CHAPTER 11
RADIOACTIVE WASTE MANAGEMENT

TABLE OF CONTENTS

Section	Title	Page
11.1	SOURCE TERMS	11.1-1
11.2	LIQUID WASTE MANAGEMENT SYSTEMS	11.2-1
11.2.1.2.4	Controlled Release of Radioactivity	11.2-1
11.2.1.2.5.2	Use of Mobile and Temporary Equipment	11.2-1
11.2.3.3	Dilution Factor	11.2-3
11.2.3.5	Estimated Doses	11.2-3
11.2.3.5.1	Estimated Individual Dose Rate	11.2-4
11.2.3.5.2	Estimated Population Dose	11.2-4
11.2.3.5.3	Liquid Radwaste Cost Benefit Analysis Methodology	11.2-4
11.2.3.5.4	Liquid Radwaste Cost Benefit Analysis	11.2-5
11.2.3.6	Quality Assurance	11.2-6
11.2.5	COMBINED LICENSE INFORMATION	11.2-6
11.2.5.1	Liquid Radwaste Processing by Mobile Equipment	11.2-6
11.2.5.2	Cost Benefit Analysis of Population Doses	11.2-6
11.2.6	REFERENCES	11.2-6
11.3	GASEOUS WASTE MANAGEMENT SYSTEM	11.3-1
11.3.3	RADIOACTIVE RELEASES	11.3-1
11.3.3.4	Estimated Doses	11.3-1
11.3.3.4.1	Estimated Individual Doses	11.3-2
11.3.3.4.2	Estimated Population Dose	11.3-2
11.3.3.4.3	Gaseous Radwaste Cost-Benefit Analysis Methodology	11.3-2
11.3.3.4.4	Gaseous Radwaste Cost-Benefit Analysis	11.3-3
11.3.3.6	Quality Assurance	11.3-3
11.3.5	COMBINED LICENSE INFORMATION	11.3-4
11.3.5.1	Cost Benefit Analysis of Population Doses	11.3-4
11.3.6	REFERENCES	11.3-4
11.4	SOLID WASTE MANAGEMENT	11.4-1
11.4.5	QUALITY ASSURANCE	11.4-1
11.4.6	COMBINED LICENSE INFORMATION FOR SOLID WASTE MANAGEMENT SYSTEM PROCESS CONTROL PROGRAM	11.4-1
11.4.6.1	Procedures	11.4-2
11.4.6.2	Third Party Vendors	11.4-2
11.4.7	REFERENCES	11.4-2
11.5	RADIATION MONITORING	11.5-1

TABLE OF CONTENTS (CONT.)

Section	Title	Page
11.5.1.2	Power Generation Design Basis	11.5-1
11.5.2.4	Inservice Inspection, Calibration, and Maintenance	11.5-1
11.5.3	EFFLUENT MONITORING AND SAMPLING	11.5-1
11.5.4	PROCESS AND AIRBORNE MONITORING AND SAMPLING	11.5-2
11.5.4.1	Effluent Sampling	11.5-2
11.5.4.2	Representative Sampling	11.5-2
11.5.6.5	Quality Assurance	11.5-4
11.5.8	COMBINED LICENSE INFORMATION	11.5-4
11.5.9	REFERENCES	11.5-5

LIST OF TABLES

Number	Title
11.2-201	Dilution Factor Parameters and Dilution Factors
11.2-202	LADTAP II Input[(a)]
11.2-203	Annual Individual Doses from Liquid Effluents (per Unit)
11.2-204	Annual Population Doses from Liquid Effluents (per Unit)
11.3-201	GASPAR II Input
11.3-202	Population Input for Population Dose Rates
11.3-203	Annual Individual Doses from Gaseous Effluents per Unit (mrem)
11.3-204	Comparison of Gaseous Effluent Doses to 10 CFR 50 Appendix I Limits
11.3-205	Annual Population Doses from Gaseous Effluents (per Unit)
11.3-206	Comparison of Maximally Exposed Individual Doses with 40 CFR Part 190 Criteria
11.5-201	Minimum Sampling Frequency
11.5-202	Minimum Sensitivities

CHAPTER 11
RADIOACTIVE WASTE MANAGEMENT

11.1 SOURCE TERMS

This section of the referenced DCD is incorporated by reference with no departures or supplements.

11.2 LIQUID WASTE MANAGEMENT SYSTEMS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

11.2.1.2.4 Controlled Release of Radioactivity

Add the following new paragraph at the end of DCD Subsection 11.2.1.2.4:

VCS SUP 11.2-1 The Liquid Radwaste System (WLS) discharge piping from the Units 2 and 3 Radwaste Building is stainless steel, enclosed within a guard pipe, and monitored for leakage to comply with 10 CFR 20.1406. The WLS discharge piping connects to the Waste Water System (WWS) blowdown line within the Exclusion Area Boundary for dilution to meet the release limits of 10 CFR Part 20 Appendix B, Table II, Column 2. Dilution at this point, downstream of the WWS Blowdown Sump, is primarily supplied from circulating water blowdown flow.

The WWS blowdown line to the Plant Outfall at Parr Reservoir is a buried, high density polyethylene single-walled pipe. Waste water gravity drains from the Blowdown Sump to the diffuser at the Plant Outfall. There are no valves, vacuum breakers, or pumps along the WWS blowdown line between the point where WLS connects and the Plant Outfall. Monitoring for leakage of the WWS blowdown line will be evaluated and implemented if necessary as part of the Units 2 and 3 Groundwater Monitoring Program described in NEI 08-08A (Reference 203).

11.2.1.2.5.2 Use of Mobile and Temporary Equipment

Add the following information at the end of DCD Subsection 11.2.1.2.5.2:

STD COL 11.2-1 When mobile or temporary equipment is selected to process liquid effluents, the equipment design and testing meets the applicable requirements of Regulatory Guide 1.143. When confirmed through sampling that the radioactive waste contents do not exceed the A_2 quantities for radionuclides specified in Appendix A to 10 CFR Part 71, the liquid effluent may be processed with mobile or temporary equipment in the Radwaste Building. When the A_2 quantities are exceeded, liquid effluent is processed in the Seismic Category I auxiliary building.

Mobile and temporary equipment are designed in accordance with the applicable mobile and temporary radwaste treatment systems guidance provided in Regulatory Guide 1.143, including the codes and standards listed in Table 1 of the Regulatory Guide.

Mobile and temporary equipment have the following features:

- Level indication and alarms (high-level) on tanks.
- Screwed connections are permitted only for instrument connections beyond the first isolation valve.
- Remote operated valves are used where operations personnel would be required to frequently manipulate a valve.
- Local control panels are located away from the equipment, in low dose areas.
- Instrumentation readings are accessible from the local control panels (i.e., temperature, flow, pressure, liquid level, etc.).
- Wetted parts are 300 series stainless steel, except flexible hose and gaskets.
- Flexible hose is used only for mobile equipment within the designated “black box” locations between mobile components and at the interface with the permanent plant piping.
- The contents of tanks are capable of being mixed, either through recirculation or with a mixer.
- Grab sample points are located in tanks and upstream and downstream of the process equipment.

Inspection and testing of mobile or temporary equipment is in accordance with the codes and standards listed in Table 1 of Regulatory Guide 1.143 with the following additions:

- After placement in the station, the mobile or temporary equipment is hydrostatically, or pneumatically, tested prior to tie-in to permanent plant piping.
- A functional test, using demineralized water, is performed. Remote operated valves are stroked (open-closed-open or closed-open-closed) under full flow conditions. The proper function of the instrumentation, including alarms, is verified. The operating procedures are verified correct during the functional test.
- Tank overflows are routed to floor drains.
- Floor drains are confirmed to be functional prior to placing mobile or temporary equipment into operation.

11.2.3.3 Dilution Factor

Add the following information at the end of DCD Subsection 11.2.3.3.

VCS COL 11.2-2 The dilution factors used for the maximum exposed individual and the population dose are calculated by the LADTAP II code in accordance with Regulatory Guide
VCS COL 11.5-3 1.113. LADTAP II input requires information on whether effluent discharge is into a river or lake, and the average flow rate.

In calculating the effluent doses, it is assumed that there is no dilution of the effluent discharge prior to entering the Broad River at the Parr Reservoir. Neglecting the blowdown flow rate of 6,000 gpm, the effluent discharge is assumed to be directly diluted by the flow rate of the Broad River. The minimum annual average flow rate of the Broad River is 1782 cfs. The Parr Reservoir retention time is four days.

The dilution factors and a summary of parameters used to calculate them are presented in Table 11.2-201.

11.2.3.5 Estimated Doses

Replace the information in DCD Subsection 11.2.3.5 with the following paragraphs and subsections.

VCS COL 11.2-2 Dose and dose rate to man was calculated using the LADTAP II computer code. This code is based on the methodology presented in Regulatory Guide 1.109.
VCS COL 11.5-3 Factors common to both estimated individual dose rates and estimated population dose are addressed here. Unique data are discussed in the respective sections.

Activity pathways considered are drinking water, sport fishing, irrigated farm products, and recreational activities.

The irrigated farm products are vegetables, leafy vegetables, milk, and meat.

Drinking water from the Broad River is consumed by half the population of the city of Columbia and all the population of Fort Jackson using data from the state of South Carolina. The farm production is based on data for vegetables, leafy vegetables, milk, and meat from the state of South Carolina. The food production within the 50-mile radius of VCSNS is based on the total food production in each category multiplied by the ratio of the land area within the 50-mile radius (adjusted for nonproduction areas) to the total land area of the state. An irrigation model is used for food products. The food production rate using irrigation water is determined by multiplying the 50-mile production rates by the ratio of population

using drinking water to the total population within the 50-mile radius, and the fraction of irrigated to harvested cropland using data from the state of South Carolina.

11.2.3.5.1 Estimated Individual Dose Rate

Dose rates to individuals are calculated for drinking water, sport fish consumption, irrigated farm products, and recreational activities.

Table 11.2-202 contains LADTAP II input data for dose rate calculations. Table 11.2-203 gives the maximum individual dose rates.

The total site doses due to liquid and gaseous effluents from the existing Unit 1 and Units 2 and 3 would be well within the regulatory limits of 40 CFR Part 190, as shown in Table 11.3-206. The values in this table for Unit 1 are representative based on review of the Unit 1 annual radiological operating reports (Reference 202).

11.2.3.5.2 Estimated Population Dose

The population dose is based on the fraction of the 50-mile population that will be exposed to the evaluated pathways. These pathways are drinking water, recreational activities, irrigated farm products, and sport fishing.

The sport fishing harvest is estimated using data from the state of South Carolina. The sport fishing harvest is estimated to be 3.77×10^5 kg/yr. Recreational activities include swimming, boating, and shoreline use. The annual usage for each of these activities is estimated to be 3.59×10^5, 3.59×10^6, and 3.59×10^6 person-hours, respectively.

The population doses are given in Table 11.2-204.

Table 11.2-204 shows that the total body and thyroid population doses per unit are approximately 14.6 and 6.5 person-rem per unit, respectively.

11.2.3.5.3 Liquid Radwaste Cost Benefit Analysis Methodology

STD COL 11.2-2 The application of the methodology of Regulatory Guide 1.110 was used to satisfy the cost benefit analysis requirements of 10 CFR Part 50, Appendix I, Section II.D. The parameters used in calculating the Total Annual Cost (TAC) are fixed and are given for each radwaste treatment system augment listed in Regulatory Guide 1.110, including the Annual Operating Cost (AOC) (Table A-2), Annual Maintenance Cost (AMC) (Table A-3), Direct Cost of Equipment and Materials (DCEM) (Table A-1), and Direct Labor Cost (DLC) (Table A-1). The following variable parameters were used:

- Capital Recovery Factor (CRF) — This factor is taken from Table A-6 of Regulatory Guide 1.110 and reflects the cost of money for capital expenditures. A cost-of-money value of 7 percent per year is assumed in this analysis, consistent with the "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission" (NUREG/BR-0058). A CRF of 0.0806 was obtained from Table A-6.

- Indirect Cost Factor (ICF) — This factor takes into account whether the radwaste system is unitized or shared (in the case of a multi-unit site) and is taken from Table A-5 of Regulatory Guide 1.110. It is assumed that the radwaste system for this analysis is a unitized system at a 2-unit site, which equals an ICF of 1.625.

- Labor Cost Correction Factor (LCCF) — This factor takes into account the differences in relative labor costs between geographical regions and is taken from Table A-4 of Regulatory Guide 1.110. A LCCF of 1.0 (the lowest value) is assumed in this analysis.

Appendix I to 10 CFR Part 50 prescribes a $1,000 per person-rem criterion for determining the cost benefit of actions to reduce radiation exposure.

The analysis used a conservative assumption that the respective radwaste treatment system augment is a "perfect" system that reduces the effluent and dose by 100 percent. The liquid radwaste treatment system augments annual costs were determined and the lowest annual cost considered a threshold value. The lowest-cost option for liquid radwaste treatment system augments is a 20 gpm Cartridge Filter at $11,140 per year, which yields a threshold value of 11.14 person-rem total body or thyroid dose from liquid effluents.

For AP1000 sites with population dose estimates less than 11.14 person-rem total body or thyroid dose from liquid effluents, no further cost-benefit analysis is needed to demonstrate compliance with 10 CFR 50, Appendix I Section II.D.

11.2.3.5.4 Liquid Radwaste Cost Benefit Analysis

VCS COL 11.2-2 The population doses are given in Table 11.2-204. As discussed above, the lowest cost liquid radwaste system augment is $11,140. Assuming 100 percent efficiency of this augment, the minimum possible cost per person-rem is determined by dividing the cost of the augment by the population dose. This is $11,140/14.6 person-rem total body or $763 per person-rem total body, and $11,140/6.5 person-rem thyroid or $1,714 per person-rem thyroid. The cost per person-rem total body does not exceed the $1000 per person-rem criterion provided in Regulatory Guide 1.110, and therefore requires evaluation. The augment that requires evaluation is the 20 gpm cartridge filter. Of the 14.6 person-rem total body dose, 4.6 person-rem is due to tritium, which will not be mitigated by the 20 gpm cartridge filter. Assuming this augment completely eliminates the dose of 10 person-rem total body due to isotopes other than tritium, the cost of total body

dose reduction is $11,140/10 person-rem total body or $1,114 per person-rem total body. Therefore this augment is not cost-beneficial in reducing the total body dose.

11.2.3.6 Quality Assurance

STD SUP 11.2-1 Add the following to the end of DCD Subsection 11.2.3.6:

Since the impact of radwaste systems on safety is limited, the extent of control required by Appendix B to 10 CFR Part 50 is similarly limited. Thus, a supplemental quality assurance program applicable to design, construction, installation and testing provisions of the liquid radwaste system is established by procedures that complies with the guidance presented in Regulatory Guide 1.143.

11.2.5 COMBINED LICENSE INFORMATION

11.2.5.1 Liquid Radwaste Processing by Mobile Equipment

STD COL 11.2-1 This COL Item is addressed in Subsection 11.2.1.2.5.2.

11.2.5.2 Cost Benefit Analysis of Population Doses

STD COL 11.2-2 This COL Item is addressed in Subsection 11.2.3.5.3.

VCS COL 11.2-2 This COL Item is addressed in Subsections 11.2.3.3, 11.2.3.5, 11.2.3.5.1, 11.2.3.5.2, and 11.2.3.5.4.

11.2.6 REFERENCES

201. Deleted.

202. Annual Effluent and Waste Disposal Report, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2005 – December 31, 2005; April 2006.

203. NEI 08-08A, Generic FSAR Template Guidance for Life Cycle Minimization of Contamination, Revision 0, October 2009 (ML093220445).

VCS COL 11.2-2

Table 11.2-201
Dilution Factor Parameters and Dilution Factors

Parameter	Average Annual Condition
Broad River Flow Rate (cfs)[a]	1782
Dilution Factor[a]	1

a) Assumed fully mixed model with annual average Broad River flow rate at Alston, SC for 1981–2008, United States Geological Survey, 2009.

VCS COL 11.2-2
VCS COL 11.5-3

Table 11.2-202 (Sheet 1 of 2)
LADTAP II Input[a]

Input Parameter	Value
Freshwater Site	Selected
Release source terms	DCD Table 11.2-7
Discharge Flow Rate	1782 ft^3 s^{-1}
Transit time to receptor	0.1, 96 hours[b]
Impoundment reconcentration model	None
50-mile population	FSAR Figures 2.1-211 and 2.1-219[c]
Shore width factor	0.2
Fish consumption	21 kg per year[d]
Drinking water consumption	730 liters per year[d]
Sport fishing harvest	3.77E+05 kg per year[e]
Commercial fishing harvest	1.21E+07 kg per year
50-mile drinking water population	299,930[f]
50-mile shoreline usage	3.59E+06 person-hours per year[g]
50-mile swimming usage	3.59E+05 person-hours per year[h]
50-mile boating usage	3.59E+06 person-hours per year[i]
Fraction of SC crops irrigated[j]	0.0696
Fraction of population using contaminated water for drinking and food production[k]	0.141
Fraction of SC agricultural products within 50 mi radius	0.258
Irrigation rate for food products[l]	110 liters per square meter per month
Fraction of contaminated water not used for feed or drinking water	0
Total production of vegetables within 50 mi radius[m]	6.86E+07 kg per year
Production rate for irrigated vegetables[n]	6.71E+05 kg per year
Total production of leafy vegetables within 50 mi radius[o]	1.80E+07 kg per year
Production rate for irrigated leafy vegetables[n]	1.76E+05 kg per year

VCS COL 11.2-2
VCS COL 11.5-3

Table 11.2-202 (Sheet 2 of 2)
LADTAP II Input[a]

Input Parameter	Value
Total production of milk within 50 mi radius[p]	6.78E+07 liters per year
Production rate for irrigated milk[n]	6.63E+05 liters per year
Total production of meat within 50 mi radius[q]	9.15E+08 kg per year
Production rate for irrigated meat[n]	8.96E+06 kg per year

a) Input parameters not specified use default LADTAP II values.
b) 0.1 hours assumed for maximally exposed individual (MEI) at the Parr Reservoir. 96 hours for downstream users reflecting reservoir retention time.
c) 2060 population projection.
d) Values in the table are for adult MEI. Average values of fish and water consumption of 6.9 kg and 370 liters per year, respectively, are used for population doses.
e) Boating population x 21 kg per year (adult MEI fish ingestion rate).
f) 2060 population projection.
g) Assumed same as boating usage.
h) Assumed 10% of shoreline usage.
i) Assumed 10% of boats registered in Fairfield, Lexington, Newberry, and Richland counties, 2 persons per boat, 200 hours per year.
j) USDA, National Agricultural Statistics Service, 2002 Census of Agriculture.
k) Fraction of contaminated water users (144,671) divided by the 50-mile population (1,028,075) in 2000.
l) 1 inch of water applied to the crops per week.
m) USDA, National Agricultural Statistics Service, 2005 and 2006, with apples and peaches included but leafy vegetables excluded, and projected to 2060.
n) Food product production rate multiplied by fraction of irrigated crops and fraction of contaminated water users.
o) USDA, Integrated Pest Management Center for leafy vegetables—2001, and projected to 2060.
p) *Milk Production, Disposition, and Income, 2006 Summary*, USDA, National Agricultural Statistics Service, April 2007, and projected to 2060. Density of producer milk is 1.03 kg per liter.
q) *South Carolina Agricultural Statistics, Crops, Livestock, and Poultry, 2005–2007*, USDA, National Agricultural Statistics Service. The total meat production in SC consists of broilers, turkey, commercial red meat, and young chickens. Projected to 2060.

VCS COL 11.5-3

Table 11.2-203 (Sheet 1 of 2)
Annual Individual Doses from Liquid Effluents (per Unit)

	Adult Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		4.5E-02	7.8E-02	5.8E-02	5.9E-03	2.7E-02	9.2E-03	6.2E-03
Drinking		1.0E-03	2.9E-02	2.9E-02	4.1E-02	2.8E-02	2.8E-02	3.5E-02
Shoreline	6.7E-05	5.7E-05	5.7E-05	5.7E-05	5.7E-05	5.7E-05	5.7E-05	5.7E-05
Irrigated Vegetables		6.1E-03	2.9E-02	2.6E-02	2.6E-02	2.4E-02	2.1E-02	5.9E-02
Irrigated Leafy Vegetables		7.7E-04	3.5E-03	3.2E-03	4.9E-03	3.0E-03	2.6E-03	7.4E-03
Irrigated Milk		4.4E-03	1.9E-02	1.7E-02	2.2E-02	1.4E-02	1.3E-02	1.3E-02
Irrigated Meat		6.3E-03	5.1E-03	5.6E-03	4.5E-03	1.6E-02	4.3E-03	3.8E-01
Total	6.7E-05	6.3E-02	1.6E-01	1.4E-01	1.0E-01	1.1E-01	7.7E-02	5.0E-01

	Teen Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		4.7E-02	8.0E-02	3.3E-02	5.5E-03	2.7E-02	1.1E-02	4.7E-03
Drinking		9.7E-04	2.1E-02	2.0E-02	3.1E-02	2.0E-02	2.0E-02	2.5E-02
Shoreline	3.8E-04	3.2E-04	3.2E-04	3.2E-04	3.2E-04	3.2E-04	3.2E-04	3.2E-04
Irrigated Vegetables		1.0E-02	3.9E-02	3.0E-02	3.4E-02	3.1E-02	2.6E-02	7.4E-02
Irrigated Leafy Vegetables		7.0E-04	2.6E-03	2.0E-03	3.6E-03	2.1E-03	1.7E-03	5.0E-03
Irrigated Milk		7.9E-03	2.9E-02	2.1E-02	3.2E-02	2.0E-02	1.7E-02	1.6E-02
Irrigated Meat		5.3E-03	3.2E-03	3.4E-03	2.8E-03	1.2E-02	2.6E-03	2.4E-01
Total	3.8E-04	7.2E-02	1.7E-01	1.1E-01	1.1E-01	1.1E-01	7.8E-02	3.6E-01

Table 11.2-203 (Sheet 2 of 2)
Annual Individual Doses from Liquid Effluents (per Unit)

	Child Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		5.8E-02	7.0E-02	1.3E-02	5.6E-03	2.3E-02	8.4E-03	2.1E-03
Drinking		2.8E-03	4.0E-02	3.8E-02	6.4E-02	3.9E-02	3.8E-02	4.2E-02
Shoreline	7.9E-05	6.7E-05	6.7E-05	6.7E-05	6.7E-05	6.7E-05	6.7E-05	6.7E-05
Irrigated Vegetables		2.4E-02	6.2E-02	4.3E-02	5.7E-02	4.9E-02	4.1E-02	7.8E-02
Irrigated Leafy Vegetables		1.2E-03	3.1E-03	2.2E-03	4.8E-03	2.5E-03	2.1E-03	4.0E-03
Irrigated Milk		1.9E-02	4.6E-02	2.8E-02	5.6E-02	3.2E-02	2.7E-02	2.5E-02
Irrigated Meat		9.9E-03	3.9E-03	4.3E-03	3.4E-03	1.6E-02	3.1E-03	1.5E-01
Total	7.9E-05	1.2E-01	2.3E-01	1.3E-01	1.9E-01	1.6E-01	1.2E-01	3.0E-01

	Infant Dose (mrem/yr)							
Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Fish		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Drinking		3.0E-03	4.0E-02	3.7E-02	7.9E-02	3.8E-02	3.7E-02	4.0E-02
Shoreline		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	0.0E+00	3.0E-03	4.0E-02	3.7E-02	7.9E-02	3.8E-02	3.7E-02	4.0E-02

	Maximum Dose (mrem/yr)[a]							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Dose	3.8E-04	1.2E-01	2.3E-01	1.4E-01	1.9E-01	1.6E-01	1.2E-01	5.0E-01
Age Group	Teen	Child	Child	Adult	Child	Child	Child	Adult

a) Doses meet 10 CFR 50, Appendix I limits of 3 mrem for total body and 10 mrem for any organ

VCS COL 11.2-2

Table 11.2-204
Annual Population Doses from Liquid Effluents (per Unit)

Pathway	Population Dose (person-rem/yr)							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Sport Fishing		9.87E-01	1.61E+00	9.87E-01	7.54E-02	5.44E-01	1.93E-01	1.03E-01
Commercial Fishing		8.97E+00	1.46E+01	8.95E+00	4.33E-01	4.93E+00	1.75E+00	8.95E-01
Drinking		1.96E-01	4.59E+00	4.49E+00	5.82E+00	4.47E+00	4.38E+00	5.26E+00
Hydrosphere Tritium		0.0E+00	7.70E-03	7.70E-03	7.70E-03	7.70E-03	7.70E-03	7.70E-03
Shoreline	2.01E-02			1.72E-02	1.72E-02			
Swimming				4.18E-05	4.18E-05			
Boating				2.09E-04	2.09E-04			
Irrigated Vegetables		1.21E-02	4.47E-02	3.71E-02	2.98E-02	3.64E-02	3.13E-02	7.60E-02
Irrigated Leafy Vegetables		2.63E-03	1.06E-02	9.28E-03	1.42E-02	8.76E-03	7.52E-03	2.08E-02
Irrigated Milk		1.66E-02	5.45E-02	4.12E-02	5.82E-02	3.87E-02	3.34E-02	3.25E-02
Irrigated Meat		1.25E-01	8.50E-02	9.30E-02	7.55E-02	2.78E-01	7.07E-02	5.80E+00
Total	2.01E-02	1.03E+01	2.10E+01	1.46E+01	6.53E+00	1.03E+01	6.47E+00	1.22E+01

11.3 GASEOUS WASTE MANAGEMENT SYSTEM

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

11.3.3 RADIOACTIVE RELEASES

Add the following new paragraph at the end of DCD Subsection 11.3.3:

STD SUP 11.3-2 There are no gaseous effluent site interface parameters outside of the Westinghouse scope.

11.3.3.4 Estimated Doses

Add the following information at the end of DCD Subsection 11.3.3.4.

VCS COL 11.3-1 The VCSNS site-specific values are bounded by the DCD identified acceptable releases. With the annual airborne releases listed in DCD Table 11.3-3, the site
VCS COL 11.5-3 specific air doses at ground level at the site boundary are 0.71 mrad for gamma radiation and 3.0 mrad for beta radiation. These doses are based on the annual average atmospheric dispersion factor from FSAR Section 2.3. These doses are below the 10 CFR Part 50, Appendix I design objectives of 10 mrad per year for gamma radiation or 20 mrad per year for beta radiation.

Dose and dose rate to man was calculated using the GASPAR II computer code. This code is based on the methodology presented in Regulatory Guide 1.109. Factors common to both estimated individual dose rates and estimated population dose are addressed in this subsection. Unique data are discussed in the respective subsections. Activity pathways considered are plume, ground deposition, inhalation, and ingestion of vegetables, meat, and milk (both cow and goat).

Agricultural products are estimated from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service. GASPAR II evenly distributes the food production over the entire 50 miles when given a total production for calculating dose.

The population doses are based on the population, projected to the year 2060, within a 50-mile radius of the centroid between Units 2 and 3. The population

distribution is presented in FSAR Subsection 2.1.3 and Figures 2.1-211 and 2.1-219. Data from these figures are tabulated in Table 11.3-202.

11.3.3.4.1 Estimated Individual Doses

Dose rates to individuals are calculated for airborne decay and deposition, inhalation, and ingestion of milk (cow and goat), meat and vegetables. Dose from plume and ground deposition are calculated as affecting all age groups equally.

Table 11.3-201 contains GASPAR II input data for dose rate calculations. Information regarding the locations for the nearest resident, meat animal, milk animal, garden, and the dose evaluation periphery and power block area circle are described in Section 2.3. Table 11.3-203 contains total organ dose rates based on age group. Table 11.3-204 contains total air dose at each special location.

The total site doses due to liquid and gaseous effluents from Unit 1 and Units 2 and 3 would be well within the regulatory limits of 40 CFR Part 190, as shown in Table 11.3-206. The values in this table for Unit 1 are representative based on review of the Unit 1 annual radiological operating reports (References 202 through 206).

11.3.3.4.2 Estimated Population Dose

The population dose analysis performed to determine offsite dose from gaseous effluents is based upon the AP1000 generic site parameters included in DCD Chapter 11 and Tables 11.3-1, 11.3-2, and 11.3-4 and population data in Table 11.3-202. The population dose is shown in Table 11.3-205.

Table 11.3-205 shows that the total body and thyroid population doses per unit are approximately 2.7 and 6.4 person-rem per unit, respectively.

11.3.3.4.3 Gaseous Radwaste Cost-Benefit Analysis Methodology

STD COL 11.3-1 The guidance for performing cost-benefit analysis for the gaseous radwaste system is similar to that used and described for the liquid radwaste system in Section 11.2. The gaseous radwaste treatment system augments annual costs were determined and the lowest annual cost considered a threshold value. The lowest-cost option for gaseous radwaste treatment system augments is the Steam Generator Flash Tank Vent to Main Condenser at $6,320 per year, which yields a threshold value of 6.32 person-rem total body or thyroid from gaseous effluents.

For AP1000 sites with population dose estimates less than 6.32 person-rem total body or thyroid dose from gaseous effluents, no further cost-benefit analysis is needed to demonstrate compliance with 10 CFR 50, Appendix I, Section II.D.

11.3.3.4.4 Gaseous Radwaste Cost-Benefit Analysis

VCS COL 11.3-1 As discussed in Subsection 11.3.3.4.3, the lowest cost gaseous radwaste system augment is $6,320. Assuming 100 percent efficiency of this augment, the minimum possible cost per person-rem is determined by dividing the cost of the augment by the population dose. This is $2,340 per person-rem total body ($6,320/2.7 person-rem) and $988 per person-rem thyroid ($6,320/6.4 person-rem thyroid). While the costs per person-rem total body reduction exceed the $1,000 per person-rem criterion, the costs per person-rem thyroid dose are below the $1,000 per person-rem and further evaluation is required.

Since the estimated thyroid dose of 6.4 person-rem exceeds the 6.32 person-rem threshold value, those system augments listed in Regulatory Guide 1.110 with a Total Annual Cost less than $6,400 are evaluated to determine if they would be cost beneficial. The only system augment with a Total Annual Cost less than $6,400 is the lowest-cost option for gaseous radwaste treatment system augments, the Steam Generator Flash Tank Vent to Main Condenser. It is noted that this augment would not mitigate the dose contribution from noble gases. Of the 6.4 person-rem thyroid dose given in FSAR Section 11.3.3.4.2, 1.2 person-rem is due to noble gases. Assuming this system augment completely eliminates the dose of the remaining 5.2 person-rem thyroid due to isotopes other than noble gases, the cost of the thyroid dose reduction would be $6,320/5.2 person-rem thyroid, or $1,215 per person-rem thyroid. This cost per person-rem reduction exceeds the $1,000 per person-rem criterion prescribed in Appendix I to 10 CFR Part 50 and this system augment is therefore not cost beneficial.

Due to the low VCSNS population doses, there are no other system augments from those listed in Regulatory Guide 1.110 which would be considered cost beneficial.

11.3.3.6 Quality Assurance

STD SUP 11.3-1 Add the following to the end of DCD Subsection 11.3.3.6:

Since the impact of radwaste systems on safety is limited, the extent of control required by Appendix B to 10 CFR Part 50 is similarly limited. Thus, a supplemental quality assurance program applicable to design, construction, installation, and testing provisions of the gaseous radwaste system is established by procedures that complies with the guidance presented in Regulatory Guide 1.143.

11.3.5 COMBINED LICENSE INFORMATION

11.3.5.1 Cost Benefit Analysis of Population Doses

STD COL 11.3-1 This COL Item is addressed in Subsection 11.3.3.4.3.

VCS COL 11.3-1 This COL Item is addressed in Subsections 11.3.3.4, 11.3.3.4.1, 11.3.3.4.2, and 11.3.3.4.4.

VCS COL 11.5-3 This COL Item is addressed in Subsection 11.3.3.4.

11.3.6 REFERENCES

201. Deleted

202. Annual Effluent and Waste Disposal Report, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2005 – December 31, 2005; April 2006.

203. Annual Effluent and Waste Disposal Report, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2003 – December 31, 2003; April 2004.

204. Annual Effluent and Waste Disposal Report, Virgil C. Summer Nuclear Station for the Operating Period January 1, 2004 – December 31, 2004; April 2005.

205. Annual Effluent and Waste Disposal Report, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2006 – December 31, 2006; April 2007.

206. Annual Effluent and Waste Disposal Report, Virgil C. Summer Nuclear Station, for the Operating Period January 1, 2007 – December 31, 2007; April 2008.

VCS COL 11.3-1
VCS COL 11.5-3

Table 11.3-201
GASPAR II Input[a]

Input Parameter	Value
Number of Source Terms	1
Read Met data from XOQDOQ-generated file	Selected
Distance from site to NE Corner of the US	1129 mi
Source Term	DCD Table 11.3-3
Population Data	Table 11.3-202
Fraction of the year leafy vegetables are grown	0.583
Fraction of the year milk cows are on pasture	0.75
Fraction of maximally exposed individual's vegetable intake from own garden	0.76
Fraction of milk-cow feed intake from pasture while on pasture	1
Fraction of the year goats are on pasture	0.83
Fraction of goat feed intake from pasture while on pasture	1
Fraction of the year beef cattle are on pasture	0.75
Fraction of beef-cattle feed intake from pasture while on pasture	1
Total Production Rate for the 50-mile area	
-Vegetables	8.66E+07 kg per year
-Milk	6.78E+07 liters per year
-Meat	9.15E+08 kg per year
Special Location Data	Section 2.3

a) Input parameters not specified use default GASPAR II values.

VCS COL 11.3-1
VCS COL 11.5-3

Table 11.3-202
Population Input for Population Dose Rates

Direction	Distance (mi)									
	1	2	3	4	5	10	20	30	40	50
N	0	0	0	0	10	346	873	5086	9609	56103
NNE	0	0	0	10	73	491	651	9504	14976	214038
NE	0	0	115	25	83	155	2060	3485	12585	77448
ENE	0	51	0	19	0	793	12225	1477	2634	19934
E	0	19	147	0	0	915	4637	8552	31951	43930
ESE	117	4	12	133	22	321	6820	106337	19823	10765
SE	0	29	57	0	156	394	48768	343866	58718	14087
SSE	0	0	0	0	0	3242	118703	210614	59842	16596
S	0	6	0	117	102	3020	35109	57548	29388	15465
SSW	0	0	12	44	92	3907	18332	32814	14385	15326
SW	0	0	47	9	57	1576	5334	4697	10615	26568
WSW	0	36	17	0	168	1000	6268	3601	5059	9065
W	0	0	9	24	62	701	23548	2522	7991	79542
WNW	0	18	0	6	54	865	2800	4997	33560	44593
NW	0	0	0	9	0	639	721	4774	5727	20941
NNW	35	0	9	225	23	415	434	2812	23936	15182
Total	152	163	425	621	902	18780	287283	802686	340799	679583
									Grand Total	2131394

VCS COL 11.3-1
VCS COL 11.5-3

Table 11.3-203 (Sheet 1 of 2)
Annual Individual Doses from Gaseous Effluents per Unit (mrem)

Pathway	Age Group	Nearest Site Boundary (0.50 mi SE, 0.50 mi ENE/NE)[a]							
		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	All	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.4E-01	4.7E-01	2.2E+00
Ground	All	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.6E-01
Inhalation	Adult	4.8E-02	4.8E-02	7.6E-03	4.9E-02	5.0E-02	4.5E-01	6.2E-02	4.6E-02
	Teen	4.8E-02	4.9E-02	9.1E-03	5.0E-02	5.1E-02	5.6E-01	7.1E-02	4.7E-02
	Child	4.3E-02	4.2E-02	1.1E-02	4.5E-02	4.6E-02	6.6E-01	6.1E-02	4.1E-02
	Infant	2.5E-02	2.4E-02	5.6E-03	2.7E-02	2.7E-02	5.9E-01	3.8E-02	2.4E-02

Pathway	Age Group	Nearest Residence (1.68 mi SE, 1.3 mi ENE)[a]							
		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	All	5.8E-02	5.8E-02	5.8E-02	5.8E-02	5.8E-02	5.8E-02	6.2E-02	3.1E-01
Ground	All	2.9E-02	2.9E-02	2.9E-02	2.9E-02	2.9E-02	2.9E-02	2.9E-02	3.4E-02
Inhalation	Adult	7.1E-03	7.2E-03	1.1E-03	7.3E-03	7.4E-03	6.4E-02	9.1E-03	6.9E-03
	Teen	7.2E-03	7.3E-03	1.3E-03	7.5E-03	7.7E-03	8.0E-02	1.0E-02	7.0E-03
	Child	6.4E-03	6.3E-03	1.5E-03	6.7E-03	6.8E-03	9.4E-02	8.9E-03	6.2E-03
	Infant	3.7E-03	3.6E-03	7.8E-04	4.0E-03	4.0E-03	8.4E-02	5.5E-03	3.6E-03

Pathway	Age Group	Nearest Garden (1.68 mi SE, 1.3 mi ENE)[a]							
		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Vegetable	Adult	5.4E-02	5.5E-02	2.8E-01	5.4E-02	5.1E-02	6.4E-01	4.7E-02	4.6E-02
	Teen	8.0E-02	8.1E-02	4.3E-01	8.3E-02	7.9E-02	8.6E-01	7.2E-02	7.1E-02
	Child	1.7E-01	1.7E-01	1.0E+00	1.8E-01	1.7E-01	1.7E+00	1.6E-01	1.6E-01

Pathway	Age Group	Nearest Meat Animal (1.68 mi SE, 1.3 mi ENE)[a]							
		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Meat	Adult	1.6E-02	2.0E-02	6.9E-02	1.6E-02	1.6E-02	3.9E-02	1.5E-02	1.5E-02
	Teen	1.3E-02	1.5E-02	5.9E-02	1.3E-02	1.3E-02	2.9E-02	1.3E-02	1.3E-02
	Child	2.3E-02	2.4E-02	1.1E-01	2.4E-02	2.3E-02	4.8E-02	2.3E-02	2.3E-02

VCS COL 11.3-1
VCS COL 11.5-3

Table 11.3-203 (Sheet 2 of 2)
Annual Individual Doses from Gaseous Effluents per Unit (mrem)

Pathway	Age Group	Nearest Milk Cow (1.68 mi SE, 1.3 mi ENE)[a]							
		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Milk	Adult	2.4E-02	2.0E-02	8.3E-02	2.6E-02	2.4E-02	6.7E-01	2.0E-02	1.9E-02
	Teen	3.8E-02	3.4E-02	1.5E-01	4.5E-02	4.2E-02	1.1E+00	3.4E-02	3.3E-02
	Child	8.2E-02	7.7E-02	3.7E-01	9.6E-02	9.1E-02	2.1E+00	7.7E-02	7.6E-02
	Infant	1.6E-01	1.5E-01	7.1E-01	2.0E-01	1.8E-01	5.2E+00	1.6E-01	1.5E-01

Pathway	Age Group	Nearest Milk Goat (1.68 mi SE, 1.3 mi ENE)[a]							
		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Milk	Adult	3.6E-02	2.5E-02	9.6E-02	4.2E-02	3.3E-02	9.0E-01	2.5E-02	2.3E-02
	Teen	5.2E-02	4.1E-02	1.7E-01	7.0E-02	5.6E-02	1.4E+00	4.2E-02	3.9E-02
	Child	9.8E-02	8.6E-02	4.2E-01	1.4E-01	1.1E-01	2.8E+00	9.0E-02	8.5E-02
	Infant	1.8E-01	1.7E-01	7.8E-01	2.7E-01	2.1E-01	6.8E+00	1.8E-01	1.7E-01

Pathway	Age Group	Maximally Exposed Individual (1.68 mi SE, 1.3 mi ENE)[a]							
		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
All	Adult	2.0E-01	1.9E-01	5.3E-01	2.1E-01	1.9E-01	1.7E+00	1.9E-01	4.4E-01
	Teen	2.4E-01	2.3E-01	7.5E-01	2.6E-01	2.4E-01	2.5E+00	2.3E-01	4.8E-01
	Child	3.9E-01	3.7E-01	1.6E+00	4.4E-01	4.0E-01	4.7E+00	3.8E-01	6.2E-01
	Infant	2.7E-01	2.6E-01	8.7E-01	3.6E-01	3.0E-01	7.0E+00	2.7E-01	5.2E-01

a) The distances and directions are for the maximum applicable X/Q and the maximum D/Q respectively.

VCS COL 11.3-1
VCS COL 11.5-3

Table 11.3-204
Comparison of Gaseous Effluent Doses to 10 CFR 50 Appendix I Limits

Type of Dose	Location	Annual Dose per Unit	
		Unit 2 or 3	Limit
Gaseous Effluent	EAB		
Gamma Air (mrad)		0.71	10
Beta Air (mrad)		3.0	20
Total Body (mrem)		0.58	5
Skin (mrem)		2.4	15
Iodines and Particulates in Gaseous Effluent—Thyroid (mrem)	MEI[a]	7.0	15

a) Maximum X/Q occurs at 1.68 mi SE while the maximum D/Q occurs at 1.3 mi ENE. The MEI dose is based on this combination of X/Q and D/Q.

VCS COL 11.3-1
VCS COL 11.5-3

Table 11.3-205
Annual Population Doses from Gaseous Effluents (per Unit)

Pathway	Dose (person-rem/yr)							
	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.2E+00	1.4E+00	1.1E+01
Ground	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.5E-01
Inhalation	3.1E-01	3.1E-01	3.5E-02	3.1E-01	3.2E-01	2.4E+00	3.7E-01	3.0E-01
Vegetable	2.9E-01	2.9E-01	1.3E+00	2.9E-01	2.8E-01	3.0E-01	2.8E-01	2.8E-01
Cow Milk	1.5E-01	1.4E-01	6.1E-01	1.6E-01	1.5E-01	1.4E+00	1.4E-01	1.4E-01
Meat	6.2E-01	6.5E-01	2.8E+00	6.2E-01	6.1E-01	9.1E-01	6.1E-01	6.1E-01
Total	2.7E+00	2.8E+00	6.1E+00	2.8E+00	2.7E+00	6.4E+00	3.0E+00	1.3E+01

Table 11.3-206
Comparison of Maximally Exposed Individual Doses with 40 CFR Part 190 Criteria

	Dose (mrem/yr)					
	Units 2 and 3					Regulatory Limit
	Liq[a]	Gas[b]	Total	Unit 1[c]	Site Total	
Total Body	0.28	0.78	1.1	1.2	2.2	25
Thyroid	0.38	14	14	0.043	14	75
Other Organ - Bone	0.23	3.2	3.5	0.043	3.5	25

a) Doses from Table 11.2-203 are doubled for two units.
b) Maximum doses (by age group) from Table 11.3-203 are doubled for two units.
c) Unit 1 doses are based on annual effluent reports.

11.4 SOLID WASTE MANAGEMENT

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

11.4.5 QUALITY ASSURANCE

Add the following to the end of DCD Subsection 11.4.5:

STD SUP 11.4-1 Since the impact of radwaste systems on safety is limited, the extent of control required by Appendix B to 10 CFR Part 50 is similarly limited. Thus, a supplemental quality assurance program applicable to design, construction, installation and testing provisions of the solid radwaste system is established by procedures that complies with the guidance presented in Regulatory Guide 1.143.

11.4.6 COMBINED LICENSE INFORMATION FOR SOLID WASTE MANAGEMENT SYSTEM PROCESS CONTROL PROGRAM

Add the following information to the end of DCD Subsection 11.4.6.

This COL Item is addressed below.

STD COL 11.4-1 A Process Control Program (PCP) is developed and implemented in accordance with the recommendations and guidance of NEI 07-10A (Reference 201). The PCP describes the administrative and operational controls used for the solidification of liquid or wet solid waste and the dewatering of wet solid waste. Its purpose is to provide the necessary controls such that the final disposal waste product meets applicable federal regulations (10 CFR Parts 20, 50, 61, 71, and 49 CFR Part 173), state regulations, and disposal site waste form requirements for burial at a low level waste (LLW) disposal site that is licensed in accordance with 10 CFR Part 61.

Waste processing (solidification or dewatering) equipment and services may be provided by the plant or by third-party vendors. Each process used meets the applicable requirements of the PCP.

No additional onsite radwaste storage is required beyond that described in the DCD.

Table 13.4-201 provides milestones for PCP implementation.

11.4.6.1 Procedures

STD SUP 11.4-1 Operating procedures specify the processes to be followed to ship waste that complies with the waste acceptance criteria (WAC) of the disposal site, 10 CFR 61.55 and 61.56, and the requirements of third party waste processors.

Each waste stream process is controlled by procedures that specify the process for packaging, shipment, material properties, destination (for disposal or further processing), testing to verify compliance, the process to address non-conforming materials, and required documentation.

Where materials are to be disposed of as non-radioactive waste (as described in DCD Subsection 11.4.2.3.3), final measurements of each package are performed to verify there has not been an accumulation of licensed material resulting from a buildup of multiple, non-detectable quantities. These measurements are obtained using sensitive scintillation detectors, or instruments of equal sensitivity, in a low-background area.

Procedures document maintenance activities, spill abatement, upset condition recovery, and training.

Procedures document the periodic review and revision, as necessary, of the PCP based on changes to the disposal site, WAC regulations, and third party PCPs.

11.4.6.2 Third Party Vendors

Third party equipment suppliers and/or waste processors are required to supply approved PCPs. Third party vendor PCPs describe compliance with Regulatory Guide 1.143, Generic Letter 80-09, and Generic Letter 81-39. Third party vendor PCPs are referenced appropriately in the plant PCP before commencement of waste processing.

11.4.7 REFERENCES

201. NEI 07-10A, “Generic FSAR Template Guidance for Process Control Program (PCP),” Revision 0, March 2009 (ML091460627).

11.5 RADIATION MONITORING

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

11.5.1.2 Power Generation Design Basis

Revise the fourth bullet in DCD Subsection 11.5.1.2 as follows.

STD COL 11.5-2

- Data collection and data storage to support compliance reporting for the applicable NRC requirements and guidelines, such as General Design Criterion 64 and Regulatory Guide 1.21 and Regulatory Guide 4.15, Revision 1.

11.5.2.4 Inservice Inspection, Calibration, and Maintenance

Add the following information at the end of DCD Subsection 11.5.2.4:

STD COL 11.5-2 Daily checks of effluent monitoring system operability are made by observing channel behavior. Detector response is routinely observed with a remotely-positioned check source in accordance with plant procedures. Instrument background count rate is also observed to determine proper functioning of the monitors. Any detector whose response cannot be verified by observation during normal operation or by using the remotely-positioned check source can have its response checked with a portable check source. A record is maintained showing the background radiation level and the detector response.

Calibration of the continuous radiation monitors is done with commercial radionuclide standards that have been standardized using a measurement system traceable to the National Institute of Standards and Technology.

11.5.3 EFFLUENT MONITORING AND SAMPLING

Add the following information at the end of DCD Subsection 11.5.3.

VCS COL 11.5-2 SCE&G is extending the existing VCSNS Unit 1 program for quality assurance of radiological effluent and environmental monitoring that is based on Regulatory Guide 4.15, Revision 1, to apply to Units 2 and 3. Regulatory Guide 4.15, Revision 1, is a proven methodology for quality assurance of radiological effluent and environmental monitoring programs that is acceptable to the NRC staff as a method for demonstrating compliance with applicable requirements of 10 CFR Parts 20, 50, 52, 61, and 72. Use of Revision 2 of Regulatory Guide 4.15 would

necessitate conducting two separate programs involving the use of common staff, facilities and equipment, which will create an undue burden and may lead to an increased possibility for human error. Therefore, SCE&G commits to use Regulatory Guide 4.15, Revision 1, methodology for Units 2 and 3 for optimal consistency, efficiency and practicality.

11.5.4 PROCESS AND AIRBORNE MONITORING AND SAMPLING

STD COL 11.5-2 Add the following information at the end of the first paragraph in DCD Subsection 11.5.4.

The sampling program for liquid and gaseous effluents will conform to Regulatory Guide 4.15, Revision 1 (See Appendix 1AA).

Add the following information at the end of DCD Subsection 11.5.4:

11.5.4.1 Effluent Sampling

STD COL 11.5-2 Effluent sampling of potential radioactive liquid and gaseous effluent paths is conducted on a periodic basis to verify effluent processing meets the discharge limits to offsite areas. The effluent sampling program provides the information for the effluent measuring and reporting required by 10 CFR 50.36a and 10 CFR Part 20 and implemented through the Offsite Dose Calculation Manual (ODCM) and plant procedures. The frequency of the periodic sampling and analyses described herein are nominal and may be increased as permitted by procedure. Tables 11.5-201 and 11.5-202 summarize the sample and analysis schedules and sensitivities, respectively. The information contained in Tables 11.5-201 and 11.5-202 are derived from Regulatory Guide 1.21.

Laboratory isotopic analyses are performed on continuous and batch effluent releases in accordance with the ODCM. Results of these analyses are compiled and appropriate portions are utilized to produce the Radioactive Effluent Release Report.

11.5.4.2 Representative Sampling

Representative samples are obtained from well-mixed streams or volumes of effluent liquid through the use of proper sampling equipment, proper location of sampling points, and the development and use of sampling procedures. The recommendations of ANSI N42.18 (Reference 203) are considered for the selection of instrumentation specific to the continuous monitoring of radioactivity in liquid effluents.

Sampling of effluent liquids is consistent with guidance in Regulatory Guide 1.21. When practical, effluent releases are batch-controlled, and prior to sampling, large volumes of liquid waste are mixed, in as short a time span as practicable, so that solid particulates are uniformly distributed in the liquid volume. Sampling and analysis is performed, and release conditions set, before release. Sample points are located to minimize flow disturbance due to fittings and other characteristics of equipment and components. Sample lines are flushed consistent with plant procedures to remove sediment deposits.

Representative sampling of process effluents is attained through sample and monitor locations and methods and criteria detailed in plant procedures.

Composite sampling is employed to analyze for hard to measure radionuclides and to monitor effluent streams that normally are not expected to contain significant amounts of radioactive contamination. Composite liquid samples are collected in proportion to the volume of each batch of effluent release. The composite is thoroughly mixed prior to analysis. Collection periods for composites are as short as practicable and periodic checks are performed to identify changes in composite samples. When grab samples are collected instead of composite samples, the time of the sample, location, and frequency are considered to provide a representative sample of the radioactive materials.

The pressure head of the fluid, if available, is used for taking samples. If sufficient pressure head is not available to take samples, then sample pumps are used to draw the sample from the process fluid to the detector panels and back to the process.

Testing and obtaining representative samples using the radiation monitors described in DCD Subsection 11.5 will be performed in accordance with ANSI N13.1 (Reference 201).

For obtaining representative samples in unfiltered ducts, isokinetic probes are tested and used in accordance with ANSI N13.1 (Reference 201).

Analytical Procedures

Typically, samples of process and effluent gases and liquids are analyzed in the station laboratory or by an outside laboratory via the following techniques:

- Gross alpha/beta counting
- Gamma spectrometry
- Liquid scintillation counting

"Available" instrumentation and counting techniques change as other instruments and techniques become available. For this reason, the frequency of sampling and the analysis of samples are generalized in this subsection.

Gross alpha/beta analysis may be performed directly on unprocessed samples (e.g., air filters) or on processed samples (e.g., evaporated liquid samples). Sample volume, counting geometry, and counting time are chosen to match measurement capability with sample activity. Correction factors for sample-detector geometry, self-absorption and counter resolving time are applied to provide the required accuracy.

Liquid effluent samples are prepared for alpha/beta counting by evaporation onto steel planchets. Gamma analysis may be done on any type of sample (gas, solid or liquid) in a gamma spectrometer.

Tritiated water vapor samples are collected by condensation or adsorption, and the resultant liquid is analyzed by liquid scintillation counting techniques.

Radiochemical separations are used for the routine analysis of Sr-89 and Sr-90.

Liquid samples are collected in polyethylene bottles to minimize absorption of nuclides onto container walls.

11.5.6.5 Quality Assurance

Add the following information at the end of DCD Subsection 11.5.6.5.

STD COL 11.5-2 The sampling program and the associated monitors conform to Regulatory Guide 4.15, Revision 1 (See Appendix 1AA).

11.5.8 COMBINED LICENSE INFORMATION

STD COL 11.5-1 An Offsite Dose Calculation Manual (ODCM) is developed and implemented in accordance with the recommendations and guidance of NEI 07-09A (Reference 202). The ODCM contains the methodology and parameters used for calculating doses resulting from liquid and gaseous effluents. The ODCM addresses operational setpoints, including planned discharge rates, for radiation monitors and monitoring programs (process and effluent monitoring and environmental monitoring) for the control and assessment of the release of radioactive material to the environment. The ODCM provides the limitations on operation of the radwaste systems, including functional capability of monitoring instruments, concentrations of effluents, sampling, analysis, 10 CFR Part 50, Appendix I dose and dose commitments, and reporting. The ODCM will be finalized prior to fuel load with site-specific information.

Table 13.4-201 provides milestones for ODCM implementation.

STD COL 11.5-2 This COL Item is addressed in Subsections 11.5.1.2, 11.5.2.4, 11.5.4, 11.5.4.1, 11.5.4.2, and 11.5.6.5.

VCS COL 11.5-2 This COL Item is addressed in Subsection 11.5.3.

VCS COL 11.5-3 This COL Item is addressed in Subsection 11.2.3.5 and 11.3.3.4 for liquid and gaseous effluents, respectively.

Add the following subsection after DCD Subsection 11.5.8.

11.5.9 REFERENCES

201. ANSI N13.1-1969, “Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities.”

202. NEI 07-09A, “Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description,” Revision 0, March 2009 (ML091050234).

203. ANSI N42.18-2004, “Specification and Performance of On-Site Instrumentation for Continuous Monitoring Radioactivity in Effluents.”

STD COL 11.5-2

Table 11.5-201 (Sheet 1 of 2)
Minimum Sampling Frequency

Stream	Sampled Medium	Frequency
Gaseous	Continuous Release	A sample is taken within one month of initial criticality, and at least weekly thereafter to determine the identity and quantity for principal nuclides being released. A similar analysis of samples is performed following each refueling, process change, or other occurrence that could alter the mixture of radionuclides. When continuous monitoring shows an unexplained variance from an established norm. Monthly for tritium.
	Batch Release	Prior to release to determine the identity and quantity of the principal radionuclides (including tritium).
	Filters (particulates)	Weekly. Quarterly for Sr-89 and Sr-90. Monthly for gross alpha.

STD COL 11.5-2

Table 11.5-201 (Sheet 2 of 2)
Minimum Sampling Frequency

Stream	Sampled Medium	Frequency
Liquid	Continuous Releases	Weekly for principal gamma-emitting radionuclides.
		Monthly, a composite sample for tritium and gross alpha.
		Monthly, a representative sample for dissolved and entrained fission and activation gases.
		Quarterly, a composite sample for Sr-89, Sr-90, and Fe-55.
	Batch Releases	Prior to release for principal gamma-emitting radionuclides.
		Monthly, a composite sample for tritium and gross alpha.
		Monthly, a representative sample from at least one representative batch for dissolved and entrained fission and activation gases.
		Quarterly, a composite sample for Sr-89, Sr-90 and Fe-55.

STD COL 11.5-2

Table 11.5-202
Minimum Sensitivities

Stream	Nuclide	Sensitivity
Gaseous	Fission & Activation Gases	1.0E-04 μCi/cc
	Tritium	1.0E-06 μCi/cc
	Iodines & Particulates	Sufficient to permit measurement of a small fraction of the activity that would result in annual exposures of 15 mrem to thyroid for iodines, and 15 mrem to any organ for particulates, to an individual in an unrestricted area.
	Gross Radioactivity	Sufficient to permit measurement of a small fraction of the activity that would result in annual air dose of 1) 10 mrad due to gamma, and 2) 20 mrad of beta at any location near ground level at or beyond the site boundary.
Liquid	Gross Radioactivity	1.0E-07 μCi/ml
	Gamma-emitters	5.0E-07 μCi/ml
	Dissolved & Entrained Gases	1.0E-05 μCi/ml
	Gross Alpha	1.0E-07 μCi/ml
	Tritium	1.0E-05 μCi/ml
	Sr-89 & Sr-90	5.0E-08 μCi/ml
	Fe-55	1.0E-06 μCi/ml