FINAL SAFETY ANALYSIS REPORT

CHAPTER 11

RADIOACTIVE WASTE MANAGEMENT

11.0 RADIOACTIVE WASTE MANAGEMENT

This chapter of the U.S. EPR Final Safety Analysis Report (FSAR) is incorporated by reference with supplements {and departures} as identified in the following sections.

11.1 SOURCE TERMS

{This section of the U.S. EPR FSAR is incorporated by reference.}

11.2 LIQUID WASTE MANAGEMENT SYSTEM

{This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.}

11.2.1 Design Basis

No departures or supplements.

11.2.1.1 Design Objective

No departures or supplements.

11.2.1.2 Design Criteria

No departures or supplements.

11.2.1.2.1 Capacity

No departures or supplements.

11.2.1.2.2 Quality Group Classification

No departures or supplements.

11.2.1.2.3 Controlled Releases of Radioactivity

No departures or supplements.

11.2.1.2.4 Mobile Systems and Temporary Equipment

The U.S. EPR FSAR includes the following COL Item in Section 11.2.1.2.4:

> A COL applicant that references the U.S. EPR design certification and that chooses to install and operate mobile radioactive waste processing skids, or mobile decontamination systems connected to permanently installed U.S. EPR equipment will include plant and site-specific information describing how design features and implementation of operating procedures will address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.2, RG 4.21 and 1.143, IE Bulletin 80-10, NEI 08-08, and all quality assurance requirements as stated in Section 4.3 of ANSI/ANS 55.6-1993.

The COL Item is addressed as follows:

Should {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operation Services, LLC} choose to install and operate mobile radioactive waste processing skids, or mobile decontamination systems connected to permanently installed U.S. EPR equipment, then this section of the FSAR will be revised to include plant and site-specific information describing how design features and implementation of operating procedures will address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.2, RG 4.21 and 1.143, IE Bulletin 80-10, NEI 08-08A (NEI, 2009), and the quality assurance requirements as stated in Section 4.3 of ANSI/ANS 55.6-1993 (ANS, 2007).

11.2.2 System Description

{No departures or supplements.}

11.2.3 Radioactive Effluent Releases

{No departures or supplements.}

11.2.3.1 Discharge Requirements

{No departures or supplements.}

11.2.3.2 Estimated Annual Releases

{No departures or supplements.}

11.2.3.3 Release Points and Dilution Factors

The U.S. EPR FSAR includes the following COL Item in Section 11.2.3.3:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information on the release pathway, including a detailed description of the discharge path and plant sources of dilution, the need for backflow prevention to the retention pond, the discharge flow rate, and dilution factors at or beyond the point of discharge.

The COL Item is addressed as follows:

{After the isolation valves of the liquid waste storage system, the treated wastewater travels through a double-walled pipe to the discharge line. The waste water discharge line connects to the cooling tower retention basin discharge line downstream of the basin for added dilution flow before release in the Chesapeake Bay via an off-shore submerged multi-port (three) discharge nozzle arrangement. The discharges from the liquid waste storage system do not interact with the Circulating Water System (CWS).

Prior to discharge into the Chesapeake Bay, CWS cooling tower and ESWS cooling tower blowdown, and miscellaneous low volume waste are directed to the waste water retention basin. Wastes resulting from the Desalination Plant membrane filtration and reverse osmosis equipment will also collect in the waste water retention basin. The waste water retention basin serves as an intermediate discharge reservoir. During plant startup, start-up flushes and chemical cleaning wastes will first collect in temporary tanks or bladders, and will then be discharged into the waste water retention basin. Waste water retention basin effluents and treated sanitary waste and liquid radwaste collect in the seal well. The seal well is a collection point for effluents. It is used to prevent waste water backflow, and allows solid particles to settle and liquids to be discharged back into the Chesapeake Bay. Additionally, the normal water level in the waste water retention basin is at least 60 feet above the normal Chesapeake Bay level. Therefore, backflow from Chesapeake Bay is not credible. The potential contamination sources, the radwaste pipe, the treated sewage line, and the turbine drains line are small in comparison to the retention basin discharge. The piping is sloped from the retention basin down to the junction of the potential on site contamination sources, which are also sloped down from their respective buildings to the junction points of the retention basin discharge pipe. This provides sufficient elevation difference to prevent backflow into the retention basin.

Treated liquid radwaste effluent is released to the Chesapeake Bay at a flow rate of 11 gpm via the CCNPP Unit 3 discharge line situated downstream of the waste water retention basin. The average discharge flow rate from the seal well for waste water streams other than treated liquid radwaste is 21,008 gpm, resulting in a total average flow of 21,019 gpm for liquid effluents discharged to the bay. Retention basin flow provides dilution flow to discharged treated liquid radwaste. As shown in Table 11.2-1, a near-field dilution factor of 13.3 was utilized for calculating the maximum individual dose to man for exposures associated with fish and invertebrate ingestion and boating pathways. For swimming and shoreline exposure pathways, an environmental dilution factor of 58 was applied for the nearest shore with the minimum tidal average mixing. For members of the public under Appendix I to 10 CFR 50 who may be associated with ships in the Chesapeake Bay that use desalinization of sea water to create drinking water, a conservative discharge dilution factor of 296 to 1 was applied to the annual consumption quantities for four ages groups (730, 510, 510 and 330 liters/year for adults, teens, children and infants, respectively). These dilution factors are based on a submerged, multi-port diffuser (with three nozzles), with a discharge line situated approximately 550 ft off the near shoreline with the nozzles directed out into the Chesapeake Bay and into the overhead water column.

The liquid effluent environmental dilution factors were calculated using the Cornell Mixing Expert System (CORMIX) (Jirka, 1996) and FLOW-3D® (Flow Science, 2007) computer codes along with average flow conditions in the Chesapeake Bay and information on the configuration, placement and operation of the multi-port diffuser. The CORMIX computer program was used to determine the size of the plume and to calculate near-field dilution factors. The FLOW-3D computer program was used to construct a depth-averaged tidal flow model of the estuary for the determination of far-field dilution factors. The following conservative assumptions were applied calculating the time averaged dilution factors:

- The drift velocity is based on inflows from upstream locations only, not accounting for water that enters the bay at downstream locations,
- The bay cross-section used is conservatively low compared to the actual cross section of the Chesapeake Bay,
- The effect of winds to increase mixing was not explicitly included in the tidal model and
- The approach used in calculating the 50-mile dilution factor of 296 does not include the effect of tides.}

11.2.3.4 Estimated Doses

11.2.3.4.1 Liquid Pathways

{No departures or supplements.}

11.2.3.4.2 Liquid Pathway Doses

The U.S. EPR FSAR includes the following COL Item in Section 11.2.3.4.2:

> A COL applicant that references the U.S. EPR design certification will confirm that the site-specific parameters are bounded by those provided in Table 11.2-5 and the dose pathways provided in Section 11.2.3.4.1. For site-specific parameters that are not bounded by the values provided in Table 11.2-5 and dose pathways other than those provided in Section 11.2.3.4.1, a COL applicant that references the U.S. EPR design certification will

perform a site-specific liquid pathway dose analysis following the guidance provided in RG 1.109 and RG 1.113, and compare the doses to the numerical design objectives of 10 CFR Part 50, Appendix I and demonstrate compliance with requirements of 10 CFR Part 20.1302 and 40 CFR Part 190.

The COL Item is addressed as follows:

{The LADTAP II computer program (NRC, 1986) was used to calculate doses to the maximally exposed individual (MEI) from liquid effluents. LADTAP II implements the exposure methodology described in RG 1.109 (NRC, 1977). The following exposure pathways were considered:

- Ingestion of aquatic foods (fish and invertebrates)
- External exposure to shoreline
- External exposure to water through boating and swimming
- Ingestion of drinking water (via desalinization treatment)

Due to the brackish nature of Chesapeake Bay, liquid pathways for irrigation are not considered significant. The input parameters for the liquid pathway are presented in Table 11.2-1 in addition to default maximum individual food consumption factors from Regulatory Guide 1.109 (Table E-5).

The doses calculated by the LADTAP II code meet the 10 CFR 50, Appendix I, ALARA design objectives. The dose calculation is based on a discharge flow rate of 46.8 cfs. Table 11.2-2 provides individual doses by pathway and organ. Table 11.2-3 summarizes the total body and maximum organ dose commitment and regulatory requirements.

In addition to the CCNPP Unit 3 dose impacts assessed for the maximum exposed individual and general population, the combined historical dose impacts of CCNPP Units 1 and 2 are added to the CCNPP Unit 3 projected impacts to compare to the uranium fuel cycle dose standard of 40 CFR 190. Since there are no other fuel cycle facilities within 5 mi of the CCNPP site, the combined impacts for three units can be used to determine the total impact from liquid and gaseous effluents, along with direct radiation from fixed radiation sources onsite to determine compliance with the dose limits of the standard (25 mrem/yr whole body, 75 mrem/yr thyroid, and 25 mrem/yr for any other organ). Table 11.2-4 illustrates the impact from CCNPP Units 1 and 2 over a recent eleven year historical period. Using the highest observed annual dose impact from CCNPP Units 1 and 2, Table 11.2-5 shows the combined impact along with the projected contributions from CCNPP Unit 3.}

11.2.3.5 Maximum Release Concentrations

The U.S. EPR FSAR includes the following COL Item in Section 11.2.3.5:

A COL applicant that references the U.S. EPR design certification will confirm that the site-specific annual average liquid effluent concentrations are bounded by those specified in Table 11.2-7. For site-specific annual average liquid effluent concentrations that exceed the values provided in Table 11.2-7, a COL applicant that references the U.S. EPR design certification will demonstrate that the annual average liquid effluent concentrations for expected and design basis conditions meet the limits of 10 CFR Part 20, Appendix B, Table 2 in unrestricted areas.

The COL Item is addressed as follows:

{The annual average concentrations of radioactive materials released in liquid effluents to the discharge point have been determined by dividing the annual liquid effluent release rates (Ci/yr) as calculated using GALE (NRC, 1985) and presented in U.S. EPR FSAR Table 11.2-4, by the discharge flow rate of 21,019 gallons per minute. Annual average concentrations were determined in the immediate vicinity of the discharge point. No further mixing, dilution, or transport was assumed to occur.

For each radionuclide released, the average concentration has been compared to the limiting value for that radionuclide specified in 10 CFR Part 20, Appendix B, Table 2. Table 11.2-8 presents the results of this comparison. For the annual average radionuclide release concentrations for expected releases, the sum of the fractions of the effluent concentration limits is 0.04, which is well below the allowable value of 1.0.

Average liquid effluent concentrations for each radionuclide based on design basis conditions (one percent failed fuel fraction) have also been determined and compared to the limiting value for that radionuclide specified in 10 CFR Part 20, Appendix B, Table 2. The expected release concentrations were upwardly adjusted by a multiplication factor that represents the ratio of design basis fuel failure primary coolant activity to expected fuel failure primary coolant activity. (Note: For calculated multiplication factors less than 1, a value of 1 was conservatively used. For primary coolant activities reported by GALE that were less than 1.0E-05 µCi/ml (and therefore displayed by GALE as zero), a conservative value of 1,000 was used for the multiplication factor.) Table 11.2-8 presents the results of this comparison. For the annual average radionuclide release concentrations for design basis releases, the sum of the fractions of the effluent concentration limits is 0.21, which is below the allowable value of 1.0.}

11.2.3.6 Radioactive Liquid Waste System Leak or Failure

{No departures or supplements.}

11.2.3.7 Postulated Radioactive Releases due to Liquid-Containing Tank Failure

The U.S. EPR FSAR includes the following COL Item in Section 11.2.3.7:

> A COL applicant that references the U.S. EPR design certification will confirm that the site-specific data (such as distance from release location to unrestricted area, contaminant migration time, and dispersion and dilution in surface or ground water) are bounded by those specified in Section 11.2.3.7. For site-specific parameters that exceed the values provided in Section 11.2.3.7, a COL applicant that references the U.S. EPR design certification will provide a site-specific analysis to demonstrate that the resulting water concentrations in the unrestricted area would meet the concentration limits of 10 CFR Part 20, Appendix B, Table 2 using the guidance provided in SRP Sections 2.4.12, 2.4.13, 11.2 and BTP 11-6.

The COL Item is addressed as follows:

{Results of the radiological impacts associated with a postulated radioactive waste tank failure are presented in FSAR Section 2.4.13. The results show that although tritium (H 3) and iodine (I-131) concentrations could potentially exceed the 10 CFR Part 20, Appendix B, Table 2 Effluent Concentration Limit (ECL) given the accidental liquid release of effluents to groundwater for the pathways to Branch 2 and to Chesapeake Bay, the resulting annual dose is below the allowable total exposure level to individual members of the public of 100 millirem per year required in 10 CFR 20.1301.}

11.2.3.8 Quality Assurance

{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 SRP Section 11.2, RG 4.21 and 1.143, IE Bulletin 80-10, NEI 08-08A (NEI, 2009), and ANSI/ANS 55.6-1993 (ANS, 2007).}

11.2.4 Liquid Waste Management System Cost-Benefit Analysis

The U.S. EPR FSAR includes the following COL Item in Section 11.2.4:

> A COL applicant that references the U.S. EPR design certification will perform a site-specific liquid waste management system cost-benefit analysis.

This COL Item is addressed as follows:

{10 CFR Part 50, Appendix I, Section II.D requires that plant designs consider additional items based on a cost-benefit analysis. Specifically, the design must include items of reasonably demonstrated cleanup technology that, when added to the liquid waste processing system sequentially and in order of diminishing cost-benefit return, can, at a favorable cost-benefit ratio, reduce the dose to the population reasonably expected to be within 50 miles of the reactor. The threshold used to make this decision is $1000 per person-rem or person-thyroid rem annual cost to reduce the cumulative dose to a population within a 50-mile radius of the reactor site. The methodology of Regulatory Guide 1.110 (NRC, 1976) was used to perform a site-specific cost benefit analysis to satisfy these requirements. Regulatory Guide 1.110 provides values in 1975 dollars and instructs that these values not be adjusted for inflation.

The following parameters used in determining the Total Annual Cost (TAC) for the cost-benefit analysis are fixed and are provided in Regulatory Guide 1.110 for each radwaste system augment: the Direct Cost of Equipment, Materials and Labor (Table A-1 of Regulatory Guide 1.110), the Annual Operating Cost (AOC) (Table A-2 of Regulatory Guide 1.110), and the Annual Maintenance Cost (AMC) (Table A-3 of Regulatory Guide 1.110). The following variable parameters were used in the cost-benefit analysis:

- ♦ Labor Cost Correction Factor (LCCF) – This factor accounts for the differences in relative labor costs between geographical regions and is taken from Table A-4 of Regulatory Guide 1.110. The lowest LCCF value of 1.0 was conservatively used in the analysis.
- ♦ 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. A value of 1.75 was used for the ICF since the radwaste system for CCNPP Unit 3 is for a single unit site.
- ♦ Capital Recovery Factor (CRF) – This factor reflects the cost of money for capital expenditures. A cost-of-money value of 7% per year was assumed in the analysis, consistent with NUREG/BR-0058 (NRC, 2004). From Table A-6 of Regulatory Guide 1.110, the corresponding CRF is 0.0806.

If it is conservatively assumed that each radwaste system augment is a "perfect" technology that would reduce the effluent dose by 100 percent, the annual cost of the augment can be determined and the lowest annual cost can be considered a threshold value. The lowest cost option for the liquid radwaste treatment system augments was determined to be a 20-gpm cartridge filter at $11,390 per year. Dividing this cost by $1000 per person-rem results in a threshold value of 11.39 person-rem total body or thyroid dose from liquid effluents.

Population dose impacts within a 50 mile radius of the CCNPP site are listed in Table 11.2-7. The input parameters used in calculating the population doses are provided in Table 11.2-6. As shown by the results in Table 11.2-7, the total body and thyroid population doses for liquid effluents are a small fraction of the threshold value of 11.39 person-rem. It is therefore concluded that no further cost-benefit analysis is needed to demonstrate compliance with 10 CFR Part 50, Appendix I, Section II.D.}

11.2.5 References

{ANS, 2007. Liquid Radioactive Waste Processing System for Light Water Reactor Plants, ANSI/ANS 55.6-1993, R2007, American National Standards Institute/American Nuclear Society, 2007.

CFR, 2007. Title 10, Code of Federal Regulations, Part 20, Appendix B, Table 2, Radionuclides, Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage, 2007.

Flow Science, 2007. "FLOW-3D User's Manual Version 9.0," Flow Science, Santa Fe, NM.

Jirka, 1996. User's Manual for CORMIX: A Hydro-Dynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters, G. Jirka, R. Doneker and S. Hinton, EPA #823/B-97-006, U.S. Environmental Protection Agency, Website: http://www.epa.gov/waterscience/models/cormix/users.pdf, Date accessed: June 02, 1997.

NEI, 2009. NEI 08-08A, Generic FSAR Template Guidance for Life Cycle Minimization of Contamination, Revision 0, Nuclear Energy Institute, October 2009.

NRC, 1976. Regulatory Guide 1.110, Cost-Benefit Analysis for Radwaste Systems for Light Water-Cooled Nuclear Power Reactors (For Comment), Nuclear Regulatory Commission, March, 1976.

NRC, 1977. Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluent for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Revision 1, U.S. Nuclear Regulatory Commission, October 1977.

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

NRC, 1986. NUREG/CR-4013, "LADTAP II – Technical Reference and User Guide," U.S. Nuclear Regulatory Commission, April 1986.

NRC, 2004. NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," Revision 4, September, 2004.}

Table 11.2-1 — {LADTAP II Input Parameters used in Maximum Exposed Individual Dose Calculation}

Parameter[1]	Value
Source Term	GALE (U.S. EPR FSAR Table 11.2-4) (Total as Adjusted)
Site Type	Saltwater
Shore-Width Factor	1.0
Discharge Flow Rate	46.8 cfs (1.33 m^3/s)
Impoundment Reconcentration Model	None
Shoreline usage (all age groups)[2]	200 hr/yr
Swimming usage (all age groups)[3]	100 hr/yr
Boating usage (all age groups)[3]	200 hr/yr
Dilution factor for fish, invertebrate, boating pathways	13.3
Dilution factor for swimming and shoreline activity	58
Dilution factor for potable water	296
Decontamination factor for potable water treated via the reverse osmosis unit	10 for all nuclides except H-3
Transit time for all pathways	0 hr

Notes:

1. All other values are LADTAP II default values.
2. The shoreline usage values used in the maximum exposed individual (MEI) dose calculation are conservative compared to the default values cited in Regulatory Guide 1.109, Table E-5.
3. The usage values for swimming and boating were selected to bound data for actual usage values for the population within the site vicinity (See Table 11.2-6).}

Table 11.2-2 — {Detailed Dose Commitment Results By Age Group and Organs Due to Liquid Effluent Releases}
(Page 1 of 2)

Pathway	Skin (mrem/yr)	Bone (mrem/yr)	Liver (mrem/yr)	Total Body (mrem/yr)	Thyroid (mrem/yr)	Kidney (mrem/yr)	Lung (mrem/yr)	GI-LLI (mrem/yr)
Fish								
Adult		1.02E-03	5.10E-03	4.47E-03	2.85E-02	4.11E-03	3.59E-03	1.12E-02
Teen		1.06E-03	4.36E-03	3.32E-03	2.62E-02	3.33E-03	2.84E-03	8.18E-03
Child		1.31E-03	3.68E-03	2.59E-03	2.70E-02	2.77E-03	2.35E-03	4.18E-03
Invertebrates								
Adult		1.67E-03	2.63E-03	1.78E-03	3.08E-02	3.36E-03	9.79E-04	5.91E-02
Teen		1.72E-03	2.44E-03	1.55E-03	2.87E-02	3.25E-03	8.13E-04	4.71E-02
Child		2.20E-03	2.09E-03	1.53E-03	3.11E-02	2.88E-03	6.99E-04	2.06E-02
Shoreline								
Adult	1.08E-03	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04
Teen	1.08E-03	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04
Child	1.08E-03	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04
Infant	1.08E-03	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04
Swimming								
Adult		9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06
Teen		9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06
Child		9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06
Infant		9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06	9.60E-06
Boating								
Adult		4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05
Teen		4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05
Child		4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05
Infant		4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05	4.19E-05
Potable Water								
Adult		5.01E-06	5.91E-03	5.91E-03	6.38E-03	5.91E-03	5.91E-03	5.95E-03
Teen		4.88E-06	4.17E-03	4.16E-03	4.57E-03	4.17E-03	4.16E-03	4.19E-03
Child		1.42E-05	8.00E-03	7.99E-03	9.01E-03	8.00E-03	7.99E-03	8.02E-03
Infant		1.67E-05	7.86E-03	7.85E-03	9.45E-03	7.86E-03	7.84E-03	7.86E-03

Table 11.2-2 — {Detailed Dose Commitment Results By Age Group and Organs Due to Liquid Effluent Releases}
(Page 2 of 2)

Pathway	Skin (mrem/yr)	Bone (mrem/yr)	Liver (mrem/yr)	Total Body (mrem/yr)	Thyroid (mrem/yr)	Kidney (mrem/yr)	Lung (mrem/yr)	GI-LLI (mrem/yr)
Total								
Adult	1.08E-03	3.66E-03	1.46E-02	1.31E-02	6.66E-02	1.43E-02	1.14E-02	7.72E-02
Teen	1.08E-03	3.75E-03	1.19E-02	1.00E-02	6.04E-02	1.17E-02	8.78E-03	6.04E-02
Child	1.08E-03	4.49E-03	1.47E-02	1.31E-02	6.81E-02	1.46E-02	1.20E-02	3.38E-02
Infant	1.08E-03	9.86E-04	8.83E-03	8.82E-03	1.04E-02	8.83E-03	8.81E-03	8.83E-03

Table 11.2-3 — {Dose Commitment Due To Liquid Releases}

Type of Dose	Calculated (mrem/yr)	10 CFR Part 50, Appendix I ALARA Design Objective (mrem/yr)
Total Body Dose	1.31E-02 (adult)	3
Maximum Organ Dose	7.72E-02 (adult, GI-LLI)	10
Thyroid Dose	6.81E-02 (child)	N/A

Table 11.2-4 — {Annual Historical Dose Compliance with 40 CFR 190 for CCNPP Units 1 and 2[1]}

Year	Whole Body (mrem)	Thyroid (mrem)	Maximum Organ (mrem)
2009	0.002	0.040	0.003
2008	0.004	0.035	0.010
2007	0.002	0.010	0.005
2006	0.004	0.052	0.010
2005	0.005	0.006	0.095
2004	0.002	0.007	0.006
2003	0.004	0.006	0.023
2002	0.007	0.003	0.1740
2001	0.010	0.005	0.351
2000	0.018	0.018	0.211
1999	0.013	0.011	0.686
Max value any year	0.018	0.052	0.686

Note 1: Historical doses for CCNPP Units 1 and 2 were obtained from the annual radiological environmental operating reports for years 2000-2010. Doses above represent total dose from liquid and gaseous effluents. There was no plant-related contribution from direct radiation during the periods of interest.

Table 11.2-5 — {40 CFR 190 Annual Site Dose Compliance}

CCNPP Unit 3		Whole Body (mrem)	Thyroid (mrem)	Max. Organ[7] (mrem)
CCNPP Unit 3 Liquids[1]		1.31E-02	6.81E-02	7.72E-02
CCNPP Unit 3 Gaseous External	Plume[2]	2.24E-01	2.24E-01	2.24E-01
	Ground Plane[3]	1.67E-03	1.67E-03	1.67E-03
Ingestion	Meat[4]	2.74E-02	3.20E-02	1.33E-01
	Vegetable[4]	1.87E-01	5.42E-01	9.08E-01
Inhalation[4]		4.47E-03	1.26E-02	1.12E-04
CCNPP Unit 3 Direct[5]		4.86E-05	4.86E-05	4.86E-05
Total (CCNPP Unit 3)[6]		4.58E-01	8.80E-01	1.34E+00
Total (CCNPP Units 1 and 2)[7]		1.8E-02	5.2E-02	6.86E-01
CCNPP Site Total		4.76E-01	9.32E-01	2.03E+00

Notes:

1. Values from Table 11.2-2 and Table 11.2-3.
2. External dose from plume is calculated at the SE site boundary (0.88 mi) only for noble gases and is used for assessment of compliance with 40 CFR 190. (See Table 11.3-6)
3. Exposure pathway assumed to exist at maximum site boundary (S, 0.86 mi) (See Table 11.3-1 and Table 11.3-6).
4. Exposure pathway assumed to exist at maximum site boundary (SE, 0.88 mi) (See Table 11.3-1 and Table 11.3-5).
5. Unit 3 doses projected based on design performance calculations using the GALE code, and both real and potential maximum pathway locations. Direct radiation exposure from containment and other plant buildings is negligible based on information in U.S. EPR FSAR Section 12.3.5.3.
6. Unit 1 & 2 doses based on actual plant recorded effluents and exposure pathways (different basis from that applied to Unit 3 projected assessments). - see Table 11.2-4
7. For Unit 3, the liquid effluent critical organ is adult GI-LLI (gastro-intestinal - lower large intestine); for gaseous effluents, critical organ is Child bone. These are conservatively added to represent maximum dose.

Table 11.2-6 — {Input Parameters for the LADTAP II Computer Code used in Liquid Waste Cost-Benefit Analysis}

Parameter	Value[1]
Source Term (Unadjusted)	GALE (U.S. EPR FSAR Table 11.2-4)
50-Mile Population	6.42E+06
Shoreline Activity (person-hours per year)	3.8E+07
Boating (person-hours per year)	4.4E+07
Swimming (person-hours per year)	3.0E+07
Commercial Fishing Harvest (kg per year)	1.5E+08
Commercial Invertebrate Harvest (kg per year)	2.6E+07
Sport Fishing Harvest (kg per year)	1.3E+06
Sport Invertebrate Harvest (kg per year)	1.6E+06
Shore-Width Factor	1.0
Discharge Flow Rate (cfs)	46.8
Impoundment Reconcentration Model	None
Site Type	Saltwater
Dilution factor (for all pathways)	296
Note 1: All other input values are LADTAP II default values.	

Table 11.2-7 — {Population Doses from Liquid Effluents[1]}

Total Body Dose (person-rem)	Thyroid Dose (person-rem)
0.168	0.712
Note 1: Includes dose contribution from commercial and sport harvest of fish and shellfish, shoreline, swimming and boating exposures to the 50-mile population.	

Table 11.2-8 — {Comparison of Annual Average Liquid Release Concentrations with 10 CFR Part 20 Concentration Limits}

Nuclide	Expected Release Concentration (μCi/ml)	Design Basis Release Concentration (μCi/ml)	10 CFR 20 Appendix B Table 2, Col. 2 Limit (μCi/ml)	Fraction of Limit	
				Expected Release Concentration	Design Basis Release Concentration
Na24	1.46E-10	1.90E-10	5.00E-05	2.92E-06	3.80E-06
Cr51	2.39E-11	3.44E-11	5.00E-04	4.78E-08	6.88E-08
Mn54	1.29E-11	1.82E-11	3.00E-05	4.30E-07	6.07E-07
Fe55	9.80E-12	1.40E-11	1.00E-04	9.80E-08	1.40E-07
Fe59	2.39E-12	3.39E-12	1.00E-05	2.39E-07	3.39E-07
Co58	3.58E-11	5.10E-11	2.00E-05	1.79E-06	2.55E-06
Co60	4.30E-12	6.22E-12	3.00E-06	1.43E-06	2.07E-06
Zn65	4.06E-12	5.75E-12	5.00E-06	8.13E-07	1.15E-06
W187	1.10E-11	1.43E-11	3.00E-05	3.66E-07	4.78E-07
Np239	1.39E-11	4.49E-11	2.00E-05	6.93E-07	2.25E-06
Sr89	1.19E-12	4.80E-11	8.00E-06	1.49E-07	5.99E-06
Sr91	1.91E-12	1.22E-11	2.00E-05	9.56E-08	6.11E-07
Y91m	1.19E-12	4.93E-12	2.00E-03	5.97E-10	2.46E-09
Y93	8.60E-12	8.60E-12	2.00E-05	4.30E-07	4.30E-07
Zr95	3.11E-12	6.64E-12	2.00E-05	1.55E-07	3.32E-07
Nb95	2.39E-12	7.07E-12	3.00E-05	7.97E-08	2.36E-07
Mo99	4.30E-11	5.95E-09	2.00E-05	2.15E-06	2.97E-04
Tc99m	4.06E-11	2.18E-09	1.00E-03	4.06E-08	2.18E-06
Ru103	5.97E-11	5.97E-11	3.00E-05	1.99E-06	1.99E-06
Rh103m	5.97E-11	5.97E-08	6.00E-03	9.96E-09	9.96E-06
Ru106	7.41E-10	7.41E-10	3.00E-06	2.47E-04	2.47E-04
Ag110m	1.05E-11	1.05E-11	6.00E-06	1.75E-06	1.75E-06
Te129m	1.43E-12	9.81E-11	7.00E-06	2.05E-07	1.40E-05
Te129	9.56E-13	9.56E-13	4.00E-04	2.39E-09	2.39E-09
Te131m	7.41E-12	1.39E-10	8.00E-06	9.26E-07	1.74E-05
Te131	1.43E-12	1.59E-12	8.00E-05	1.79E-08	1.98E-08
I131	8.13E-10	2.90E-08	1.00E-06	8.13E-04	2.90E-02
Te132	1.15E-11	2.25E-09	9.00E-06	1.27E-06	2.50E-04
I132	2.87E-11	5.36E-11	1.00E-04	2.87E-07	5.36E-07
I133	8.36E-10	1.37E-08	7.00E-06	1.19E-04	1.96E-03
Cs134	6.21E-11	1.22E-08	9.00E-07	6.90E-05	1.36E-02
I135	3.58E-10	1.49E-09	3.00E-05	1.19E-05	4.97E-05
Cs136	7.41E-12	3.55E-09	6.00E-06	1.23E-06	5.92E-04
Cs137	8.36E-11	7.87E-09	1.00E-06	8.36E-05	7.87E-03
Ba140	1.00E-10	1.00E-10	8.00E-06	1.25E-05	1.25E-05
La140	1.82E-10	1.82E-10	9.00E-06	2.02E-05	2.02E-05
Ce141	1.19E-12	6.24E-12	3.00E-05	3.98E-08	2.08E-07
Ce143	1.46E-11	1.46E-11	2.00E-05	7.29E-07	7.29E-07
Pr143	1.19E-12	1.19E-09	2.00E-05	5.97E-08	5.97E-05
Ce144	3.11E-11	3.11E-11	3.00E-06	1.04E-05	1.04E-05
Pr144	3.11E-11	3.11E-08	6.00E-04	5.18E-08	5.18E-05
H3	3.97E-05	1.59E-04	1.00E-03	3.97E-02	1.59E-01
			Sum of Fractions	**4.11E-02**	**2.13E-01**

11.3 GASEOUS WASTE MANAGEMENT SYSTEMS

{This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.}

11.3.1 Design Basis

{No departures or supplements.}

11.3.1.1 Design Objectives

{No departures or supplements.}

11.3.1.2 Design Criteria

{No departures or supplements.}

11.3.1.2.1 Quality Group Classification

{No departures or supplements.}

11.3.1.2.2 Seismic Design Classification

{No departures or supplements.}

11.3.1.2.3 Controlled Releases of Radioactivity

{No departures or supplements.}

11.3.1.2.4 Mobile Systems

The U.S. EPR FSAR includes the following COL Item in Section 11.3.1.2.4:

> A COL applicant that references the U.S. EPR design certification and that chooses to install and operate mobile skid-mounted processing systems connected to permanently installed GWMS processing equipment will include plant and site-specific information describing how design features and implementation of operating procedures for the GWMS will address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.3, RG 4.21, RG, 1.143, IE Bulletin 80-10, and NEI 08-08.

The COL Item is addressed as follows:

Should {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operation Services, LLC} choose to install and operate mobile skid-mounted equipment to connect to the permanently installed GWMS, then this section of the FSAR will be revised to include plant and site-specific information describing how design features and implementation of operating procedures for the GWMS address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.3, RG 4.21, RG, 1.143, IE Bulletin 80-10, NEI 08-08A (NEI, 2009), and the quality assurance requirements as stated in Section 4.3 of ANSI/ANS 55.4-1993 (ANS, 2007).

11.3.2 System Description

{No departures or supplements.}

11.3.3 Radioactive Effluent Releases

{No departures or supplements.}

11.3.3.1 Discharge Requirements

{No departures or supplements.}

11.3.3.2 Estimated Annual Releases

{No departures or supplements.}

11.3.3.3 Release Points

The U.S. EPR FSAR includes the following COL Item in Section 11.3.3.3:

> A COL applicant that references the U.S. EPR design certification will provide a discussion of the onsite vent stack design parameters and site-specific release point characteristics.

The COL Item is addressed as follows:

{All gaseous effluents are released at the top of the plant stack. The stack height is approximately 197 ft above plant grade, or about 6.56 ft above the height of the adjacent Reactor Building. For the purpose of analyzing the effective stack height, a conservative stack flow rate of 242,458 cfm was utilized in the atmospheric dispersion calculations. The stack diameter is 12.5 ft. The releases of radioactive effluent to the plant stack include contributions from:

- Gaseous Waste Processing System discharges via the carbon delay beds for noble gas holdup and decay,
- Containment purge ventilation discharges,
- Ventilation discharges from (1) the four Safeguards and Access Building controlled areas, (2) the Fuel Pool Building, (3) the Radwaste Building and (4) the Nuclear Auxiliary Building, and
- Main Condenser air evacuation exhaust.}

11.3.3.4 Estimated Doses

The U.S. EPR FSAR includes the following COL Item in Section 11.3.3.4:

> A COL applicant that references the U.S. EPR design certification will confirm that the site-specific parameters are bounded by those provided in Table 11.3-4 and the dose pathways provided in Section 11.3.3.4. For site-specific parameters that are not bounded by the values provided in Table 11.3-4 and dose pathways other than those provided in Section 11.3.3.4, a COL applicant that references the U.S. EPR design certification will perform a site-specific gaseous pathway dose analysis following the guidance provided in RG1.109 and RG 1.111, and compare the doses to the numerical design objectives of 10 CFR Part 50, Appendix I and demonstrate compliance with requirements of 10 CFR Part 20.1302 and 40 CFR Part 190.

The COL Item is addressed as follows:

{The GASPAR II computer program (NRC, 1987) was used to calculate doses to the maximally exposed individual (MEI) from gaseous releases. GASPAR II implements the exposure methodology described in RG 1.109, Rev. 1 for estimated dose associated with the radioactive releases in gaseous effluent. The following exposure pathways were considered:

- External exposure to contaminated ground.
- External exposure to noble gas radionuclides in the airborne plume.
- Exposure from inhalation of radioactivity.
- Exposure from ingestion of farm products grown in contaminated soil.
- Exposure from ingestion of meat from animals fed with contaminated feed. (Milk animals are not considered as there are no animals producing milk for human consumption within a 5-mile radius of the site.

The gaseous effluent is transported and diluted in a manner determined by the prevailing meteorological conditions. Section 2.3 discusses the meteorological modeling which has been used for all dose estimates, including estimated dispersion values for the 50-mile radius of the CCNPP site. Dilution factors due to atmospheric dispersion are deduced from historical onsite meteorological data and are summarized for the maximum exposed individual in Table 11.3-1. The gaseous source term for CCNPP Unit 3 expected routine operations is provided in US EPR FSAR Table 11.3-3. The CCNPP Unit 3 stack is located adjacent to the reactor building and qualifies as a mixed mode release point. All ventilation air from areas of significant potential contamination, along with waste gas processing effluents, is released through the plant stack.

The input parameters for the gaseous pathway are presented in Tables 11.3-2 and Table 11.3-3, and the receptor locations are shown in Table 11.3-4. The locations of nearest residences, gardens, milk and meat animals were identified via a land-use census conducted in 2005. The locations of the site boundary and vegetable garden chosen for the analysis represent the respective locations with the most limiting atmospheric dispersion and deposition factors, not necessarily the site boundary location or garden closest to the reactor centerline. Although the use of beef cattle within 5 miles of CCNPP was identified in the land-use census, specific locations for beef cattle were not available. Therefore, it is conservatively assumed that beef cattle exist at the most limiting site boundary location (excluding sectors bordering or extending over water).

The release of radioactive materials in gaseous effluents from CCNPP Unit 3 to the environment results in minimal radiological impacts. Annual radiation exposures to the maximum exposed individual near the CCNPP site via the pathways of submersion, ground contamination, inhalation and ingestion are provided in Tables 11.3-5 and 11.3-6 for the four age groups of interest. Table 11.3-7 provides a summary of the dose to the MEI compared to the dose limits of 10 CFR 50, Appendix I. Table 11.3-7 shows that the critical organ dose to the MEI is 0.868 mrem/yr to a child's bone This maximum exposed individual is assumed to reside at the limiting site boundary and consume beef raised at the limiting site boundary and garden vegetables from the nearest garden at 0.98 miles SE. Table 11.3-7 also provides the beta and gamma air dose at the site boundary. Projected dose impacts are well within the design objectives of Appendix I.In order to bound any future changes in land use over the operating life of the plant, a second analysis was performed for a "hypothetical MEI." This hypothetical individual is assumed to be exposed to the same pathways, at the same receptor locations, as the MEI, with the following exceptions: a) the vegetable pathway is assumed to exist at the limiting site boundary, rather than at the real vegetable garden location used for the MEI, and b) a milk pathway is assumed, where none exists for the MEI. Using these conservative assumptions, the maximum critical organ (child bone) dose increases to 1.47 mrem/yr which is still below the dose objective of 10 CFR 50, Appendix I, Section II.C. (Note: The dose of 1.47 mrem represents a summation of the following values from Table 11.3-5: 1.67E-03 mrem from ground plane, 1.12E-04 mrem from inhalation, 0.908 mrem from vegetables, 0.423 mrem from milk and 0.133 mrem from meat.)

In addition to the CCNPP Unit 3 dose impacts assessed for the maximum exposed individual and general population, the combined historical dose impacts of CCNPP Units 1 and 2 are added to the CCNPP Unit 3 projected impacts to compare to the uranium fuel cycle dose standard of 40 CFR 190. Since there are no other fuel cycle facilities within 5 mi of the CCNPP site, the combined impacts for three units can be used to determine the total impact from liquid and gaseous effluents along with direct radiation from fixed radiation sources onsite to determine compliance with the dose limits of the standard (25 mrem/yr whole body, 75 mrem/yr thyroid, and 25 mrem/yr for any other organ). Table 11.2-4 illustrates the impact from CCNPP Units 1 and 2 over a recent eleven year historical period. Using the highest observed annual dose impact from CCNPP Units 1 and 2, Table 11.2-5 shows the combined impact along with the projected contributions from CCNPP Unit 3. The projected direct dose component for Unit 3 is based on a projected dose rate to the site boundary from the Fuel Building. The Fuel Building is the only structure which contains significant radiation sources that could contribute to direct dose at the boundary line. This is due to the shielding effect of other plant structures that are situated between buildings with radiation sources and the CCNPP site boundary line. The exterior walls of the Fuel Building provide sufficient shielding to limit the exterior dose rate to 0.25 mrem/hr at 1 foot from the exterior walls. Therefore, the projected direct annual dose at the site boundary (approximately 5400 ft) from CCNPP Unit 3 would not exceed 4.86E-05 mrem/yr.}

11.3.3.5 Maximum Release Concentrations

The U.S. EPR FSAR includes the following COL Item in Section 11.3.3.5:

> A COL applicant that references the U.S. EPR design certification will confirm that the site-specific annual average gaseous effluent concentrations are bounded by those specified in Table 11.3-6. For site-specific annual average gaseous effluent concentrations that exceed the values provided in Table 11.3-6, a COL applicant that references the U.S. EPR design certification will demonstrate that the annual average gaseous effluent concentrations for expected and design basis conditions meet the limits of 10 CFR Part 20, Appendix B, Table 2 in unrestricted areas.

The COL Item is addressed as follows:

{The annual average concentrations of radioactive materials released in gaseous effluents to the discharge point have been determined by multiplying the annual gaseous effluent release rates (Ci/yr) as calculated using the GALE (NRC, 1985) code and presented in U.S. EPR FSAR Table 11.3-3, by the maximum annual average site boundary dispersion factor of 1.076E-06 sec/m^3.

For each radionuclide released, the average concentration has been compared to the limiting value for that radionuclide specified in 10 CFR Part 20, Appendix B, Table 2. Table 11.3-18 presents the results of this comparison. For the annual average radionuclide release concentrations for expected releases, the sum of the fractions of the effluent concentration limits is 0.004, which is well below the allowable value of 1.0.

Average gaseous effluent concentrations for each radionuclide based on design basis conditions (one percent failed fuel fraction) have also been determined and compared to the limiting value for that radionuclide specified in 10 CFR Part 20, Appendix B, Table 2. The expected release concentrations were upwardly adjusted by a multiplication factor. For noble gases and iodine isotopes, the multiplication factor is the ratio of the primary coolant activity for the maximum expected fuel failure to the expected primary coolant activity. The maximum primary coolant activity for noble gases and iodine isotopes is controlled by Technical Specifications (TS). Corrosion products are not affected by the percentage of fuel defects and do not need a multiplication factor. Similarly, Carbon-14 and Argon-41 release rates are also independent of fuel defect level. Tritium is adjusted using the ratio of the primary coolant activity for maximum failed fuel defect (1 percent failed fuel) to expected primary coolant concentration. The release rate for all other isotopes is conservatively adjusted upward by a factor of 1,000. The results of the design basis case are also presented in Table 11.3-18. For the annual average radionuclide release concentrations for design basis (one percent failed fuel) releases, the sum of the fractions of the effluent concentration limits is 0.02, which is well below the allowable value of 1.0.}

11.3.3.6 Radioactive Gaseous Waste System Leak or Failure

U.S. EPR FSAR includes the following COL Item in Section 11.3.3.6:

> A COL applicant that references the U.S. EPR design certification will confirm that the site-specific accident atmospheric dispersion data is bounded by the values provided in Table 2.1-1. For site-specific accident atmospheric dispersion data that exceed the values provided in Table 2.1-1, a COL applicant that references the U.S. EPR design certification will provide a site-specific analysis demonstrating that the resulting dose at the exclusion area boundary associated with a radioactive release due to gaseous waste system leak or failure does not exceed 0.1 rem in accordance with SRP Section 11.3, BTP 11-5.

The COL Item is addressed as follows:

{The evaluation performed in support of the US EPR FSAR Section 11.3.3.6 used an atmospheric dispersion factor of 1.0E-03 sec/m^3. This dispersion factor bounds the accident dispersion factors for CCNPP Unit 3 as shown in Table 2.3-75. Therefore, the resulting dose associated with a gaseous waste system leak or failure at CCNPP Unit 3 would be less than 0.1 rem, in accordance with BTP 11 5. (NRC, 2007)}

11.3.3.7 Quality Assurance

{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 SRP Section 11.3, RG 4.21 and 1.143, IE Bulletin 80-10, NEI 08-08A (NEI, 2009), and ANSI/ANS 55.4-1993 (ANS, 2007).}

11.3.4 Gaseous Waste Management System Cost-Benefit Analysis

The U.S. EPR FSAR includes the following COL Item in Section 11.3.4:

> A COL applicant that references the U.S. EPR design certification will perform a site-specific gaseous waste management system cost-benefit analysis.

This COL Item is addressed as follows:

{10 CFR Part 50, Appendix I Section II.D requires that plant designs consider additional items based on a cost-benefit analysis. Specifically, the design must include all items of reasonably demonstrated cleanup technology that, when added to the gaseous waste processing system sequentially and in order of diminishing cost-benefit return, can, at a favorable cost-benefit ratio, reduce the dose to the population reasonably expected to be within 50 miles of the reactor. The threshold used to make this decision is $1000 per person-rem or person-thyroid rem annual cost to reduce the cumulative dose to a population within a 50-mile radius of the reactor site. The methodology of Regulatory Guide 1.110 was used to perform a site-specific cost benefit analysis to satisfy these requirements. Regulatory Guide 1.110 provides values in 1975 dollars and instructs that these values not be adjusted for inflation.

The following parameters used in determining the Total Annual Cost (TAC) for the cost-benefit analysis are fixed and are provided in Regulatory Guide 1.110 for each radwaste system augment: the Direct Cost of Equipment, Materials and Labor (Table A-1 of Regulatory Guide 1.110), the Annual Operating Cost (AOC) (Table A-2 of Regulatory Guide 1.110), and the Annual Maintenance Cost (AMC) (Table A-3 of Regulatory Guide 1.110). The following variable parameters were used in the cost-benefit analysis:

- ♦ Labor Cost Correction Factor (LCCF) – This factor accounts for the differences in relative labor costs between geographical regions and is taken from Table A-4 of Regulatory Guide 1.110. The lowest LCCF value of 1.0 was conservatively used in the analysis.
- ♦ 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. A value of 1.75 was used for the ICF since the radwaste system for CCNPP Unit 3 is for a single unit site.
- ♦ Capital Recovery Factor (CRF) – This factor reflects the cost of money for capital expenditures. A cost-of-money value of 7% per year was assumed in the analysis, consistent with NUREG/BR-0058 (NRC, 2004). From Table A-6 of Regulatory Guide 1.110, the corresponding CRF is 0.0806.

If it is conservatively assumed that each radwaste system augment is a “perfect” technology that would reduce the effluent dose by 100 percent, the annual cost of the augment can be determined and the lowest annual cost can be considered a threshold value. The lowest cost option for the gaseous radwaste treatment system was determined to be the steam generator flash tank vent to main condenser augment at $6,650 per year. Dividing this cost by $1000 per person-rem results in a threshold value of 6.65 person-rem total body or thyroid dose from gaseous effluents.

Population dose impacts within a 50 mile radius of the CCNPP site are listed in Table 11.3-8. The input parameters used in calculating the population doses are provided in Table 11.3-2 and Tables 11.3-9 through 11.3-17. As shown by the results in Table 11.3-8, the total body and thyroid population doses for gaseous effluents are lower than the threshold value of

6.65 person-rem. It is therefore concluded that no further cost-benefit analysis is needed to demonstrate compliance with 10 CFR Part 50, Appendix I, Section II.D.}

11.3.5 References

{**ANS, 2007.** Gaseous Radioactive Waste Processing System for Light Water Reactor Plants, ANSI/ANS 55.4-1993, R2007, American National Standards Institute/American Nuclear Society, 2007.

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USDA, 2002. USDA, National Agricultural Statistics Service (NASS), 2002 Census of Agriculture for Delaware, Maryland and Virginia.

VEC, 2006. State Demographer Projections Population Data, Virginia Employment Commission, Website: http://velma.virtuallmi.com, Date accessed: June 22, 2007.}

Table 11.3-1 — {Locations and Atmospheric Dispersion/Deposition Factors for Gaseous Effluent Maximum Dose Evaluations[c]}

Location (Distance, Sector)	Dose Pathways Evaluated	Undecayed χ/Q (sec/m^3)	Depleted χ/Q (sec/m^3)	D/Q (1/m^2)
Site Boundary (0.88 mi SE)	Plume Ground Inhalation Meat(b)	1.076E-06	9.733E-07	1.060E-08
Site Boundary (0.86 mi S)	Plume Ground Inhalation Meat(b)	8.681E-07	7.939E-07	1.186E-08
Nearest Garden(a) (0.98 mi SE)	Vegetables	8.707E-07	7.859E-07	8.234E-09

Notes:

a. The term nearest garden refers to the most limiting locations.

b. Assumed to exist at the site boundary with most limiting atmospheric dispersion (excluding sectors bordering or extending over water). Specific locations for beef cattle are not available. Therefore, it is conservatively assumed that beef cattle exist at the site boundary.

c. The locations of nearest garden and cattle were identified via a land-use census (CCNPP, 2005). No milk animals were identified within 5 miles of CCNPP.

Table 11.3-2 — {Gaseous Pathway Parameters}

Parameter Description	Value
Growing season, fraction of year (April - October)[1]	0.583
Fraction time animals on pasture per year	0.583
Intake from Pasture when on Pasture	1.0
Fraction of the maximum individual's vegetable intake that is from his own garden	0.76
Absolute Humidity, g/m^3	8.4
50-mile Population Distribution	Table 11.3-9
50-mile distribution of normal effluent undecayed/undepleted atmospheric dispersion factors [2]	Table 11.3-10
50-mile distribution of normal effluent decayed/undepleted atmospheric dispersion factors[3]	Table 11.3-10
50-mile distribution of normal effluent decayed/depleted atmospheric dispersion factors[4]	Table 11.3-10
50-mile distribution of normal effluent deposition (D/Q) values	Table 2.3-91 and Table 2.3-92
Milk Production within 50 mi (kg/yr)[5]	Table 11.3-11
Meat Production within 50 mi (kg/yr)[5]	Table 11.3-14
Vegetable/Grain Production within 50 mi (kg/yr)[5]	Table 11.3-17

Notes:

1. The growing season is the span of months when the temperature is above freezing for all days during the month. Based on local climatological data, this occurs from April through October. (NOAA, 2002)
2. A bounding set of dispersion factors (see Table 11.3-10) representing the more limiting (i.e., higher) value of the undecayed/undepleted χ/Q (Table 2.3-83) and gamma χ/Q (Table 2.3-88 and Table 2.3-89) for each distance and sector is used as a bounding input to the GASPAR II population dose input file for the undecayed/undepleted atmospheric dispersion factors. This approach is conservative as it results in a bounding dose estimate.
3. A bounding set of dispersion factors (see Table 11.3-10) representing the more limiting (i.e., higher) value of the undecayed/undepleted χ/Q (Table 2.3-83) and gamma χ/Q (Table 2.3-88 and Table 2.3-89) for each distance and sector is used as a bounding input to the GASPAR II population dose input file for the decayed/undepleted atmospheric dispersion factors. This approach is conservative since no credit is taken for either decay, resulting in a conservative dose estimate
4. A bounding set of dispersion factors (see Table 11.3-10) representing the more limiting (i.e., higher) value of the undecayed/undepleted χ/Q (Table 2.3-83) and gamma χ/Q (Table 2.3-88 and Table 2.3-89) for each distance and sector is used as a bounding input to the GASPAR II population dose input file for the decayed/depleted atmospheric dispersion factors. This approach is conservative since no credit is taken for either decay or depletion, resulting in a conservative dose estimate.
5. Data for 50-mile food and crop production obtained from the U.S. Department of Agriculture statistics for Delaware, Maryland, and Virginia, the states within 50 miles of CCNPP. (USDA, 2002)

Table 11.3-3 — {Gaseous Pathway Consumption Factors for MEI [1]}

Consumption Factor	Adult	Teen	Child	Infant
Leafy vegetables: kg/yr	64	42	26	0
Meat Consumption: kg/yr	110	65	41	0
Milk Consumption: liter/yr	310	400	330	330
Vegetable/fruit consumption: kg/yr	520	630	520	0
[1] Values from Table E-5 of Regulatory Guide 1.109				

Table 11.3-4 — {Distance to Nearest Gaseous Dose Receptors [1][3]}

Sector	Site Boundary (m/mi)	Residence (km/mi)	Vegetable Garden (km/mi)
N [2]	623/0.39	-	-
NNE[2]	429/0.27	-	-
NE[2]	443/0.28	-	-
ENE[2]	471/0.29	-	-
E[2]	554/0.34	-	-
ESE[2]	693/0.43	-	-
SE	1413/0.88	1.6/1.0	1.6/1.0
SSE	1607/1.0	2.0/1.2	2.1/1.3
S	1385/0.86	2.2/1.4	2.2/1.4
SSW	1371/0.85	-	-
SW	1759/1.09	1.9/1.2	2.3/1.4
WSW	1745/1.08	1.6/1.0	1.6/1.0
W	1732/1.08	2.1/1.3	2.5/1.6
WNW	2313/1.44	2.5/1.5	2.8/1.7
NW	1662/1.03	4.1/2.5	4.1/2.5
NNW[2]	762/0.47	-	-

Notes:

1. Distance measure from the center of containment to site boundary based on the 2005 Land-Use Census (CCNPP, 2005).
2. Sector includes portions bordering or over water; distance measured are to the nearest shoreline property boundary.
3. No milk cows or goats identified within 5 miles of the site. Meat animals assumed to be at location of critical receptor for dose assessment projections.}

Table 11.3-5 — {Detailed Dose Commitment Results By Age Group and Organs Due to Gaseous Effluent Releases}

(Page 1 of 2)

Pathway	Total Body (mrem/yr)	GI-Tract (mrem/yr)	Bone (mrem/yr)	Liver (mrem/yr)	Kidney (mrem/yr)	Thyroid (mrem/yr)	Lung (mrem/yr)	Skin (mrem/yr)
Plume (0.88 mi SE) [3]	2.24E-01							2.11E+00
Ground (0.86 mi S) [3]	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.96E-03
Inhalation (0.88 mi SE)[3]								
Adult	4.42E-03	4.43E-03	7.55E-05	4.44E-03	4.46E-03	1.01E-02	4.48E-03	4.41E-03
Teen	4.47E-03	4.47E-03	9.21E-05	4.49E-03	4.51E-03	1.17E-02	4.55E-03	4.45E-03
Child	3.95E-03	3.94E-03	1.12E-04	3.97E-03	3.99E-03	1.26E-02	4.02E-03	3.93E-03
Infant	2.27E-03	2.26E-03	5.90E-05	2.30E-03	2.30E-03	1.02E-02	2.32E-03	2.26E-03
Vegetables (0.98 mi SE)[3]								
Adult	4.09E-02	4.09E-02	1.85E-01	4.08E-02	4.08E-02	1.50E-01	4.02E-02	4.01E-02
Teen	6.48E-02	6.48E-02	3.04E-01	6.50E-02	6.50E-02	2.10E-01	6.40E-02	6.39E-02
Child	1.51E-01	1.50E-01	7.33E-01	1.51E-01	1.51E-01	4.27E-01	1.50E-01	1.49E-01
Vegetables (0.88 mi SE)[1]								
Adult	5.05E-02	5.06E-02	2.30E-01	5.05E-02	5.05E-02	1.91E-01	4.96E-02	4.96E-02
Teen	8.02E-02	8.01E-02	3.77E-01	8.04E-02	8.04E-02	2.67E-01	7.91E-02	7.90E-02
Child	1.87E-01	1.86E-01	9.08E-01	1.87E-01	1.87E-01	5.42E-01	1.85E-01	1.85E-01
Milk (0.88 mi SE)[1]								
Adult	2.45E-02	2.37E-02	9.38E-02	2.49E-02	2.46E-02	1.68E-01	2.36E-02	2.35E-02
Teen	4.17E-02	4.08E-02	1.73E-01	4.30E-02	4.25E-02	2.69E-01	4.07E-02	4.05E-02
Child	9.50E-02	9.39E-02	4.23E-01	9.79E-02	9.68E-02	5.47E-01	9.39E-02	9.36E-02
Meat (0.88 mi SE)[3]								
Adult	1.79E-02	1.80E-02	8.39E-02	1.79E-02	1.79E-02	2.21E-02	1.78E-02	1.78E-02
Teen	1.48E-02	1.49E-02	7.09E-02	1.48E-02	1.48E-02	1.79E-02	1.48E-02	1.48E-02
Child	2.74E-02	2.74E-02	1.33E-01	2.74E-02	2.74E-02	3.20E-02	2.74E-02	2.74E-02
Totals[2,3]								
Adult	2.26E-01	6.50E-02	2.71E-01	6.48E-02	6.48E-02	1.84E-01	6.42E-02	2.11E+00
Teen	2.26E-01	8.58E-02	3.77E-01	8.60E-02	8.60E-02	2.41E-01	8.50E-02	2.11E+00
Child	2.26E-01	1.83E-01	8.68E-01	1.84E-01	1.84E-01	4.73E-01	1.83E-01	2.11E+00
Infant	2.26E-01	3.93E-03	1.73E-03	3.97E-03	3.97E-03	1.19E-02	3.99E-03	2.11E+00

Table 11.3-5 — {Detailed Dose Commitment Results By Age Group and Organs Due to Gaseous Effluent Releases}
(Page 2 of 2)

Pathway	Total Body (mrem/yr)	GI-Tract (mrem/yr)	Bone (mrem/yr)	Liver (mrem/yr)	Kidney (mrem/yr)	Thyroid (mrem/yr)	Lung (mrem/yr)	Skin (mrem/yr)

Notes:

1. Doses for hypothetical individual located at the maximum site boundary location (SE, 0.88 mi) for 40 CFR 190 compliance in Table 11.2-5. Values for the hypothetical individual are not included in the total.

2. Totals for total body and skin are external doses from the plume and the ground plane (i.e., they do not include inhalation or ingestion pathways).

3. Doses represent the dose to the maximally exposed individual (MEI) or nearest resident, who is assumed to reside at the limiting site boundary and consume meat from cattle raised at the site boundary and vegetables grown at the nearest garden at 0.98 miles SE.

Table 11.3-6 — {Gaseous Pathway Doses for Maximally Exposed Individuals (MEI)[(1)(2)]}

Location	Pathway	Total Body (mrem/yr)	Max Organ (Bone) (mrem/yr)	Thyroid (mrem/yr)	Skin (mrem/yr)
Site Boundary					
0.88 mi SE	Plume	2.24E-01			2.11E+00
0.86 mi S	Ground Plane	1.67E-03	1.67E-03	1.67E-03	1.96E-03
0.88 mi SE	Inhalation				
	Adult	4.42E-03	7.55E-05	1.01E-02	4.41E-03
	Teen	4.47E-03	9.21E-05	1.17E-02	4.45E-03
	Child	3.95E-03	1.12E-04	1.26E-02	3.93E-03
	Infant	2.27E-03	5.90E-05	1.02E-02	2.26E-03
Nearest Garden	Vegetable				
0.98 mi SE	Adult	4.09E-02	1.85E-01	1.50E-01	4.01E-02
	Teen	6.48E-02	3.04E-01	2.10E-01	6.39E-02
	Child	1.51E-01	7.33E-01	4.27E-01	1.49E-01
Nearest Beef	Meat				
0.88 mi SE	Adult	1.79E-02	8.39E-02	2.21E-02	1.78E-02
	Teen	1.48E-02	7.09E-02	1.79E-02	1.48E-02
	Child	2.74E-02	1.33E-01	3.20E-02	2.74E-02

Note:

1. Results for milk ingestion are not presented as there are no milk producing animals for human consumption within 5 mi. Nearest meat animal assumed to be at limiting site boundary location since actual location of animals within 5 mi is not available. (CCNPP, 2005).
2. Doses represent the dose to the maximally exposed individual (MEI) or nearest resident, who is assumed to reside at the limiting site boundary and consume meat from cattle raised at the site boundary and vegetables grown at the nearest garden at 0.98 miles SE.

Table 11.3-7 — {CCNPP Unit 3 Gaseous Effluent MEI Dose Summary}

10 CFR 50; Appendix I Section	Type of Dose	Calculated Dose	10 CFR 50; Appendix I Limit
II.B.1	Beta Air Dose mrad/yr	2.87	20
	Gamma Air Dose mrad/yr	0.356	10
II.B.2	External Total Body Dose mrem/yr(1)	0.226	5
	External Skin Dose mrem/yr(1)	2.11	15
II.C	Organ Dose mrem/yr(2)	0.868 (child bone)	15

Notes:

1. Exposure from plume and ground plane pathways at site boundary.
2. Exposure from ground plane, inhalation and meat pathways at site boundary; vegetable pathway at location of nearest garden (CCNPP, 2005).

Table 11.3-8 — {Population Doses from Gaseous Effluents[1]}

Total Body Dose (person-rem)	Thyroid Dose (person-rem)
3.70	3.96
Note 1: Includes dose contribution from ingestion of milk, meat and vegetables.	

Table 11.3-9 — {Population within 50 mi of the CCNPP Site for Year 2080 (Projected)[1]}

Sector	Distance (Miles)										
	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	**Total**
N	0	0	0	0	0	0	0	15,715	182,399	289,551	**487,665**
NNE	0	0	0	0	0	0	807	12,969	27,008	18,816	**59,600**
NE	0	0	0	0	0	2	2,042	17,916	39,078	28,341	**87,379**
ENE	0	0	0	0	0	396	3,338	35,028	18,041	58,405	**115,208**
E	0	0	0	0	0	70	472	936	9,480	155,142	**166,100**
ESE	0	0	0	0	0	0	1,420	1,188	7,275	30,489	**40,372**
SE	0	0	0	0	377	0	366	0	2,062	14,333	**17,138**
SSE	0	0	66	880	6,497	9,349	955	1,591	2,273	3,713	**25,324**
S	0	134	56	379	3,014	11,698	41,024	4,561	10,858	14,438	**86,162**
SSW	0	86	415	286	409	10,657	32,348	8,689	17,538	13,653	**84,081**
SW	0	660	0	330	114	4,766	17,003	5,979	6,835	10,054	**45,741**
WSW	0	1,715	1,226	130	170	4,589	15,150	8,436	27,947	15,714	**75,077**
W	60	866	578	351	716	2,665	23,177	17,956	16,728	50,219	**113,316**
WNW	0	110	118	170	1,015	4,702	23,764	109,939	135,130	694,298	**969,246**
NW	0	866	2,014	2,079	574	4,842	23,172	38,106	546,610	2,577,585	**3,195,848**
NNW	0	0	0	0	0	1,436	41,128	45,609	191,174	570,966	**850,313**
Totals	**60**	**4,437**	**4,473**	**4,605**	**12,886**	**55,172**	**226,166**	**324,618**	**1,240,436**	**4,545,717**	**6,418,570**

[1] 50-mile population projections estimated using the SECPOP 2000 code in conjunction with U.S. census data and county census projection data for Delaware, Maryland, Virginia and the District of Columbia (NRC, 2003, USCB, 2005, USCB, 2000c, DEDO, 2000, MDP, 2005, VEC, 2006).

Table 11.3-10 — {Bounding 50-mile Dispersion Factors (sec/m^3) for CCNPP Site}

(Page 1 of 2)

Sector	Distance (miles)										
	0.5	0.75	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
N	1.923E-06	1.065E-06	5.811E-07	2.571E-07	1.538E-07	1.055E-07	8.046E-08	6.401E-08	5.261E-08	4.482E-08	3.881E-08
NNE	3.287E-06	1.754E-06	9.348E-07	3.980E-07	2.333E-07	1.584E-07	1.201E-07	9.528E-08	7.821E-08	6.663E-08	5.773E-08
NE	5.039E-06	2.711E-06	1.443E-06	6.059E-07	3.491E-07	2.334E-07	1.748E-07	1.372E-07	1.117E-07	9.446E-08	8.134E-08
ENE	2.038E-06	1.090E-06	5.855E-07	2.548E-07	1.519E-07	1.034E-07	7.835E-08	6.210E-08	5.093E-08	4.335E-08	3.752E-08
E	1.516E-06	8.448E-07	4.771E-07	2.182E-07	1.299E-07	8.848E-08	6.751E-08	5.374E-08	4.421E-08	3.773E-08	3.273E-08
ESE	1.987E-06	1.123E-06	6.238E-07	2.761E-07	1.627E-07	1.099E-07	8.269E-08	6.509E-08	5.305E-08	4.489E-08	3.866E-08
SE	2.416E-06	1.464E-06	8.347E-07	3.833E-07	2.214E-07	1.458E-07	1.072E-07	8.261E-08	6.606E-08	5.495E-08	4.660E-08
SSE	1.381E-06	8.911E-07	5.240E-07	2.393E-07	1.396E-07	9.489E-08	6.969E-08	5.363E-08	4.280E-08	3.554E-08	3.008E-08
S	1.815E-06	1.127E-06	6.501E-07	3.095E-07	1.771E-07	1.155E-07	8.420E-08	6.481E-08	5.148E-08	4.256E-08	3.589E-08
SSW	1.599E-06	1.050E-06	6.224E-07	2.824E-07	1.628E-07	1.066E-07	7.786E-08	5.963E-08	4.741E-08	3.922E-08	3.308E-08
SW	1.557E-06	1.013E-06	5.897E-07	2.619E-07	1.496E-07	9.750E-08	7.102E-08	5.432E-08	4.314E-08	3.568E-08	3.009E-08
WSW	1.053E-06	7.219E-07	4.396E-07	2.056E-07	1.204E-07	7.956E-08	5.843E-08	4.492E-08	3.580E-08	2.968E-08	2.508E-08
W	8.038E-07	5.327E-07	3.282E-07	1.627E-07	9.803E-08	6.584E-08	4.888E-08	3.787E-08	3.036E-08	2.528E-08	2.143E-08
WNW	5.959E-07	3.950E-07	2.331E-07	1.108E-07	6.956E-08	4.823E-08	3.671E-08	2.902E-08	2.365E-08	2.079E-08	1.781E-08
NW	7.179E-07	4.689E-07	2.742E-07	1.399E-07	8.563E-08	5.846E-08	4.403E-08	3.454E-08	2.799E-08	2.353E-08	2.012E-08
NNW	1.586E-06	9.808E-07	5.737E-07	2.658E-07	1.580E-07	1.062E-07	7.933E-08	6.190E-08	4.999E-08	4.193E-08	3.580E-08

Table 11.3-10 — {Bounding 50-mile Dispersion Factors (sec/m^3) for CCNPP Site}
(Page 2 of 2)

Sector	Distance (miles)									
	7.5	10	15	20	25	30	35	40	45	50
N	2.217E-08	1.608E-08	1.013E-08	7.265E-09	5.602E-09	4.526E-09	3.937E-09	3.363E-09	2.926E-09	2.584E-09
NNE	3.321E-08	2.429E-08	1.555E-08	1.129E-08	8.797E-09	7.170E-09	6.090E-09	5.239E-09	4.773E-09	4.236E-09
NE	4.586E-08	3.318E-08	2.099E-08	1.515E-08	1.236E-08	1.005E-08	8.434E-09	7.247E-09	6.340E-09	5.625E-09
ENE	2.155E-08	1.580E-08	1.018E-08	7.445E-09	6.198E-09	5.078E-09	4.290E-09	3.706E-09	3.258E-09	2.903E-09
E	1.892E-08	1.390E-08	8.963E-09	6.547E-09	5.263E-09	4.304E-09	3.629E-09	3.129E-09	2.746E-09	2.443E-09
ESE	2.176E-08	1.570E-08	9.870E-09	7.089E-09	5.615E-09	4.546E-09	3.802E-09	3.257E-09	2.841E-09	2.514E-09
SE	2.468E-08	1.706E-08	1.011E-08	6.975E-09	5.294E-09	4.183E-09	3.429E-09	2.888E-09	2.482E-09	2.169E-09
SSE	1.578E-08	1.081E-08	6.328E-09	4.322E-09	3.249E-09	2.550E-09	2.079E-09	1.743E-09	1.492E-09	1.299E-09
S	1.862E-08	1.270E-08	7.407E-09	5.053E-09	3.791E-09	2.977E-09	2.429E-09	2.037E-09	1.746E-09	1.522E-09
SSW	1.716E-08	1.170E-08	6.808E-09	4.636E-09	3.470E-09	2.721E-09	2.217E-09	1.857E-09	1.590E-09	1.385E-09
SW	1.562E-08	1.065E-08	6.206E-09	4.230E-09	3.169E-09	2.487E-09	2.078E-09	1.741E-09	1.519E-09	1.322E-09
WSW	1.306E-08	8.908E-09	5.187E-09	3.526E-09	2.614E-09	2.048E-09	1.779E-09	1.486E-09	1.290E-09	1.120E-09
W	1.128E-08	7.736E-09	4.767E-09	3.231E-09	2.399E-09	1.876E-09	1.525E-09	1.275E-09	1.089E-09	9.469E-10
WNW	9.934E-09	6.957E-09	4.180E-09	2.903E-09	2.411E-09	1.901E-09	1.571E-09	1.321E-09	1.234E-09	1.074E-09
NW	1.095E-08	7.658E-09	4.619E-09	3.201E-09	2.677E-09	2.106E-09	1.789E-09	1.499E-09	1.309E-09	1.139E-09
NNW	2.036E-08	1.421E-08	9.444E-09	6.507E-09	5.273E-09	4.148E-09	3.389E-09	2.847E-09	2.442E-09	2.130E-09

Table 11.3-11 — {Cow Milk Production (kg/yr)[1] within 50 miles of CCNPP Site}

Sector	Distance (miles)										
	1	2	3	4	5	10	20	30	40	50	**Total**
N	0	0	0	0	0	0	0	1,057,927	2,962,194	5,903,230	**9,923,351**
NNE	0	0	0	0	0	0	59,596	595,958	3,159,091	3,874,225	**7,688,870**
NE	0	0	0	0	0	79,344	1,174,298	844,274	7,208,509	9,268,082	**18,574,507**
ENE	0	0	0	0	0	396,722	3,110,304	4,231,706	7,208,509	9,268,082	**24,215,323**
E	0	0	0	0	0	396,722	3,173,780	5,289,633	7,405,486	9,521,339	**25,786,960**
ESE	0	0	0	0	0	79,344	2,856,402	2,644,816	5,183,840	9,045,272	**19,809,674**
SE	0	0	0	0	0	39,672	634,756	1,057,927	1,851,371	3,808,536	**7,392,262**
SSE	0	0	0	0	0	515,739	634,756	1,057,927	740,549	361,163	**3,310,134**
S	0	0	0	0	0	674,428	2,856,402	2,644,816	2,247,238	3,250,470	**11,673,354**
SSW	0	0	0	0	0	634,756	2,380,335	1,244,007	2,809,048	2,889,306	**9,957,452**
SW	0	0	0	0	0	674,428	2,697,713	802,585	2,809,048	3,611,633	**10,595,407**
WSW	0	0	0	0	0	555,411	3,173,780	2,644,816	2,387,691	3,611,633	**12,373,331**
W	0	0	0	0	0	634,756	2,856,402	4,760,669	5,924,389	7,617,071	**21,793,287**
WNW	0	0	0	0	0	793,445	2,697,713	5,289,633	6,664,937	8,093,138	**23,538,866**
NW	0	0	0	0	0	714,100	2,856,402	5,289,633	7,405,486	0	**16,265,621**
NNW	0	0	0	0	0	238,033	2,697,713	5,025,151	7,405,486	9,521,339	**24,887,722**
Total	**0**	**0**	**0**	**0**	**0**	**6,426,900**	**33,860,352**	**44,481,478**	**73,372,872**	**89,644,519**	**247,786,121**

Notes:

1. Values are converted to liters/yr by dividing by a density of 1.03 kg/L for input into the GASPAR code.

Table 11.3-12 — {Beef Production (kg/yr) within 50 miles of CCNPP Site}

Sector	Distance (miles)										
	1	2	3	4	5	10	20	30	40	50	**Total**
N	0	0	0	0	0	0	0	6,557	18,360	36,589	**61,506**
NNE	0	0	0	0	0	0	721	7,205	30,815	37,791	**76,532**
NE	0	0	0	0	0	991	14,662	10,207	24,871	31,977	**82,708**
ENE	0	0	0	0	0	4,953	38,835	9,607	24,871	31,977	**110,243**
E	0	0	0	0	0	4,953	39,627	12,009	92,464	118,882	**267,935**
ESE	0	0	0	0	0	991	35,665	6,004	64,725	112,938	**220,323**
SE	0	198	198	231	297	495	7,925	2,402	23,116	30,490	**65,352**
SSE	0	396	660	925	1,189	6,439	6,631	11,052	1,824	2,345	**31,461**
S	0	396	660	925	1,189	8,421	29,841	6,513	14,588	322,421	**384,954**
SSW	0	396	660	925	951	6,631	24,867	123,396	278,635	286,596	**723,057**
SW	0	396	614	601	476	7,046	28,183	79,610	278,635	358,245	**753,806**
WSW	0	396	495	925	713	5,802	33,156	27,630	236,840	358,245	**664,202**
W	0	396	528	925	1,189	6,631	29,841	30,515	37,974	286,596	**394,595**
WNW	0	396	660	925	1,189	9,907	28,183	55,261	100,177	121,643	**318,341**
NW	0	258	429	647	892	8,916	29,841	33,906	42,813	0	**117,702**
NNW	0	0	0	0	0	2,972	33,683	31,147	45,901	59,015	**172,718**
Total	**0**	**3,228**	**4,904**	**7,029**	**8,085**	**75,148**	**381,661**	**453,021**	**1,316,609**	**2,195,750**	**4,445,435**

Table 11.3-13 — {Poultry Production (kg/yr) within 50 miles of CCNPP Site}

Sector	Distance (miles)									
	1	2	3	4	5	10	20	30	40	50	**Total**
N	0	0	0	0	0	0	0	1,631	4,567	9,101	**15,299**
NNE	0	0	0	0	0	0	202,571	2,025,710	3,072,327	2,470,110	**777,0718**
NE	0	0	0	0	0	59,337	878,182	2,869,756	16,502,080	21,216,960	**41,526,315**
ENE	0	0	0	0	0	296,683	2,325,996	3,164,621	16,502,080	57,610,866	**79,900,246**
E	0	0	0	0	0	296,683	2,373,465	3,955,776	20,957,134	57,610,866	**85,193,924**
ESE	0	0	0	0	0	59,337	2,136,119	1,977,888	14,669,994	25,597,643	**44,440,981**
SE	0	47	47	55	71	118	474,693	791,155	4,569,955	9,401,049	**15,237,190**
SSE	0	95	158	221	284	1,538	110	183	185,492	238,489	**426,570**
S	0	95	158	221	284	2,012	493	662,471	1,483,934	2,146,405	**4,296,073**
SSW	0	95	158	221	227	110	411	821,464	1,854,918	1,907,916	**4,585,520**
SW	0	95	147	144	114	116	466	529,977	1,854,918	2,384,894	**4,770,871**
WSW	0	95	118	221	170	96	548	457	1,576,680	2,384,894	**3,963,279**
W	0	95	126	221	284	1,893	493	145	181	1,907,916	**1,911,354**
WNW	0	95	158	221	284	2,367	466	913	1,669,426	2,027,160	**3,701,090**
NW	0	62	103	155	213	2,130	493	260	364	0	**3,780**
NNW	0	0	0	0	0	710	8,047	7,747	364	468	**17,336**
Total	**0**	**774**	**1173**	**1680**	**1931**	**723,130**	**8,402,553**	**16,810,154**	**84,904,414**	**186,914,737**	**297,760,546**

Table 11.3-14 — {Meat (Beef and Poultry) Production (kg/yr) within 50 miles of CCNPP Site}

Sector	**Distance (miles)**										
	1	2	3	4	5	10	20	30	40	50	**Total**
N	0	0	0	0	0	0	0	8188	22,927	45,690	**76,805**
NNE	0	0	0	0	0	0	20,3292	2,032,915	3,103,142	2,507,901	**7,847,250**
NE	0	0	0	0	0	60,328	892,844	2,879,963	16,526,951	2,1248,937	**41,609,023**
ENE	0	0	0	0	0	301,636	2,364,831	3,174,228	16,526,951	5,7642,843	**80,010,489**
E	0	0	0	0	0	301,636	2,413,092	3,967,785	21,049,598	5,7729,748	**85,461,859**
ESE	0	0	0	0	0	60,328	2,171,784	1,983,892	14,734,719	25,710,581	**44,661,304**
SE	0	245	245	286	368	613	482,618	793,557	4,593,071	9,431,539	**15,302,542**
SSE	0	491	818	1146	1,473	7,977	6,741	11,235	187,316	240,834	**458,031**
S	0	491	818	1146	1,473	10,433	30,334	668,984	1,498,522	2,468,826	**4,681,027**
SSW	0	491	818	1146	1,178	6,741	25,278	944,860	2,133,553	2,194,512	**5,308,577**
SW	0	491	761	745	590	7,162	28,649	609,587	2,133,553	2,743,139	**5,524,677**
WSW	0	491	613	1146	883	5,898	33,704	28,087	1,813,520	2,743,139	**4,627,481**
W	0	491	654	1146	1,473	8,524	30,334	30,660	38,155	2,194,512	**2,305,949**
WNW	0	491	818	1146	1,473	12,274	28,649	56,174	1,769,603	2,148,803	**4,019,431**
NW	0	320	532	802	1,105	11,046	30,334	34,166	43,177	0	**121,482**
NNW	0	0	0	0	0	3,682	41,730	38,894	46,265	59,483	**190,054**
Total	**0**	**4002**	**6077**	**8709**	**10,016**	**798,278**	**8,784,214**	**17,263,175**	**86,221,023**	**189,110,487**	**302,205,981**

Table 11.3-15 — {Grain Production (kg/yr) within 50 miles of CCNPP Site}

Sector	Distance (miles)										
	1	2	3	4	5	10	20	30	40	50	**Total**
N	0	0	0	0	0	0	0	852,203	2,386,170	4,755,296	**7,993,669**
NNE	0	0	0	0	0	0	1,915,751	19,157,508	37,020,433	45,400,883	**103,494,575**
NE	0	0	0	0	0	230,809	3,415,980	27,139,803	56,954,513	73,227,230	**160,968,335**
ENE	0	0	0	0	0	1,154,047	9,047,731	25,543,344	44,700,852	55,589,006	**136,034,980**
E	0	0	0	0	0	1,154,047	9,232,378	31,929,180	21,542,216	55,589,006	**119,446,827**
ESE	0	0	0	0	0	230,809	8,309,140	15,964,590	15,079,551	21,193,035	**60,777,125**
SE	0	13,407	13,407	15,641	20,110	33,516	1,846,476	6,385,836	5,385,554	7,232,354	**20,946,301**
SSE	0	26,813	44,688	62,564	80,439	435,716	789,229	1,315,382	3,240,262	4,166,051	**10,161,144**
S	0	26,813	44,688	62,564	80,439	569,778	3,551,531	11,572,363	25,922,093	37,494,456	**79,324,725**
SSW	0	26,813	44,688	62,564	64,351	789,229	2,959,609	12,489,743	28,202,646	26,952,086	**71,591,729**
SW	0	26,813	41,560	40,667	32,176	838,556	3,354,224	8,057,899	28,202,646	33,690,108	**74,284,649**
WSW	0	26,813	33,516	62,564	48,264	690,575	3,946,146	3,288,455	23,972,249	8,427,616	**40,496,198**
W	0	26,813	35,751	62,465	80,439	789,229	3,551,531	2,093,125	2,604,778	3,349,000	**12,593,131**
WNW	0	26,813	44,688	62,564	80,439	670,327	3,354,224	6,576,909	2,930,375	3,558,312	**17,304,651**
NW	0	17,429	29,048	43,795	60,329	603,295	3,551,531	2,325,694	2,669,361	0	**9,300,482**
NNW	0	0	0	0	0	201,098	2,279,113	4,047,968	5,965,426	7,669,833	**20,163,438**
Total	**0**	**218,527**	**332,034**	**475,388**	**546,986**	**8,391,031**	**61,104,594**	**178,740,002**	**306,779,125**	**388,294,272**	**944,881,959**

Table 11.3-16 — {Leafy Vegetable Production (kg/yr) within 50 miles of CCNPP Site}

Sector	Distance (miles)									
	1	2	3	4	5	10	20	30	40	50	**Total**
N	0	0	0	0	0	0	0	11,390	31,893	63,558	**106,841**
NNE	0	0	0	0	0	0	0	34,171	51,826	63,558	**149,555**
NE	0	0	0	0	0	854	12,643	48,409	79,732	102,512	**244,150**
ENE	0	0	0	0	0	4,271	33,487	45,561	79,732	512,771	**675,822**
E	0	0	0	0	0	4,271	34,171	56,951	79,732	512,771	**687,896**
ESE	0	0	0	0	0	854	30,754	28,476	55,812	97,387	**213,283**
SE	0	171	171	199	256	427	6,834	11,390	19,933	41,005	**80,386**
SSE	0	342	570	797	1,025	5,553	6,834	11,390	7,973	3,421	**37,905**
S	0	342	570	797	1,025	7,261	30,754	28,476	21,288	30,792	**121,305**
SSW	0	342	570	797	820	6,834	25,628	11,785	26,610	27,371	**100,757**
SW	0	342	530	518	410	7,261	29,045	7,603	26,610	34,213	**106,532**
WSW	0	342	427	797	615	5,980	34,171	28,476	22,619	34,213	**127,640**
W	0	342	456	797	1,025	6,834	30,754	51,256	63,785	82,010	**237,259**
WNW	0	342	570	797	1,025	8,543	29,045	56,951	71,759	87,135	**256,167**
NW	0	222	370	558	769	7,688	30,754	56,951	79,732	0	**177,044**
NNW	0	0	0	0	0	2,563	29,045	54,104	79,732	120,512	**285,956**
Total	**0**	**2,787**	**4,234**	**6,057**	**6,970**	**69,194**	**363,919**	**543,340**	**798,768**	**1,813,229**	**3,608,498**

Table 11.3-17 — {Vegetable (Grain and Leafy) Production (kg/yr) within 50 miles of CCNPP Site}

Sector	Distance (miles)									
	1	2	3	4	5	10	20	30	40	50	**Total**
N	0	0	0	0	0	0	0	863,593	2,418,063	4,818,854	**8,100,510**
NNE	0	0	0	0	0	0	1,915,751	19,191,679	37,072,259	45,464,441	**103,644,130**
NE	0	0	0	0	0	231,663	3,428,623	27,188,212	57,034,245	73,329,742	**161,212,485**
ENE	0	0	0	0	0	1,158,318	9,081,218	25,588,905	44,780,584	56,101,777	**136,710,802**
E	0	0	0	0	0	1,158,318	9,266,549	31,986,131	21,621,948	56,101,777	**120,134,723**
ESE	0	0	0	0	0	231,663	8,339,894	15,993,066	15,135,363	21,290,422	**60,990,408**
SE	0	13,578	13,578	15,840	20,366	33,943	1,853,310	6,397,226	5,405,487	7,273,359	**21,026,687**
SSE	0	27,155	45,258	63,361	81,464	441,269	796,063	1,326,772	3,248,235	4,169,472	**10,199,049**
S	0	27,155	45,258	63,361	81,464	577,039	3,582,285	11,600,839	25,943,381	37,525,248	**79,446,030**
SSW	0	27,155	45,258	63,361	65,171	796,063	2,985,237	12,501,528	28,229,256	26,979,457	**71,692,486**
SW	0	27,155	42,090	41,185	32,586	845,817	3,383,269	8,065,502	28,229,256	33,724,321	**74,391,181**
WSW	0	27,155	33,943	63,361	48,879	696,555	3,980,317	3,316,931	23,994,868	8,461,829	**40,623,838**
W	0	27,155	36,207	63,262	81,464	796,063	3,582,285	2,144,381	2,668,563	3,431,010	**12,830,390**
WNW	0	27,155	45,258	63,361	81,464	678,870	3,383,269	6,633,860	3,002,134	3,645,447	**17,560,818**
NW	0	17,651	29,418	44,353	61,098	610,983	3,582,285	2,382,645	2,749,093	0	**9,477,526**
NNW	0	0	0	0	0	203,661	2,308,158	4,102,072	6,045,158	7,790,345	**20,449,394**
Total	**0**	**221,314**	**336,268**	**481,445**	**553,956**	**8,460,225**	**61,468,513**	**179,283,342**	**307,577,893**	**390,107,501**	**948,490,457**

Table 11.3-18 — {Comparison of Annual Average Gaseous Release Concentrations with 10 CFR Part 20 Concentration Limits}

Nuclide	10CFR20 App. B, Table 2, Col. 1 Effluent Conc. (μCi/ml)	Site Boundary Concentration (μCi/ml)		Fraction of Allowable 10CFR20 App. B, Table 2, Col. 1 Concentration	
		Expected Releases	Releases for Maximum Fuel Defect	Normal Releases	Releases for Maximum Fuel Defect
H-3	1.00E-07	6.14E-12	2.45E-11	6.14E-05	2.45E-04
C-14	3.00E-09	2.49E-13	2.49E-13	8.30E-05	8.29E-05
Ar-41	1.00E-08	1.16E-12	1.16E-12	1.16E-04	1.16E-04
I-131	2.00E-10	3.00E-16	1.07E-14	1.50E-06	5.37E-05
I-133	1.00E-09	1.09E-15	1.80E-14	1.09E-06	1.80E-05
Kr-85m	1.00E-07	5.46E-12	1.54E-11	5.46E-05	1.54E-04
Kr-85	7.00E-07	1.16E-09	9.00E-10	1.66E-03	1.29E-03
Kr-87	2.00E-08	1.91E-12	3.34E-12	9.55E-05	1.67E-04
Kr-88	9.00E-09	6.48E-12	1.84E-11	7.20E-04	2.04E-03
Xe-131m	2.00E-06	1.19E-10	1.07E-10	5.97E-05	5.37E-05
Xe-133m	6.00E-07	6.48E-12	9.68E-11	1.08E-05	1.61E-04
Xe-133	5.00E-07	2.93E-10	7.41E-09	5.87E-04	1.48E-02
Xe-135m	4.00E-08	5.12E-13	6.26E-13	1.28E-05	1.57E-05
Xe-135	7.00E-08	4.09E-11	1.29E-10	5.85E-04	1.84E-03
Xe-137	1.00E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-138	2.00E-08	4.09E-13	4.35E-13	2.05E-05	2.17E-05
Cr-51	3.00E-08	3.31E-18	3.31E-18	1.10E-10	1.10E-10
Mn-54	1.00E-09	1.94E-18	1.95E-18	1.94E-09	1.95E-09
Co-57	9.00E-10	2.80E-19	2.80E-19	3.11E-10	3.11E-10
Co-58	1.00E-09	1.64E-17	1.64E-17	1.64E-08	1.64E-08
Co-60	5.00E-11	3.75E-18	3.76E-18	7.51E-08	7.51E-08
Fe-59	5.00E-10	9.55E-19	9.55E-19	1.91E-09	1.91E-09
Sr-89	2.00E-10	5.46E-18	5.46E-15	2.73E-08	2.73E-05
Sr-90	6.00E-12	2.15E-18	2.15E-15	3.58E-07	3.59E-04
Zr-95	4.00E-10	3.41E-19	3.41E-16	8.53E-10	8.53E-07
Nb-95	2.00E-09	1.43E-18	1.43E-15	7.17E-10	7.16E-07
Ru-103	9.00E-10	5.80E-19	5.80E-16	6.44E-10	6.44E-07
Ru-106	2.00E-11	2.66E-20	2.66E-17	1.33E-09	1.33E-06
Sb-125	7.00E-10	2.08E-20	2.08E-17	2.97E-11	2.97E-08
Cs-134	2.00E-10	1.64E-18	1.64E-15	8.19E-09	8.18E-06
Cs-136	9.00E-10	1.13E-18	1.13E-15	1.25E-09	1.26E-06
Cs-137	2.00E-10	3.07E-18	3.07E-15	1.54E-08	1.53E-05
Ba-140	2.00E-09	1.43E-19	1.43E-16	7.17E-11	7.16E-08
Ce-141	8.00E-10	4.44E-19	4.43E-16	5.54E-10	5.54E-07
		Sum of Fractions:		4.07E-03	2.15E-02

11.4 SOLID WASTE MANAGEMENT SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

11.4.1 Design Basis

No departures or supplements.

11.4.1.1 Design Objective

No departures or supplements.

11.4.1.2 Design Criteria

No departures or supplements.

11.4.1.2.1 Capacity

The U.S. EPR FSAR includes the following COL Item in Section 11.4.1.2.1:

> A COL applicant that references the U.S. EPR design certification will address plant-specific commitments to address the long-term storage of LLRW beyond the provisions described in the U.S. EPR design certification when such storage capacity is exhausted and describe how additional onsite LLRW storage or alternate LLRW storage will be integrated in plant operations. To address the need for additional storage, the commitment will address the requirements of 10 CFR Part 20, Appendix B (Table 2, Column 1 and 2); dose limits of 10 CFR 20.1301, 20.1302, and 20.1301(e) in unrestricted areas; Part 20.1406(b) in minimizing the contamination of plant facilities and environs; and design objectives of Sections II.A, II.B, II.C, and II.D of Appendix I to 10 CFR Part 50. The design and operations of additional onsite storage capacity will be integrated in the plant-specific process control program and consider the guidance of SRP Section 11.4 and Appendix 11.4-A, Regulatory Guides 1.206, 4.21 and 1.143, IE Bulletin 80-10, industry standards, and NEI 08-08.

The COL Item is addressed as follows:

Should {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operation Services, LLC} require additional LLRW storage capacity, then this section of the FSAR will be revised to describe how additional onsite LLRW storage or alternate LLRW storage will be integrated in plant operations. Any additional LLRW storage capacity required will address the requirements of 10 CFR Part 20, Appendix B (Table 2, Column 1 and 2); dose limits of 10 CFR 20.1301, 20.1302, and 20.1301(e) in unrestricted areas; Part 20.1406(b) in minimizing the contamination of plant facilities and environs; and design objectives of Sections II.A, II.B, II.C, and II.D of Appendix I to 10 CFR Part 50. Should additional onsite storage LLRW capacity be used, it will be integrated in the plant specific process control program and consider the guidance of SRP Section 11.4 and Appendix 11.4-A, Regulatory Guides 1.206, 4.21 and 1.143, IE Bulletin 80-10, industry standards, and NEI 08-08A (NEI, 2009b).

11.4.1.2.2 Quality Group Classification

No departures or supplements.

11.4.1.2.3 Seismic Design Classification

No departures or supplements.

11.4.1.2.4 Controlled Releases

No departures or supplements.

11.4.1.2.5 Mobile Systems

The U.S. EPR FSAR includes the following COL Item in Section 11.4.1:

> A COL applicant that references the U.S. EPR design certification and that chooses to install and operate mobile skid-mounted processing systems connected to permanently installed solid waste management system (SWMS) processing equipment will include plant and site-specific information describing how design features and implementation of operating procedures for the SWMS will address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.4, Regulatory Guides 4.21 and 1.143, IE Bulletin 80-10, industry standards, NEI 08-08, and all quality assurance requirements as stated in Section 7 of ANSI/ANS 40.37-1993.

The COL Item is addressed as follows:

Should {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operation Services, LLC} choose to install and operate mobile skid-mounted equipment to connect to the permanently installed SWMS, then this section of the FSAR will be revised to include plant and site-specific information describing how design features and implementation of operating procedures for the SWMS address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.4, Regulatory Guides 4.21 and 1.143, IE Bulletin 80-10, industry standards, NEI 08-08A (NEI, 2009b), and the quality assurance requirements as stated in Section 7 of ANSI/ANS 40.37-2009 (ANS, 2009).

11.4.2 System Description

No departures or supplements.

11.4.3 Radioactive Effluent Releases

{This section of the U.S. EPR FSAR is incorporated by reference with the following supplement.

Solid wastes will be shipped from the site for burial at a NRC licensed burial site or to a licensed radioactive waste processing facility.

As of July 1, 2008, the Barnwell LLRW disposal facility in Barnwell, South Carolina no longer accepts Class B and C waste from sources in states outside of the Atlantic Compact. The only other operating disposal site in Richland, Washington, does not currently accept Class B and C wastes from outside the Northwest or Rocky Mountain LLRW Compacts. Maryland is affiliated with the Appalachian Compact.

CCNPP Unit 3 expects to enter into an agreement prior to initial criticality with an NRC-licensed facility that will process or otherwise accept Class B and C LLRW. For example, a site in Andrews County, Texas was recently licensed to accept Class B and C waste. For now, however, the site will only accept waste from Texas and Vermont.

In the event that no offsite disposal facility is available to accept Class B and C waste from CCNPP Unit 3 when it commences operation, additional waste minimization measures could be implemented to reduce or eliminate the generation of Class B and C waste. These measures include: reducing the service run length for resin beds; short loading media volumes in ion exchange vessels; and other techniques discussed in the EPRI Class B/C Waste Reduction Guide (EPRI, 2007a) and EPRI Operational Strategies to Reduce Class B/C Wastes (EPRI 2007b). These measures would extend the capacity of the Solid Waste Storage System to store Class B and C waste to over ten years. This would provide additional time for offsite disposal capability to be developed or additional onsite capacity to be added. Continued storage of Class B and C waste in the Solid Waste Storage System would be in accordance with procedures that maintain occupational exposures within permissible limits and result in no additional environmental impacts.

If additional onsite storage capacity for Class B and C were necessary, CCNPP Unit 3 could elect to construct a new temporary storage facility. The facility would meet applicable NRC guidance, including Appendix 11.4-A of the Standard Review Plan, "Design Guidance for Temporary Storage of Low-Level Waste." Such a facility would be located in an appropriate onsite location. The environmental impacts of constructing such a facility would be minimal and would be addressed at the time the facility was announced. The operation of a storage facility meeting the standards in Appendix 11.4-A would provide appropriate protection against releases, maintain exposures to workers and the public below applicable limits, and result in no significant environmental impact.

As an alternative to onsite storage, CCNPP Unit 3 could enter into a commercial agreement with a third-party contractor to process, store, own, and ultimately dispose of low-level waste generated as a result of CCNPP Unit 3 operations. Activities associated with the transportation, processing, and ultimate disposal of low level waste by the third-party contractor would necessarily comply with applicable laws and regulations in order to assure public health and safety and protection of the environment. In particular, the third-party contractor would conduct its operations consistent with applicable Agreement State or NRC regulations (e.g., 10 CFR Part 20), which assure that the radiological impacts from these activities would be acceptable. Environmental impacts resulting from management of low-level wastes are expected to be bounded by the NRC findings in 10 CFR 51.51(b) (Table S-3). Table S-3 assumes that solid, low-level waste from reactors will be disposed of through shallow land burial, and concludes that this kind of disposal will not result in the release of any significant effluent to the environment.}

The U.S. EPR FSAR includes the following COL Item in Section 11.4.3:

> A COL applicant that references the U.S. EPR will fully describe, at the functional level, elements of the Process Control Program (PCP). This program description will identify the administrative and operational controls for waste processing process parameters and surveillance requirements which demonstrate that the final waste products meet the requirements of applicable federal, state, and disposal site waste form requirements for burial at a 10 CFR Part 61 licensed low level waste (LLW) disposal site, toxic or hazardous waste requirements per 10 CFR 20.2007, and will be in accordance with the guidance provided in RG 1.21, NUREG-0800, BTP 11-3, ANSI/ANS-55.1-1992 and Generic Letters 80-09, 81-38, and 81-39. NEI 07-10A PCP Template is an alternate means of demonstrating compliance with GL 89-01 and SECY 05-0197 until a plant specific PCP is developed under license conditions.

This COL Item is addressed as follows:

{CCNPP Unit 3} will adopt NEI 07-10A, "Generic FSAR Template Guidance for Process Control Program (PCP)," (NEI, 2009). The milestone for development and implementation of the PCP is addressed in Table 13.4-1.

11.4.4 Solid Waste Management System Cost-Benefit Analysis

No departures or supplements.

11.4.5 Failure Tolerance

No departures or supplements.

11.4.6 Quality Assurance

{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 SRP Section 11.4, RG 4.21 and 1.143, IE Bulletin 80-10, NEI 08-08A (NEI, 2009), and ANSI/ANS 40.37-2009 (ANS, 2009).}

11.4.7 References

{ANS, 2009. Mobile Low-Level Radioactive Waste Processing Systems, ANSI/ ANS 40.37-2009, American National Standards Institute/American Nuclear Society, 2009.

EPRI, 2007a. “Waste Class B/C Reduction Guide,” Electric Power Research Institute, 2007.

EPRI 2007b. “Operational Strategies to Reduce Class B/C Wastes,” Electric Power Research Institute, 2007.

NEI, 2009a. NEI 07-10A, "Generic FSAR Template Guidance for Process Control Program (PCP)”, Nuclear Energy Institute, March, 2009.

NEI, 2009b. NEI 08-08A, Generic FSAR Template Guidance for Life Cycle Minimization of Contamination, Revision 0, Nuclear Energy Institute, October 2009.}

11.5 PROCESS AND EFFLUENT RADIOLOGICAL MONITORING AND SAMPLING SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

11.5.1 Design Basis

The U.S. EPR FSAR includes the following COL Item in Section 11.5.1:

> A COL applicant that references the U.S. EPR design certification and that chooses to install and operate skid-mounted radiation monitoring and sampling systems connected to permanently installed radioactive process and waste management systems will include plant-specific information describing how design features and implementation of operating procedures for the PERMSS will address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.5, Regulatory Guides 4.21 and 1.143, IE Bulletin 80-10, ANSI/HPS-13.1-1999 and ANSI N42.18-2004, and NEI 08-08.

The COL Item is addressed as follows:

Should {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operation Services, LLC} choose to install and operate mobile skid-mounted radiation monitoring and sampling systems connect to the permanently installed radioactive process and waste management systems, then this section of the FSAR will be revised to include plant and site-specific information describing how design features and implementation of operating procedures for the PERMSS address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.5, Regulatory Guides 4.21 and 1.143, IE Bulletin 80-10, ANSI/HPS-13.1-1999 and ANSI N42.18-2004, and NEI 08-08A (NEI, 2009a).

11.5.1.1 Design Objective

No departures or supplements.

11.5.1.2 Design Criteria

No departures or supplements.

11.5.2 System Description

The U.S. EPR FSAR includes the following COL Item in Section 11.5.2:

> A COL applicant that references the U.S. EPR design certification will fully describe, at the functional level, elements of the process and effluent monitoring and sampling programs required by 10 CFR Part 50, Appendix I and 10 CFR 52.79(a)(16). This program description, Offsite Dose Calculation Manual (ODCM), will specify how a licensee controls, monitors, and performs radiological evaluations of releases. The program will also document and report radiological effluents discharged to the environment. NEI 07-09A is an alternate means of demonstrating compliance with GL 89-01 and SECY 05-0197 until a plant and site-specific ODCM is developed under a license condition. The lower limits of detection (LLD) for liquid and gaseous process monitors and detection sensitivities for liquid and gaseous process monitors will be calculated in accordance with the methodology provided in the ODCM.

This COL Item is addressed as follows:

{CCNPP Unit 3} will adopt NEI 07-09A, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description," (NEI, 2009). The milestone for development and implementation of the ODCM is addressed in Table 13.4-1.

{Additionally, a notification process that shares release and release rates information between CCNPP Units 1 and 2 and CCNPP Unit 3 will be established between the two licensees on the property to ensure the site dose and dose rate limits will not be exceeded. The notification requirements and cross company information exchange and tracking will be incorporated into the respective licensees' implementing procedures. This process will ensure that each organization is aware of the overall site releases for normal as well as Anticipated Operational Occurrences and each plant will have the ability to ensure that site wide releases will not exceed the applicable limits of 40 CFR 190 and 10 CFR 20.}

The U.S. EPR FSAR includes the following COL Item in Section 11.5.2:

A COL applicant that references the U.S.EPR design certification is responsible for deriving PERMSS subsystem's lower limits of detection or detection sensitivities, and set-points (alarms and process termination/diversion) for liquid and gaseous process radiation monitoring equipment not covered by the ODCM based on plant and site specific conditions and operating characteristics of each installed radiation monitoring subsystem.

The COL Item is addressed as follows:

{Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operation Services, LLC} will develop PERMSS subsystem's LLDs or detection sensitivities, and set-points (alarms and process termination/diversion) for liquid and gaseous process radiation monitoring equipment not covered by the ODCM based on plant and site specific conditions and operating characteristics of each installed radiation monitoring subsystem.

The U.S. EPR FSAR includes the following COL Item in Section 11.5.2:

A COL applicant that references the U.S. EPR design certification is responsible for developing a plant-specific process and effluent radiological sampling and analysis plan for systems not covered by the ODCM, including provisions describing sampling and analytical frequencies, and radiological analyses for the expected types of liquid and gaseous samples and waste media generated by the LWMS, GWMS, and SWMS.

The COL Item is addressed as follows:

{Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operation Services, LLC} will develop a plant-specific process and effluent radiological sampling and analysis plan for systems not covered by the ODCM, including provisions describing sampling and analytical frequencies, and radiological analyses for the expected types of liquid and gaseous samples and waste media generated by the LWMS, GWMS, and SWMS.

11.5.3 Effluent Monitoring and Sampling

No departures or supplements.

11.5.4 Process Monitoring and Sampling

No departures or supplements.

11.5.5 References

{**CFR, 2008a.** Domestic Licensing of Production and Utilization Facilities, Title 10, Code of Federal Regulations, Part 50, U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008b. Contents of Applications; Technical Information in Final Safety Analysis Report, Title 10, Code of Federal Regulations, Part 52.79, U.S. Nuclear Regulatory Commission, 2008.

NEI, 2009a. NEI 08-08A, Generic FSAR Template Guidance for Life Cycle Minimization of Contamination, Revision 0, Nuclear Energy Institute, October 2009.

NEI, 2009b. NEI 07-09A, Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description, Revision 0, Nuclear Energy Institute, March 2009.}