E+02
Total	5.36E+15	3.61E+15	2.44E+15	2.21E+15	1.59E+15	1.26E+15

Table 12.2-21—Post-LOCA Photon Spectra for Waterborne Sources
Sheet 3 of 3

Energy (MeV)	Photon Spectra (MeV/sec-m^3) as a Function of Post-LOCA Time (hrs)				
	200	500	720	4320	8766
0.01	1.09E+11	4.17E+10	2.74E+10	7.44E+09	6.86E+09
0.025	1.26E+12	4.12E+11	2.44E+11	5.07E+10	4.02E+10
0.0375	9.61E+11	6.03E+11	5.02E+11	3.49E+11	3.31E+11
0.0575	6.18E+11	2.30E+11	1.34E+11	2.86E+08	1.22E+08
0.085	1.21E+12	4.49E+11	2.27E+11	1.97E+09	1.28E+09
0.125	6.80E+11	1.71E+11	1.17E+11	1.69E+10	9.64E+09
0.225	1.79E+13	5.35E+12	2.71E+12	5.09E+10	4.29E+10
0.375	1.40E+14	5.02E+13	2.41E+13	3.77E+11	3.27E+11
0.575	3.57E+14	3.05E+14	2.93E+14	2.53E+14	2.22E+14
0.85	3.17E+14	2.58E+14	2.42E+14	1.92E+14	1.62E+14
1.25	8.29E+13	4.95E+13	3.84E+13	1.88E+13	1.58E+13
1.75	8.49E+13	4.50E+13	2.75E+13	8.02E+10	1.88E+10
2.25	2.35E+12	7.99E+11	4.82E+11	3.24E+10	1.70E+10
2.75	5.02E+12	2.67E+12	1.62E+12	2.03E+09	1.09E+09
3.5	5.26E+10	2.83E+10	1.74E+10	3.00E+08	2.09E+08
5	1.96E+04	1.95E+04	1.94E+04	1.85E+04	1.77E+04
7	3.17E+03	3.15E+03	3.14E+03	2.98E+03	2.86E+03
9.5	4.94E+02	4.91E+02	4.89E+02	4.65E+02	4.45E+02
Total	1.01E+15	7.18E+14	6.31E+14	4.65E+14	4.01E+14

Table 12.2-22—Photon Spectra for Residual Heat Removal System

Energy (MeV)	Photon Spectra (MeV/sec-m^3) as a Function of Post-Shutdown Time (hrs) – Coolant at 1 g/cc					
	3	6	9	12	15	18
0.01	1.87E+07	1.84E+07	1.80E+07	1.77E+07	1.74E+07	1.72E+07
0.025	8.37E+07	7.89E+07	7.57E+07	7.32E+07	7.11E+07	6.93E+07
0.0375	5.76E+08	5.78E+08	5.79E+08	5.77E+08	5.74E+08	5.70E+08
0.0575	2.78E+07	2.73E+07	2.68E+07	2.64E+07	2.60E+07	2.56E+07
0.085	1.13E+09	1.13E+09	1.13E+09	1.13E+09	1.12E+09	1.12E+09
0.125	3.29E+08	3.59E+08	3.81E+08	3.92E+08	3.97E+08	3.96E+08
0.225	2.82E+09	3.23E+09	3.35E+09	3.29E+09	3.12E+09	2.90E+09
0.375	9.38E+09	9.04E+09	8.80E+09	8.60E+09	8.43E+09	8.28E+09
0.575	3.91E+10	3.31E+10	2.95E+10	2.69E+10	2.48E+10	2.30E+10
0.85	2.05E+10	1.55E+10	1.34E+10	1.23E+10	1.16E+10	1.10E+10
1.25	2.91E+10	2.19E+10	1.72E+10	1.38E+10	1.13E+10	9.44E+09
1.75	9.61E+09	6.79E+09	4.92E+09	3.60E+09	2.64E+09	1.94E+09
2.25	1.85E+09	1.18E+09	8.19E+08	5.88E+08	4.32E+08	3.25E+08
2.75	3.34E+09	2.86E+09	2.48E+09	2.16E+09	1.88E+09	1.64E+09
3.5	1.73E+07	4.66E+06	3.09E+06	2.33E+06	1.85E+06	1.53E+06
5	2.12E+06	7.92E+05	3.93E+05	2.01E+05	1.08E+05	6.12E+04
7	9.65E-04	9.65E-04	9.65E-04	9.64E-04	9.64E-04	9.64E-04
9.5	1.51E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04	1.51E-04
Total	1.18E+11	9.57E+10	8.26E+10	7.34E+10	6.63E+10	6.08E+10

Table 12.2-23—Photon Release Rates for Aeroballs

Photon Energy Group (MeV)	Photon Release Rate (photon/m^3-sec)								
	Discharge	1 Hour	2 Hours	4 Hours	8 Hours	1 Day	2 Days	1 Week	1 Month
0.01	5.56E+15	1.32E+15	1.25E+15	1.16E+15	1.07E+15	1.02E+15	9.90E+14	8.74E+14	4.91E+14
0.025	1.00E+15	6.07E+13	4.64E+13	2.71E+13	9.25E+12	1.25E+11	2.08E+08	1.47E+06	2.37E+02
0.0375	6.70E+14	4.07E+13	3.11E+13	1.82E+13	6.20E+12	8.40E+10	1.39E+08	9.21E+05	1.48E+02
0.0575	1.01E+15	6.06E+13	4.63E+13	2.71E+13	9.23E+12	1.25E+11	2.06E+08	1.22E+06	1.97E+02
0.085	6.43E+14	3.86E+13	2.95E+13	1.72E+13	5.87E+12	7.96E+10	1.30E+08	6.46E+05	1.04E+02
0.125	4.42E+14	2.64E+13	2.02E+13	1.18E+13	4.02E+12	5.45E+10	8.86E+07	3.62E+05	5.83E+01
0.225	6.57E+14	3.88E+13	2.97E+13	1.73E+13	5.91E+12	8.05E+10	4.07E+08	4.19E+07	6.80E+03
0.375	1.11E+15	7.96E+14	7.90E+14	7.82E+14	7.73E+14	7.57E+14	7.39E+14	6.52E+14	3.67E+14
0.575	2.41E+14	1.20E+13	9.15E+12	5.34E+12	1.82E+12	2.47E+10	3.91E+07	2.70E+03	4.34E-01
0.85	8.29E+15	6.21E+15	4.75E+15	2.77E+15	9.46E+14	1.28E+13	2.58E+10	8.28E+08	1.33E+05
1.25	8.47E+16	1.20E+13	8.16E+12	4.77E+12	1.64E+12	3.51E+10	8.99E+09	1.34E+09	2.16E+05
1.75	2.38E+15	1.77E+15	1.35E+15	7.90E+14	2.70E+14	3.66E+12	5.78E+09	5.66E-05	4.09E-13
2.25	1.11E+15	8.50E+14	6.50E+14	3.80E+14	1.30E+14	1.76E+12	2.78E+09	2.72E-05	0.00E+00
2.75	1.56E+14	1.19E+14	9.10E+13	5.32E+13	1.81E+13	2.46E+11	3.89E+08	3.81E-06	0.00E+00
3.5	1.34E+13	1.02E+13	7.80E+12	4.55E+12	1.55E+12	2.11E+10	3.33E+07	3.26E-07	0.00E+00
5	1.55E-03	8.21E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	7.98E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9.5	5.05E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total (photon/m^3-sec)	1.08E+17	1.14E+16	9.11E+15	6.07E+15	3.26E+15	1.79E+15	1.73E+15	1.53E+15	8.58E+14
Total (MeV/m^3-sec)	1.21E+17	1.10E+16	8.48E+15	5.08E+15	1.93E+15	3.16E+14	2.87E+14	2.53E+14	1.42E+14

Table 12.2-24—Radioactivity Content of Group I Liquid Waste Storage Tanks

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
Kr-83m	6.36E-02	Te-127	4.33E-02	Np-239	3.18E-02
Kr-85m	8.09E-05	Te-129m	9.54E-02	Y-90	1.28E-03
Kr-85	1.41E-08	Te-129	6.36E-02	Y-91m	5.11E-03
Xe-131m	6.50E-02	Te-131m	8.84E-02	Y-91	5.87E-03
Xe-133m	4.20E-01	Te-131	2.05E-02	Y-92	8.15E-04
Xe-133	8.19E+00	Te-132	1.75E+00	Y-93	5.52E-04
Xe-135m	6.77E-01	Te-133m	2.87E-03	Y-95	4.10E-07
Xe-135	4.40E+00	Te-133	6.82E-04	Zr-95	6.27E-03
Br-83	6.36E-02	Te-134	3.91E-03	Zr-97	9.43E-04
Br-84	7.45E-03	Sr-89	4.32E-02	Nb-95	6.46E-03
Br-85	8.09E-05	Sr-90	2.25E-03	Ag-110m	1.36E-05
I-129	3.18E-06	Sr-91	8.18E-03	Ag-110	1.81E-07
I-130	5.17E-01	Sr-92	3.95E-04	La-140	2.70E-02
I-131	4.19E+01	Ba-137m	7.07E+00	La-141	1.82E-04
I-132	2.44E+00	Ba-139	2.86E-02	La-142	4.33E-05
I-133	2.15E+01	Ba-140	3.76E-02	Pr-143	5.69E-03
I-134	1.81E-01	Mo-99	4.23E+00	Pr-144	4.77E-03
I-135	4.40E+00	Tc-99m	3.79E+00	Nd-147	2.04E-03
Rb-86m	4.27E-09	Ru-103	5.14E-03	Am-241	5.46E-07
Rb-86	1.22E-01	Ru-105	3.70E-04	Cm-242	1.29E-04
Rb-88	2.55E-01	Ru-106	1.85E-03	Cm-244	7.06E-06
Rb-89	1.01E-02	Rh-103m	4.63E-03	Na-24	4.65E-01
Cs-134	1.18E+01	Rh-105	1.49E-03	Cr-51	1.30E-01
Cs-136	3.23E+00	Rh-106	1.85E-03	Mn-54	6.88E-02
Cs-137	7.47E+00	Ce-141	5.84E-03	Fe-55	5.25E-02
Cs-138	9.94E-02	Ce-143	1.93E-03	Fe-59	1.27E-02
Sb-125	5.51E-05	Ce-144	4.77E-03	Co-58	1.96E-01
Sb-127	2.31E-04	Pu-238	1.38E-05	Co-60	2.35E-02
Sb-129	2.49E-05	Pu-239	1.41E-06	Zn-65	2.20E-02
Sb-131	8.37E-07	Pu-240	1.94E-06	W-187	3.51E-02
Te-127m	3.00E-02	Pu-241	4.77E-04	H-3	6.92E+01

Note:

1. Activity based on a continuous flow of undecayed RCS coolant at a flow rate of 2.6 gpm and a total tank volume of 18,500 gallons with decay during processing and no decay thereafter. Noble gases not used in the shielding analyses as they are processed through gaseous waste processing system.

Table 12.2-25—Radioactivity Content of Liquid Waste Processing System Evaporator

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
Br-83	9.61E-04	Sr-89	3.43E-01	Y-93	1.75E-04
Br-84	3.21E-09	Sr-90	4.03E-02	Zr-95	5.72E-02
I-129	5.71E-05	Sr-91	2.42E-03	Zr-97	4.71E-04
I-130	2.00E-01	Sr-92	9.10E-06	Nb-95	8.03E-02
I-131	9.42E+01	Ba-137m	1.27E+02	Ag-110m	2.00E-04
I-132	2.30E+00	Ba-139	3.90E-05	Ag-110	2.66E-06
I-133	1.23E+01	Ba-140	1.15E-01	La-140	1.18E-01
I-134	1.32E-05	Mo-99	4.85E+00	La-141	1.18E-05
I-135	7.96E-01	Tc-99m	4.63E+00	La-142	1.06E-07
Rb-86	4.84E-01	Ru-103	3.47E-02	Pr-143	1.86E-02
Cs-134	1.98E+02	Ru-105	3.19E-05	Pr-144	7.18E-02
Cs-136	1.00E+01	Ru-106	2.89E-02	Nd-147	5.63E-03
Cs-137	1.34E+02	Rh-103m	3.13E-02	Am-241	1.26E-05
Cs-138	5.00E-08	Rh-105	1.21E-03	Cm-242	1.72E-03
Sb-125	9.46E-04	Rh-106	2.89E-02	Cm-244	1.26E-04
Sb-127	3.26E-04	Ce-141	3.46E-02	Na-24	2.13E-01
Sb-129	2.01E-06	Ce-143	1.46E-03	Cr-51	6.87E-01
Te-127m	3.50E-01	Ce-144	7.18E-02	Mn-54	1.05E+00
Te-127	3.47E-01	Pu-238	2.52E-04	Fe-55	8.94E-01
Te-129m	5.78E-01	Pu-239	2.54E-05	Fe-59	9.35E-02
Te-129	3.76E-01	Pu-240	3.48E-05	Co-58	1.89E+00
Te-131m	6.32E-02	Pu-241	8.50E-03	Co-60	4.11E-01
Te-131	1.42E-02	Np-239	3.32E-02	Zn-65	3.22E-01
Te-132	2.23E+00	Y-90	3.92E-02	W-187	2.19E-02
Te-133m	2.91E-07	Y-91m	1.54E-03	H-3	8.89E+00
Te-133	4.88E-08	Y-91	5.14E-02		
Te-134	3.48E-08	Y-92	7.54E-05		

Notes:

1. Liquid waste processing system activity based on 18 batches of Group I liquid waste being processed within 160 days. Combined liquid volume for the evaporator (3.94 m^3) and the evaporator column (4.92 m^3) is approximately 9 m^3.

2. Credit is taken for buildup and decay during the fill time of the liquid waste tanks of approximately 237 hrs at 1.3 gpm (16 batches) and approximately 119 hrs at 2.6 gpm (2 batches) and the process time of approximately 18 hours per batch during the entire 160-day processing period and no decay thereafter.

3. Steam spectra is 1/10,000 of liquid distributed over 18 m^3 combined gaseous volume for evaporator (7.87 m^3) and the evaporator column (9.84 m^3).

Table 12.2-26—Radioactivity Content of Liquid Waste Concentrate Tank

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
Br-83	9.61E-04	Sr-89	3.81E-01	Y-93	1.75E-04
Br-84	3.21E-09	Sr-90	1.50E-01	Zr-95	6.82E-02
I-129	2.16E-04	Sr-91	2.42E-03	Zr-97	4.71E-04
I-130	2.00E-01	Sr-92	9.10E-06	Nb-95	1.03E-01
I-131	9.42E+01	Ba-137m	4.71E+02	Ag-110m	4.43E-04
I-132	2.30E+00	Ba-139	3.90E-05	Ag-110	5.90E-06
I-133	1.23E+01	Ba-140	1.15E-01	La-140	1.18E-01
I-134	1.32E-05	Mo-99	4.85E+00	La-141	1.18E-05
I-135	7.96E-01	Tc-99m	4.63E+00	La-142	1.06E-07
Rb-86	4.85E-01	Ru-103	3.65E-02	Pr-143	1.86E-02
Cs-134	6.10E+02	Ru-105	3.19E-05	Pr-144	1.68E-01
Cs-136	1.00E+01	Ru-106	7.40E-02	Nd-147	5.63E-03
Cs-137	4.98E+02	Rh-103m	3.30E-02	Am-241	8.03E-05
Cs-138	5.00E-08	Rh-105	1.21E-03	Cm-242	3.13E-03
Sb-125	3.06E-03	Rh-106	7.40E-02	Cm-244	4.64E-04
Sb-127	3.26E-04	Ce-141	3.56E-02	Na-24	2.13E-01
Sb-129	2.01E-06	Ce-143	1.46E-03	Cr-51	6.97E-01
Te-127m	5.23E-01	Ce-144	1.68E-01	Mn-54	2.55E+00
Te-127	5.16E-01	Pu-238	9.66E-04	Fe-55	2.87E+00
Te-129m	5.96E-01	Pu-239	9.60E-05	Fe-59	1.01E-01
Te-129	3.88E-01	Pu-240	1.32E-04	Co-58	2.33E+00
Te-131m	6.32E-02	Pu-241	3.11E-02	Co-60	1.43E+00
Te-131	1.42E-02	Np-239	3.32E-02	Zn-65	7.06E-01
Te-132	2.23E+00	Y-90	1.49E-01	W-187	2.19E-02
Te-133m	2.91E-07	Y-91m	1.54E-03	H-3	3.40E+01
Te-133	4.88E-08	Y-91	5.95E-02		
Te-134	3.48E-08	Y-92	7.54E-05		

Notes:

1. Activity based on the processing of 72 liquid waste tanks in four batches (18 liquid waste tanks per evaporator concentrate transfer) over a period of about 22 months, with buildup and decay during processing and no decay thereafter. Noble gas decay products are excluded from the source term since they would be transferred to the monitoring tank with the evaporator steam.

2. Source volume is 34 m^3.

Table 12.2-27—Radioactivity Content of Liquid Waste Monitoring Tanks

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
Br-83	9.61E-08	Sr-90	2.25E-10	La-140	2.95E-09
I-129	3.18E-10	Sr-91	2.42E-10	Pr-143	5.54E-10
I-130	2.00E-05	Ba-137m	7.07E-07	Pr-144	4.76E-10
I-131	3.93E-03	Ba-140	3.61E-09	Nd-147	1.94E-10
I-132	3.22E-05	Mo-99	3.52E-07	Na-24	2.12E-08
I-133	1.21E-03	Tc-99m	3.35E-07	Cr-51	1.28E-08
I-134	1.31E-09	Ru-103	5.07E-10	Mn-54	6.87E-09
I-135	7.96E-05	Ru-106	1.84E-10	Fe-55	5.25E-09
Rb-86	1.19E-08	Rh-103m	4.57E-10	Fe-59	1.25E-09
Cs-134	1.18E-06	Rh-105	1.09E-10	Co-58	1.95E-08
Cs-136	3.10E-07	Rh-106	1.84E-10	Co-60	2.35E-09
Cs-137	7.47E-07	Ce-141	5.75E-10	Zn-65	2.19E-09
Te-127m	2.98E-09	Ce-143	1.34E-10	W-187	2.13E-09
Te-127	3.34E-09	Ce-144	4.76E-10	H-3	6.92E+01
Te-129m	9.39E-09	Np-239	2.57E-09	Kr-83m	9.46E-08
Te-129	6.12E-09	Y-90	1.34E-10	Xe-131m	9.30E-07
Te-131m	5.92E-09	Y-91m	4.76E-10	Xe-133m	4.11E-06
Te-131	1.33E-09	Y-91	5.86E-10	Xe-133	6.07E-05
Te-132	1.50E-07	Zr-95	6.22E-10	Xe-135m	1.22E-05
Sr-89	4.27E-09	Nb-95	6.46E-10	Xe-135	4.37E-05

Note:

1. Activity based on the processing of a single waste tank with the liquid waste tank being filled at a rate of 26,500 gal/wk, a transfer rate from the liquid waste storage tank to the evaporator of 1050 gal/hr and immediate transfer to the monitoring tank with buildup and decay during processing and no decay thereafter. Source volume is 18,500 gallons.

Table 12.2-28—Radioactivity Content of Purge Gas Circuit

Nuclide	Activity (Ci)
Kr-83m	1.26E+01
Kr-85m	8.15E+01
Kr-85	1.10E+03
Kr-87	2.61E+01
Kr-88	1.25E+02
Kr-89	1.28E-01
Xe-131m	2.22E+02
Xe-133m	2.69E+02
Xe-133	1.93E+04
Xe-135m	4.52E+00
Xe-135	5.77E+02
Xe-137	2.90E-01
Xe-138	3.57E+00
Rb-88	1.09E+02
Rb-89	1.14E-01
Cs-137	2.22E-06
Cs-138	2.81E+00
Sr-89	1.88E-04
Ba-137m	2.06E-06

Note:

1. Activity based on equilibrium conditions for a degasification flow rate into the purge gas circuit of 158,730 lb/hr (20 kg/sec) and a removal rate equal to the surge gas flow rate to the delay beds of 0.0765 lb/sec. The estimated source volume is 290 m^3 and includes all components and piping in the entire circuit.

Table 12.2-29—Radioactivity Content of Charcoal Holdup Beds

Nuclide	Activity (Ci)
Kr83m	1.74E+01
Kr85m	1.05E+02
Kr85	1.62E+03
Kr87	3.05E+01
Kr88	1.55E+02
Kr89	1.34E-01
Kr90	3.92E-03
Rb88	1.70E+02
Rb89	7.24E-01
Rb90m	4.19E-03
Rb90	1.97E-02
Sr89	1.80E-01
Xe131m	3.98E+02
Xe133m	4.05E+02
Xe133	3.14E+04
Xe135m	3.48E+01
Xe135	8.34E+02
Xe137	3.05E-01
Xe138	3.83E+00
Xe139	7.04E-03
Cs135	1.64E-05
Cs137	2.39E-02
Cs138	1.11E+01
Cs139	1.02E-01
Ba137m	2.27E-02
Ba139	6.61E-01

Note:

1. Activity based on a degasification flow rate of 158,730 lb/hr (20 kg/sec) to the purge gas circuit and instant transfer of the noble gases to the charcoal holdup beds with a holdup (decay) period of 40 hours for kryptons and 27.7 days for xenons.

2. Source volume of charcoal delay beds of 14.25 m^3 (3 beds at 4.75 m^3 per bed).

Table 12.2-30—Radioactivity Content of Concentrate Buffer Tank

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
Br-83	4.79E-01	Te-133m	2.14E-02	Y-92	6.10E-03
Br-84	5.62E-02	Te-133	5.09E-03	Y-93	4.15E-03
Br-85	6.09E-04	Te-134	2.92E-02	Y-95	3.06E-06
I-129	1.33E-02	Sr-89	4.96E+00	Zr-95	9.14E-01
I-130	3.95E+00	Sr-90	8.55E+00	Zr-97	7.20E-03
I-131	9.33E+02	Sr-91	6.14E-02	Nb-95	1.42E+00
I-132	2.60E+01	Sr-92	2.95E-03	Ag-110m	7.56E-03
I-133	1.68E+02	Ba-137m	1.38E+04	Ag-110	1.01E-04
I-134	1.36E+00	Ba-139	1.87E-01	La-140	1.26E+00
I-135	3.33E+01	Ba-140	1.22E+00	La-141	1.30E-03
Rb-86m	1.63E-08	Mo-99	4.55E+01	La-142	3.05E-04
Rb-86	2.89E+00	Tc-99m	4.17E+01	Pr-143	2.00E-01
Rb-88	9.70E-01	Ru-103	4.68E-01	Pr-144	3.01E+00
Rb-89	3.83E-02	Ru-105	2.65E-03	Nd-147	5.84E-02
Cs-134	9.24E+03	Ru-106	1.50E+00	Am-241	1.28E-02
Cs-136	5.58E+01	Rh-103m	4.22E-01	Cm-242	4.68E-02
Cs-137	1.46E+04	Rh-105	1.27E-02	Cm-244	2.55E-02
Cs-138	3.78E-01	Rh-106	1.50E+00	Na-24	3.54E+00
Sb-125	1.03E-01	Ce-141	4.45E-01	Cr-51	8.52E+00
Sb-127	2.99E-03	Ce-143	1.61E-02	Mn-54	4.76E+01
Sb-129	1.86E-04	Ce-144	3.01E+00	Fe-55	9.46E+01
Sb-131	6.24E-06	Pu-238	5.79E-02	Fe-59	1.31E+00
Te-127m	7.36E+00	Pu-239	5.87E-03	Co-58	3.15E+01
Te-127	7.31E+00	Pu-240	8.05E-03	Co-60	6.21E+01
Te-129m	7.49E+00	Pu-241	1.66E+00	Zn-65	1.19E+01
Te-129	4.88E+00	Np-239	3.18E-01	W-187	2.75E-01
Te-131m	7.20E-01	Y-90	8.54E+00	H-3	9.88E+00
Te-131	1.67E-01	Y-91m	3.84E-02		
Te-132	2.06E+01	Y-91	7.92E-01		

Note:

1. Concentrate buffer tank assumed to be filled with evaporator concentrates and spent resins from the coolant purification system. No correction was made for radioactive decay after tank filling. The concentrate buffer mix of concentrates and resins is equivalent to the annual processing of 22 m^3 of evaporator concentrates and 5 m^3 of resins.

2. The source volume for concentrate buffer tank is 10 m^3.

Table 12.2-31—Radioactivity Content of Resin Waste Tank

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
Br-83	3.88E+00	Te-133m	1.73E-01	Y-92	4.92E-02
Br-84	4.55E-01	Te-133	4.12E-02	Y-93	3.33E-02
Br-85	4.94E-03	Te-134	2.36E-01	Y-95	2.48E-05
I-129	1.07E-01	Sr-89	3.95E+01	Zr-95	7.27E+00
I-130	3.16E+01	Sr-90	6.89E+01	Zr-97	5.74E-02
I-131	7.37E+03	Sr-91	4.93E-01	Nb-95	1.13E+01
I-132	2.06E+02	Sr-92	2.39E-02	Ag-110m	6.04E-02
I-133	1.34E+03	Ba-137m	1.11E+05	Ag-110	8.03E-04
I-134	1.10E+01	Ba-139	1.51E+00	La-140	9.99E+00
I-135	2.68E+02	Ba-140	9.67E+00	La-141	1.05E-02
Rb-86m	1.32E-07	Mo-99	3.59E+02	La-142	2.47E-03
Rb-86	2.24E+01	Tc-99m	3.29E+02	Pr-143	1.58E+00
Rb-88	7.85E+00	Ru-103	3.72E+00	Pr-144	2.40E+01
Rb-89	3.10E-01	Ru-105	2.14E-02	Nd-147	4.62E-01
Cs-134	7.37E+04	Ru-106	1.20E+01	Am-241	1.03E-01
Cs-136	4.33E+02	Rh-103m	3.35E+00	Cm-242	3.73E-01
Cs-137	1.17E+05	Rh-105	1.00E-01	Cm-244	2.05E-01
Cs-138	3.06E+00	Rh-106	1.20E+01	Na-24	2.82E+01
Sb-125	8.31E-01	Ce-141	3.53E+00	Cr-51	6.77E+01
Sb-127	2.36E-02	Ce-143	1.27E-01	Mn-54	3.81E+02
Sb-129	1.50E-03	Ce-144	2.40E+01	Fe-55	7.61E+02
Sb-131	5.05E-05	Pu-238	4.67E-01	Fe-59	1.04E+01
Te-127m	5.86E+01	Pu-239	4.73E-02	Co-58	2.51E+02
Te-127	5.82E+01	Pu-240	6.49E-02	Co-60	5.00E+02
Te-129m	5.95E+01	Pu-241	1.34E+01	Zn-65	9.52E+01
Te-129	3.88E+01	Np-239	2.51E+00	W-187	2.19E+00
Te-131m	5.71E+00	Y-90	6.89E+01	H-3	1.50E+01
Te-131	1.32E+00	Y-91m	3.08E-01		
Te-132	1.62E+02	Y-91	6.30E+00		

Note:

1. Activity based on the transfer of a total of 7.5 batches of primary coolant purification resins with the first 6.5 batches accounting for decay ranging from 1 to 7 years, and the last batch having no decay after accumulation. Source volume for the resin within the resin waste tank is 15 m^3.

Table 12.2-32—Radioactivity Content of Steam Generator Blowdown Mixed Bed Demineralizer

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
C-14	4.40E-13	Sb-127	6.14E-06	Ce-143	3.17E-05
Na-24	5.93E-03	Sb-129	2.62E-07	Ce-144	2.93E-03
Cr-51	1.63E-02	Sb-131	1.95E-09	Pu-238	1.16E-05
Mn-54	3.95E-02	Te-127m	1.24E-02	Pu-239	1.16E-06
Fe-55	3.58E-02	Te-127	1.24E-02	Pu-240	1.59E-06
Fe-59	2.47E-03	Te-129m	1.57E-02	Pu-241	3.85E-04
Co-58	5.54E-02	Te-129	1.02E-02	Np-239	6.42E-04
Co-60	1.68E-02	Te-131m	1.41E-03	Y-90	1.81E-03
Zn-65	1.18E-02	Te-131	3.19E-04	Y-91m	6.71E-05
W-187	4.83E-04	Te-132	4.19E-02	Y-91	1.59E-03
Br-83	5.27E-03	Te-133m	1.34E-05	Y-92	9.33E-06
Br-84	2.28E-04	Te-133	2.51E-06	Y-93	7.25E-06
Br-85	2.69E-07	Te-134	1.48E-05	Y-95	4.72E-10
I-129	2.63E-05	Sr-89	1.02E-02	Zr-95	1.81E-03
I-130	7.08E-02	Sr-90	1.83E-03	Zr-97	1.35E-05
I-131	1.94E+01	Sr-91	1.06E-04	Nb-95	2.73E-03
I-132	4.88E-01	Sr-92	3.46E-06	Ag-110m	8.07E-06
I-133	3.20E+00	Ba-137m	5.74E+00	Ag-110	1.07E-07
I-134	8.25E-03	Ba-139	1.76E-04	La-140	2.65E-03
I-135	5.30E-01	Ba-140	2.55E-03	La-141	1.86E-06
Rb-86m	4.64E-13	Mo-99	9.24E-02	La-142	2.84E-07
Rb-86	1.07E-02	Tc-99m	8.56E-02	Pr-143	4.19E-04
Rb-88	4.32E-04	Ru-103	9.74E-04	Pr-144	2.93E-03
Rb-89	1.48E-05	Ru-105	3.94E-06	Nd-147	1.22E-04
Cs-134	7.93E+00	Ru-106	1.21E-03	Am-241	6.56E-07
Cs-136	2.05E-01	Rh-103m	8.78E-04	Cm-242	6.54E-05
Cs-137	5.57E+00	Rh-105	2.53E-05	Cm-244	5.71E-06
Cs-138	2.79E-04	Rh-106	1.21E-03	H-3	Negligible
Sb-125	4.17E-05	Ce-141	9.32E-04		

Note:

1. Activity based on an accumulation period of 36 weeks, a resin volume of 4.2 m^3 and no post-accumulation radioactive decay.

Table 12.2-33—Activity Inventory for Water Phase of Volume Control Tank

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br83	1.00E-02	Y90	3.61E-06	Te134	1.26E-03
Br84	2.66E-03	Y91m	2.39E-04	Ba137m	7.14E-02
Br85	4.25E-05	Y91	3.66E-05	Ba140	2.77E-04
I129	2.04E-08	Y92	6.19E-05	La140	7.71E-05
I130	2.05E-02	Y93	2.66E-05	Ce141	3.99E-05
I131	3.28E-01	Zr95	4.18E-05	Ce143	3.31E-05
I132	1.22E-01	Nb95	4.20E-05	Ce144	3.12E-05
I133	5.29E-01	Mo99	4.75E-02	Pr143	3.95E-05
I134	5.15E-02	Tc99m	2.37E-02	Pr144	3.12E-05
I135	3.06E-01	Ru103	3.48E-05	Np239	3.86E-04
Rb88	7.51E-01	Ru106	1.21E-05	Na24	1.54E-02
Rb89	8.02E-03	Rh103m	3.10E-05	Cr51	8.87E-04
Cs134	1.22E-01	Rh106	1.21E-05	Mn54	4.54E-04
Cs136	3.76E-02	Ag110m	8.88E-08	Fe55	3.41E-04
Cs137	7.67E-02	Te127m	1.98E-04	Fe59	8.60E-05
Cs138	7.69E-02	Te129m	6.51E-04	Co58	1.31E-03
Sr89	2.92E-04	Te129	7.87E-04	Co60	1.51E-04
Sr90	1.46E-05	Te131m	1.63E-03	Zn65	1.45E-04
Sr91	4.18E-04	Te131	6.07E-04	W187	7.96E-04
Sr92	5.75E-05	Te132	1.81E-02	H3	9.86E-01

Note:

1. VCT contains both purified and unpurified reactor coolant and is based on a 13 gpm flow rate of unpurified reactor coolant and a 16 gpm flow rate of purified reactor coolant with an accumulation period of 1 year and no post-accumulation radioactive decay.

Table 12.2-34—Activity Inventory for Gas Phase of Volume Control Tank

Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/m^3)
Kr83m	1.61E-01	Xe133m	3.43E+00	Rb89	1.45E-03
Kr85m	1.04E+00	Xe133	2.46E+02	Cs137	2.84E-08
Kr85	1.40E+01	Xe135m	5.79E-02	Cs138	3.59E-02
Kr87	3.33E-01	Xe135	7.36E+00	Sr89	2.40E-06
Kr88	1.59E+00	Xe137	3.71E-03	Ba137m	2.63E-08
Kr89	1.64E-03	Xe138	4.55E-02		
Xe131m	2.83E+00	Rb88	1.39E+00		

Note:

1. Activity concentration in VCT is the same as that contained in the purge gas circuit, accounting for pressure differential.

Table 12.2-35—Activity Inventory for the Coolant Purification System (CPS1) Mixed Bed Demineralizer

Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)
Br-83	1.94E+00	Te-133m	8.65E-02	Y-92	2.47E-02
Br-84	2.28E-01	Te-133	2.06E-02	Y-93	1.67E-02
Br-85	2.47E-03	Te-134	1.19E-01	Y-95	1.24E-05
I-129	7.15E-03	Sr-89	1.96E+01	Zr-95	3.57E+00
I-130	1.58E+01	Sr-90	4.97E+00	Zr-97	2.88E-02
I-131	3.69E+03	Sr-91	2.47E-01	Nb-95	5.50E+00
I-132	1.03E+02	Sr-92	1.20E-02	Ag-110m	1.93E-02
I-133	6.70E+02	Ba-137m	7.95E+03	Ag-110	2.56E-04
I-134	5.55E+00	Ba-139	7.60E-01	La-140	5.00E+00
I-135	1.35E+02	Ba-140	4.84E+00	La-141	5.25E-03
Rb-86m	6.60E-08	Mo-99	1.80E+02	La-142	1.24E-03
Rb-86	1.12E+01	Tc-99m	1.65E+02	Pr-143	7.95E-01
Rb-88	3.93E+00	Ru-103	1.86E+00	Pr-144	7.10E+00
Rb-89	1.56E-01	Ru-105	1.07E-02	Nd-147	2.31E-01
Cs-134	1.15E+04	Ru-106	3.00E+00	Am-241	2.05E-03
Cs-136	2.17E+02	Rh-103m	1.68E+00	Cm-242	1.47E-01
Cs-137	8.40E+03	Rh-105	5.00E-02	Cm-244	1.55E-02
Cs-138	1.54E+00	Rh-106	3.00E+00	Na-24	1.42E+01
Sb-125	1.09E-01	Ce-141	1.77E+00	Cr-51	3.39E+01
Sb-127	1.18E-02	Ce-143	6.35E-02	Mn-54	1.06E+02
Sb-129	7.50E-04	Ce-144	7.10E+00	Fe-55	1.03E+02
Sb-131	2.53E-05	Pu-238	3.14E-02	Fe-59	5.20E+00
Te-127m	2.64E+01	Pu-239	3.16E-03	Co-58	1.22E+02
Te-127	2.63E+01	Pu-240	4.33E-03	Co-60	4.93E+01
Te-129m	2.98E+01	Pu-241	1.04E+00	Zn-65	3.08E+01
Te-129	1.94E+01	Np-239	1.26E+00	W-187	1.10E+00
Te-131m	2.86E+00	Y-90	4.93E+00	H-3	1.00E+00
Te-131	6.60E-01	Y-91m	1.54E-01		
Te-132	8.10E+01	Y-91	3.11E+00		

Note:

1. Activity based on a purification flow rate of 79,366 lb/hr and an accumulation period of 1 year with no post-accumulation radioactive decay.

Table 12.2-36—Photon Spectra for the Coolant Purification System Cartridge Filter

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	4.99E+10
0.025	1.33E+05
0.0375	4.39E+05
0.0575	1.86E+09
0.085	9.59E+08
0.125	1.44E+09
0.225	9.70E+07
0.375	1.08E+11
0.575	2.00E+12
0.85	1.92E+13
1.25	1.63E+13
1.75	1.08E+11
2.25	1.20E+08
2.75	3.96E+12
3.5	3.46E+09
5	5.14E+07
7	0.00E+00
9.5	0.00E+00
Total	4.17E+13

Note:

1. Activity based on a purification flow rate of 79,366 lb/hr and an accumulation period of 1 year with no post-accumulation radioactive decay.

Table 12.2-37—Activity Inventory for Resin Waste Tank

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br-83	2.59E-01	Te-132	1.08E+01	Y-91	4.20E-01
Br-84	3.03E-02	Te-133m	1.16E-02	Y-92	3.28E-03
Br-85	3.29E-04	Te-133	2.75E-03	Y-93	2.22E-03
I-129	7.16E-03	Te-134	1.58E-02	Y-95	1.65E-06
I-130	2.11E+00	Sr-89	2.63E+00	Zr-95	4.85E-01
I-131	4.92E+02	Sr-90	4.60E+00	Zr-97	3.83E-03
I-132	1.38E+01	Sr-91	3.29E-02	Nb-95	7.53E-01
I-133	8.91E+01	Sr-92	1.59E-03	Ag-110m	4.03E-03
I-134	7.36E-01	Ba-137m	7.39E+03	Ag-110	5.35E-05
I-135	1.79E+01	Ba-139	1.01E-01	La-140	6.66E-01
Rb-86m	8.78E-09	Ba-140	6.44E-01	La-141	7.02E-04
Rb-86	1.50E+00	Mo-99	2.40E+01	La-142	1.65E-04
Rb-88	5.24E-01	Tc-99m	2.19E+01	Pr-143	1.06E-01
Rb-89	2.07E-02	Ru-103	2.48E-01	Pr-144	1.60E+00
Cs-134	4.91E+03	Ru-105	1.43E-03	Nd-147	3.08E-02
Cs-136	2.88E+01	Ru-106	7.98E-01	Am-241	6.90E-03
Cs-137	7.81E+03	Rh-103m	2.23E-01	Cm-242	2.48E-02
Cs-138	2.04E-01	Rh-105	6.68E-03	Cm-244	1.37E-02
Sb-125	5.54E-02	Rh-106	7.98E-01	Na-24	1.88E+00
Sb-127	1.57E-03	Ce-141	2.35E-01	Cr-51	4.51E+00
Sb-129	1.00E-04	Ce-143	8.48E-03	Mn-54	2.54E+01
Sb-131	3.37E-06	Ce-144	1.60E+00	Fe-55	5.07E+01
Te-127m	3.90E+00	Pu-238	3.11E-02	Fe-59	6.96E-01
Te-127	3.88E+00	Pu-239	3.16E-03	Co-58	1.67E+01
Te-129m	3.97E+00	Pu-240	4.33E-03	Co-60	3.34E+01
Te-129	2.59E+00	Pu-241	8.94E-01	Zn-65	6.35E+00
Te-131m	3.81E-01	Np-239	1.67E-01	W-187	1.46E-01
Te-131	8.82E-02	Y-90	4.59E+00	H-3	1.00E+00
Te-132	1.08E+01	Y-91m	2.05E-02		

Note:

1. Activity based on the transfer of a total of 7.5 batches of primary coolant purification resins with the first 6.5 batches accounting for decay ranging from 1 to 7 years, and the last batch having no decay after accumulation.

Table 12.2-38—Photon Spectra for Resin Waste Tank

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	1.93E+10
0.025	3.08E+10
0.0375	7.27E+11
0.0575	1.19E+10
0.085	4.44E+10
0.125	1.13E+11
0.225	5.30E+11
0.375	5.65E+12
0.575	2.98E+14
0.85	1.40E+14
1.25	1.87E+13
1.75	3.60E+11
2.25	6.51E+10
2.75	1.98E+11
3.5	1.32E+09
5	1.71E+08
7	7.38E+01
9.5	1.15E+01
Total	4.64E+14

Note:

1. Activity based on the transfer of a total of 7.5 batches of primary coolant purification resins with the first 6.5 batches accounting for decay ranging from 1 to 7 years, and the last batch having no decay after accumulation.

Table 12.2-39—Activity Inventory for Water Phase of Degasifier

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br83	3.08E-04	Y90	1.52E-07	Te134	1.27E-04
Br84	1.57E-04	Y91m	1.04E-05	Ba137m	2.15E-02
Br85	1.24E-05	Y91	1.60E-06	Ba140	1.23E-05
I129	4.53E-10	Y92	2.79E-06	La140	3.19E-06
I130	4.90E-04	Y93	1.28E-06	Ce141	1.75E-06
I131	7.34E-03	Zr95	1.84E-06	Ce143	1.50E-06
I132	3.63E-03	Nb95	1.85E-06	Ce144	1.37E-06
I133	1.23E-02	Mo99	2.11E-03	Pr143	1.74E-06
I134	2.30E-03	Tc99m	9.19E-04	Pr144	1.37E-06
I135	7.77E-03	Ru103	1.53E-06	Np239	1.72E-05
Rb88	4.60E-01	Ru106	5.29E-07	Na24	7.29E-04
Rb89	2.10E-02	Rh103m	1.35E-06	Cr51	3.95E-05
Cs134	8.44E-02	Rh106	5.29E-07	Mn54	1.98E-05
Cs136	2.62E-02	Ag110m	3.91E-09	Fe55	1.50E-05
Cs137	5.33E-02	Te127m	8.69E-06	Fe59	3.75E-06
Cs138	1.03E-01	Te129m	2.86E-05	Co58	5.73E-05
Sr89	1.30E-05	Te129	4.69E-05	Co60	6.72E-06
Sr90	6.42E-07	Te131m	7.38E-05	Zn65	6.32E-06
Sr91	2.11E-05	Te131	4.91E-05	W187	3.55E-05
Sr92	3.38E-06	Te132	8.06E-04	H3	9.88E-01

Note:

1. Activity based on a degasification flow rate of 158,730 lb/hr (20 kg/sec).

Table 12.2-40—Activity Inventory for Gas Phase of Degasifier

Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/m^3)
Kr83m	8.92e-02	Kr89	9.65e-03	Xe135	2.41e+00
Kr85m	4.03e-01	Xe131m	7.69e-01	Xe137	1.97e-02
Kr85	3.78e+00	Xe133m	9.61e-01	Xe138	9.93e-02
Kr87	2.25e-01	Xe133	6.75e+01		
Kr88	7.23e-01	Xe135m	1.20e-01		

Note:

1. Activity based on equilibrium conditions for a degasification flow rate into the purge gas circuit of 158,730 lb/hr (20 kg/sec) and a removal rate equal to the surge gas flow rate to the delay beds of 0.0765 lb/sec, accounting for pressure and temperature differential.

Table 12.2-41—Activity Inventory for Steam Generator Blowdown Mixed Bed Demineralizer

Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)
C-14	1.05E-13	Sb-127	1.46E-06	Ce-143	7.54E-06
Na-24	1.41E-03	Sb-129	6.24E-08	Ce-144	6.98E-04
Cr-51	3.87E-03	Sb-131	4.63E-10	Pu-238	2.75E-06
Mn-54	9.40E-03	Te-127m	2.96E-03	Pu-239	2.75E-07
Fe-55	8.51E-03	Te-127	2.94E-03	Pu-240	3.78E-07
Fe-59	5.87E-04	Te-129m	3.74E-03	Pu-241	9.16E-05
Co-58	1.32E-02	Te-129	2.43E-03	Np-239	1.53E-04
Co-60	3.99E-03	Te-131m	3.36E-04	Y-90	4.30E-04
Zn-65	2.80E-03	Te-131	7.60E-05	Y-91m	1.60E-05
W-187	1.15E-04	Te-132	9.99E-03	Y-91	3.78E-04
Br-83	1.25E-03	Te-133m	3.18E-06	Y-92	2.22E-06
Br-84	5.42E-05	Te-133	5.97E-07	Y-93	1.73E-06
Br-85	6.39E-08	Te-134	3.52E-06	Y-95	1.12E-10
I-129	6.25E-06	Sr-89	2.43E-03	Zr-95	4.30E-04
I-130	1.69E-02	Sr-90	4.35E-04	Zr-97	3.21E-06
I-131	4.61E+00	Sr-91	2.53E-05	Nb-95	6.49E-04
I-132	1.16E-01	Sr-92	8.23E-07	Ag-110m	1.92E-06
I-133	7.61E-01	Ba-137m	1.37E+00	Ag-110	2.55E-08
I-134	1.96E-03	Ba-139	4.19E-05	La-140	6.31E-04
I-135	1.26E-01	Ba-140	6.08E-04	La-141	4.42E-07
Rb-86m	1.10E-13	Mo-99	2.20E-02	La-142	6.75E-08
Rb-86	2.54E-03	Tc-99m	2.04E-02	Pr-143	9.97E-05
Rb-88	1.03E-04	Ru-103	2.32E-04	Pr-144	6.98E-04
Rb-89	3.53E-06	Ru-105	9.39E-07	Nd-147	2.90E-05
Cs-134	1.89E+00	Ru-106	2.88E-04	Am-241	1.56E-07
Cs-136	4.89E-02	Rh-103m	2.09E-04	Cm-242	1.56E-05
Cs-137	1.33E+00	Rh-105	6.02E-06	Cm-244	1.36E-06
Cs-138	6.63E-05	Rh-106	2.88E-04	H-3	Negligible
Sb-125	9.94E-06	Ce-141	2.22E-04		

Note:

1. Activity based on an accumulation period of 36 weeks, a resin volume of 4.2 m^3, and no post-accumulation radioactive decay.

Table 12.2-42—Photon Spectra for Steam Generator Blowdown Mixed Bed Demineralizer

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	1.03E+07
0.025	2.08E+08
0.0375	2.06E+08
0.0575	1.78E+07
0.085	3.68E+08
0.125	1.07E+08
0.225	3.42E+09
0.375	5.14E+10
0.575	1.08E+11
0.85	6.37E+10
1.25	1.49E+10
1.75	2.20E+09
2.25	4.46E+08
2.75	1.52E+08
3.5	1.31E+06
5	5.62E+04
7	1.05E-02
9.5	1.65E-03
TOTAL	2.45E+11

Note:

1. Activity based on an accumulation period of 36 weeks, a resin volume of 4.2 m^3 and no post-accumulation radioactive decay.

Table 12.2-43—Activity Inventory for Steam Generator Blowdown Cation Demineralizer

Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/ m^3)
C-14	1.47E-13	Te-131m	1.42E-03	Pu-240	5.31E-07
Na-24	6.63E-03	Te-131	3.21E-04	Pu-241	1.30E-04
Cr-51	1.60E-02	Te-132	4.22E-02	Np-239	6.45E-04
Mn-54	1.75E-02	Te-133m	1.34E-05	Y-90	5.94E-04
Fe-55	1.41E-02	Te-133	2.52E-06	Y-91m	6.75E-05
Fe-59	2.04E-03	Te-134	1.49E-05	Y-91	1.06E-03
Co-58	3.79E-02	Sr-89	7.26E-03	Y-92	9.38E-06
Co-60	6.42E-03	Sr-90	6.15E-04	Y-93	7.29E-06
Zn-65	5.46E-03	Sr-91	1.07E-04	Y-95	4.75E-10
W-187	5.40E-04	Sr-92	3.47E-06	Zr-95	1.16E-03
Rb-86m	5.13E-13	Ba-137m	1.93E+00	Zr-97	1.35E-05
Rb-86	1.13E-02	Ba-139	1.77E-04	Nb-95	1.53E-03
Rb-88	4.77E-04	Ba-140	2.54E-03	Ag-110m	3.35E-06
Rb-89	1.64E-05	Mo-99	9.29E-02	Ag-110	4.46E-08
Cs-134	3.15E+00	Tc-99m	8.61E-02	La-140	2.64E-03
Cs-136	2.24E-01	Ru-103	7.66E-04	La-141	1.87E-06
Cs-137	2.06E+00	Ru-105	3.97E-06	La-142	2.85E-07
Cs-138	3.08E-04	Ru-106	4.70E-04	Pr-143	4.15E-04
Sb-125	1.48E-05	Rh-103m	6.90E-04	Pr-144	1.19E-03
Sb-127	6.17E-06	Rh-105	2.54E-05	Nd-147	1.22E-04
Sb-129	2.63E-07	Rh-106	4.70E-04	Am-241	1.72E-07
Sb-131	1.96E-09	Ce-141	7.84E-04	Cm-242	3.00E-05
Te-127m	6.47E-03	Ce-143	3.19E-05	Cm-244	1.93E-06
Te-127	6.52E-03	Ce-144	1.19E-03	H-3	negligible
Te-129m	1.30E-02	Pu-238	3.83E-06		
Te-129	8.50E-03	Pu-239	3.88E-07		

Note:

1. Activity based on an accumulation period of 12 weeks, an active resin volume of 9.04 m^3 and no post-accumulation radioactive decay.

Table 12.2-44—Photon Spectra for Steam Generator Blowdown Cation Demineralizer

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	1.62E+07
0.025	3.38E+07
0.0375	2.60E+08
0.0575	8.08E+07
0.085	4.62E+07
0.125	4.39E+08
0.225	1.03E+09
0.375	1.39E+09
0.575	1.28E+11
0.85	9.64E+10
1.25	1.86E+10
1.75	1.86E+08
2.25	1.02E+07
2.75	6.87E+08
3.5	1.26E+06
5	1.54E+05
7	1.69E-02
9.5	2.64E-03
TOTAL	2.47E+11

Note:

1. Activity based on an accumulation period of 12 weeks, an active resin volume of 9.04 m^3, and no post-accumulation radioactive decay.

Table 12.2-45—Radioactivity Content of Steam Generator Blowdown Cation Demineralizer

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
C-14	1.33E-12	Te-131m	1.28E-02	Pu-240	4.80E-06
Na-24	5.99E-02	Te-131	2.90E-03	Pu-241	1.18E-03
Cr-51	1.44E-01	Te-132	3.81E-01	Np-239	5.83E-03
Mn-54	1.58E-01	Te-133m	1.21E-04	Y-90	5.37E-03
Fe-55	1.28E-01	Te-133	2.28E-05	Y-91m	6.10E-04
Fe-59	1.84E-02	Te-134	1.34E-04	Y-91	9.58E-03
Co-58	3.42E-01	Sr-89	6.56E-02	Y-92	8.48E-05
Co-60	5.80E-02	Sr-90	5.56E-03	Y-93	6.59E-05
Zn-65	4.93E-02	Sr-91	9.65E-04	Y-95	4.29E-09
W-187	4.88E-03	Sr-92	3.14E-05	Zr-95	1.05E-02
Rb-86m	4.64E-12	Ba-137m	1.75E+01	Zr-97	1.22E-04
Rb-86	1.02E-01	Ba-139	1.60E-03	Nb-95	1.38E-02
Rb-88	4.32E-03	Ba-140	2.30E-02	Ag-110m	3.03E-05
Rb-89	1.48E-04	Mo-99	8.40E-01	Ag-110	4.03E-07
Cs-134	2.85E+01	Tc-99m	7.78E-01	La-140	2.38E-02
Cs-136	2.03E+00	Ru-103	6.92E-03	La-141	1.69E-05
Cs-137	1.87E+01	Ru-105	3.59E-05	La-142	2.58E-06
Cs-138	2.79E-03	Ru-106	4.25E-03	Pr-143	3.75E-03
Sb-125	1.34E-04	Rh-103m	6.24E-03	Pr-144	1.08E-02
Sb-127	5.58E-05	Rh-105	2.30E-04	Nd-147	1.10E-03
Sb-129	2.38E-06	Rh-106	4.25E-03	Am-241	1.56E-06
Sb-131	1.77E-08	Ce-141	7.09E-03	Cm-242	2.71E-04
Te-127m	5.85E-02	Ce-143	2.88E-04	Cm-244	1.74E-05
Te-127	5.89E-02	Ce-144	1.08E-02	H-3	Negligible
Te-129m	1.18E-01	Pu-238	3.46E-05	Total	7.06E+01
Te-129	7.69E-02	Pu-239	3.50E-06		

Note:

1. Activity based on an accumulation period of 12 weeks, an active resin volume of 9.04 m^3, and no post-accumulation radioactive decay.

Table 12.2-46—Activity Inventory for FPCPS Mixed Bed Demineralizer

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Na 24	7.30E-04	Te127m	2.45E-02
Cr 51	1.72E-01	Te129m	2.26E-02
Mn 54	6.10E-01	Te129	1.47E-02
Fe 55	5.90E-01	Te131m	2.49E-04
Fe 59	2.81E-02	Te131	5.60E-05
Co 58	6.73E-01	Te132	2.67E-02
Co 60	2.78E-01	Te134	6.30E-44
Zn 65	1.76E-01	I129	2.83E-06
Br 83	2.53E-15	I130	3.27E-05
Rb 88	4.43E-13	I131	1.06E+00
Sr 89	7.87E-03	I132	2.95E-02
Sr 90	4.37E-03	I133	1.17E-02
Sr 91	5.80E-08	I134	6.37E-34
Sr 92	5.33E-16	I135	3.18E-06
Y 90	4.33E-03	CS134	1.86E+01
Y 91m	3.63E-08	CS136	2.19E-01
Y 91	1.79E-03	CS137	8.27E+00
Y 92	1.29E-13	BA137M	7.83E+00
Y 93	1.72E-08	BA140	2.64E-03
Zr 95	2.27E-03	LA140	2.76E-03
Nb 95	3.57E-03	CE141	1.11E-03
Mo 99	4.97E-02	CE143	6.07E-06
Tc 99m	4.60E-02	CE144	4.67E-03
Ru103	1.46E-03	PR143	4.53E-04
Ru106	4.30E-03	PR144	4.67E-03
Rh103m	1.31E-03	W187	3.27E-04
Rh106	4.30E-03	NP239	4.20E-04
Ag110m	6.30E-05	H3	5.03E-01

Note:

1. Activity based on a 1 year accumulation period and no post-accumulation radioactive decay.

Table 12.2-47—SFP Water and Fuel Building Airborne Activity Inventory
Sheet 1 of 3

Nuclide	SFP Water Activity (µCi/cm^3)	Fuel Building Airborne Activity (µCi/cm^3)
H 3	5.03E-01	2.28E-06
Na 24	1.13E-06	5.10E-12
Cr 51	6.01E-06	2.72E-11
Mn 54	3.40E-06	1.54E-11
Fe 55	2.57E-06	1.17E-11
Fe 59	6.06E-07	2.75E-12
Co 58	9.50E-06	4.30E-11
Co 60	1.14E-06	5.15E-12
Zn 65	1.08E-06	4.91E-12
Br 83	2.43E-17	1.07E-22
Kr 83m	4.87E-16	2.13E-21
Kr 85m	1.18E-10	5.28E-16
Kr 85	3.70E-03	1.68E-08
Kr 87	3.71E-26	1.60E-31
Kr 88	6.73E-14	2.98E-19
Rb 88	6.79E-14	3.06E-19
Sr 89	1.52E-07	6.89E-13
Sr 90	1.69E-08	7.67E-14
Sr 91	1.42E-10	6.39E-16
Sr 92	4.58E-18	2.02E-23
Y 90	4.69E-09	2.13E-14
Y 91m	7.84E-11	3.56E-16
Y 91	3.01E-08	1.36E-13
Y 92	8.42E-16	3.75E-21
Y 93	3.95E-11	1.78E-16
Zr 95	3.50E-08	1.59E-13
Nb 95	3.67E-08	1.66E-13
Mo 99	1.75E-05	7.92E-11
Tc 99m	9.60E-06	4.38E-11
Ru103	3.59E-08	1.63E-13
Ru106	2.27E-08	1.03E-13

Table 12.2-47—SFP Water and Fuel Building Airborne Activity Inventory Sheet 2 of 3

Nuclide	SFP Water Activity (µCi/cm^3)	Fuel Building Airborne Activity (µCi/cm^3)
Rh103m	3.24E-08	1.47E-13
Rh106	2.27E-08	1.03E-13
Ag110m	3.83E-10	1.74E-15
Te127m	2.41E-07	1.09E-12
TE129M	6.52E-07	2.95E-12
TE129	4.24E-07	1.92E-12
TE131M	1.92E-07	8.70E-13
TE131	4.33E-08	1.96E-13
TE132	7.92E-06	3.59E-11
TE134	2.09E-45	8.64E-51
I129	1.08E-11	4.87E-17
I130	6.09E-08	2.74E-13
I131	1.26E-04	5.72E-10
I132	2.87E-05	1.27E-10
I133	1.29E-05	5.83E-11
I134	1.67E-35	7.03E-41
I135	1.11E-08	4.96E-14
XE131M	2.81E-04	1.27E-09
XE133M	1.39E-04	6.30E-10
XE133	1.67E-02	7.54E-08
XE135M	3.39E-09	1.37E-14
XE135	4.68E-06	2.11E-11
CS134	1.64E-04	7.44E-10
CS136	3.16E-05	1.43E-10
CS137	6.29E-05	2.85E-10
BA137M	5.92E-05	2.69E-10
BA140	2.00E-07	9.04E-13
LA140	6.93E-08	3.15E-13
CE141	3.29E-08	1.49E-13
CE143	4.26E-09	1.93E-14
CE144	2.70E-08	1.22E-13

Table 12.2-47—SFP Water and Fuel Building Airborne Activity Inventory
Sheet 3 of 3

Nuclide	SFP Water Activity ($\mu Ci/cm^3$)	Fuel Building Airborne Activity ($\mu Ci/cm^3$)
PR143	3.19E-08	1.44E-13
PR144	2.70E-08	1.22E-13
W187	3.17E-07	1.43E-12
NP239	1.73E-07	7.81E-13

Note:

1. Activity based on 1 year operation and no post-accumulation radioactive decay.

Table 12.2-48—Photon Spectra for SFP Water and Fuel Building Air

Energy (MeV)	Photon Spectra for SFP Water Activity (MeV/sec-m^3)	Photon Spectra for Fuel Building Airborne Activity (MeV/sec-m^3)
0.01	1.68E+05	7.61E-01
0.025	2.18E+05	9.85E-01
0.0375	9.20E+06	4.17E+01
0.0575	1.21E+04	5.47E-02
0.085	1.87E+07	8.45E+01
0.125	5.21E+04	2.37E-01
0.225	5.11E+05	2.31E+00
0.375	1.62E+06	7.34E+00
0.575	7.61E+06	3.44E+01
0.85	7.08E+06	3.20E+01
1.25	2.25E+06	1.02E+01
1.75	5.01E+04	2.23E-01
2.25	4.19E+04	1.86E-01
2.75	1.17E+05	5.26E-01
3.5	1.03E+02	4.64E-04
5	1.49E+00	6.72E-06
7	6.04E-06	2.74E-11
9.5	9.41E-07	4.27E-12
Total	4.76E+07	2.15E+02

Note:

1. Activity based on 1 year operation and no post-accumulation radioactive decay.

Table 12.2-49—Activity Inventory for Group I Liquid Waste Storage Tanks and Sludge Tank

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Kr-83m	9.08E-04	Te-129m	1.36E-03	Y-91m	7.30E-05
Kr-85m	1.16E-06	Te-129	9.08E-04	Y-91	8.39E-05
Kr-85	2.01E-10	Te-131m	1.26E-03	Y-92	1.16E-05
Xe-131m	9.29E-04	Te-131	2.93E-04	Y-93	7.89E-06
Xe-133m	6.00E-03	Te-132	2.50E-02	Y-95	5.85E-09
Xe-133	1.17E-01	Te-133m	4.10E-05	Zr-95	8.96E-05
Xe-135m	9.67E-03	Te-133	9.74E-06	Zr-97	1.35E-05
Xe-135	6.28E-02	Te-134	5.59E-05	Nb-95	9.23E-05
Br-83	9.08E-04	Sr-89	6.16E-04	Ag-110m	1.94E-07
Br-84	1.06E-04	Sr-90	3.21E-05	Ag-110	2.59E-09
Br-85	1.16E-06	Sr-91	1.17E-04	La-140	3.86E-04
I-129	4.54E-08	Sr-92	5.64E-06	La-141	2.59E-06
I-130	7.38E-03	Ba-137m	1.01E-01	La-142	6.18E-07
I-131	5.98E-01	Ba-139	4.08E-04	Pr-143	8.12E-05
I-132	3.48E-02	Ba-140	5.37E-04	Pr-144	6.81E-05
I-133	3.07E-01	Mo-99	6.05E-02	Nd-147	2.91E-05
I-134	2.59E-03	Tc-99m	5.42E-02	Am-241	7.79E-09
I-135	6.28E-02	Ru-103	7.34E-05	Cm-242	1.84E-06
Rb-86m	6.10E-11	Ru-105	5.29E-06	Cm-244	1.01E-07
Rb-86	1.74E-03	Ru-106	2.64E-05	C-14	7.67E-15
Rb-88	3.64E-03	Rh-103m	6.61E-05	Na-24	6.65E-03
Rb-89	1.44E-04	Rh-105	2.13E-05	Cr-51	1.86E-03
Cs-134	1.69E-01	Rh-106	2.64E-05	Mn-54	9.83E-04
Cs-136	4.61E-02	Ce-141	8.35E-05	Fe-55	7.50E-04
Cs-137	1.07E-01	Ce-143	2.76E-05	Fe-59	1.81E-04
Cs-138	1.42E-03	Ce-144	6.81E-05	Co-58	2.80E-03
Sb-125	7.86E-07	Pu-238	1.98E-07	Co-60	3.36E-04
Sb-127	3.29E-06	Pu-239	2.01E-08	Zn-65	3.14E-04
Sb-129	3.55E-07	Pu-240	2.77E-08	W-187	5.01E-04
Sb-131	1.20E-08	Pu-241	6.82E-06	H-3	9.88E-01
Te-127m	4.28E-04	Np-239	4.55E-04		
Te-127	6.19E-04	Y-90	1.83E-05		

Note:

1. Activity based on a continuous flow of un-decayed RCS coolant at a flow rate of 2.6 gpm and a total tank volume of 18,500 gallons with decay during processing

and no decay thereafter. Noble gases not used in the shielding analyses as they are processed through gaseous waste processing system.

Table 12.2-50—Activity Inventory for Liquid Waste Processing System Evaporator and Evaporator Column – Liquid Phase

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br-83	1.07E-04	Te-133	5.42E-09	Y-92	8.38E-06
Br-84	3.56E-10	Te-134	3.87E-09	Y-93	1.94E-05
Br-85	1.09E-63	Sr-89	3.81E-02	Y-95	4.57E-25
I-129	6.35E-06	Sr-90	4.47E-03	Zr-95	6.36E-03
I-130	2.23E-02	Sr-91	2.69E-04	Zr-97	5.24E-05
I-131	1.05E+01	Sr-92	1.01E-06	Nb-95	8.93E-03
I-132	2.56E-01	Ba-137m	1.41E+01	Ag-110m	2.23E-05
I-133	1.37E+00	Ba-139	4.33E-06	Ag-110	2.96E-07
I-134	1.46E-06	Ba-140	1.27E-02	La-140	1.31E-02
I-135	8.84E-02	Mo-99	5.39E-01	La-141	1.32E-06
Rb-86	5.38E-02	Tc-99m	5.14E-01	La-142	1.18E-08
Rb-88	7.90E-13	Ru-103	3.85E-03	Pr-143	2.06E-03
Rb-89	7.89E-16	Ru-105	3.54E-06	Pr-144	7.98E-03
Cs-134	2.20E+01	Ru-106	3.21E-03	Nd-147	6.26E-04
Cs-136	1.11E+00	Rh-103m	3.47E-03	Am-241	1.40E-06
Cs-137	1.49E+01	Rh-105	1.35E-04	Cm-242	1.91E-04
Cs-138	5.55E-09	Rh-106	3.21E-03	Cm-244	1.40E-05
Sb-125	1.05E-04	Ce-141	3.84E-03	C-14	1.07E-12
Sb-127	3.62E-05	Ce-143	1.62E-04	Na-24	2.36E-02
Sb-129	2.23E-07	Ce-144	7.98E-03	Cr-51	7.63E-02
Sb-131	3.52E-16	Pu-238	2.80E-05	Mn-54	1.17E-01
Te-127m	3.89E-02	Pu-239	2.82E-06	Fe-55	9.93E-02
Te-127	3.86E-02	Pu-240	3.87E-06	Fe-59	1.04E-02
Te-129m	6.42E-02	Pu-241	9.44E-04	Co-58	2.09E-01
Te-129	4.18E-02	Np-239	3.68E-03	Co-60	4.57E-02
Te-131m	7.03E-03	Y-90	4.35E-03	Zn-65	3.58E-02
Te-131	1.58E-03	Y-91m	1.71E-04	W-187	2.44E-03
Te-132	2.47E-01	Te-133	5.42E-09	H-3	9.88E-01
Te-133m	3.23E-08	Y-91	5.71E-03		

Notes:

1. Liquid waste processing system activity based on 18 batches of Group I liquid waste being processed within 160 days. Combined liquid volume for the evaporator (3.94 m^3) and the evaporator column (4.92 m^3) is approximately 9 m^3.

2. Credit is taken for decay during the fill time of the liquid waste tanks of approximately 237 hrs at 1.3 gpm (16 batches) and approximately 119 hrs at 2.6 gpm (2 batches) and the process time of approximately 18 hours per batch during the entire 160 day processing period and no decay thereafter.

3. Steam spectra is 1/10,000 of liquid distributed over 18 m^3 combined gaseous volume for evaporator (7.87 m^3) and the evaporator column (9.84 m^3).

Table 12.2-51—Activity Inventory for Liquid Waste Concentrate Tank

Nuclide	Inventory (Ci/m^3)	Nuclide	Inventory (Ci/m^3)	Nuclide	Inventory (Ci/m^3)
Br-83	2.83E-05	Te-133	1.44E-09	Y-93	5.15E-06
Br-84	9.43E-11	Te-134	1.02E-09	Y-95	1.21E-25
Br-85	2.89E-64	Sr-89	1.12E-02	Zr-95	2.01E-03
I-129	6.35E-06	Sr-90	4.40E-03	Zr-97	1.39E-05
I-130	5.89E-03	Sr-91	7.12E-05	Nb-95	3.03E-03
I-131	2.77E+00	Sr-92	2.68E-07	Ag-110m	1.30E-05
I-132	6.77E-02	Ba-137m	1.38E+01	Ag-110	1.73E-07
I-133	3.63E-01	Ba-139	1.15E-06	La-140	3.47E-03
I-134	3.87E-07	Ba-140	3.37E-03	La-141	3.48E-07
I-135	2.34E-02	Mo-99	1.43E-01	La-142	3.11E-09
Rb-86	1.43E-02	Tc-99m	1.36E-01	Pr-143	5.46E-04
Rb-88	2.09E-13	Ru-103	1.07E-03	Pr-144	4.93E-03
Rb-89	2.09E-16	Ru-105	9.37E-07	Nd-147	1.66E-04
Cs-134	1.80E+01	Ru-106	2.18E-03	Am-241	2.36E-06
Cs-136	2.94E-01	Rh-103m	9.69E-04	Cm-242	9.20E-05
Cs-137	1.46E+01	Rh-105	3.56E-05	Cm-244	1.37E-05
Cs-138	1.47E-09	Rh-106	2.18E-03	C-14	1.07E-12
Sb-125	9.01E-05	Ce-141	1.05E-03	Na-24	6.25E-03
Sb-127	9.59E-06	Ce-143	4.30E-05	Cr-51	2.05E-02
Sb-129	5.91E-08	Ce-144	4.93E-03	Mn-54	7.49E-02
Sb-131	9.32E-17	Pu-238	2.84E-05	Fe-55	8.43E-02
Te-127m	1.54E-02	Pu-239	2.82E-06	Fe-59	2.97E-03
Te-127	1.52E-02	Pu-240	3.87E-06	Co-58	6.85E-02
Te-129m	1.75E-02	Pu-241	9.16E-04	Co-60	4.21E-02
Te-129	1.14E-02	Np-239	9.75E-04	Zn-65	2.08E-02
Te-131m	1.86E-03	Y-90	4.37E-03	W-187	6.45E-04
Te-131	4.19E-04	Y-91m	4.52E-05	H-3	9.88E-01
Te-132	6.54E-02	Y-91	1.75E-03		
Te-133m	8.56E-09	Y-92	2.22E-06		

Notes:

1. Activity based on the processing of 72 liquid waste tanks in four batches (18 liquid waste tanks per evaporator concentrate transfer) over a period of about 22 months, with buildup and decay during processing and no decay thereafter. Noble gas decay products are excluded from the source term since they would be transferred to the monitoring tank with the evaporator steam.

Table 12.2-52—Photon Spectra for Liquid Waste Concentrate Tank

Energy (MeV)	Photon Spectra ($MeV/sec\text{-}m^3$)
0.01	5.15E+07
0.025	1.65E+08
0.0375	1.52E+09
0.0575	1.03E+08
0.085	2.61E+08
0.125	6.56E+08
0.225	3.15E+09
0.375	3.07E+10
0.575	7.96E+11
0.85	5.10E+11
1.25	6.58E+10
1.75	6.64E+08
2.25	1.50E+08
2.75	6.15E+08
3.5	6.46E+05
5	7.78E+03
7	8.95E-02
9.5	1.40E-02
Total	1.41E+12

Notes:

1. Activity based on the processing of 72 liquid waste tanks in four batches (18 liquid waste tanks per evaporator concentrate transfer) over a period of about 22 months, with buildup and decay during processing and no decay thereafter. Noble gas decay products are excluded from the source term since they would be transferred to the monitoring tank with the evaporator steam.

Table 12.2-53—Activity Inventory for Liquid Waste Monitoring Tanks and Distillate Tank

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br-83	1.37E-09	Te-133	6.97E-17	Y-93	2.50E-13
Br-84	4.58E-15	Te-134	4.97E-17	Y-95	5.87E-33
Br-85	1.40E-68	Sr-89	6.10E-11	Zr-95	8.89E-12
I-129	4.54E-12	Sr-90	3.21E-12	Zr-97	6.68E-13
I-130	2.86E-07	Sr-91	3.46E-12	Nb-95	9.23E-12
I-131	5.62E-05	Sr-92	1.30E-14	Ag-110m	1.94E-14
I-132	4.59E-07	Ba-137m	1.01E-08	Ag-110	2.58E-16
I-133	1.73E-05	Ba-139	5.57E-14	La-140	4.22E-11
I-134	1.87E-11	Ba-140	5.16E-11	La-141	1.69E-14
I-135	1.14E-06	Mo-99	5.03E-09	La-142	1.51E-16
Rb-86	1.70E-10	Tc-99m	4.78E-09	Pr-143	7.91E-12
Rb-88	1.02E-20	Ru-103	7.24E-12	Pr-144	6.80E-12
Rb-89	1.01E-23	Ru-105	4.55E-14	Nd-147	2.78E-12
Cs-134	1.69E-08	Ru-106	2.63E-12	Am-241	7.81E-16
Cs-136	4.43E-09	Rh-103m	6.53E-12	Cm-242	1.83E-13
Cs-137	1.07E-08	Rh-105	1.56E-12	Cm-244	1.01E-14
Cs-138	7.13E-17	Rh-106	2.63E-12	C-14	7.67E-22
Sb-125	7.86E-14	Ce-141	8.22E-12	Na-24	3.03E-10
Sb-127	2.89E-13	Ce-143	1.92E-12	Cr-51	1.83E-10
Sb-129	2.87E-15	Ce-144	6.80E-12	Mn-54	9.81E-11
Sb-131	4.53E-24	Pu-238	1.98E-14	Fe-55	7.49E-11
Te-127m	4.26E-11	Pu-239	2.01E-15	Fe-59	1.79E-11
Te-127	4.77E-11	Pu-240	2.77E-15	Co-58	2.78E-10
Te-129m	1.34E-10	Pu-241	6.82E-13	Co-60	3.36E-11
Te-129	8.73E-11	Np-239	3.67E-11	Zn-65	3.13E-11
Te-131m	8.46E-11	Y-90	2.07E-12	W-187	3.04E-11
Te-131	1.90E-11	Y-91m	2.20E-12	H-3	9.88E-01
Te-132	2.14E-09	Y-91	8.37E-12		
Te-133m	4.16E-16	Y-92	1.08E-13		

Note:

1. Activity based on the processing of a single waste tank with the liquid waste tank being filled at a rate of 26,500 gal/wk, a transfer rate from the liquid waste storage tank to the evaporator of 1050 gal/hr, and immediate transfer to the monitoring tank with buildup and decay during processing and no decay thereafter.

Table 12.2-54—Photon Spectra for Liquid Waste Monitoring Tanks and Distillate Tank

Energy (MeV)	Photon Spectra ($MeV/sec\text{-}m^3$)
0.01	4.87E+01
0.025	2.42E+03
0.0375	6.35E+02
0.0575	1.96E+00
0.085	4.36E+03
0.125	3.28E+01
0.225	3.87E+04
0.375	6.23E+05
0.575	4.39E+05
0.85	9.70E+04
1.25	8.31E+04
1.75	1.84E+04
2.25	3.13E+03
2.75	5.06E+01
3.5	2.84E-02
5	4.00E-04
7	9.52E-11
9.5	1.49E-11
Total	1.31E+06

Note:

1. Activity based on the processing of a single waste tank with the liquid waste tank being filled at a rate of 26,500 gal/wk, a transfer rate from the liquid waste storage tank to the evaporator of 1050 gal/hr, and immediate transfer to the monitoring tank with buildup and decay during processing and no decay thereafter.

Table 12.2-55—Activity Inventory for Charcoal Holdup System

Nuclide	Activity (Ci/m^3)
Kr83m	1.22E+00
Kr85m	7.39E+00
Kr85	1.14E+02
Kr87	2.14E+00
Kr88	1.09E+01
Kr89	9.42E-03
Kr90	2.75E-04
Rb88	1.19E+01
Rb89	5.08E-02
Rb90m	2.94E-04
Rb90	1.38E-03
Sr89	1.26E-02
Xe131m	2.79E+01
Xe133m	2.84E+01
Xe133	2.20E+03
Xe135m	2.44E+00
Xe135	5.85E+01
Xe137	2.14E-02
Xe138	2.69E-01
Xe139	4.94E-04
Cs135	1.15E-06
Cs137	1.68E-03
Cs138	7.81E-01
Cs139	7.18E-03
Ba137m	1.59E-03
Ba139	4.64E-02

Note:

1. Activity based on a degasification flow rate of 158,730 lb/hr (20 kg/sec) to the purge gas circuit and instant transfer of the noble gases to the charcoal holdup beds with a holdup (decay) period of 40 hours for kryptons and 27.7 days for xenons.

Table 12.2-56—Activity Inventory for Purge Gas Circuit

Nuclide	Activity (Ci/ m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Kr83m	4.35E-02	Xe133m	9.27E-01	Rb89	3.92E-04
Kr85m	2.81E-01	Xe133	6.64E+01	Cs137	7.66E-09
Kr85	3.78E+00	Xe135m	1.56E-02	Cs138	9.70E-03
Kr87	9.00E-02	Xe135	1.99E+00	Sr89	6.49E-07
Kr88	4.30E-01	Xe137	1.00E-03	Ba137m	7.10E-09
Kr89	4.42E-04	Xe138	1.23E-02		
Xe131m	7.64E-01	Rb88	3.75E-01		

Note:

1. Activity based on equilibrium conditions for a degasification flow rate into the purge gas circuit of 158,730 lb/hr (20 kg/sec) and a removal rate equal to the surge gas flow rate to the delay beds of 0.0765 lb/sec.

Table 12.2-57—Activity Inventory for Concentrate Buffer Tank and Waste Drum
Sheet 1 of 3

Nuclide	Concentrate Buffer Tank (Ci/m^3)	Waste Drum (Ci/m^3)
Br-83	4.79E-02	1.62E-01
Br-84	5.62E-03	1.90E-02
Br-85	6.09E-05	2.06E-04
I-129	1.33E-03	4.50E-03
I-130	3.95E-01	1.33E+00
I-131	9.33E+01	3.15E+02
I-132	2.60E+00	8.79E+00
I-133	1.68E+01	5.67E+01
I-134	1.36E-01	4.61E-01
I-135	3.33E+00	1.13E+01
Rb-86m	1.63E-09	5.49E-09
Rb-86	2.89E-01	9.74E-01
Rb-88	9.70E-02	3.28E-01
Rb-89	3.83E-03	1.29E-02
Cs-134	9.24E+02	3.12E+03
Cs-136	5.58E+00	1.89E+01
Cs-137	1.46E+03	4.93E+03
Cs-138	3.78E-02	1.28E-01
Sb-125	1.03E-02	3.49E-02
Sb-127	2.99E-04	1.01E-03
Sb-129	1.86E-05	6.28E-05
Sb-131	6.24E-07	2.11E-06
Te-127m	7.36E-01	2.48E+00
Te-127	7.31E-01	2.47E+00
Te-129m	7.49E-01	2.53E+00
Te-129	4.88E-01	1.65E+00
Te-131m	7.20E-02	2.43E-01
Te-131	1.67E-02	5.63E-02
Te-132	2.06E+00	6.95E+00
Te-133m	2.14E-03	7.23E-03
Te-133	5.09E-04	1.72E-03

Table 12.2-57—Activity Inventory for Concentrate Buffer Tank and Waste Drum
Sheet 2 of 3

Nuclide	Concentrate Buffer Tank (Ci/m^3)	Waste Drum (Ci/m^3)
Te-134	2.92E-03	9.86E-03
Sr-89	4.96E-01	1.68E+00
Sr-90	8.55E-01	2.89E+00
Sr-91	6.14E-03	2.08E-02
Sr-92	2.95E-04	9.95E-04
Ba-137m	1.38E+03	4.66E+03
Ba-139	1.87E-02	6.31E-02
Ba-140	1.22E-01	4.12E-01
Mo-99	4.55E+00	1.54E+01
Tc-99m	4.17E+00	1.41E+01
Ru-103	4.68E-02	1.58E-01
Ru-105	2.65E-04	8.95E-04
Ru-106	1.50E-01	5.05E-01
Rh-103m	4.22E-02	1.42E-01
Rh-105	1.27E-03	4.28E-03
Rh-106	1.50E-01	5.05E-01
Ce-141	4.45E-02	1.50E-01
Ce-143	1.61E-03	5.42E-03
Ce-144	3.01E-01	1.02E+00
Pu-238	5.79E-03	1.96E-02
Pu-239	5.87E-04	1.98E-03
Pu-240	8.05E-04	2.72E-03
Pu-241	1.66E-01	5.62E-01
Np-239	3.18E-02	1.07E-01
Y-90	8.54E-01	2.88E+00
Y-91m	3.84E-03	1.30E-02
Y-91	7.92E-02	2.68E-01
Y-92	6.10E-04	2.06E-03
Y-93	4.15E-04	1.40E-03
Y-95	3.06E-07	1.03E-06
Zr-95	9.14E-02	3.09E-01

Table 12.2-57—Activity Inventory for Concentrate Buffer Tank and Waste Drum
Sheet 3 of 3

Nuclide	Concentrate Buffer Tank (Ci/m^3)	Waste Drum (Ci/m^3)
Zr-97	7.20E-04	2.43E-03
Nb-95	1.42E-01	4.79E-01
Ag-110m	7.56E-04	2.55E-03
Ag-110	1.01E-05	3.40E-05
La-140	1.26E-01	4.26E-01
La-141	1.30E-04	4.40E-04
La-142	3.05E-05	1.03E-04
Pr-143	2.00E-02	6.76E-02
Pr-144	3.01E-01	1.02E+00
Nd-147	5.84E-03	1.97E-02
Am-241	1.28E-03	4.32E-03
Cm-242	4.68E-03	1.58E-02
Cm-244	2.55E-03	8.60E-03
C-14	8.74E-13	2.95E-12
Na-24	3.54E-01	1.19E+00
Cr-51	8.52E-01	2.88E+00
Mn-54	4.76E+00	1.61E+01
Fe-55	9.46E+00	3.20E+01
Fe-59	1.31E-01	4.44E-01
Co-58	3.15E+00	1.06E+01
Co-60	6.21E+00	2.10E+01
Zn-65	1.19E+00	4.03E+00
W-187	2.75E-02	9.30E-02
H-3	9.88E-01	0.00E+00

Note:

1. Concentrate buffer tank assumed to be filled with evaporator concentrates and spent resins from the coolant purification system. The concentrate buffer mix of concentrates and resins is equivalent to the annual processing of 22 m^3 of evaporator concentrates and 5 m^3 of resins. After drying, the mix in the waste drum consists of 4.4 m^3 of concentrates and 3.6 m^3 of resins. No correction was made for radioactive decay after tank/drum filling.

Table 12.2-58—Photon Spectra for Concentrate Buffer Tank and Waste Drum

Energy (MeV)	Concentrate Buffer Tank ($MeV/sec-m^3$)	Waste Drum ($MeV/sec-m^3$)
0.01	3.61E+09	1.22E+10
0.025	5.84E+09	1.97E+10
0.0375	1.36E+11	4.59E+11
0.0575	2.28E+09	7.70E+09
0.085	8.43E+09	2.85E+10
0.125	2.14E+10	7.23E+10
0.225	1.01E+11	3.40E+11
0.375	1.07E+12	3.62E+12
0.575	5.58E+13	1.88E+14
0.85	2.63E+13	8.88E+13
1.25	3.52E+12	1.19E+13
1.75	6.72E+10	2.27E+11
2.25	1.22E+10	4.11E+10
2.75	3.71E+10	1.25E+11
3.5	2.45E+08	8.28E+08
5	3.18E+07	1.07E+08
7	1.37E+01	4.64E+01
9.5	2.14E+00	7.24E+00
Total	8.71E+13	2.94E+14

Note:

1. Concentrate buffer tank assumed to be filled with evaporator concentrates and spent resins from the coolant purification system. The concentrate buffer mix of concentrates and resins is equivalent to the annual processing of 22 m^3 of evaporator concentrates and 5 m^3 of resins. After drying, the mix in the waste drum consists of 4.4 m^3 of concentrates and 3.6 m^3 of resins. No correction was made for radioactive decay after tank/drum filling.

Table 12.2-59—Activity Inventory for Water Phase of Coolant Storage Tank

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br83	7.18E-04	Y90	8.75E-07	Te134	5.03E-05
Br84	8.67E-05	Y91m	3.95E-05	Ba137m	5.39E-02
Br85	9.39E-07	Y91	7.86E-06	Ba140	5.76E-05
I129	3.92E-09	Y92	8.82E-06	La140	1.95E-05
I130	3.06E-03	Y93	4.10E-06	Ce141	8.33E-06
I131	6.21E-02	Zr95	8.77E-06	Ce143	6.28E-06
I132	1.09E-02	Nb95	8.84E-06	Ce144	6.54E-06
I133	8.73E-02	Mo99	9.50E-03	Pr143	8.30E-06
I134	2.11E-03	Tc99m	6.30E-03	Pr144	6.54E-06
I135	3.74E-02	Ru103	7.30E-06	Np239	7.64E-05
Rb88	3.32E-01	Ru106	2.53E-06	Na24	2.61E-03
Rb89	8.71E-04	Rh103m	6.57E-06	Cr51	1.86E-04
Cs134	9.07E-02	Rh106	2.53E-06	Mn54	9.54E-05
Cs136	2.78E-02	Ag110m	1.87E-08	Fe55	7.18E-05
Cs137	5.72E-02	Te127m	4.14E-05	Fe59	1.80E-05
Cs138	1.16E-02	Te129m	1.37E-04	Co58	2.75E-04
Sr89	6.58E-05	Te129	1.08E-04	Co60	3.18E-05
Sr90	3.07E-06	Te131m	3.06E-04	Zn65	3.05E-05
Sr91	6.40E-05	Te131	7.69E-05	W187	1.46E-04
Sr92	4.87E-06	Te132	3.65E-03	H3	9.86E-01

Note:

1. Activity based on a flow rate of 3.1 gpm of unpurified reactor coolant and a flow rate of 37 gpm of purified reactor coolant and no post-accumulation radioactive decay. Source volume is 4,061 ft^3 (115 m^3).

Table 12.2-60—Photon Spectra for Water Phase of Coolant Storage Tank

Energy (MeV)	Photon Spectra ($MeV/sec-m^3$)
0.01	9.40E+05
0.025	5.33E+06
0.0375	1.36E+07
0.0575	9.63E+06
0.085	1.06E+07
0.125	3.60E+07
0.225	1.88E+08
0.375	9.32E+08
0.575	6.00E+09
0.85	5.94E+09
1.25	3.95E+09
1.75	5.54E+09
2.25	3.16E+08
2.75	1.11E+09
3.5	2.48E+08
5	9.53E+07
7	9.17E-05
9.5	1.43E-05
Total	2.44E+10

Note:

1. Activity based on a flow rate of 3.1 gpm of unpurified reactor coolant and a flow rate of 37 gpm of purified reactor coolant and no post-accumulation radioactive decay. Source volume is 4,061 ft^3 (115 m^3).

Table 12.2-61—Activity Inventory for Gas Phase of Coolant Storage Tank

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Kr83m	4.35E-02	Xe133m	9.27E-01	Rb89	3.92E-04
Kr85m	2.81E-01	Xe133	6.64E+01	Cs137	7.66E-09
Kr85	3.78E+00	Xe135m	1.56E-02	Cs138	9.70E-03
Kr87	9.00E-02	Xe135	1.99E+00	Sr89	6.49E-07
Kr88	4.30E-01	Xe137	1.00E-03	Ba137m	7.10E-09
Kr89	4.42E-04	Xe138	1.23E-02		
Xe131m	7.64E-01	Rb88	3.75E-01		

Note:

1. Activity concentration is the same as the purge gas circuit. Source volume is conservatively assumed to be 4,061 ft^3 (115 m^3).

Table 12.2-62—Photon Spectra for Gas Phase of Coolant Storage Tank

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	6.92E+08
0.03	8.49E+08
0.04	3.68E+10
0.06	1.47E+04
0.09	7.44E+10
0.13	8.92E+06
0.23	1.98E+10
0.38	1.61E+09
0.58	2.13E+09
0.85	4.36E+09
1.25	2.37E+09
1.75	9.48E+09
2.25	2.27E+10
2.75	2.41E+09
3.50	3.36E+08
5.00	1.07E+08
7.00	0.00E+00
9.50	0.00E+00
Total	1.78E+11

Note:

1. Activity concentration is the same as the purge gas circuit. Source volume is conservatively assumed to be 4,061 ft^3 (115 m^3).

Table 12.2-63—Activity Inventory for Coolant Purification System (CPS2) Mixed Bed Demineralizer

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br-83	3.12E-02	Te-132	5.18E+00	Y-91m	7.02E-03
Br-84	8.35E-04	Te-133m	6.18E-04	Y-91	2.10E-01
Br-85	8.15E-07	Te-133	1.14E-04	Y-92	8.08E-04
I-129	4.33E-04	Te-134	6.38E-04	Y-93	7.53E-04
I-130	6.87E-01	Sr-89	1.44E+00	Y-95	1.68E-08
I-131	2.18E+02	Sr-90	3.35E-01	Zr-95	2.40E-01
I-132	5.65E+00	Sr-91	1.11E-02	Zr-97	1.52E-03
I-133	3.30E+01	Sr-92	2.40E-04	Nb-95	3.70E-01
I-134	3.42E-02	Ba-137m	3.28E+03	Ag-110m	1.30E-03
I-135	4.50E+00	Ba-139	1.44E-02	Ag-110	1.73E-05
Rb-86m	5.30E-11	Ba-140	3.22E-01	La-140	3.37E-01
Rb-86	4.62E+00	Mo-99	1.14E+01	La-141	1.48E-04
Rb-88	9.97E-01	Tc-99m	1.07E+01	La-142	1.56E-05
Rb-89	2.23E-03	Ru-103	1.25E-01	Pr-143	5.28E-02
Cs-134	4.73E+03	Ru-105	3.30E-04	Pr-144	4.78E-01
Cs-136	8.83E+01	Ru-106	2.02E-01	Am-241	5.67E-05
Cs-137	3.47E+03	Rh-103m	1.13E-01	Na-24	7.13E-01
Cs-138	6.27E-02	Rh-105	3.07E-03	Cr-51	2.25E+00
Sb-125	7.37E-03	Rh-106	2.02E-01	Mn-54	7.22E+00
Sb-127	7.62E-04	Ce-141	1.18E-01	Fe-55	6.97E+00
Sb-129	2.17E-05	Ce-143	3.77E-03	Fe-59	3.52E-01
Sb-131	7.48E-08	Ce-144	4.78E-01	Co-58	8.25E+00
Te-127m	1.78E+00	Pu-238	2.07E-03	Co-60	3.28E+00
Te-127	1.75E+00	Pu-239	2.13E-04	Zn-65	2.10E+00
Te-129m	2.00E+00	Pu-240	2.92E-04	W-187	6.33E-02
Te-129	1.30E+00	Pu-241	7.02E-02	H-3	1.00E+00
Te-131m	1.67E-01	Np-239	7.85E-02		
Te-131	3.77E-02	Y-90	3.33E-01		

Note:

1. Activity is based on a coolant purification flow rate of 37 gpm and does not account for any activity removal by the mechanical pre-filters. Activity based on a one year operating period and no post-accumulation radioactive decay.

Table 12.2-64—Photon Spectra for Coolant Purification System (CPS2) Mixed Bed Demineralizer

Energy (MeV)	Photon Spectra at End of One-Year Operation (MeV/sec)
0.010	9.12E+09
0.03	1.40E+10
0.038	3.62E+11
0.0575	2.87E+10
0.085	3.48E+10
0.125	5.57E+10
0.225	4.65E+11
0.375	2.95E+12
0.575	2.02E+14
0.85	1.35E+14
1.25	1.70E+13
1.75	1.21E+11
2.25	1.98E+10
2.75	7.67E+10
3.5	8.43E+08
5	2.85E+08
7	6.90E-02
9.5	1.06E-02
Total	3.57E+14

Note:

1. Activity is based on a coolant purification flow rate of 37 gpm and does not account for any activity removal by the mechanical pre-filters. Activity based on a one year operating period and no post-accumulation radioactive decay.

Table 12.2-65—Activity Inventory for Coolant Treatment System Vapor Compressor

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Kr83m	2.70E-02	Rb89	4.36E-04	Te129m	1.37E-05
Kr85m	2.49E-01	Cs134	4.54E-02	Te129	1.08E-05
Kr85	5.26E+00	Cs136	1.39E-02	Te131m	3.07E-05
Kr87	4.68E-02	Cs137	2.86E-02	Te131	7.69E-06
Kr88	3.16E-01	Cs138	5.79E-03	Te132	3.65E-04
Kr89	1.44E-04	Sr89	6.59E-06	Te134	5.04E-06
Xe131m	1.05E+00	Sr90	3.08E-07	Ba137m	5.44E-03
Xe133m	1.23E+00	Sr91	6.41E-06	Ba140	5.77E-06
Xe133	9.06E+01	Sr92	4.87E-07	La140	1.96E-06
Xe135m	1.13E-02	Y90	8.76E-08	Ce141	8.34E-07
Xe135	2.18E+00	Y91m	3.95E-06	Ce143	6.28E-07
Xe137	3.29E-04	Y91	7.87E-07	Ce144	6.55E-07
Xe138	4.38E-03	Y92	8.83E-07	Pr143	8.31E-07
Br83	7.19E-05	Y93	4.10E-07	Pr144	6.55E-07
Br84	8.67E-06	Zr95	8.78E-07	Np239	7.64E-06
Br85	9.38E-08	Nb95	8.84E-07	Na24	2.61E-04
I129	4.04E-10	Mo99	9.50E-04	Cr51	1.86E-05
I130	3.06E-04	Tc99m	6.31E-04	Mn54	9.55E-06
I131	6.22E-03	Ru103	7.31E-07	Fe55	7.19E-06
I132	1.09E-03	Ru106	2.53E-07	Fe59	1.80E-06
I133	8.74E-03	Rh103m	6.58E-07	Co58	2.75E-05
I134	2.11E-04	Rh106	2.53E-07	Co60	3.17E-06
I135	3.75E-03	Ag110m	1.87E-09	Zn65	3.05E-06
Rb88	1.66E-01	Te127m	4.14E-06	W187	1.45E-05

Note:

1. Activity based on a flow rate of 37 gpm and no post-accumulation radioactive decay.

Table 12.2-66—Photon Spectra for Coolant Treatment System Vapor Compressor

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	9.25E+08
0.03	1.14E+09
0.04	5.01E+10
0.06	4.40E+06
0.09	1.01E+11
0.13	1.11E+07
0.23	2.15E+10
0.38	1.34E+09
0.58	3.80E+09
0.85	4.45E+09
1.25	2.45E+09
1.75	5.32E+09
2.25	1.65E+10
2.75	1.30E+09
3.5	1.55E+08
5	4.79E+07
7	9.17E-06
9.5	1.43E-06
Total	2.10E+11

Note:

1. Activity based on a flow rate of 37 gpm and no post-accumulation radioactive decay.

Table 12.2-67—Activity Inventory for Coolant Treatment System Recuperative Boric Acid Cooler and Electrical Pre-Heater

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br83	6.68E-05	Y90	6.26E-05	Te134	1.37E-06
Br84	1.79E-06	Y91m	1.50E-05	Ba137m	5.99E+00
Br85	1.74E-09	Y91	1.52E-04	Ba140	5.81E-04
I129	8.95E-08	Y92	1.73E-06	La140	5.95E-04
I130	1.47E-03	Y93	1.61E-06	Ce141	1.31E-04
I131	4.43E-01	Zr95	1.63E-04	Ce143	8.06E-06
I132	1.21E-02	Nb95	1.89E-04	Ce144	1.39E-04
I133	7.07E-02	Mo99	2.44E-02	Pr143	9.34E-05
I134	7.32E-05	Tc99m	2.28E-02	Pr144	1.39E-04
I135	9.64E-03	Ru103	1.22E-04	Np239	1.68E-04
Rb88	1.92E-02	Ru106	5.43E-05	Na24	1.52E-03
Rb89	4.29E-05	Rh103m	1.10E-04	Cr51	2.77E-03
Cs134	9.90E+00	Rh106	5.43E-05	Mn54	2.04E-03
Cs136	1.42E+00	Ag110m	3.95E-07	Fe55	1.57E-03
Cs137	6.33E+00	Te127m	8.25E-04	Fe59	3.10E-04
Cs138	1.21E-03	Te129m	2.17E-03	Co58	5.17E-03
Sr89	1.18E-03	Te129	1.41E-03	Co60	6.99E-04
Sr90	6.80E-05	Te131m	3.58E-04	Zn65	6.43E-04
Sr91	2.37E-05	Te131	8.07E-05	W187	1.35E-04
Sr92	5.13E-07	Te132	1.11E-02	H3	1.00E+00

Note:

1. Activity based on a 34 day accumulation period and no post-accumulation radioactive decay.

Table 12.2-68—Photon Spectra for Coolant Treatment System Recuperative Boric Acid Cooler and Electrical Pre-Heater

Energy (MeV)	Photon Spectra (MeV/sec-m^3)
0.01	2.13E+07
0.025	2.95E+07
0.0375	9.36E+08
0.0575	4.41E+08
0.085	3.21E+08
0.125	1.40E+08
0.225	4.63E+09
0.375	1.34E+10
0.575	4.02E+11
0.85	3.19E+11
1.25	8.46E+10
1.75	5.82E+08
2.25	5.92E+07
2.75	2.10E+08
3.5	1.47E+07
5	5.48E+06
7	1.97E-03
9.5	3.07E-04
Total	8.26E+11

Note:

1. Activity based on a 34 day accumulation period and no post-accumulation radioactive decay.

Table 12.2-69—Activity Inventory for the Boric Acid Storage Tanks

Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)	Nuclide	Activity (Ci/m^3)
Br83	3.17E-07	Y91	1.21E-05	Ba140	3.79E-05
Br84	8.91E-13	Y92	2.68E-08	La140	3.96E-05
I129	1.05E-08	Y93	5.61E-08	Ce141	9.56E-06
I130	5.72E-05	Zr95	1.31E-05	Ce143	4.30E-07
I131	2.79E-02	Nb95	1.65E-05	Ce144	1.40E-05
I132	6.83E-04	Mo99	1.43E-03	Pr143	6.15E-06
I133	3.38E-03	Tc99m	1.36E-03	Pr144	1.40E-05
I134	4.06E-09	Ru103	9.10E-06	Np239	9.70E-06
I135	2.42E-04	Ru106	5.63E-06	Na24	6.48E-05
Rb88	9.12E-13	Rh103m	8.20E-06	Cr51	1.97E-04
Cs134	1.09E+00	Rh106	5.63E-06	Mn54	2.08E-04
Cs136	9.31E-02	Ag110m	3.92E-08	Fe55	1.75E-04
Cs137	7.37E-01	Te127m	7.26E-05	Fe59	2.37E-05
Cs138	6.97E-10	Te129m	1.59E-04	Co58	4.25E-04
Sr89	9.18E-05	Te129	1.03E-04	Co60	7.96E-05
Sr90	7.92E-06	Te131m	1.87E-05	Zn65	6.37E-05
Sr91	7.92E-07	Te131	4.22E-06	W187	6.71E-06
Sr92	3.31E-09	Te132	6.60E-04	H-3	1.00E+00
Y90	7.60E-06	Te134	1.14E-11		
Y91m	5.03E-07	Ba137m	6.98E-01		

Table 12.2-70—Photon Spectra for the Boric Acid Storage Tanks

Energy (MeV)	Photon Spectra ($MeV/sec-m^3$)
0.01	2.00E+06
0.025	1.85E+06
0.0375	9.28E+07
0.0575	2.89E+07
0.085	2.09E+07
0.125	8.43E+06
0.225	3.02E+08
0.375	8.66E+08
0.575	4.48E+10
0.85	3.30E+10
1.25	6.70E+09
1.75	1.33E+07
2.25	1.60E+06
2.75	6.75E+06
3.5	7.16E+03
5	8.53E+01
7	2.08E-04
9.5	3.25E-05
Total	8.58E+10

Figure 12.2-1—Nitrogen-16 Concentration Along Reactor Coolant Loop

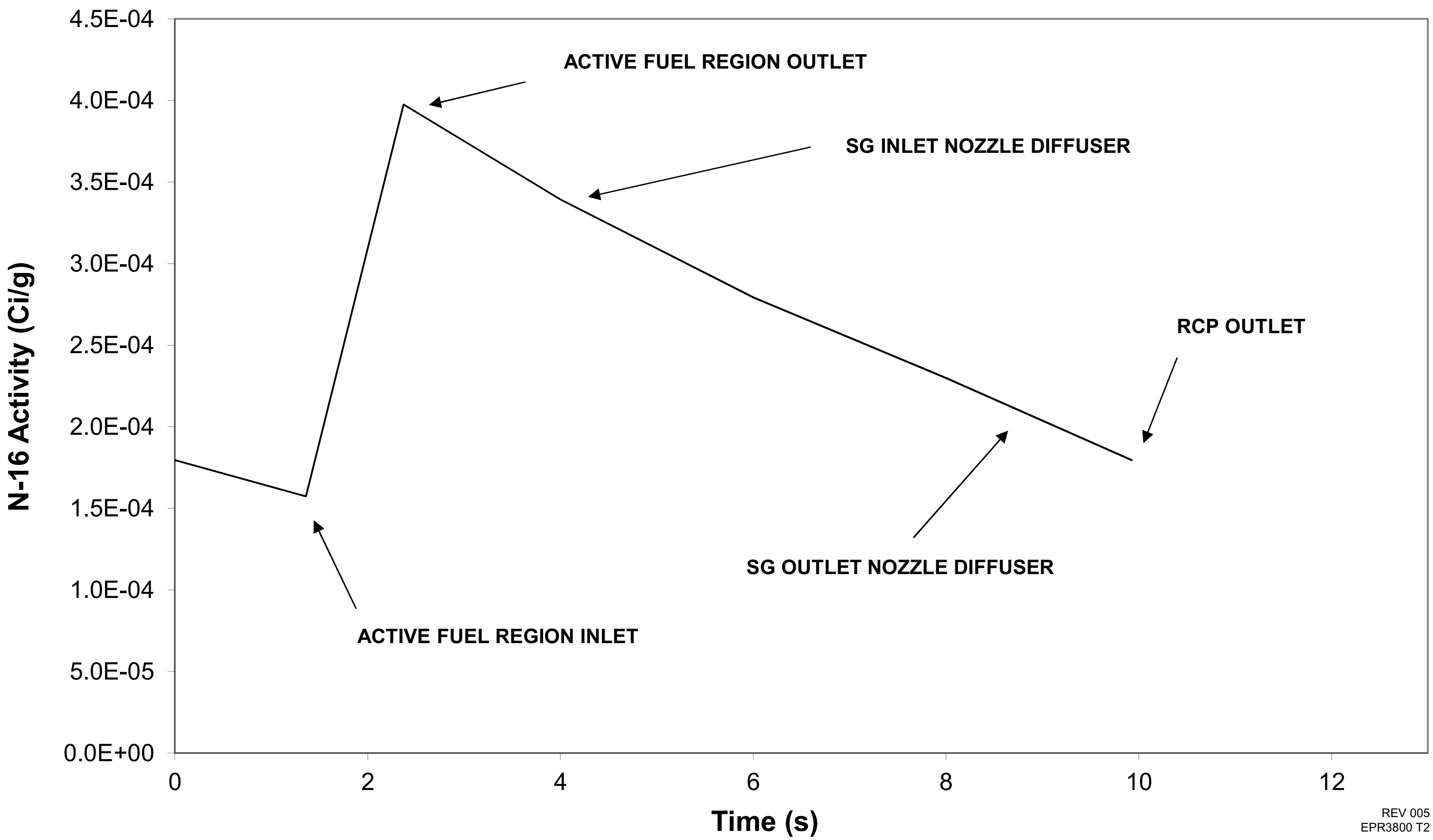


Figure 12.2-2—Simplified Flow Diagram for Volume Control Tank

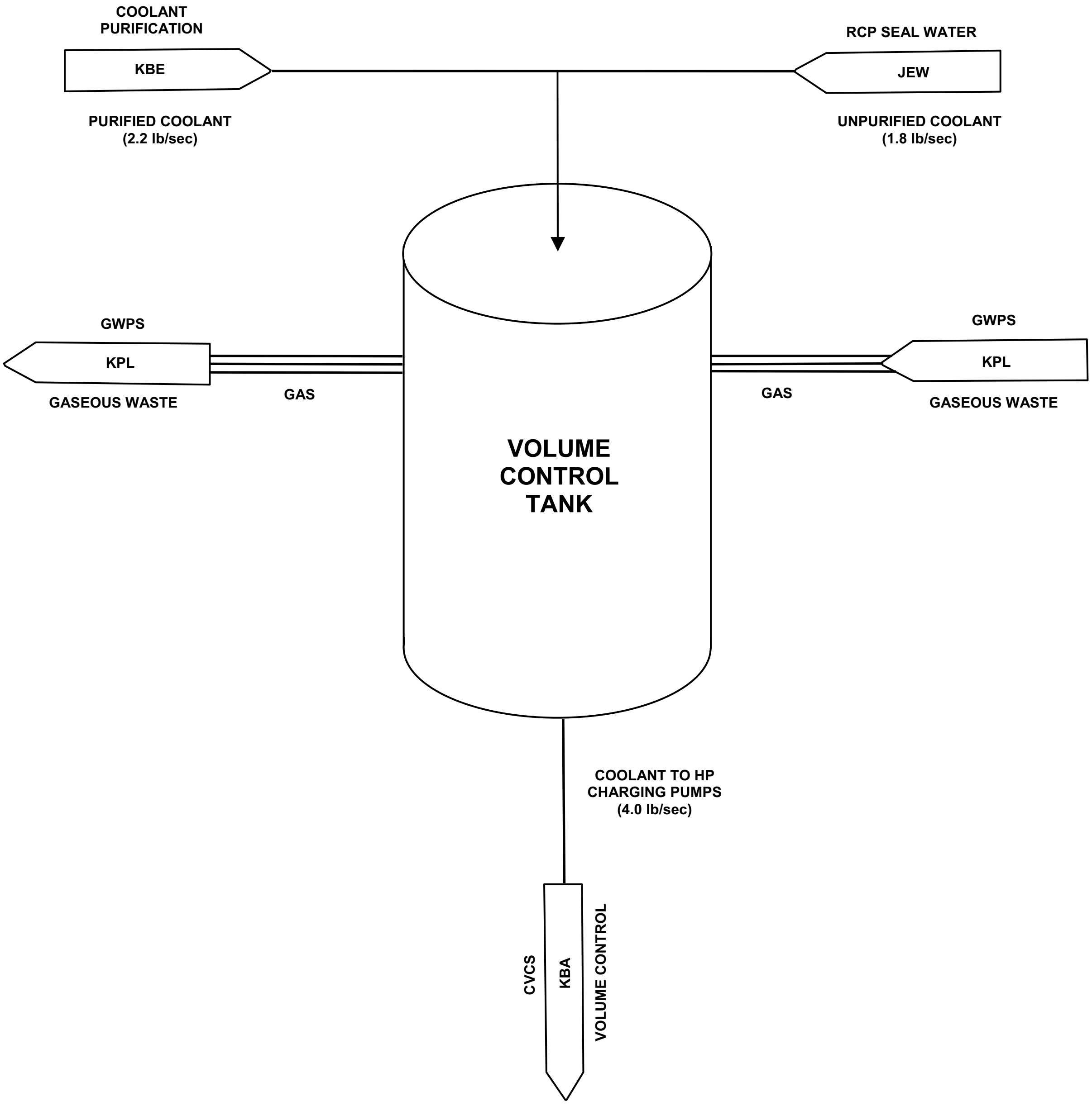
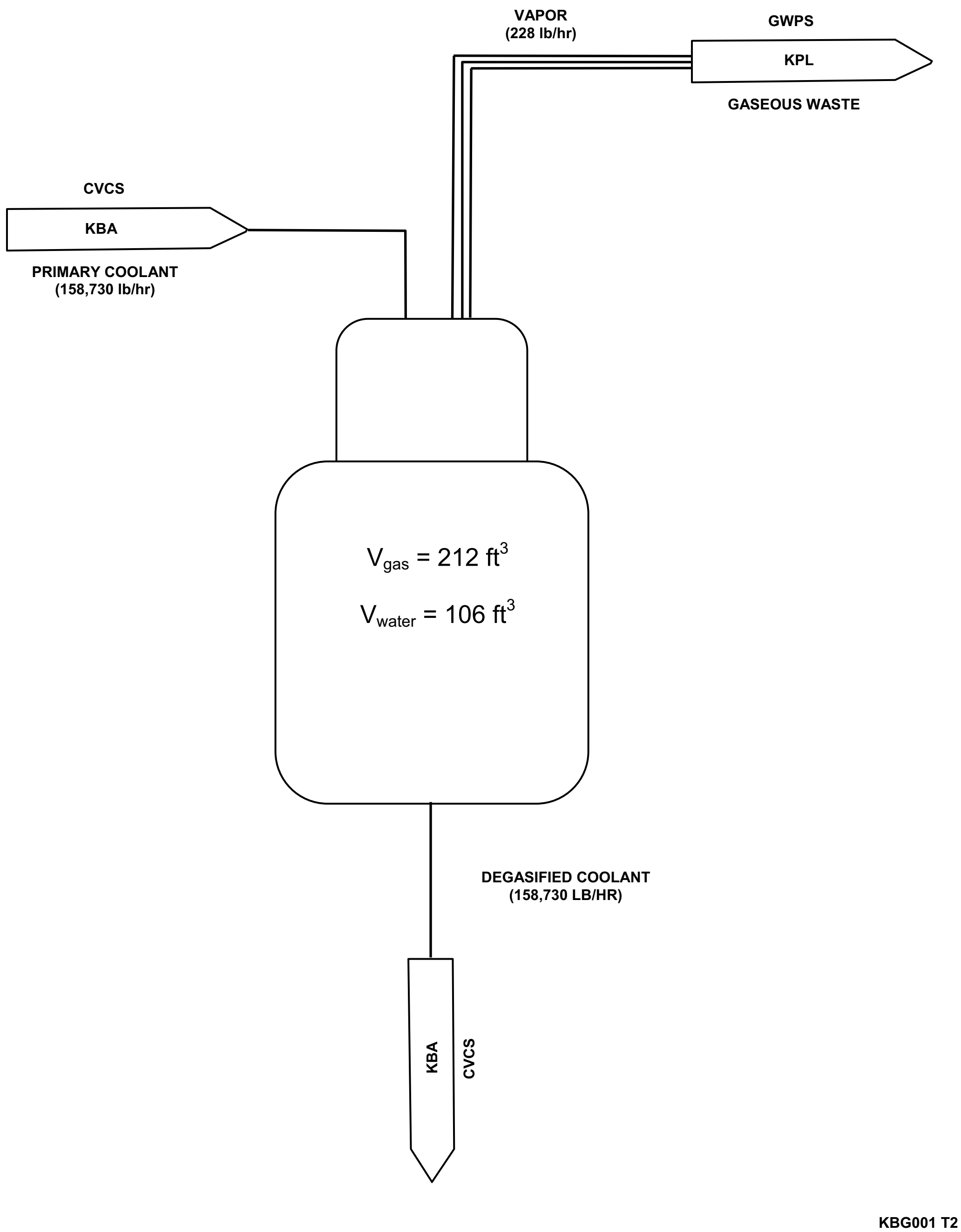


Figure 12.2-3—Simplified Flow Diagram for the Primary Coolant Degasification System Degasifier



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