12.2 Radiation Sources

The information in this section of the reference ABWR DCD, including all subsections and tables, is incorporated by reference with the following departures and supplements.

STD DEP T1 2.15-1

STD DEP 5.4-1 (Table 12.2-9)

STD DEP 11.2-1(Tables 12.2-5a, 12.2-5b, 12.2-5c, and 12.2-13a through 12.2-13j)

STD DEP 11.4-1 (Tables 12.2-5a, 12.2-5b, 12.2-5c, and 12.2-15a through 12.2-15l)

STD DEP 12.2-1 (Tables 12.2-3b and 12.2-3c)

STD DEP Admin

12.2.1.2.6.2 Radioactive Sources in Liquid Radwaste System

STD DEP 11.2-1

The Liquid Radwaste System is composed of ~~three~~ four *subsystems designed to collect, treat and cycle or discharge different categories of waste water (Subsection 11.2.2). The radioactive sources for the components in the systems are provided in Table*s *12.2-13*a through 12.2-13j*. The isotopic inventories in the liquid radwaste components were calculated assuming a fission product release rate from the fuel equivalent to that required to produce 3.7 GBq/s of offgas following a 30-min holdup period.*

12.2.1.2.6.2.4 Radioactive Sources in the Solid Radwaste System

STD DEP 11.4-1

The Solid Radwaste System provides the capability for solidifying or packaging waste from the other radwaste systems (Subsection 11.4.2). The wastes ~~are not~~ can be *solidified separately by type or source. The final waste is placed in a* waste *~~steel~~ container ~~or drums~~. The radioactive sources for the components in the system ~~container and drums~~ are given in Table*s *12.2-15*a through 12.2-15l*.*

12.2.1.2.9.6 Other Contained Sources

The following supplementary information is provided:

The radiation sources for installed radiation monitoring system detectors and portable radiation detector calibration activities are expected to be less than 100 millicuries. It is expected that large sources used for radiography at STP 3&4 will be under a license granted to the State of Texas. Other operations that could be expected to utilize a source exceeding 100 millicuries are associated with general dosimetry calibration and the calibration of portable radiation monitoring equipment utilized by Health Physics personnel. These activities are expected to be performed by the Metrology Laboratory for STP Units 1 & 2.

Procurement, receipt, inventory, labeling, leak testing, control, storage, issuance for use, and disposal of all sources (including sources that contain Special Nuclear Material) maintained on site is in accordance with plant procedures developed to comply with the radiation protection program elements required by 10 CFR Parts 19 and 20, to maintain personnel exposure ALARA. Sources brought to the site and utilized by contract or vendor personnel are controlled in accordance with the provisions of the license held by the contractor or vendor. If required while on site, storage of vendor-supplied sources is in accordance with site procedures.

12.2.1.2.10 Post-accident Radioactive Sources

STD DEP Admin

STD DEP T1 2.15-1

With respect to the Reactor Building, the overall plant design has divided the Reactor Building into three separate and independent divisions. ECCS components are contained in each division in separate isolated rooms such that the failure of one system in one division will not affect components in another division. Releases of radioactive material either in the form of water or steam (airborne) are contained in and isolated to a large extent in the compartment in which it might occur by the use of watertight doors and ~~area~~ process *radiation monitors which isolate the HVAC System from the compartment* on a high radiation signal*. Divisional separation under such conditions is complete. Sumps are designed to detect and alarm in the event of leaks in excess of 0.063 liter per second*.*~~, establishing a threshold for leak before break on the larger water-carrying piping systems.~~ All connections to the Primary Containment not terminating in the Reactor Building meet GDC 54, 55, 56, and 57. Therefore, in the event of an accident involving radioactive sources in the Primary Containment or Reactor Building, such sources would be contained and isolated for further treatment and decontamination.*

Likewise, potential releases in the Radwaste Building will be contained by ~~isolating~~ filtering *the Radwaste Building atmosphere and sealing any water releases in the building, which is ~~seismically qualified and~~ steel-lined to prevent any potential water releases. Such potential releases are discussed in Section 15.7.*

12.2.1.3 Turbine Building Sources

The following site specific supplement provides information concerning the design of the Condensate Storage Tank (CST).

The CST has a capacity of 2110 m^3 and is located outside in the yard at STP 3&4. Specifically, it is located adjacent to and just north of the Radwaste Building and to the west of the Turbine Building (see Figure 1.2-37 - Plot Plan). It is a right cylinder with a radius of approximately seven meters and a height of approximately 14 meters. It is located inside an enclosed open top reinforced concrete structure of approximately 19 meters square and 11 meters in height designed to contain the entire contents of the CST. The structure encompasses the CST as depicted on Figure 1.2-37. Outside wall thickness of the concrete structure is approximately 0.3 meters on all four sides. The structure is equipped with a metal cover to preclude rainwater entry, and with a controlled access door.

Normal operational CST contamination levels are expected to yield a contact dose rate of approximately 0.1 mrem/hr, however, the CST will be surveyed by Health Physics personnel periodically and after abnormal operational occurrences (AOO) in accordance with plant procedures to ensure occupational dose remains ALARA. Should an AOO occur which required controlling access to the CST such access would be controlled in accordance with plant Radiation Protection procedures, as described in Section 12.5.

In order to maintain the quality of the CST water, the inputs to the CST are limited. The CST's primary makeup water is purified water from the Makeup Water Purified (MUWP) System. In addition to makeup water from the MUWP System, which contains no radioactive contamination, there are three inputs to the CST that are potentially contaminated. Recycled water from the CRD System is routed back to the CST. The design of the CRD System ensures that the recycle water is not contaminated by other water systems so that the recycled water is the same quality as the CST water. Condensate reject is sent back to the CST to compensate for the clean gland seal steam injection and the thermal expansion of the feed and condensate systems during plant start-up. The point at which condensate is transferred to the CST is located downstream of the condensate filters and demineralizers so that the water that is rejected to the CST has the same quality as the condensate demineralizer effluent. In order to minimize liquid releases from the plant, treated water from the LWMS may also be recycled to the CST.

To establish a design source term, the weighted average of the activity concentrations for each isotope for the condensate reject and the LWMS recycle were cycled through the CST to calculate an equilibrium activity. The condensate reject activity concentration was estimated by taking the reactor water source terms in DCD Section 11.1, except for noble gas and N-16, and adjusting them by the main steam carryover fractions and the condensate filter removal factor of 99% for insoluble nuclides and condensate demineralizer removal parameters from DCD Table 11.1-7. The LWMS recycle activity in the CST is estimated by transferring the activity in the Low Conductivity Waste (LCW) Sample Tanks in COLA Table 12.2-13d to the CST at a rate of 55 m^3/day, which is the normal LCW System influent rate from COLA Table 11.2-2. The transfer was continued for a period of time long enough to ensure that equilibrium concentrations were reached in the 2110 m^3 CST. Tritium activity was assumed to be 3.7E-04 MBq/g in accordance with DCD Section 11.1.2.3. This is conservative because it does not account for the dilution due to the makeup from the MUWP System. The resulting activity concentrations were then multiplied by the volume of the CST, 2110 m^3, to obtain the total activity in the CST. The design source term activity by isotope is shown in Table 12.2-37. The dose rate at 30 cm from the CST containing this activity is less than 0.001 mSv/hr, and is small enough that no radiation shielding is required.

The CST is provided with design features to prevent environmental releases and the spread of contamination. As stated above, the CST is surrounded by a reinforced concrete enclosure that is sufficient to hold the entire contents of the CST. The drain from the enclosure is routed to the LWMS for processing, if required. The CST is provided with high level alarms in the control room and the Radwaste Building in order to prevent overflow. Any overflow that does occur is routed to the LWMS. The MUWC System contains lines that are used to transfer condensate quality water between the CST and systems in the Radwaste Building, Turbine Building and Reactor Building. All of the piping is routed in trenches or tunnels (not buried pipe). These trenches and tunnels provide the capability to identify and collect any leakage from the lines handling CST water and to transfer this water to the LWMS for processing.

Radiation source information for the CST is shown in Tables 12.2-5a, 12.2-5b, and 12.2-5c.

12.2.2.1 Production of Airborne Sources (Site-Specific Supplemental Value Used)

The following site-specific supplement addresses COL License Information Item 12.5 for airborne releases.

(1) χ/Q values obtained from Table 2.3S-27.

STP has re-performed the gaseous release dose analysis using site-specific parameters to determine conformance with 10 CFR 20 and 10 CFR 50 Appendix I (see Subsection 12.2.3 for COL License Information), concluding that identified limits are not exceeded. As shown in Table 12.2-20 the expected per unit release is a small fraction of the site wide release limits of 10 CFR 20.

12.2.2.4 Average Annual Doses

The following site-specific supplement addresses COL License Information Item 12.5.

For compliance with 10 CFR 50 Appendix I, evaluations have been made to determine average annual doses to unrestricted areas subject to airborne and liquid releases. For airborne dose calculations, isotopic releases were taken from Table 12.2-20. ~~assuming a 0.8 km exclusion boundary.~~ Releases were assumed to be from the plant stack, since all major (Reactor Building, Turbine Building and Radwaste Building) ventilation systems pipe to the stack for normal releases. ~~Since a site meteorology is not definitively defined, a statistical approach was used to evaluate the releases over a series of meteorologies discussed in References 12.26 and 12.27. Doses were calculated using methodologies and conversion factors consistent with Regulatory Guides 1.109 and 1.111 as implemented in References 12.28 and 12.29.~~ Results of the airborne evaluations are given in Table 12.2-21. For the ingestion doses given in Table 12.2-21, ingestion values given in Table E-5 of Regulatory Guide 1.109 were used. ~~COL applicants need to update the airborne dose calculations to conform to the as-designed plant and site-specific meteorology (see Subsection 12.2.3 for COL~~

~~license information).~~ Tables 12.2-31, 12.2-32, and 12.2-33 describe the parameters used in the airborne release dose assessment.

12.2.2.5 Liquid Releases

The following site-specific supplement addresses COL License Information Item 12.5 for liquid releases.

The ABWR is designed not to release radioactive liquid effluents. However, under certain conditions of high water inventory, ~~*up to 3.7 GBq per year, excluding tritium*~~ radioactive liquids *may be released as described in Subsection 11.2.3. These releases are given in Table 12.2-22 and form the basis for estimating doses using methodologies consistent with Regulatory Guide 1.113 as implemented in Reference 12.2-10. The results of liquid releases*~~*, assuming dilution factors described in Subsection 11.2.3.2 12.2.2.5.1,*~~ *are shown in the dose evaluation in Table 12.2-23.* ~~*COL applicants need to update*~~ STP has re-performed *the liquid dose analysis* ~~*to conform to the as-designed plant and*~~ using *site-specific parameters* to determine conformance with 10 CFR 20 and 10 CFR 50 Appendix I *(see Subsection 12.2.3 for COL license information),* concluding that the identified limits are not exceeded*.* Table 12.2-34 describes the site-specific parameters used in the liquid release dose assessment.

12.2.2.5.1 Dilution Factors

The following site-specific supplement addresses COL License Information Item 12.5 for liquid releases.

Dilution factors used in evaluating the release of liquid effluents are site specific. Using the methodology set forth in NUREG-0016 for Liquid Releases, the quantity of radioactive isotopes has been computed and is identified in column 2 of Table 12.2-22. The GALE code methodology, as specified in NUREG-0016, was used to determine the radiological activity released. The code provides recommended values for the activity fraction for potential effluent streams. It is assumed that this quantity is released to the plant discharge piping, which has a flow of 272,550 m^3/h (circulating water flow). A maximum of 150 cubic meters per hour of liquid radwaste discharge will be mixed with normal circulating water flow of 272,550 m^3/h providing significant dilution prior to release. The annual release values are used to calculate the per unit annual average liquid release discharge concentration, shown in column 3 of Table 12.2-22. The concentrations noted in this table are less than the limits in 10 CFR 20.

The discharge piping empties into the STP Main Cooling Reservoir (MCR), a 7000-acre reservoir. The plant liquid releases are further diluted in the MCR and allow for radioactive decay to occur before ultimate release from the site to unrestricted areas. The reservoir lies totally within the confines of the site and the use of its water is restricted to plant operation.

Liquid effluent discharge into the MCR can be released to unrestricted areas in the Little Robbins Slough or the Colorado River, and ultimately Matagorda Bay, providing further dilution prior to reaching the potential Maximally Exposed Individual (MEI).

Dilution flow rates in the Colorado River, Matagorda Bay and Little Robbins Slough used to evaluate the liquid pathway dose to the MEI, were obtained using information from the STP 2006 Offsite Dose Calculation Manual (ODCM). They were inputs to the LADTAP II computer program, as referenced in Table 12.2-34, footnotes 1, 2, and 3.

The liquid pathway doses to the MEI are determined to be in Little Robbins Slough and are presented in Table 12.2-23. Dose to the MEI comply with the requirements of 10 CFR 50 Appendix I.

12.2.3 COL License Information

12.2.3.1 Compliance with 10 CFR 20 and 10 CFR 50 Appendix I

The following supplement addresses COL License Information Item 12.5.

Using site-specific parameters, doses from the average annual liquid releases and the average annual airborne releases to the environment have been computed. The releases and doses are shown in Tables 12.2-20 through 12.2-23. Tables 12.2-35 and 36 demonstrate that the average annual liquid and airborne releases are in compliance with 10 CFR 20 and 10 CFR 50 Appendix I. Table 12.2-36 demonstrates compliance with 40 CFR 190 as specified in 10 CFR 20.1301(e).

12.2.4 References

12.2-12 NRC (U.S. Nuclear Regulatory Commission) 1987. GASPAR II Technical Reference and User Guide, NUREG/CR-4653, Office of Nuclear Reactor Regulation, Washington D.C., March.

12.2-13 STP (South Texas Project) 2007. Offsite Dose Calculation Manual, Revision 15, South Texas Project, STI32207439, October 1, 2007.

12.2-14 STP (South Texas Project) 2006. 2005 Radioactive Effluent Release Report, South Texas Project Electric Generating Station, April 27, 2006.

12.2-15 NRC (U.S. Nuclear Regulatory Commission) 1986. LADTAP II Technical Reference and User Guide, NUREG/CR-4013, Office of Nuclear Reactor Regulation, Washington D.C., April.

12.2-16 NRC (U.S. Nuclear Regulatory Commission) 1977. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Regulatory Guide 1.109, Revision 1, Office of Standards Development, Washington D.C., October.

Table 12.2-3b Gamma Ray Source Energy Spectra - Post-Operation Gamma Sources in the Core* (pJ/W.s)‡

Energy Bounds (pJ)	Time after Shutdown 0 s	1 day	1 week	1 month
9.6E-01				
	1.3E-03	1.6E-01	1.6E+00	1.6E-01
6.4E-01				
	2.9E+03	1.1E+00	7.4E-01	1.6E-01
4.8E-01				
	1.7E+03	9.1E-01	5.9E-01	1.6E-01
4.2E-01				
	2.7E+03	4.6E+01	2.7E+01	1.6E-01
3.5E-01				
	3.4E+03	7.2E+01	6.4E+00	8.0E-02
2.9E-01				
	5.3E+03	5.0E+02	3.4E+02	1.0E+02
2.2E-01				
	5.9E+03	3.7E+02	2.6E+02	1.8E+02
1.4E-01				
	8.2E+03	1.2E+03	6.1E+02	3.4E+02
6.4E-02				
	1.9E+03	2.9E-03	1.4E+02	5.8E+01
1.6E-02				

* Operating history of 3.2 years.

‡ The information provided in this table shall not be used for detailed facility design, including shielding design and evaluation of equipment qualification, operational procedures, or as a basis for any changes to the final safety analysis report (FSAR).

Table 12.2-3c Gamma Ray Source Energy Spectra - Gamma Ray Sources External to the Core During Operation‡

	Gamma Ray Source pJ/cm^3/s/MWt			
Energy Bounds (pJ)	***Zone H***	***Shroud***	***Zone 1***	***Vessel***
E > 1.60	*1.9E-07*	*2.7E-03*	*4.3E-09*	*3.0E-07*
1.28 < E < 1.60	*5.3E-04*	*41.7*	*1.2E-05*	*3.0E-04*
0.96 < E < 1.28	*0.14*	*76.9*	*2.4E-03*	*3.0E-03*
0.64 < E < 0.96	*8.3E-04*	*24.0*	*1.6E-05*	*8.2E-04*
0.32 < E < 0.64	*35.2*	*17.6*	*4.6E-02*	*8.3E-04*
0.16 < E < 0.32	*4.5E-03*	*7.7*	*6.1E-05*	*3.8E-04*
8.2E-02 < E < 0.16	*3.7E-03*	*4.6*	*5.0E-05*	*3.3E-04*
3.2E-02 < E < 8.2E-02	*1.1E-02*	*1.3*	*1.9E-04*	*3.3E-05*
E < 3.2E-02	*1.3E-04*	*0.30*	*2.6E-06*	*1.5E-05*

‡ The information provided in this table shall not be used for detailed facility design, including shielding design and evaluation of equipment qualification, operational procedures, or as a basis for any changes to the final safety analysis report (FSAR).

Table 12.2-5a Radiation Sources—Radiation Sources

Source Table	For	Drawing	~~Location~~	Approximate Geometry
12.2-6	RHR Heat Exchanger	12.3-1	~~(R1,RF)~~ ~~(R6,RA)~~ ~~(R6,RF)~~	Rt Cylndr (r=0.9m, l=7m)
12.2-8	RCIC Turbine	12.3-1	~~(R6,RC)~~	Rt Cylndr (r=0.5m, l=0.7m)
12.2-9	CUW Filter Demineralizer	12.3-3	~~(R2,RB)~~	2 Tanks, Rt Cylndr (r=0.6m, l=3.3m)
12.2-10	CUW Regen Heat Exchanger	12.3-2	~~(R1,RC)~~	Rt Cylndr (r=~~0.4m~~ **0.63m**, l=~~6.8m~~ 4.9m)
12.2-11	CUW Non-Regen Heat Exchanger	12.3-1	~~(R1,RC)~~	Rt Cylndr (r=0.4m, l=5.5m)
~~12.2-13.1~~ **12.2-13a**	LCW Collector Tank	12.3-37 12.3-38	~~ITEM 7~~	~~2~~ 4 Tanks, Rt Cylndr (r=~~4.~~2.74m, l=~~9.49.~~9.58~~58~~m)
~~12.2-13.2~~ **12.2-13b**	LCW Filter**/Demin Skid**	12.3-39	~~ITEM 12~~	~~Rt Cylndr (r=0.5m, l=2.5m)~~**Rt cylndr (r=0.5m, l=1.8m)**
~~12.2-13.3~~	~~LCW Demineralizer~~	~~12.3-39~~	~~ITEM 11~~	~~Rt Cylndr (r=0.6m, l=2.8m)~~
~~12.2-13.4~~ **12.2-13d**	LCW Sample Tank	12.3-37 12.3-38	~~ITEM 8~~	2 Tanks, Rt Cylndr (r=~~4.~~**2.74**m, l=~~9.49~~9.58.~~58~~m)
~~12.2-13.5~~ **12.2-13e**	HCW Collector Tank	12.3-37 12.3-38	~~ITEM 13~~	3 Tanks, Rt Cylndr (~~r=2.2m, l=4.3m~~)(r=2.74m, l=9.58m)
~~12.2-13.6~~ **12.2-13f**	HCW **Filter**/ Demin~~eralizer~~ **Skid**	12.3-39	~~ITEM 20~~	~~Rt Cylnder (r=0.6m, l=2.8m)~~**Rt cylndr (r=0.5m, l=1.8m)**
12.2-13g	**HCW Sample Tank**	**12.3-37 12.3-38**		**Rt Cylinder (r=2.74m, l=9.58m)**
12.2-13h	**HSD Receiver Tank**	**12.3-37 12.3-38**		**Cylinder (r=1.98m, l=4.4m)**
12.2-13i	**HSD Sample Tank**	**12.3-37 12.3-38**		**Cylinder (r=1.98m, l=4.4m)**
12.2-13j	**Chem Drain Tank**	**12.3-37**		**Cylinder (r=0.91m, l=2.6m)**
12.2-14	Offgas	12.3-50	~~(TF,T2)~~	Tank 1, Rt Cylndr (r=0.6m, l=7.6m) Tanks 2-9, Rt Cylndr (r=1.1m, l=7.6m)
12.2-29	Steam Jet Air Ejector	12.3-51	~~(TF,T2)~~	Rt Cylndr (r=0.15m, l=4.6m) Rt Cylndr (r=0.76m, l=6.1m) Rt Cylndr (r=0.2m, l=4.6m)
12.2-14	Offgas Recombiner	12.3-51	~~(TF,T2)~~	Rt Cylndr (r=1.4m, l=7m)
~~12.2-15.1~~ **12.2-15a**	CUW Backwash Receiving Tank	12.3-1	~~(R2,RB)~~	Rt Cylndr (r=2.2m, l=5.7m)
~~12.2-15.2~~ **12.2-15b**	CF Backwash Receiving Tank	12.3-49	~~(TD,T4)~~	Rt Cylndr (r=2.2m, l=5.7m)

Table 12.2-5a Radiation Sources—Radiation Sources (Continued)

Source Table	For	Drawing	~~Location~~	Approximate Geometry
~~12.2-15.3~~ **12.2-15c**	Phase Separator**s**	12.3-37 12.3-38	~~ITEM 30~~	2 Tanks, Rt Cylndr (r=~~2.4~~ **2.3**m, l=~~6.0~~**9.7**m)
~~12.2-15.4~~ **12.2-15d**	Spent Resin Storage Tanks	12.3-37 12.3-38	~~ITEM 31~~	Rt Cylndr (r=2.0m, l=~~5.7~~**6.6**m), **2 Tanks**
~~12.2-15.5~~	~~Concentrated Waste Tank~~	~~12.3-37~~	~~ITEM 35~~	~~Rt Cylndr (r=1.5m, l=4.4m)~~
~~12.2-15.6~~	~~Solids Dryer Feed Tank~~	~~12.3-41~~	~~ITEM 39~~	~~Rt Cylndr (r=1.6m, l=3.2m)~~
~~12.2-15.7~~	~~Solids Dryer (outlet)~~	~~12.3-39~~	~~ITEM 55~~	~~Rt Cylndr (r=0.2m, l=3.2m)~~
~~12.2-15.8~~	~~Solids Pelletizer~~	~~12.3-38~~	~~ITEM 58~~	~~Rt Cylndr (r=0.4m, l=2.5m)~~
~~12.2-15.9~~	~~Sol Mist Separator (steam)~~	~~12.3-39~~	~~ITEM 56~~	~~Rt Cylndr (r=0.1m, l=2.8m)~~
~~12.2-15.10~~	~~Sol Condenser~~	~~12.3-40~~	~~ITEM 57~~	~~Rt Cylndr (r=0.2m, l=1.4m)~~
~~12.2-15.11~~	~~Sol Drum~~	~~12.3-39~~	~~(2,D)~~	~~Rt Cylndr (r=0.3m, l=0.8m) Box (1.5mx1.5mx1m)~~
12.2-15l	**LW Receiving Tank**	**12.3-37 12.3-38**		**Cylinder (r=1.98m, l=6.6m)**
12.2-16	FPC Filter Demineralizer	12.3-3	~~(R2,RB)~~	Rt Cylndr (r=0.7m, l=3.4m)
12.2-17	Suppression Pool Cleanup System*	12.3-3	~~(R2,RA)~~	Rt Cylndr (r=0.7m, l=3.4m)
12.2-18	Control Rod Drive System†	12.3-2	~~(R4,RF)~~	Distributed Source
12.2-24	Traversing Incore Probe	12.3-2	~~(R4,RB)~~	Distributed Source
12.2-25	Reactor Internal Pumps‡	12.3-2	~~(RF,R1)~~	Distributed Source
12.2-25	RIP Heat Exchanger	1.2-3b	~~El 3000~~	Rt Cylndr (r=0.322m, l=2.9m)
12.2-26	Turbine Moisture Separator/Reheater	12.3-52	~~(T6,TE)~~	Rt Cylndr (r=1.8m, l=31.m)
12.2-27	Turbine Condenser	12.3-53	~~(TD,TG)~~	Distributed Source
12.2-28	Condenser Filter/ Demineralizer Filter Demineralizer	 12.3-51 12.3-51	 ~~(TC,T2)~~ ~~(TC,T3)~~	 3 Tanks, Rt Cylndr(r=1.4m, l=6.1m) 6 Tanks, Rt Cylndr(r=1.7m, l=5.1m)
12.2-30	SGTS Filter Train	12.3-7	~~(R2,RB)~~	Surface, (3.66m x 2.54m)§
~~Applicant~~ **See Appendix 12B**	Spent Fuel Storage	12.3-6 **12.3-10**	~~(R4,RF)~~	~~See Drawings~~ **14.0m x 9.4m x 11.9m deep (pool) 10.7m x 9.0m x 4.5m (fuel racks) Active Fuel Assembly dimensions: 0.152m (6in) square x 3.8m height**
12.2-37	Condensate Storage Tank			Rt Cylinder (r=7m, l=14m)

* Suppression pool clean up F/D uses second of Fuel Pool F/D

† Maintenance Facility
‡ Maintenance Facility, see Figure 1.2-3b Elevation 3000 for drywell location
§ Surface area of HEPA and charcoal filter

Table 12.2-5b Radiation Sources—Source Geometry

Component	**Assumed Shielding Source Geometry**
RHR Heat Exchanger	Homogenous source over volume of heat exchanger
RCIC Turbine	Homogenous source over volume of turbine
CUW Filter Demineralizer	80% of source in first 15 cm, remainder dispersed over volume.
CUW Regen Heat Exchanger	Homogenous source over volume of exchanger
CUW Non-Regen Heat Exchanger	Homogenous source over volume of exchanger
LCW Collector Tank	80% non-solubles in slurry on tank bottom, rest evenly dispersed in volume
LCW Filter**/Demin Skid**	~~*Homogenous source over volume of filter*~~**Homogenous source over volume of skid**
~~*LCW Demineralizer*~~	~~*80% of source in first 15 cm, rest evenly dispersed over volume*~~
LCW Sample Tank	Homogenous source over volume of tank
HCW Collector Tank	Homogenous source over volume of tank
HCW **Filter/**Demin~~*eralizer*~~ **Skid**	~~*80% of source in first 15 cm, rest evenly dispersed over volume*~~**Homogenous source over volume of skid**
Offgas	90% of source in first tank in first (upper) 30 cm, rest evenly dispersed. Remaining tanks, homogenous source over tank volume.
Steam Jet Air Ejector*	Homogenous source over volume of ejector
Offgas Recombiner*	Homogenous source over subcomponent ~~*(Figure 12.2-14)*~~†
CUW Backwash Receiving Tank	80% non-solubles in slurry on tank bottom, rest evenly dispersed in volume
CF Backwash Receiving Tank	80% non-solubles in slurry on tank bottom, rest evenly dispersed in volume
Phase Separator	90% non-solubles in slurry on tank bottom, rest evenly dispersed in volume
Spent Resin Storage Tank	Homogenous source over volume of tank
~~*Concentrated Waste Tank*~~	~~*90% non-solubles in slurry on tank bottom, rest evenly dispersed in volume*~~
~~*Sol Dryer Feed Tank*~~	~~*Source evenly dispersed over volume*~~
~~*Sol Dryer (outlet)*~~	~~*Source evenly dispersed over volume*~~
~~*Sol Peletizer*~~	~~*Source evenly dispersed over volume*~~
~~*Sol Mist Separator (steam)*~~	~~*Source evenly dispersed over volume*~~
~~*Sol Condenser*~~	~~*Source evenly dispersed over volume*~~
~~*Sol Drum*~~	~~*Source evenly dispersed over volume*~~
FPC Filter Demineralizer	90% insolubles in first 15 cm, rest of source evenly dispersed over volume
Supression Pool Cleanup System	90% insolubles in first 15 cm, rest of source evenly dispersed over volume
Control Rod Drive System	Exposure dependent, assume evenly dispersed over length of blade
Transverse Incore Probe	Point or line geometry (Table 12.2-24)
Reactor Internal Pumps	Cylindrical source coupled to water bearing components
RIP Heat Exchanger	Homogenous source over volume of exchanger

Table 12.2-5b Radiation Sources—Source Geometry (Continued)

Component	Assumed Shielding Source Geometry
Turbine Moisture Separator/Reheater	Homogenous source over volume of exchanger
Turbine Condenser	Homogenous source over volume of exchanger
Condenser Filter/Demineralizer	Homogenous source over volume of exchanger
Filter	Source evenly dispersed over volume of filter
Demineralizer	90% insolubles in first 15 cm, rest of source evenly dispersed over volume
SGTS Filter Train	90% particulates on HEPA filter, remaining on charcoal filter
Spent Fuel Storage	~~*Applicant*~~ Spent fuel source evenly dispersed over volume of racks in the pool
HSD Receiver Tank	**Homogenous source over volume of tank**
HSD Sample Tank	**Homogenous source over volume of tank**
LW Backwash Receiving	**Homogenous source over volume of tank**
Chem Drain Tank	**Homogenous source over volume of tank**
HCW Sample Tank	**Homogenous source over volume of tank**
Condensate Storage Tank	Homogeneous source over volume of tank

* Radiation levels in SJAE and recombiner highly dependent upon power level. Actual measurements on SJAE condenser contact dose rate are $2x10^{-3}$ Gy/h at 100% power and less than $5x10^{-2}$m Gy/h at 20% power.

† See Offgas Recombiner Description, Section 11.3, use inventory for preheater, recombiner, condenser and cooler for recombiner inventory for shielding applications.

Table 12.2-5c Radiation Sources—Shielding Geometry in Meters

Component	Room Dimensions			Wall Thickness in Meters					
	Length	**Width**	**Height**	**East**	**West**	**North**	**South**	**Floor**	**Ceiling**
RHR Heat Exchanger	12.6	5.6	5.6	0.8	0.6	0.6	0.6	Ground	0.8
RCIC Turbine	14.6	7.8	5.6	0.8	2	0.6	0.6	Ground	0.8
CUW Filter Demineralizer	2.8	3	7.4	0.8	1	0.8	1	0.5	Hatch
CUW Regen Heat Exchanger	7.7	3.6	6	1.4	1.4	1	1.4*	0.8	0.5
CUW Non-Regen Heat Exchanger	7.4	4.4	5.6	1	1	1	1[†]	Ground	0.8
LCW Collector Tank **(4 Tanks)**	~~19~~**16**	~~1~~**15**	13	~~1.2~~**0.6**	~~0.8~~**0.6**	~~0.8~~**0.9**	~~1.2~~**0.9**	Ground	0.8
LCW Filter/**Demin Skid *****	~~16.4~~**10**	~~10.6~~**8**	~~8~~**3**	~~0.8~~**0.8**	~~0.8~~**0.8**	~~0.8~~**0.8**	~~0.8~~**0.8**	~~0.8~~**0.8**	~~0.8~~**0.8**
~~LCW Demineralizer[‡)]~~**HCW Filter/Demin Skid*****	~~19.6~~**10**	~~10.6~~**8**	~~8~~**3**	~~0.8~~**0.3**	~~0.8~~**0.3**	~~0.8~~**0.3**	~~0.8~~**0.3**	~~0.8~~**0.3**	~~0.8~~**0.3**
LCW Sample Tank **(2 Tanks)**	~~19~~**7.4**	~~10~~**15**	13	~~1.2~~**0.6**	~~0.8~~**0.6**	1.2	~~0.8~~**0.6**	Ground	0.8
HCW Collector Tank **(3 Tanks-L-Shape Room)**	~~9~~**16**	~~11.2~~**15**	~~5.4~~**13**	~~0.8~~**0.9**	~~0.8~~**0.6**	~~0.8~~**0.9**	~~1.2~~**0.9**	Ground	0.8
~~HCW Demineralizer[‡]~~	~~19.6~~	~~10.6~~	~~8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
Offgas	9.1	11	16	1	1	1	1	2.5	1
Steam Jet Air Ejector and Recombiner Room	9.1	14.2	7	1	1	1	1	1	1
CUW Backwash Receiving Tank	6.6	7.4	5.6	1	0.8	0.8	1	Ground	0.8
CF Backwash Receiving Tank	5	5	25	1	1	1	1	2.5	Hatch
Phase Separator Tank A	**5.4**	**8.6**	**13**	**1.2**	**1.2**	**1.2**	**0.6**	**Ground**	**0.8**
Phase Separator **Tank B**	~~16~~**5.4**	~~8.4~~**8.6**	~~4.6~~**13**	~~0.8~~**1.2**	~~0.8~~**1.2**	~~0.8~~**0.6**	1.2	~~0.8~~**Ground**	0.8
~~Spent Resin Storage Tank~~	~~6.4~~	~~6.4~~	~~4.6~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~Concentrated Waste Tank~~	~~4.6~~	~~5~~	~~5.4~~	~~0.8~~	~~0.8~~	~~1.2~~	~~0.8~~	~~Ground~~	~~0.8~~

Table 12.2-5c Radiation Sources—Shielding Geometry in Meters (Continued)

Component	Room Dimensions			Wall Thickness in Meters					
	Length	Width	Height	East	West	North	South	Floor	Ceiling
~~Sol Dryer Feed Tank~~	~~9.4~~	~~7.2~~	~~6.2~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~So Dryer (outlet)~~[‡]	~~9.2~~	~~5.2~~	~~8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~Sol Peletizer~~	~~9.2~~	~~5.2~~	~~6.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~Sol Mist Separator (steam)~~[‡]	~~9.2~~	~~5.2~~	~~8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~Sol Condenser~~	~~4.2~~	~~7.2~~	~~6.2~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~Sol Drum~~	~~3.2~~	~~3~~	~~8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
FPC Filter Demineralizer	3.2	3.2	7.4	0.8	1	0.8	0.8	0.5	Hatch
Suppression Pool Cleanup Sys	3.2	3.2	7.4	0.5	0.8	0.8	0.8	0.5	Hatch
Control Rod Drive System*	7.6	33.4	5.8	0.6	0.6	0.6	0.6	0.8	0.6
Transverse Incore Probe	4	7.3	2.7	1	1	1	1	Mezz	0.6
Reactor Internal Pumps**	8.2	8.5	5.8	0.6	0.6	0.6	0.6	0.8	0.6
RIP Heat Exchanger	Primary Containment								
Turbine Moisture Sep/Reheater	12.4	47.6	8.5	1	1	1	1	1	1
Turbine Condenser	14.2	36	25	3.5	2.5	1	1	2.5	Turbine
Condenser Filter	5	21.1	8	2.5[†]	1	1	1	1	Hatch
Condenser Demineralizer	9.8	17.3	9	1	1	1	1.6	1	1
SGTS Filter Train	14.4	5	8.2	0.2	0.5	0.2	0.2	2	0.6
Spent Fuel Storage	9.4	14	4.1	2	2	2	2	2	7.4**
HSD Receiver and Sample Tanks	**7.7**	**7.2**	**12.7**	**0.6**	**0.6**	**0.6**	**0.6**	**Ground**	**0.6**
LW Backwash Receiving	**5.6**	**7.0**	**13**	**0.6**	**0.6**	**0.6**	**0.6**	**Ground**	**0.8**
Chem Drain Collector Tank	**4.4**	**3.7**	**6.3**	**0.3**	**0.6**	**0.6**	**0.6**	**Ground**	**0.6**
HCW Sample Tank (2 Tanks)	**15**	**7.7**	**13**	**0.6**	**0.6**	**1.2**	**0.6**	**Ground**	**0.8**

Table 12.2-5c Radiation Sources—Shielding Geometry in Meters (Continued)

Component	Room Dimensions			Wall Thickness in Meters					
	Length	Width	Height	East	West	North	South	Floor	Ceiling
Spent Resin Storage Tank									
Tank A	**5.2**	**6.4**	**10.1**	**0.9**	**0.9**	**0.9**	**0.9**	**Ground**	**0.6**
Tank B	**5.2**	**5.2**	**10.1**	**0.9**	**0.9**	**0.9**	**0.9**	**Ground**	**0.6**
Condensate Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Ground	Air

*) Moveable Wall

~~†) *LCW and HCW Demineralizer share same room*~~

~~‡ *Solid dryer and Mist Separator share same room*~~

‡ Maintenance Facility

*** The LCW and HCW Filter Demineralizer Skids ~~*will be*~~, identified as “LRW System Skids”, are vendor provided. They will be located on the ground floor elevation, 10700 (See Fig. 1.2-23C). The vendor will provide the skids with shielding adequate to maintain the Room, 6381, as a Radiation Zone C. The room dimensions provided are approximate since the shield walls will be movable and the final arrangement will depend on the equipment provided.

** 7.4m water depth above fuel elements

Table 12.2-9 CUW Filter Demineralizer

Source volume = 3.7m^3

Total MBq = 1.94E+08

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	2.41E+07	Rb-89	2.82E+04	Y-91	3.66E+05	Na-24	5.01E+06
I-132	3.06E+06	Sr-89	9.40E+05	Y-92	7.37E+05	P-32	1.32E+06
I-133	2.20E+07	Sr-90	7.27E+04	Y-93	1.36E+06	Cr-51	4.99E+07
I-134	2.01E+06	Y-90	7.27E+04	Zr-95	7.41E+04	Mn-54	7.12E+05
I-135	9.52E+06	Sr-91	1.27E+06	Nb-95	7.41E+04	Mn-56	4.44E+06
		Sr-92	9.76E+05	Ru-103	1.73E+05	Co-58	1.87E+06
		Mo-99	4.05E+06	Rh-103m	1.73E+05	Co-60	4.10E+06
		Tc-99m	4.05E+06	Ru-106	3.11E+04	Fe-55	5.41E+06
		Te-129m	3.36E+05	Rh-106	3.11E+04	Fe-59	2.73E+05
		Te-131m	9.27E+04	La-140	2.51E+06	Ni-63	1.03E+07
		Te-132	2.37E+05	Ce-141	2.58E+05	Cu-64	1.22E+07
		Cs-134	1.54E+05	Ce-144	3.09E+04	Zn-65	2.00E+06
		Cs-136	6.44E+04	Pr-144	3.09E+04	Ag-110m	1.00E+04
		Cs-137	4.23E+05			W-187	2.28E+05
		Cs-138	2.07E+05				
		Ba-140	2.51E+06				
		Np-239	1.44E+07				
Total	6.06E+07	Total	2.98E+07	Total	5.85E+06	Total	9.77E+07

Table 12.2-13a Liquid Radwaste Component Inventories-LCW Collector Tank

Source volume = 140m^3

Total MBq = 7.40E+05

Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	2.03E+04	Rb-89	9.42E+01	Y-91	2.97E+04	Na-24	1.29E+04
I-132	8.06E+03	Sr-89	2.11E+03	Y-92	2.32E+03	P-32	2.65E+03
I-133	5.54E+04	Sr-90	2.67E+02	Y-93	2.72E+04	Cr-51	1.04E+05
I-134	5.28E+03	Y-90	2.67E+02	Zr-95	6.03E+03	Mn-54	2.21E+03
I-135	2.50E+04	Sr-91	3.33E+03	Nb-95	6.03E+03	Mn-56	1.17E+04
		Sr-92	2.57E+03	Ru-103	1.38E+04	Co-58	4.43E+03
		Mo-99	8.86E+03	Rh-103m	1.38E+04	Co-60	1.47E+04
		Tc-99m	8.86E+03	Ru-106	2.69E+03	Fe-55	1.09E+04
		Te-129m	7.13E+02	Rh-106	2.69E+03	Fe-59	6.02E+02
		Te-131m	2.25E+02	La-140	1.89E+05	Ni-63	3.79E+04
		Te-132	5.09E+02	Ce-141	2.04E+04	Cu-64	3.17E+04
		Cs-134	4.00E+02	Ce-144	2.66E+03	Zn-65	6.00E+03
		Cs-136	1.35E+02	Pr-144	2.66E+03	Ag-110m	3.01E+01
		Cs-137	1.22E+03			W-187	5.66E+02
		Cs-138	5.46E+02				
		Ba-140	5.04E+03				
		Np-239	3.20E+04				
Total	1.14E+05	Total	6.72E+04	Total	3.19E+05	Total	2.40E+05

Table 12.2-13b Liquid Radwaste Component Inventories-LCW Filter/Demin Skid

Source Volume = 1.42m^3

Total MBq = 6.52E+06

Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**
I-131	3.64E+05	Rb-89	1.39E+03	Y-91	3.20E+04	Na-24	6.69E+04
I-132	7.31E+04	Sr-89	4.14E+04	Y-92	3.02E+04	P-32	2.56E+04
I-133	2.79E+05	Sr-90	1.36E+04	Y-93	2.03E+04	Cr-51	1.48E+06
I-134	5.55E+04	Y-90	1.36E+04	Zr-95	4.12E+03	Mn-54	9.25E+04
I-135	1.65E+05	Sr-91	1.94E+04	Nb-95	6.09E+03	Mn-56	1.02E+05
		Sr-92	2.24E+04	Ru-103	6.51E+03	Co-58	1.09E+05
		Mo-99	4.79E+04	Rh-103m	6.52E+03	Co-60	7.36E+05
		Tc-99m	4.70E+04	Ru-106	4.30E+03	Fe-55	1.71E+06
		Te-129m	1.13E+04	Rh-106	4.30E+03	Fe-59	1.12E+04
		Te-131m	1.13E+03	La-140	5.22E+04	Ni-63	1.89E+03
		Te-132	2.84E+02	Ce-141	8.48E+03	Cu-64	1.68E+05
		Cs-134	2.94E+04	Ce-144	3.93E+03	Zn-65	2.42E+05
		Cs-136	1.36E+03	Pr-144	3.93E+03	Ag-110m	1.19E+03
		Cs-137	9.41E+04			W-187	2.79E+03
		Ba-137m	8.79E+04				
		Cs-138	5.62E+03				
		Ba-140	4.63E+04				
		Np-239	1.71E+05				
TOTAL	**9.37E+05**	**TOTAL**	**6.55E+05**	**TOTAL**	**1.83E+05**	**TOTAL**	**4.75E+06**

Table 12.2-13c ~~*Liquid Radwaste Component Inventories-LCW Demineralizer*~~ Not Used

Table 12.2-13d Liquid Radwaste Component Inventories-LCW Sample Tank

Source volume = 140m^3

Total MBq = 5.84E+02

Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	1.82E+01	Rb-89	5.63E-03	Y-91	2.92E+01	Na-24	4.30E+00
I-132	4.35E-01	Sr-89	2.07E+00	Y-92	1.94E-01	P-32	2.49E+00
I-133	2.37E+01	Sr-90	2.67E-01	Y-93	6.43E+00	Cr-51	1.01E+02
I-134	1.09E-01	Y-90	2.67E-01	Zr-95	5.95E+00	Mn-54	2.20E+00
I-135	3.90E+00	Sr-91	7.37E-01	Nb-95	5.95E+00	Mn-56	7.12E-01
		Sr-92	1.64E-01	Ru-103	1.35E+01	Co-58	4.37E+00
		Mo-99	6.54E+00	Rh-103m	1.35E+01	Co-60	1.47E+01
		Tc-99m	6.54E+00	Ru-106	2.68E+00	Fe-55	9.91E+00
		Te-129m	6.95E-01	Rh-106	2.68E+00	Fe-59	5.90E-01
		Te-131m	1.20E-01	La-140	1.76E+02	Ni-63	3.79E+01
		Te-132	3.93E-01	Ce-141	1.99E+01	Cu-64	9.22E+00
		Cs-134	3.99E+00	Ce-144	2.65E+00	Zn-65	5.98E+00
		Cs-136	1.26E+00	Pr-144	2.65E+00	Ag-110m	3.00E-02
		Cs-137	1.22E+01			W-187	2.65E-01
		Cs-138	6.92E-02				
		Ba-140	4.71E+00				
		Np-239	2.25E+01				
Total	4.63E+01	Total	6.25E+01	Total	2.82E+02	Total	1.93E+02

Table 12.2-13e Liquid Radwaste Component Inventories-HCW Collector Tank

Source volume = 140m^3

Total MBq = 1.80E+04

Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	4.45E+02	Rb-89	2.57E+02	Y-91	5.51E-01	Na-24	4.94E+01
I-132	9.76E+00	Sr-89	5.68E+00	Y-92	4.05E+02	P-32	6.51E+00
I-133	2.57E+02	Sr-90	4.27E+01	Y-93	6.59E+02	Cr-51	6.51E+00
I-134	5.68E+00	Y-90	1.32E-01	Zr-95	7.35E+01	Mn-54	4.04E+01
I-135	4.27E+01	Sr-91	1.87E+02	Nb-95	2.53E+00	Mn-56	2.19E+02
		Sr-92	1.55E+01	Ru-103	7.87E+00	Co-58	9.38E+03
		Mo-99	1.55E+01	Rh-103m	1.50E+01	Co-60	1.50E+02
		Tc-99m	6.96E+00	Ru-106	1.50E+01	Fe-55	1.41E+01
		Te-129m	3.13E+00	Rh-106	3.38E+01	Fe-59	3.79E+02
		Te-131m	2.30E+02	La-140	3.38E+01	Ni-63	8.72E+02
		Te-132	2.30E+02	Ce-141	6.56E+00	Cu-64	7.90E+02
		Cs-134	6.46E+01	Ce-144	6.56E+00	Zn-65	5.40E+01
		Cs-136	1.75E+00	Pr-144	4.05E+02	Ag-110m	2.19E+03
		Cs-137	1.64E+01			W-187	8.47E+01
		Cs-138	5.84E+01				
		Ba-140	1.88E+01				
		Np-239	1.62E+02				
Total	7.60E+02	Total	1.32E+03	Total	1.66E+03	Total	1.42E+04

Table 12.2-13f Liquid Radwaste Component Inventories-HCW ~~Demineralizer~~ Filter/Demin Skid

Source Volume = 1.42m^3

Total MBq = 2.02E+04

Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**
I-131	1.04E+03	Rb-89	1.80E+00	Y-91	1.05E+02	Na-24	1.76E+02
I-132	1.08E+02	Sr-89	1.34E+02	Y-92	6.03E+01	P-32	7.44E+01
I-133	7.71E+02	Sr-90	4.60E+01	Y-93	4.77E+01	Cr-51	4.45E+03
I-134	6.94E+01	Y-90	4.60E+01	Zr-95	1.32E+01	Mn-54	3.16E+02
I-135	3.36E+02	Sr-91	4.52E+01	Nb-95	2.02E+01	Mn-56	1.55E+02
		Sr-92	3.44E+01	Ru-103	2.05E+01	Co-58	3.60E+02
		Mo-99	1.45E+02	Rh-103m	2.06E+01	Co-60	2.47E+03
		Tc-99m	1.40E+02	Ru-106	1.46E+01	Fe-55	5.69E+03
		Te-129m	3.54E+01	Rh-106	1.46E+01	Fe-59	3.59E+01
		Te-131m	3.20E+00	La-140	1.51E+02	Ni-63	6.40E+00
		Te-132	8.34E-01	Ce-141	2.64E+01	Cu-64	4.27E+02
		Cs-134	1.53E+02	Ce-144	1.34E+01	Zn-65	8.21E+02
		Cs-136	6.13E+00	Pr-144	1.34E+01	Ag-110m	4.10E+00
		Cs-137	4.81E+02			W-187	7.97E+00
		Ba-137m	4.49E+02				
		Cs-138	7.34E+00				
		Ba-140	1.33E+02				
		Np-239	5.09E+02				
TOTAL	**2.32E+03**	**TOTAL**	**2.37E+03**	**TOTAL**	**5.21E+02**	**TOTAL**	**1.50E+04**

Table 12.2-13g Liquid Radwaste Component Inventories-HCW Sample Tank

Source volume = 140m^3

Total MBq = 1.81E+00

Halogens		Soluble Fission Products		Insoluble Fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	2.90E-02	Rb-89	9.29E-07	Y-91	6.90E-03	Na-24	3.38E-04
I-132	1.25E-03	Sr-89	1.75E-02	Y-92	4.99E-06	P-32	1.71E-02
I-133	2.99E-01	Sr-90	1.55E-03	Y-93	4.48E-05	Cr-51	8.22E-01
I-134	2.78E-04	Y-90	1.55E-03	Zr-95	1.42E-03	Mn-54	1.48E-02
I-135	1.57E-02	Sr-91	3.68E-05	Nb-95	1.42E-03	Mn-56	2.03E-05
		Sr-92	4.74E-06	Ru-103	3.09E-03	Co-58	3.60E-02
		Mo-99	7.92E-03	Rh-103m	3.09E-03	Co-60	8.70E-02
		Tc-99m	7.92E-03	Ru-106	6.50E-04	Fe-55	5.47E-02
		Te-129m	5.79E-03	Rh-106	6.50E-04	Fe-59	4.98E-03
		Te-131m	2.92E-05	La-140	3.07E-02	Ni-63	2.19E-01
		Te-132	6.41E-04	Ce-141	4.41E-03	Cu-64	6.05E-04
		Cs-134	5.77E-03	Ce-144	6.42E-04	Zn-65	4.14E-02
		Cs-136	1.43E-03	Pr-144	6.42E-04	Ag-110m	2.07E-04
		Cs-137	1.62E-02			W-187	4.20E-05
		Cs-138	1.65E-07				
		Ba-140	3.07E-02				
		Np-239	1.97E-02				
Total	3.45E-01	Total	1.17E-01	Total	5.36E-02	Total	1.30E+00

Table 12.2-13h Liquid Radwaste Component Inventories-HSD Receiver Tank

Source volume = 30.00m^3

Total MBq = 1.59E+03

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**
I-131	2.05E+02	Rb-89	3.32E-01	Y-91	2.29E+00	Na-24	4.71E+01
I-132	2.13E+01	Sr-89	5.92E+00	Y-92	5.32E+00	P-32	9.75E+00
I-133	2.25E+02	Sr-90	4.28E-01	Y-93	1.17E+01	Cr-51	3.33E+02
I-134	1.34E+01	Y-90	4.28E-01	Zr-95	4.61E-01	Mn-54	4.23E+00
I-135	7.46E+01	Sr-91	1.07E+01	Nb-95	4.61E-01	Mn-56	3.12E+01
		Sr-92	6.87E+00	Ru-103	1.12E+00	Co-58	1.16E+01
		Mo-99	4.55E+01	Rh-103m	1.12E+00	Co-60	2.41E+01
		Tc-99m	4.55E+01	Ru-106	1.85E-01	Fe-55	4.40E+01
		Te-129m	2.20E+00	Rh-106	1.85E-01	Fe-59	1.74E+00
		Te-131m	1.03E+00	La-140	1.90E+01	Ni-63	6.04E+01
		Te-132	2.59E+00	Ce-141	1.69E+00	Cu-64	1.10E+02
		Cs-134	1.64E+00	Ce-144	1.84E-01	Zn-65	1.19E+01
		Cs-136	8.76E-01	Pr-144	1.84E-01	Ag-110m	5.96E-02
		Cs-137	4.48E+00			W-187	2.41E+00
		Cs-138	1.37E+00				
		Ba-140	1.90E+01				
		Np-239	1.64E+02				
Total	5.39E+02	Total	3.13E+02	Total	4.39E+01	Total	6.91E+02

Table 12.2-13i Liquid Radwaste Component Inventories - HSD Sample Tank

Source volume = 30m^3

Total MBq = 2.43E+01

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**
I-131	3.01E+00	Rb-89	1.87E-04	Y-91	5.02E-02	Na-24	9.40E-01
I-132	1.05E-01	Sr-89	7.41E-02	Y-92	1.23E-01	P-32	1.34E-01
I-133	4.91E+00	Sr-90	5.36E-03	Y-93	1.92E-01	Cr-51	4.38E+00
I-134	2.44E-02	Y-90	5.37E-03	Zr-95	5.88E-03	Mn-54	5.33E-02
I-135	9.12E-01	Sr-91	1.73E-01	Nb-95	6.03E-03	Mn-56	1.62E-01
		Sr-92	3.75E-02	Ru-103	3.39E-03	Co-58	1.48E-01
		Mo-99	8.40E-01	Rh-103m	1.45E-02	Co-60	3.03E-01
		Tc-99m	8.08E-01	Ru-106	2.32E-03	Fe-55	7.54E-01
		Te-129m	2.88E-02	Rh-106	2.32E-03	Fe-59	2.24E-02
		Te-131m	2.21E-02	La-140	2.87E-01	Ni-63	---
		Te-132	4.54E-03	Ce-141	2.21E-02	Cu-64	2.04E+00
		Cs-134	2.08E-02	Ce-144	2.32E-03	Zn-65	1.50E-01
		Cs-136	1.22E-02	Pr-144	2.32E-03	Ag-110m	7.50E-04
		Cs-137	5.62E-02			W-187	5.23E-02
		Cs-138	1.57E-03				
		Ba-140	2.65E-01				
		Np-239	3.15E+00				
TOTAL	**8.96E+00**	TOTAL	**5.51E+00**	TOTAL	**7.14E-01**	TOTAL	**9.15E+00**

Table 12.2-13j Liquid Radwaste Component Inventories - Chemical Drain Tank

Source volume = 4m^3

Total MBq = 6.52E+00

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**
I-131	3.68E-01	Rb-89	4.10E-03	Y-91	4.93E-03	Na-24	3.56E-01
I-132	2.46E-01	Sr-89	8.15E-03	Y-92	1.36E-01	P-32	1.56E-02
I-133	1.40E+00	Sr-90	5.79E-04	Y-93	1.05E-01	Cr-51	4.91E-01
I-134	1.58E-01	Y-90	5.79E-04	Zr-95	6.45E-04	Mn-54	5.78E-03
I-135	7.61E-01	Sr-91	9.99E-02	Nb-95	6.52E-04	Mn-56	3.53E-01
		Sr-92	7.75E-02	Ru-103	1.60E-03	Co-58	1.62E-02
		Mo-99	1.29E-01	Rh-103m	1.61E-03	Co-60	3.27E-02
		Tc-99m	1.25E-01	Ru-106	2.51E-04	Fe-55	8.15E-02
		Te-129m	3.21E-03	Rh-106	2.51E-04	Fe-59	2.48E-03
		Te-131m	4.92E-03	La-140	3.23E-02	Ni-63	---
		Te-132	6.64E-04	Ce-141	2.46E-03	Cu-64	8.96E-01
		Cs-134	2.24E-03	Ce-144	2.51E-04	Zn-65	1.63E-02
		Cs-136	1.42E-03	Pr-144	2.51E-04	Ag-110m	8.13E-05
		Cs-137	6.06E-03			W-187	1.36E-02
		Cs-138	1.64E-02				
		Ba-140	3.10E-02				
		Np-239	5.14E-01				
TOTAL	**2.94E+00**	TOTAL	**1.02E+00**	TOTAL	**2.86E-01**	TOTAL	**2.28E+00**

Table 12.2-15a Solid Radwaste Component Inventories CUW Backwash Receiving Tank

Source volume = 28m^3

Total MBq = 1.94E+08

Halogens		**Soluble fission Products**		**Insoluble fission Products**		**Activation Products**	
Isotope	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**
I-131	2.41E+07	Rb-89	2.82E+04	Y-91	3.66E+05	Na-24	5.01E+06
I-132	3.06E+06	Sr-89	9.40E+05	Y-92	7.37E+05	P-32	1.32E+06
I-133	2.20E+07	Sr-90	7.27E+04	Y-93	1.36E+06	Cr-51	4.99E+07
I-134	2.01E+06	Y-90	7.27E+04	Zr-95	7.41E+04	Mn-54	7.12E+05
I-135	9.52E+06	Sr-91	1.27E+06	Nb-95	7.41E+04	Mn-56	4.44E+06
		Sr-92	9.76E+05	Ru-103	1.73E+05	Co-58	1.87E+06
		Mo-99	4.05E+06	Rh-103m	1.73E+05	Co-60	4.10E+06
		Tc-99m	4.05E+06	Ru-106	3.11E+04	Fe-55	5.41E+06
		Te-129m	3.36E+05	Rh-106	3.11E+04	Fe-59	2.73E+05
		Te-131m	9.27E+04	La-140	2.51E+06	Ni-63	1.03E+07
		Te-132	2.37E+05	Ce-141	2.58E+05	Cu-64	1.22E+07
		Cs-134	1.54E+05	Ce-144	3.09E+04	Zn-65	2.00E+06
		Cs-136	6.44E+04	Pr-144	3.09E+04	Ag-110m	1.00E+04
		Cs-137	4.23E+05			W-187	2.28E+05
		Cs-138	2.07E+05				
		Ba-140	2.51E+06				
		Np-239	1.44E+07				
Total	6.06E+07	Total	2.98E+07	Total	5.85E+06	Total	9.77E+07

Table 12.2-15b Solid Radwaste Component Inventories CF Backwash Receiving Tank

Source volume = 60m³

Total MBq = 2.59E+03

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	0.00E+00	Rb-89	0.00E+00	Y-91	2.06E+02	Na-24	0.00E+00
I-132	0.00E+00	Sr-89	0.00E+00	Y-92	2.63E+02	P-32	0.00E+00
I-133	0.00E+00	Sr-90	0.00E+00	Y-93	4.88E+02	Cr-51	0.00E+00
I-134	0.00E+00	Y-90	0.00E+00	Zr-95	4.21E+01	Mn-54	0.00E+00
I-135	0.00E+00	Sr-91	0.00E+00	Nb-95	4.21E+01	Mn-56	0.00E+00
		Sr-92	0.00E+00	Ru-103	9.45E+01	Co-58	0.00E+00
		Mo-99	0.00E+00	Rh-103m	9.45E+01	Co-60	0.00E+00
		Tc-99m	0.00E+00	Ru-106	1.87E+01	Fe-55	0.00E+00
		Te-129m	0.00E+00	Rh-106	1.87E+01	Fe-59	0.00E+00
		Te-131m	0.00E+00	La-140	1.14E+03	Ni-63	0.00E+00
		Te-132	0.00E+00	Ce-141	1.37E+02	Cu-64	0.00E+00
		Cs-134	0.00E+00	Ce-144	1.85E+01	Zn-65	0.00E+00
		Cs-136	0.00E+00	Pr-144	1.85E+01	Ag-110m	0.00E+00
		Cs-137	0.00E+00			W-187	0.00E+00
		Cs-138	0.00E+00				
		Ba-140	0.00E+00				
		Np-239	0.00E+00				
Total	0.00E+00	Total	0.00E+00	Total	2.59E+03	Total	0.00E+00

Table 12.2-15c Solid Radwaste Component Inventories Phase Separator

Source volume = 100m^3

Total MBq = 5.10E+08

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	2.41E+07	Rb-89	8.06E+04	Y-91	1.05E+06	Na-24	1.43E+07
I-132	8.75E+06	Sr-89	2.69E+06	Y-92	2.11E+06	P-32	3.76E+06
I-133	6.28E+07	Sr-90	2.08E+05	Y-93	3.90E+06	Cr-51	1.43E+08
I-134	5.74E+06	Y-90	2.08E+05	Zr-95	2.12E+05	Mn-54	2.03E+06
I-135	2.72E+07	Sr-91	3.63E+06	Nb-95	2.12E+05	Mn-56	1.27E+07
		Sr-92	2.79E+06	Ru-103	4.96E+05	Co-58	5.34E+06
		Mo-99	1.16E+07	Rh-103m	4.96E+05	Co-60	1.17E+07
		Tc-99m	1.16E+07	Ru-106	8.89E+04	Fe-55	1.54E+07
		Te-129m	9.61E+05	Rh-106	8.89E+04	Fe-59	7.81E+05
		Te-131m	2.65E+05	La-140	7.17E+06	Ni-63	2.94E+07
		Te-132	6.78E+05	Ce-141	7.37E+05	Cu-64	3.48E+07
		Cs-134	4.39E+05	Ce-144	8.84E+04	Zn-65	5.71E+06
		Cs-136	1.84E+05	Pr-144	8.84E+04	Ag-110m	2.86E+04
		Cs-137	1.21E+06			W-187	6.50E+05
		Cs-138	5.93E+05				
		Ba-140	7.17E+06				
		Np-239	4.10E+07				
Total	1.29E+08	Total	8.53E+07	Total	1.67E+07	Total	2.79E+08

Table 12.2-15d Solid Radwaste Component Inventories Spent Resin Storage Tank

Source volume = 50m^3

Total MBq = 5.72E+06

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	1.48E+06	Rb-89	1.58E+02	Y-91	7.01E+01	Na-24	3.37E+04
I-132	1.53E+05	Sr-89	2.47E+04	Y-92	3.34E+01	P-32	1.43E+04
I-133	1.11E+06	Sr-90	4.45E+03	Y-93	6.21E+01	Cr-51	8.46E+05
I-134	9.88E+04	Y-90	4.45E+03	Zr-95	1.51E+01	Mn-54	3.66E+04
I-135	4.79E+05	Sr-91	8.53E+03	Nb-95	1.51E+01	Mn-56	2.97E+04
		Sr-92	6.52E+03	Ru-103	2.57E+01	Co-58	5.91E+04
		Mo-99	2.75E+04	Rh-103m	2.57E+01	Co-60	2.45E+05
		Tc-99m	2.75E+04	Ru-106	1.12E+01	Fe-55	4.74E+04
		Te-129m	6.52E+03	Rh-106	1.12E+01	Fe-59	6.59E+03
		Te-131m	6.24E+02	La-140	1.73E+02	Ni-63	6.31E+05
		Te-132	1.62E+03	Ce-141	3.32E+01	Cu-64	8.19E+04
		Cs-134	7.28E+03	Ce-144	1.06E+01	Zn-65	9.87E+04
		Cs-136	6.02E+02	Pr-144	1.06E+01	Ag-110m	4.95E+02
		Cs-137	2.35E+04			W-187	1.53E+03
		Cs-138	6.76E+02				
		Ba-140	2.55E+04				
		Np-239	9.69E+04				
Total	3.32E+06	Total	2.67E+05	Total	4.97E+02	Total	2.13E+06

Table 12.2-15e ~~*Solid Radwaste Component Inventories Concentrated Waste Tank*~~
Not Used

Table 12.2-15f ~~*Solid Radwaste Component Inventories Solids Dryer Feed Tank*~~
Not Used

Table 12.2-15g ~~*Solid Radwaste Component Inventories Solids Dryer (Outlet)*~~
Not Used

Table 12.2-15h ~~*Solid Radwaste Component Inventories Solids Dryer Pelletizer*~~
Not Used

Table 12.2-15i ~~*Solid Radwaste Component Inventories Solids Mist Separator (Steam)*~~
Not Used

Table 12.2-15j ~~*Solid Radwaste Component Inventories Solids Condenser*~~
Not Used

Table 12.2-15k ~~*Solid Radwaste Component Inventories Solids Drum*~~
Not Used

Table 12.2-15I Solid Radwaste Component Inventories LW Backwash Receiving Tank

Source volume = 50m^3

Total MBq = 2.33E+6

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	MBq	Isotope	MBq	Isotope	MBq	Isotope	MBq
I-131	1.36E+05	Rb-89	8.72E+01	Y-91	1.92E+04	Na-24	9.75E+03
I-132	5.40E+03	Sr-89	2.31E+04	Y-92	3.22E+03	P-32	1.23E+04
I-133	4.51E+04	Sr-90	3.65E+03	Y-93	2.83E+03	Cr-51	8.47E+05
I-134	3.39E+03	Y-90	3.65E+03	Zr-95	2.42E+03	Mn-54	3.46E+04
I-135	1.74E+04	Sr-91	2.40E+03	Nb-95	3.42E+03	Mn-56	8.54E+03
		Sr-92	1.71E+03	Ru-103	4.19E+03	Co-58	6.27E+04
		Mo-99	1.16E+04	Rh-103m	4.20E+03	Co-60	2.25E+05
		Tc-99m	1.12E+04	Ru-106	1.55E+03	Fe-55	5.43E+05
		Te-129m	6.57E+03	Rh-106	1.56E+03	Fe-59	7.16E+03
		Te-131m	2.02E+02	La-140	2.44E+04	Ni-63	5.84E+02
		Te-132	7.20E+01	Ce-141	5.50E+03	Cu-64	2.33E+04
		Cs-134	8.68E+03	Ce-144	1.50E+03	Zn-65	8.52E+04
		Cs-136	6.80E+02	Pr-144	1.50E+03	Ag-110m	4.62E+02
		Cs-137	2.52E+04			W-187	5.31E+02
		Ba-137m	2.35E+04				
		Cs-138	3.56E+02				
		Ba-140	2.11E+04				
		Np-239	3.86E+04				
Total	2.08E+05	Total	1.82E+05	Total	7.55E+04	Total	1.86E+06

Table 12.2-20 Airborne Concentrations

Nuclides	Annual Average Airborne per Unit (Site-specific)		Site Wide
	Release MBq/yr	Concentration MBq/cm^3	10CFR20 Limits MBq/cm^3
Kr-83m	3.10E+01	1.28E-17	1.85E-06
Kr-85m	7.80E+05	3.22E-13	3.70E-09
Kr-85	2.10E+07	8.66E-12	2.59E-08
Kr-87	9.30E+05	3.83E-13	7.40E-10
Kr-88	1.40E+06	5.77E-13	3.33E-10
Kr-89	8.90E+06	3.67E-12	
Kr-90	1.20E+01	4.95E-18	
Xe-131m	1.90E+06	7.83E-13	7.40E-08
Xe-133m	3.20E+03	1.32E-15	2.22E-08
Xe-133	8.90E+07	3.67E-11	1.85E-08
Xe-135m	1.50E+07	6.18E-12	1.48E-09
Xe-135	1.70E+07	7.01E-12	2.59E-09
Xe-137	1.90E+07	7.83E-12	
Xe-138	1.60E+07	6.60E-12	7.40E-10
Xe-139	1.50E+01	6.18E-18	
I-131	9.60E+03	3.96E-15	7.40E-12
I-132	8.10E+04	3.34E-14	7.40E-10
I-133	6.30E+04	2.60E-14	3.70E-11
I-134	1.40E+05	5.77E-14	2.22E-09
I-135	8.90E+04	3.67E-14	2.22E-10
H-3	2.70E+06	1.11E-12	3.70E-09
C-14	3.40E+05	1.40E-13	1.11E-10
Na-24	1.50E+02	6.18E-17	2.59E-10
P-32	3.40E+01	1.40E-17	3.70E-11
Ar-41	2.50E+05	1.03E-13	3.70E-10
Cr-51	1.30E+03	5.36E-16	1.11E-09
Mn-54	2.00E+02	8.24E-17	3.70E-11
Mn-56	1.30E+02	5.36E-17	7.40E-10
Fe-55	2.40E+02	9.89E-17	1.11E-10

Table 12.2-20 Airborne Concentrations (Continued)

Nuclides	Annual Average Airborne per Unit (Site-specific)		Site Wide
	Release MBq/yr	Concentration MBq/cm^3	10CFR20 Limits MBq/cm^3
Fe-59	3.00E+01	1.24E-17	1.85E-11
Co-58	8.90E+01	3.67E-17	3.70E-11
Co-60	4.80E+02	1.98E-16	1.85E-12
Ni-63	2.40E-01	9.89E-20	3.70E-11
Cu-64	3.70E+02	1.53E-16	1.11E-09
Zn-65	4.10E+02	1.69E-16	1.48E-11
Rb-89	1.60E+00	6.60E-19	7.40E-09
Sr-89	2.10E+02	8.66E-17	3.70E-11
Sr-90	2.60E+00	1.07E-18	2.22E-13
Y-90	1.70E+00	7.01E-19	3.33E-11
Sr-91	3.70E+01	1.53E-17	1.85E-10
Sr-92	2.90E+01	1.20E-17	3.33E-10
Y-91	8.90E+00	3.67E-18	7.40E-12
Y-92	2.30E+01	9.48E-18	3.70E-10
Y-93	4.10E+01	1.69E-17	1.11E-10
Zr-95	5.90E+01	2.43E-17	1.48E-11
Nb-95	3.10E+02	1.28E-16	7.40E-11
Mo-99	2.20E+03	9.07E-16	1.48E-10
Tc-99m	1.10E+01	4.53E-18	7.40E-09
Ru-103	1.30E+02	5.36E-17	3.33E-11
Rh-103m	4.10E+00	1.69E-18	7.40E-08
Ru-106	7.00E-01	2.89E-19	3.70E-12
Rh-106	7.00E-01	2.89E-19	1.48E-09
Ag-110m	7.40E-02	3.05E-20	3.70E-12
Sb-124	6.70E+00	2.76E-18	1.11E-11
Te-129m	8.10E+00	3.34E-18	3.33E-11
Te-131m	2.80E+00	1.15E-18	3.70E-11
Te-132	7.00E-01	2.89E-19	3.70E-11
Cs-134	2.30E+02	9.48E-17	7.40E-12

Table 12.2-20 Airborne Concentrations (Continued)

Nuclides	Annual Average Airborne per Unit (Site-specific) Release MBq/yr	Concentration MBq/cm^3	Site Wide 10CFR20 Limits MBq/cm^3
Cs-136	2.20E+01	9.07E-18	3.33E-11
Cs-137	3.50E+02	1.44E-16	7.40E-12
Cs-138	6.30E+00	2.60E-18	2.69E-09
Ba-140	1.00E+03	4.12E-16	7.40E-11
La-140	6.70E+01	2.76E-17	7.40E-11
Ce-141	3.40E+02	1.40E-16	3.70E-11
Ce-144	7.00E-01	2.89E-19	1.48E-12
Pr-144	7.00E-01	2.89E-19	7.40E-09
W-187	7.00E+00	2.89E-18	3.70E-10
Np-239	4.40E+02	1.81E-16	1.11E-10

Table 12.2-21 Gaseous Pathway Doses for Maximally Exposed Individual [1] One Unit (millirem per year)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID [4]	LUNG	SKIN
PLUME	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	8.63E-02	1.70E-01	4.62E-01
GROUND	2.36E-02	2.36E-02	2.36E-02	2.36E-02	2.36E-02	2.84E-02	2.36E-02	2.77E-02
VEGETABLE								
ADULT [2]	4.09E-02	4.03E-02	1.76E-01	4.41E-02	4.03E-02	8.31E-01	3.43E-02	3.34E-02
TEEN [2]	6.14E-02	6.13E-02	2.84E-01	7.00E-02	6.38E-02	1.05E+00	5.55E-02	5.40E-02
CHILD	1.38E-01	1.35E-01	6.84E-01	1.55E-01	1.44E-01	1.99E+00	1.31E-01	1.29E-01
MEAT								
ADULT	1.33E-02	1.81E-02	6.18E-02	1.38E-02	1.32E-02	3.99E-02	1.24E-02	1.23E-02
TEEN	1.10E-02	1.36E-02	5.21E-02	1.15E-02	1.10E-02	2.97E-02	1.05E-02	1.04E-02
CHILD	2.01E-02	2.11E-02	9.79E-02	2.09E-02	2.02E-02	4.67E-02	1.95E-02	1.94E-02
COW MILK [2]								
ADULT	2.08E-02	1.65E-02	7.36E-02	2.49E-02	2.17E-02	9.77E-01	1.43E-02	1.36E-02
TEEN	3.35E-02	2.84E-02	1.36E-01	4.45E-02	3.90E-02	1.55E+00	2.64E-02	2.49E-02
CHILD	7.21E-02	6.34E-02	3.31E-01	9.34E-02	8.39E-02	3.10E+00	6.31E-02	6.09E-02
INFANT [2]	1.43E-01	1.35E-01	6.43E-01	1.93E-01	1.64E-01	7.52E+00	1.31E-01	1.27E-01
GOAT MILK [3]								
ADULT	3.10E-02	1.60E-02	8.26E-02	3.83E-02	2.70E-02	1.28E+00	1.63E-02	1.40E-02
TEEN	4.33E-02	2.80E-02	1.51E-01	6.79E-02	4.81E-02	2.03E+00	3.01E-02	2.55E-02
CHILD	7.89E-02	6.37E-02	3.71E-01	1.33E-01	9.88E-02	4.05E+00	6.86E-02	6.17E-02
INFANT	1.50E-01	1.31E-01	7.08E-01	2.70E-01	1.89E-01	9.82E+00	1.40E-01	1.28E-01
INHAL								
ADULT	1.62E-03	2.14E-03	8.13E-04	2.41E-03	3.06E-03	7.46E-02	3.67E-03	1.03E-03
TEEN	1.75E-03	2.33E-03	1.13E-03	2.92E-03	3.79E-03	9.76E-02	5.04E-03	1.04E-03
CHILD	1.67E-03	1.76E-03	1.52E-03	2.72E-03	3.46E-03	1.21E-01	4.25E-03	9.18E-04
INFANT	1.03E-03	9.57E-04	1.13E-03	2.10E-03	2.17E-03	1.10E-01	3.05E-03	5.28E-04
SUM OF VIABLE PATHWAYS (CHILD)	3.50E-01	3.48E-01	9.74E-01	3.69E-01	3.58E-01	2.27E+00	3.49E-01	6.39E-01

[1] Site-specific maximally exposed individual for total body and all organs except thyroid is child resident, 2.18 miles WSW of STP3/4.

[2] Adult, teen and infant doses are presented as additional information.

[3] Cow milk and goat milk pathway doses are hypothetical for this location and are presented as additional information only; no milk animals are located within 5 miles of the plant.

[4] Maximally exposed individual for thyroid. Child resident 3.03 miles NNW.

Ground level releases assumed.

Source: GASPAR II calculated pathway doses for locations indicated in footnotes [1] and [4]

Table 12.2-22 Annual Average Liquid Releases

Nuclide	Annual Release (Site-specific) MBq/yr	Concentration (Site-specific) MBq/ml
I-131	3.35E+02	1.75E-13
I-132	7.15E+01	3.75E-14
I-133	1.38E+03	7.23E-13
I-134	4.22E+00	2.21E-15
I-135	4.03E+02	2.11E-13
H-3	2.96E+05	1.55E-10
C-14	0.00E+00	0.00E+00
Na-24	1.87E+02	9.78E-14
P-32	2.10E+01	1.10E-14
Cr-51	6.30E+02	3.30E-13
Mn-54	1.47E+02	7.68E-14
Mn-56	7.55E+01	3.95E-14
Co-56	0.00E+00	0.00E+00
Co-57	0.00E+00	0.00E+00
Co-58	3.10E+02	1.62E-13
Co-60	5.69E+02	2.98E-13
Fe-55	3.50E+02	1.83E-13
Fe-59	8.24E+01	4.31E-14
Ni-63	6.29E+01	3.30E-14
Cu-64	4.67E+02	2.45E-13
Zn-65	1.63E+01	8.53E-15
Rb-89	0.00E+00	0.00E+00
Sr-89	1.16E+01	6.08E-15
Sr-90	9.92E-01	5.19E-16
Y-90	0.00E+00	0.00E+00
Sr-91	4.64E+01	2.43E-14
Y-91	8.70E+00	4.55E-15
Sr-92	1.64E+01	8.58E-15
Y-92	6.27E+01	3.28E-14
Y-93	5.05E+01	2.64E-14
Zr-95	4.10E+01	2.14E-14

Table 12.2-22 Annual Average Liquid Releases (Continued)

Nuclide	Annual Release (Site-specific) MBq/yr	Concentration (Site-specific) MBq/ml
Nb-95	1.16E+01	6.08E-15
Mo-99	9.66E+01	5.06E-14
Tc-99m	2.10E+02	1.10E-13
Ru-103	1.21E+01	6.34E-15
Rh-103m	0.00E+00	0.00E+00
Ru-106	3.29E+02	1.72E-13
Rh-106	0.00E+00	0.00E+00
Ag-110m	4.44E+01	2.32E-14
Sb-124	0.00E+00	0.00E+00
Te-129m	3.12E+00	1.63E-15
Te-131m	3.10E+00	1.63E-15
Te-132	5.00E-01	2.62E-16
Cs-134	4.18E+02	2.19E-13
Cs-136	2.78E+01	1.46E-14
Cs-137	6.57E+02	3.44E-13
Cs-138	2.96E-02	1.55E-17
Ba-140	6.23E+01	3.26E-14
La-140	0.00E+00	0.00E+00
Ce-141	1.10E+01	5.74E-15
Ce-144	1.44E+02	7.56E-14
Pr-144	3.00E+00	1.57E-15
Nd-147	7.40E-02	3.87E-17
W-187	8.24E+00	4.32E-15
Np-239	3.51E+02	1.84E-13

Table 12.2-23 Liquid Pathway Dose Analysis[1] (millirem per year) (One Unit)

Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI [2]
2.12 E-4	1.15 E-3	2.92E-4	2.63E-4	2.03 E-4	2.13E-4	2.05 E-4	4.34 E-4

[1] Site-specific liquid pathway MEI is a teenager ingesting fresh water sport fish and receiving shoreline exposure from the Little Robbins Slough.

[2] GI-LLI = Gastrointestinal-lining of lower intestine.

Table 12.2-31 Gaseous Pathway Parameters

Parameter	Value
Release Source Terms	Table 12.2-20
Population distribution	ER Table 2.5-2
Dispersion and deposition factors (χ/q and d/q) [1]	Table 2.3S-27
50-Mile Milk Production (L/yr)	2.13E6 [2]
50-Mile Meat Production (kg/yr)	4.05E7 [2]
50-Mile Vegetable Production (kg/yr)	9.64E6 [2]

[1] Air concentration and deposition per unit release rate.

[2] Animal and vegetable production from 2002 National Census of Agriculture. Production converted to food products using average conversion factors: 21,328 lb-milk/cow, 524 lb beef per cattle/calf, 92.2 lb pork/hog-pig, 61.1 lb meat/sheep, and 8,090 kg vegetables/acre

Table 12.2-32 Gaseous Pathway Consumption Factors for Maximally Exposed Individual

Consumption Factor	Annual Rate			
	Infant	Child	Teen	Adult
Milk consumption (L/yr) [1]	330	330	400	310
Meat consumption (kg/yr) [1]	0	41	65	110
Leafy vegetable consumption (kg/yr) [2]	0	26	42	64
Vegetable consumption (kg/yr) [2]	0	520	630	520

Source: Reference 12.2-12

[1] Cattle are assumed on pasture for 11 months of the year.

[2] Leafy vegetables are assumed grown in the MEI's garden for 11 months of the year; the garden is assumed to supply 76% of the other vegetables ingested annually.

Table 12.2-33 Gaseous Pathway Receptor Locations

Receptor	Direction	Distance (miles)
Site boundary	NNW	0.69
Maximally exposed individual (MEI), total body and all organs but thyroid	WSW	2.18
MEI, thyroid	NNW	3.03

Source: from GASPAR II (Reference 12.2-12) calculations of dose at nearby receptors (receptors given in Reference 12.2-13). Locations of maximum dose reported above.

Table 12.2-34 Liquid Pathway Parameters

Parameter	Value
Release source terms	Table 12.2-22 [1]
Water body flow	600, 97800, 18.3 cubic feet per second [2]
Dilution factor for discharge	1 [3]
Transit time to receptor	1 hour [4]
Impoundment reconcentration model	None [5]
50-Mile population	514,003 [6]
50-Mile sport fishing, invertebrate catch	4.5E4, 1.8E6 kg/yr [7]
50-Mile shoreline usage	7.84E6 person-hours/yr [8]
50-Mile swimming, boating usage	3.92E6 person-hours/yr [9]
Fish consumption	21 kilograms per year [10]
Drinking water consumption	None [11]

[1] Table 12.2-22 gives single unit releases to the main cooling reservoir. Sources to the Colorado River, Matagorda Bay, and Little Robbins Slough are calculated by multiplying the values in Table 12.2-22 by the factors for each water body and nuclide in Table B4-1 of Reference 12.2-13.

[2] Dilution flow rate in Colorado River, Matagorda Bay, and Little Robbins Slough (Reference 12.2-14).

[3] Liquid discharge assumed fully mixed with annual average dilution flows.

[4] 1 hour assumed for transit time from reservoir discharge in all water bodies. This parameter is inconsequential because of residence time in the reservoir.

[5] Completely mixed model used for all water bodies. Reservoir characteristics built into Reference 12.2-13 Table B4-1 factors.

[6] Estimated 2060 population, ER Table 2.5-2.

[7] One-half of fish catch in each of Colorado River and Matagorda Bay. All invertebrate catch in Matagorda Bay (Reference 12.2-13)

[8] One-half at each of Colorado River and Matagorda Bay (Reference 12.2-13)

[9] Each of swimming and boating assumed one-half of shoreline usage.

[10] Adult MEI. 6.9 kilograms per year average (adult population) fish consumption (Reference 12.2-15)

[11] References 12.2-13 and 12.2-14

Table 12.2-35 Comparison of Annual Maximally Exposed Individual Doses with 10 CFR 50, Appendix I Criteria

		Annual Dose	
Type of Dose	Location	ABWR (per unit)	Limit
Liquid effluent	Little Robbins Slough		
Total body (mrem) [5]		2.63E-4 [1]	3
Maximum organ – Bone (mrem)		1.15E-3 [7]	10
Gaseous effluent [2]	Site Boundary		
Gamma air (mrad) [6]		3.30	10
Beta air (mrad)		4.28	20
Total external body (mrem)		3.20	5
Skin (mrem)		7.25	15
Iodines and particulates [3] (gaseous effluents)			
Maximum organ – thyroid (mrem)	MEI	2.19 [4]	15

[1] Teenager using Little Robbins Slough.

[2] North-northwest Site Boundary. Ground level releases assumed.

[3] Includes Tritium and Carbon-14 terrestrial food chain dose (and inhalation dose for calculation ease and conservatism), consistent with Table 1 of Reference 12.2-16.

[4] Child eating home grown meat and vegetables. Difference between Tables 12.2-21 and 12.2-35 thyroid dose is 0.087 millirem per unit from noble gases in the plume.

[5] One-one thousandth of a rem (roentgen equivalent man). For gamma and beta exposure, one mrem = one mrad.

[6] One-one thousandth of a rad (radiation absorbed dose), or 0.1 ergs per gram of, biological mass.

[7] Child using Little Robbins Slough.

Source: GASPAR II and LADTAP II calculated doses.

Table 12.2-36 Comparison of Pathway Bounding Maximally Exposed Individual Doses with 10 CFR 20.1301(e) Criteria [1] – (millirem per year)

		Units 3 and 4 (ABWR)			Units 1 and 2 (Existing) [6]				
	Direct Radiation	Liquid	Gaseous	Total	Liquid	Gaseous	Total	Site Total	Regulatory Limit
Total body	5.0	0.00053 [2]	0.70 [4]	5.70	0.0042	0.0080	0.012	5.71	25
Thyroid	NA	0.00041 [2]	4.54 [5]	4.54	0.0041	0.0097	0.014	4.55	75
Other organ - bone	NA	0.0023 [3]	1.94 [4]	1.94	0.00077	0.0011	0.0019	1.94	25

[1] Compliance with 40 CFR 190 specified in 10 CFR 20.1301(e).

[2] Teenager using Little Robbins Slough for shoreline activities and fishing.

[3] Child using Little Robbins Slough for shoreline activities and fishing.

[4] Residence with meat animal and vegetable garden, dose to child, 2.18 miles WSW of new units.

[5] Residence with meat animal and vegetable garden, dose to child, 3.03 miles NNW of new units.

[6] References 12.2-12, 12.2-14, and 12.2-15. Same receptor locations as STP 3 & 4.

Table 12.2-37 Activity in the Condensate Storage Tank[1]

Source Volume = 2110m^3

Total MBq = 8.08E+03

Halogens		Soluble fission Products		Insoluble fission Products		Activation Products	
Isotope	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**	**Isotope**	**MBq**
I 131	1.31E+03	Rb 89	7.16E+01	Y 91	3.95E+01	Na 24	5.11E+01
I 132	5.51E+02	Sr 89	8.23E+00	Y 92	1.15E+01	P 32	6.87E+00
I 133	3.05E+03	Sr 90	5.38E-01	Y 93	2.00E+00	Cr 51	2.62E+02
I 134	3.61E+02	Y 90	4.58E-01	Zr 95	7.68E+00	Mn 54	3.86E+00
I 135	1.61E+03	Sr 91	1.40E+01	Nb 95	7.95E+00	Mn 56	2.77E+01
		Sr 92	1.17E+01	Ru 103	1.77E+01	Co 58	8.20E+00
		Mo 99	2.93E+01	Rh 103m	1.78E+01	Co 60	2.50E+01
		Tc 99m	2.83E+01	Ru 106	3.74E+00	Fe 55	1.48E+01
		Te 129m	1.73E+00	Rh 106	3.74E+00	Fe 59	7.88E-01
		Te 131m	8.14E-01	La 140	1.08E+02	Ni 63	7.62E-02
		Te 132	4.41E-01	Ce 141	2.56E+01	Cu 64	1.27E+02
		Cs 134	6.18E+00	Ce 144	3.66E+00	Zn 65	1.31E+01
		Cs 136	1.81E+00	Pr 144	3.66E+00	Ag 110m	4.27E-02
		Cs 137	1.91E+01			W 187	2.07E-01
		Ba 137m	1.78E+01				
		Cs 138	5.93E+01				
		Ba 140	1.32E+01				
		Np 239	1.08E+02				
Total	**6.89E+03**	**Total**	**3.93E+02**	**Total**	**2.52E+02**	**Total**	**5.42E+02**

Note:

1) The H-3 source term value is 7.77E+05 MBq.