CHAPTER 11

RADIOACTIVE WASTE MANAGEMENT

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CHAPTER 11

RADIOACTIVE WASTE MANAGEMENT

11.1 SOURCE TERMS

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

11.2 LIQUID WASTE MANAGEMENT SYSTEMS

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

11.2.1.2.4 Controlled Release of Radioactivity

Add the following to the end of DCD Subsection 11.2.1.2.4:

LNP SUP 11.2-1

The exterior radwaste discharge piping is enclosed within a guard pipe and monitored for leakage. The radwaste discharge piping connects to the cooling tower blowdown piping. The double wall radwaste discharge piping terminates at this connection. Dilution of the radwaste with cooling tower blowdown occurs at this connection. Upstream of the connection point, at the high point on the system, two vacuum breakers exist on the blowdown line to preclude water hammer during pump shutdown and startup and ensure the continued integrity of the line. The vacuum breaker location is shown on Figure 10.4-201; this location ensures liquid radwaste always remains downstream of the vacuum breakers. Planned liquid radwaste releases are only executed with dilution flow established either from the blowdown or Salt Water Sub-System of the Raw Water System.

Beyond this point of connection, the cooling tower blowdown piping is singlewalled, buried and constructed of High Density Polyethylene. Downstream of the radwaste discharge connection will be one vent valve on each blowdown line. The vents shall be capped and locked closed to prevent inadvertent operation and are capable of manual operation as required for pump startup. The radwaste discharge line will be isolated during pump startup. As required during pump startup, personnel will be present at the vent valves to allow air to escape and then to close the valve when the line fills with water. Any spillage shall be contained and properly managed in accordance with Radiation Protection and ALARA Program requirements. Leak detection of the cooling tower and radwaste mixture will be accomplished by ground water monitoring and periodic walk down of the vent valves in accordance with NEI 08-08A. This reduces the potential for undetected leakage from this discharge to the environment to support compliance with 10 CFR 20.1406. The cooling tower blowdown with the diluted radwaste is discharged to the Crystal River Energy Complex discharge canal.

11.2.1.2.5.2 Use of Mobile and Temporary Equipment

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

LNP COL 11.2-1

When mobile or temporary equipment is selected to process liquid effluents, the equipment design and testing meets the applicable requirements of Regulatory Guide 1.143. When confirmed through sampling that the radioactive waste contents result in an inventory on a mobile system that is below the A_2 quantity limit for radionuclides specified in Appendix A to 10 CFR Part 71, the liquid effluent may be processed with the mobile liquid waste processing system in the Radwaste Building. When pre-process sampling and controls indicate that A_2 quantity limits may be exceeded by processing liquid effluent in the Radwaste Building, liquid waste is processed in the Seismic Category I auxiliary building. Procedural controls also ensure that the total cumulative source term of unpackaged wastes including liquid, wet solid, gaseous, activated, and contaminated waste present at any time in the Radwaste Building is limited consistent with RG 1.143, Revision 2, dose acceptance criteria. The unmitigated, unshielded worker dose is calculated at 10 feet from the source. Unlimited worker occupancy workstations and low dose rate waiting areas are located no closer than 10 feet from a mobile radwaste processing system or a waste monitor tank.

STD COL 11.2-1 Mobile and temporary equipment are designed in accordance with the applicable mobile and temporary radwaste treatment systems guidance provided in Regulatory Guide 1.143, including the codes and standards listed in Table 1 of the Regulatory Guide.

Mobile and temporary equipment has the following features:

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

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

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

11.2.3.5 Estimated Doses

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

LNP COL 11.2-2 Dose and dose rate to man was calculated using the LADTAP II computer code. This code is based on the methodology presented in Regulatory Guide 1.109.

LNP COL 11.5-3 Factors common to both estimated individual dose rates and estimated population dose are addressed here. Unique data are discussed in the respective sections.

Activity pathways considered are commercial fishing, sport fishing, and recreational activities.

11.2.3.5.1 Estimated Individual Dose Rates

Dose rates to individuals are calculated for fish and invertebrate consumption, and recreational activities.

Fish and invertebrate consumption assumes they are caught at the plant discharge. LADTAP II default consumption values are used in lieu of site-specific consumption data. The estimated maximum dose rates to a single organ are 0.009 mrem/yr from fish and 0.062 mrem/yr from invertebrates to an adult GI-LLI. The maximum total body dose rates are calculated to be 0.0027 mrem/yr from fish and 0.0013 mrem/yr from invertebrates to an adult.

Shoreline, swimming, and boating recreation results in a maximum dose rate to a single organ of 0.0025 mrem/yr to a teenager's skin. The maximum total body dose rate is calculated to be 0.0022 mrem/yr to a teenager.

The maximum dose rate to any organ considering all pathways was calculated to be 0.071 mrem/yr to an adult's GI-LLI. The maximum total body dose rate is calculated to be 0.0052 mrem/yr to a teenager.

Tables 11.2-201 and 11.2-202 contain LADTAP II input data for dose rate calculations. Table 11.2-203 provides individual doses by pathway and organ.

In order to demonstrate compliance with the requirements of 40 CFR 190 (per 10 CFR 20.1301(e)), the liquid and gaseous effluent doses presented in Tables 11.2-203 and 11.3-206 were adjusted to reflect the whole body dose equivalent. The total effective dose equivalent (TEDE) for the whole body was determined using the adult dose values given in the tables and the applicable organ dose weighting factor. The liquid effluent doses per unit were added to the gaseous effluent doses per unit and the resulting maximum doses to whole body, thyroid, and organ multiplied by two (2) to account for the operation of the Levy Units 1 and 2 at the site.

In addition to the exposures from Levy, the liquid doses from Crystal River Unit 3 contribute to the total public dose due to the common location of the liquid effluent releases from Levy and Crystal River via the Crystal River discharge canal. Crystal River Unit 3 doses, based on actual plant effluent radioactive releases for the calendar years 2003 to 2006, are: 0.00008 mrem/yr (whole body), 0.002 mrem/yr (thyroid) and 0.002 mrem/yr (maximum organ). Direct radiation exposure from containment and other plant buildings is negligible based on information documented in AP1000 DCD, Tier 2, Chapter 12, Section 12.4.2.1.

The sum of the annual doses due to the releases of liquid and gaseous radioactive materials from all sources at the Levy site are presented in Table 11.2-205 and are below the 40 CFR Part 190 limits for whole body dose equivalent, thyroid, and maximum organ.

11.2.3.5.2 Estimated Population Dose

The estimated population dose within 81 km (50 miles) is calculated as 1.13 person-rem total body and 1.21 person-rem thyroid. Table 11.2-204 provides population doses by pathway and organ.

11.2.3.5.3 Liquid Radwaste Cost Benefit Analysis Methodology

STD COL 11.2-2 The application of the methodology of Regulatory Guide 1.110 was used to satisfy the cost benefit analysis requirements of 10 CFR Part 50. Appendix I, Section II.D. The parameters used in calculating the Total Annual Cost (TAC) are fixed and are given for each radwaste treatment system augment listed in

Regulatory Guide 1.110, including the Annual Operating Cost (AOC) (Table A-2), Annual Maintenance Cost (AMC) (Table A-3), Direct Cost of Equipment and Materials (DCEM) (Table A-1), and Direct Labor Cost (DLC) (Table A-1). The following variable parameters were used:

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

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

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

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

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

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

11.2.3.5.4 Liquid Radwaste Cost Benefit Analysis

LNP COL 11.2-2

The LNP population doses are given in Section 11.2.3.5.2. As discussed above, the lowest cost liquid radwaste system augment is $11,140. Assuming 100% efficiency of this augment, the minimum possible cost per person-rem is determined by dividing the cost of the augment by the population dose. This is $9,858 per person-rem total body ($11,140/1.13 person-rem) and $9,207 per person-rem thyroid. These costs per person-rem reduction exceed the $1,000 per person-rem criteria prescribed in Appendix I to 10 CFR Part 50 and are therefore not cost beneficial.

11.2.3.6 Quality Assurance

Add the following to the end of DCD Subsection 11.2.3.6:

STD SUP 11.2-1

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

11.2.5 COMBINED LICENSE INFORMATION

11.2.5.1 Liquid Radwaste Processing by Mobile Equipment

STD COL 11.2-1

This COL Item is addressed in Subsection 11.2.1.2.5.2.

11.2.5.2 Cost Benefit Analysis of Population Doses

STD COL 11.2-2

This COL item is addressed in Subsection 11.2.3.5.3.

LNP COL 11.2-2

This COL item is addressed in Subsections 11.2.3.5, 11.2.3.5.1, 11.2.3.5.2 and 11.2.3.5.4.

11.2.6 REFERENCES

Add the following information at the end of DCD Subsection 11.2.6:

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

LNP COL 11.2-2

Table 11.2-201
Dilution Factors

Input Parameter	Value
Dilution Factor for all Pathways	21[(a)]

a) The dilution factor of 21 is conservatively based on the following:

1. LNP Cooling Tower Blowdown Rate
   56,520 gpm (gallons per minute)
   81.4 Mgd (million gallons per day)
2. Crystal River Plant Discharge Canal Actual Flow Rates
   1568.2 Mgd Average 2/1/03-2/28/07
   44.4 Mgd Average 11/1/05-2/28/07
   39.2 Mgd Average 11/1/05-2/28/07
   1651.8 Mgd Total Average Existing Canal Flow Rate
3. Dilution Factor in Crystal River Discharge Canal
   = (Flow rate in canal (#2) + LNP Blowdown (#1)) / LNP Blowdown (#1)
   = (1651.8 Mgd + 81.4 Mgd) / 81.4 Mgd = 21

Table 11.2-202
LADTAP II Input for Dose Rates[a]

LNP COL 11.2-2

Input Parameter	Value
Saltwater Site	Selected
Source Term	DCD Table 11.2-7
Reconcentration Model	None
Shore Width Factor	1.0
Dilution Factors	Table 11.2-201
50-mi. Population	1,440,207
Transit time – Aquatic Food and Recreational Uses (h)[b]	0
Sport Fish Harvest (kg/yr)[b]	210,246
Commercial Fish Harvest (kg/yr)	734,960
Sport Invertebrate Harvest (kg/yr)	142,438
Commercial Invertebrate Harvest (kg/yr)	1,424,384
Shoreline Usage (person-hrs/yr)[b]	32,541,940
Swimming Exposure (person-hrs/yr)	32,541,940
Boating Exposure (person-hrs/yr)	32,071,440

a) For input parameters not specified, default LADTAP II values are used.
b) h – hour
kg/yr – kilograms per year
hrs/yr – hours per year

LNP COL 11.2-2

LNP COL 11.5-3

Table 11.2-203
Individual Dose Rates [a]

Dose (mrem/yr)

Adult Pathway	**Skin**	**Bone**	**Liver**	**Total Body**	**Thyroid**	**Kidney**	**Lung**	**GI-LLI**
Fish		1.51E-03	3.57E-03	2.71E-03	5.66E-03	1.90E-03	1.28E-03	8.96E-03
Inverterbrate		1.83E-03	2.26E-03	1.33E-03	5.82E-03	2.94E-03	4.09E-04	6.20E-02
Shoreline	4.53E-04	3.87E-04	3.87E-04	3.87E-04	3.87E-04	3.87E-04	3.87E-04	3.87E-04
Swimming		1.89E-06	1.89E-06	1.89E-06	1.89E-06	1.89E-06	1.89E-06	1.89E-06
Boating		7.87E-06	7.87E-06	7.87E-06	7.87E-06	7.87E-06	7.87E-06	7.87E-06
Total	4.53E-04	3.74E-03	6.23E-03	4.44E-03	1.19E-02	5.23E-03	2.09E-03	7.14E-02
Teenager Pathway	**Skin**	**Bone**	**Liver**	**Total Body**	**Thyroid**	**Kidney**	**Lung**	**GI-LLI**
Fish		1.58E-03	3.41E-03	1.83E-03	5.14E-03	1.68E-03	1.12E-03	6.42E-03
Inverterbrate		1.89E-03	2.21E-03	1.20E-03	5.40E-03	2.97E-03	3.87E-04	4.95E-02
Shoreline	2.53E-03	2.16E-03	2.16E-03	2.16E-03	2.16E-03	2.16E-03	2.16E-03	2.16E-03
Swimming		1.05E-05	1.05E-05	1.05E-05	1.05E-05	1.05E-05	1.05E-05	1.05E-05
Boating		5.27E-06	5.27E-06	5.27E-06	5.27E-06	5.27E-06	5.27E-06	5.27E-06
Total	2.53E-03	5.65E-03	7.80E-03	5.20E-03	1.27E-02	6.83E-03	3.68E-03	5.81E-02
Child Pathway	**Skin**	**Bone**	**Liver**	**Total Body**	**Thyroid**	**Kidney**	**Lung**	**GI-LLI**
Fish		1.96E-03	2.93E-03	1.18E-03	5.19E-03	1.40E-03	9.16E-04	2.66E-03
Inverterbrate		2.41E-03	1.89E-03	1.22E-03	5.79E-03	2.64E-03	3.33E-04	2.14E-02
Shoreline	5.28E-04	4.51E-04	4.51E-04	4.51E-04	4.51E-04	4.51E-04	4.51E-04	4.51E-04
Swimming		2.20E-06	2.20E-06	2.20E-06	2.20E-06	2.20E-06	2.20E-06	2.20E-06
Boating		1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.10E-06	1.10E-06
Total	5.28E-04	4.82E-03	5.27E-03	2.85E-03	1.14E-02	4.49E-03	1.70E-03	2.45E-02

a) 10 CFR 50 Appendix I: Total Body Dose Limit = 3 mrem/yr and Dose to Any Organ = 10 mrem/yr

LNP COL 11.2-2

LNP COL 11.5-3

Table 11.2-204
Population Doses from Liquid Effluents

Dose (person rem/yr)

Pathway	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Sport Fish		1.85E-02	3.99E-02	2.72E-02	4.12E-02	2.06E-02	1.40E-02	8.28E-02
Commercial Fish		8.24E-04	1.78E-03	1.22E-03	1.53E-03	9.22E-04	6.27E-04	3.63E-03
Sport Invertebrate		6.29E-02	7.10E-02	4.22E-02	1.12E-01	9.43E-02	1.29E-02	1.70E+00
Commercial Invertebrate		1.86E-03	2.10E-03	1.25E-03	2.64E-03	2.80E-03	3.84E-04	5.05E-02
Shoreline	1.23E+00			1.05E+00	1.05E+00			
Swimming				5.12E-03	5.12E-03			
Boating				2.52E-03	2.52E-03			
Total	1.23E+00	8.41E-02	1.15E-01	1.13E+00	1.21E+00	1.19E-01	2.79E-02	1.84E+00

LNP COL 11.2-2

LNP COL 11.5-3

Table 11.2-205
Comparison of Maximum Exposed Individual Doses from the LNP Site with the 40 CFR 190 Criteria (mrem/yr)

Type of Dose	Design Objective (40 CFR 190)	Crystal River Unit 3 Liquid Dose based on Operating Data	LNP Calculated Liquid Dose (two units)	LNP Calculated Gaseous Dose (two units)	Total Site Dose
Whole Body Dose Equivalent	25	0.00008	0.021	5.5	5.52
Dose to Thyroid	75	0.002	0.025	12.8	12.87
Dose to another organ	25	0.002	0.14	19.4	19.54

11.3 GASEOUS WASTE MANAGEMENT SYSTEM

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

11.3.3 RADIOACTIVE RELEASES

STD SUP 11.3-2

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

There are no gaseous effluent site interface parameters outside of the Westinghouse scope.

11.3.3.4 Estimated Doses

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

LNP COL 11.3-1
LNP COL 11.5-3

The LNP site-specific values are bounded by the DCD identified acceptable releases. With the annual airborne releases listed in DCD Table 11.3-3, the site-specific air doses at ground level at the exclusion area boundary are 1.7 mrad for gamma radiation and 9.4 mrad for beta radiation. These doses are based on the annual average atmospheric dispersion factor from FSAR Section 2.3. As shown in Table 11.3-209, these doses are below the 10 CFR Part 50, Appendix I design objectives of 10 mrad per year for gamma radiation or 20 mrad per year for beta radiation.

Dose and dose rate to man was calculated using the GASPAR II computer code. This code is based on the methodology presented in the Regulatory Guide 1.109. Factors common to both estimated individual dose rates and estimated population dose are addressed in this subsection. Unique data are discussed in the respective subsections.

Activity pathways considered are plume, ground deposition, inhalation, and ingestion of vegetables, meat, and milk (both cow and goat).

Based on site meteorological conditions, the highest rate of plume exposure and ground deposition occurs at the exclusion area boundary (EAB) 1.34 km (0.83 mi.) WSW of the plant.

Agricultural products are estimated from U. S. Department of Agriculture (USDA) National Agricultural Statistics Service.

Population distribution within 81 km (50-mi.) radius is presented in FSAR Tables 2.1.3-202 and 2.1.3-204. Table 11.3-201 contains GASPAR II input data for dose rate calculations. Information regarding the locations for the nearest man, milk animal, garden, and the EAB is located in Section 2.3.

11.3.3.4.1 Estimated Individual Doses

Dose rates to individuals are calculated for airborne decay and deposition, inhalation, and ingestion of milk (goat), meat and vegetables. Dose from plume and ground deposition are calculated as affecting all age groups equally. Table 11.3-206 summarizes the maximum exposed individual annual organ dose by pathway and age group.

Plume exposure approximately 1.34 km (0.83 mi.) WSW of the LNP produced a maximum dose rate to a single organ of 6.32 mrem/yr to skin. The maximum total body dose rate was calculated to be 0.99 mrem/yr.

Ground deposition approximately 1.34 km (0.83 mi.) WSW of the LNP produced a maximum dose rate to a single organ of 0.13 mrem/yr to skin. The maximum total body dose rate was calculated to be 0.11 mrem/yr.

Inhalation dose at the nearest residence, 2.7 km (1.7 mi.) WSW of the LNP, results in a maximum dose rate to a single organ of 0.75 mrem/yr to a child's thyroid. The maximum total body dose rate is calculated to be 0.061 mrem/yr to a teenager.

Vegetable consumption assumes that the dose is received from the gardens, approximately 2.7 km (1.7 mi.) WSW of the plant. GASPAR II default vegetable consumption values are used in lieu of site-specific vegetable consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 8.16 mrem/yr to a child's bone. The maximum total body dose rate is calculated to be 1.80 mrem/yr to a child.

Meat consumption assumes that the dose is received from an animal, approximately 4.5 km (2.8 mi.) SSW of the LNP. GASPAR II default meat consumption values are used in lieu of site-specific meat consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 0.087 mrem/yr to a child's bone. The maximum total body dose rate is calculated to be 0.019 mrem/yr to a child.

Goat milk consumption assumes that the dose is received from an animal, approximately 3.9 km (2.4 mi.) NNW of LNP. GASPAR II default goat milk consumption values are used in lieu of site-specific goat milk consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 1.17 mrem/yr to an infant's thyroid. The maximum total body dose rate is calculated to be 0.17 mrem/yr to an infant.

The maximum dose rate to any organ considering every pathway is calculated to be 9.71 mrem/yr to a child's bone. The maximum total body dose rate is calculated to be 3.06 mrem/yr to a child, which includes the pathway doses (milk, meat, vegetable, and inhalation) plus the plume and ground deposition doses (Table 11.3-206). These doses are below the 10 CFR 50, Appendix I design objectives of 5 mrem/yr to total body, and 15 mrem/yr to any organ including skin, (Table 11.3-209).

Table 11.3-207 contains total air dose at each special location.

11.3.3.4.2 Estimated Population Dose

Table 11.3-208 presents a listing of the estimated annual population doses by pathway and organ. The estimated population dose within 81 km (50 mi.) is calculated as 5.74 person-rem total body and 8.33 person-rem thyroid.

11.3.3.4.3 Gaseous Radwaste Cost-Benefit Analysis Methodology

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

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

11.3.3.4.4 Gaseous Radwaste Cost Benefit Analysis

LNP COL 11.3-1 The LNP population doses are given in Subsection 11.3.3.4.2. The augments provided in Regulatory Guide 1.110 were reviewed and were found not to be cost beneficial in reducing the population dose of 5.74 person-rem total body. The lowest cost gaseous radwaste system augment is $6,320, which would be $6,320/5.74 person-rem or $1,100 per person-rem. This cost per person-rem reduction exceeds the $1,000 per person-rem criteria provided in Regulatory Guide 1.110 and is therefore not cost beneficial.

As shown in Subsection 11.3.3.4.2 and the table below, the LNP thyroid dose from gaseous effluents is 8.33 person-rem, which exceeds the 6.32 person-rem threshold value. Further analysis is provided below using the methodology of Regulatory Guide 1.110.

Source	Total Body (person-rem)	Thyroid (person-rem)	% of Total Thyroid Dose
Noble Gases	1.02E+00	1.02E+00	12%
Iodine	5.08E-03	2.63E+00	32%
Particulates	1.33E-01	9.83E-02	1%
C-14	3.48E+00	3.48E+00	42%
H-3	1.09E+00	1.09E+00	13%
Total	5.74E+00	8.33E+00	100%

Based on the estimated 8.33 person-rem/year thyroid dose, those augments with a "Total Annual Cost" less than $8,330 are considered below:

Main Condenser Vacuum Pump Charcoal/HEPA Filtration System

The TAC for this augment is $7,690. Thus, to be cost beneficial at $1000 per person-rem, this augment must remove at least 7.69 person-rem (thyroid); that is decrease the thyroid dose from 8.33 to 0.64 person-rem. However, no iodine is released through the condenser air removal system as shown in DCD Table 11.3-3, sheet 2 of 3. This augment does not affect the iodine discharged by the plant which accounts for 2.63 person-rem in the thyroid population dose. Therefore, it would be impossible to achieve the necessary dose reduction, and this augment is not cost beneficial.

1000 cfm Charcoal/HEPA Filtration System

The TAC for this augment is $7,580. Thus, to be cost beneficial at $1000 per person-rem, this augment must remove at least 7.58 person-rem (thyroid); that is decrease the thyroid dose from 8.33 to 0.75 person-rem. Conservatively assuming that this rather small capacity augment could be placed in the ventilation system at some point that would eliminate all iodine and particulate releases, it would not be effective in reducing the noble gas releases, the carbon-14 release, or the airborne tritium release. The noble gases, carbon-14, and tritium discharged by the plant account for 5.59 person rem in the thyroid population dose. Therefore, it would be impossible to achieve the necessary dose reduction, and this augment is not cost-beneficial.

600 ft^3 Gas Decay Tank

The TAC for this augment is $7,460. Thus, to be cost beneficial at $1000 per person-rem, this augment must remove at least 7.46 person-rem (thyroid); that is decrease the thyroid dose from 8.33 to 0.87 person-rem. No iodine is released through the waste gas system as shown in DCD Table 11.3-3. This augment does not affect the iodine discharged by the plant which accounts for 2.63

person-rem in the thyroid population dose. Therefore, it would be impossible to achieve the necessary dose reduction, and this augment is not cost-beneficial.

Steam Generator Flash Tank Vent to Main Condenser

The TAC for this augment is $6,320. Thus, to be cost beneficial at $1000 per person-rem, this augment must remove at least 6.32 person-rem (thyroid); that is decrease the thyroid dose from 8.33 to 2.01 person-rem. Addition of this augment presumes that the design already includes a steam generator flash tank with the augment evaluated being installation of vent piping and instrumentation from the tank to the main condenser. The AP1000 design does not include a steam generator flash tank. Therefore, the TAC of $6,320 for this augment is underestimated. As shown in DCD Figure 10.4.8-1, the AP1000 design includes steam generator blowdown heat exchangers that provide cooling of the blowdown fluid and prevent flashing prior to the blowdown flow entering the main condenser. Therefore, this augment would not provide any additional dose reduction, and this augment is not cost-beneficial.

Conclusion

Based on the above evaluation, none of the radwaste augments are cost-beneficial in reducing the annual thyroid dose from gaseous effluents for LNP.

11.3.3.6 Quality Assurance

Add the following to the end of DCD Subsection 11.3.3.6:

STD SUP 11.3-1

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

11.3.5 COMBINED LICENSE INFORMATION

11.3.5.1 Cost Benefit Analysis of Population Doses

STD COL 11.3-1

This COL Item is addressed in Subsection 11.3.3.4.3.

LNP COL 11.3-1

This COL Item is addressed in Subsections 11.3.3.4, 11.3.3.4.1, 11.3.3.4.2 and 11.3.3.4.4.

11.3.6 REFERENCES

201. Deleted.

Table 11.3-201
GASPAR II Input for Dose Rates

	Input Parameter	Value
LNP COL 11.3-1	Number of Source Terms	1
LNP COL 11.5-3	Distance from site to NE Corner of the United States (mi.)	1680
	Source Term	DCD Table 11.3-3
	Population Data	Table 11.3-202
	Fraction of the year leafy vegetables are grown	0.92
	Fraction of the year milk cows are on pasture	0.92[(a)]
	Fraction of max individual's vegetable intake from own garden	1.0
	Humidity over growing season (g/m^3)	8.0
	Average temperature, T, over growing season	0[(b)]
	Fraction of the year goats are on pasture	1.0
	Fraction of goat feed intake from pasture while on pasture	1.0
	Fraction of the year beef cattle are on pasture	0.92
	Fraction of beef-cattle feed intake from pasture while on pasture	1.0
	Total Production Rate for the 50-mile area	
	-Vegetables (kg/yr)	Table 11.3-203
	-Milk (l/yr)	Table 11.3-204
	-Meat (kg/yr)	Table 11.3-205
	Meteorological data	Sector average X/Q
	Special Location Data	FSAR Section 2.3.5

a) There are no milk cows identified within 5 mi. of LNP.
b) With humidity specified in units of g/m^3 temperature is not needed. GASPAR default value = 0.

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-202 (Sheet 1 of 2)
Population Data

Population Data	**Distance (mi.)**									
Direction	1	2	3	4	5	10	20	30	40	50
N	0	7	51	97	26	17	918	8,049	11,760	16,050
NNE	0	6	20	20	10	384	3,850	11,390	29,590	212,100
NE	1	1	8	14	7	1,304	3,444	5,847	18,120	9,438
ENE	1	0	0	0	6	1,786	13,000	53,640	97,210	11,570
E	1	2	2	0	15	3,845	9,920	57,860	109,200	28,950
ESE	2	11	17	65	132	4,005	9,725	8,503	50,200	122,000
SE	2	11	45	468	431	2,315	35,570	41,260	21,690	38,330
SSE	2	11	37	69	406	3,628	25,890	17,100	40,270	29,610
S	2	11	19	22	62	2,126	15,520	6,006	48,660	144,800
SSW	2	7	73	610	45	145	288	0	0	0
SW	2	12	79	731	869	309	0	0	0	0
WSW	2	15	38	206	353	1,074	0	0	0	0
W	1	7	3	9	32	10	0	740	0	0

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-202 (Sheet 2 of 2)
Population Data

Population Data	**Distance (mi.)**									
Direction	1	2	3	4	5	10	20	30	40	50
WNW	0	2	6	4	1	8	2	1,584	684	344
NW	0	2	6	7	7	3	88	1,058	1,746	7,540
NNW	0	2	32	26	51	9	659	1,323	17,730	13,140

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-203 (Sheet 1 of 2)
Vegetable Production

Vegetable Production (kg/yr)	**Distance (mi.)**									
Direction	1	2	3	4	5	10	20	30	40	50
S	0	0	0	0	74,800	38,600	139,000	791,000	2,090,000	13,000,000
SSW	0	0	0	290,000	7,300	38,500	41,700	3,470	0	0
SW	0	0	245,000	339,000	189,000	32,900	405	0	0	0
WSW	0	150,000	245,000	339,000	431,000	1,970,000	4,100	0	0	0
W	0	0	0	0	0	3,000,000	731,000	309,000	0	0
WNW	0	0	0	0	0	3,590,000	7,480,000	17,000,000	5,380,000	2,880
NW	0	150,000	245,000	339,000	433,000	3,580,000	14,200,000	23,700,000	13,400,000	90,000
NNW	0	0	245,000	339,000	433,000	3,580,000	14,200,000	23,700,000	36,600,000	47,300,000
N	0	0	245,000	339,000	433,000	3,580,000	14,200,000	23,700,000	37,600,000	52,800,000
NNE	0	0	0	0	433,000	3,580,000	14,100,000	21,400,000	30,400,000	41,200,000
NE	0	0	0	0	433,000	2,140,000	9,380,000	8,580,000	18,300,000	31,800,000
ENE	0	0	0	0	0	1,380,000	4,760,000	7,910,000	11,100,000	14,200,000

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-203 (Sheet 2 of 2)
Vegetable Production

Vegetable Production (kg/yr)					**Distance (mi.)**					
Direction	1	2	3	4	5	10	20	30	40	50
E	0	0	0	0	433,000	1,220,000	4,760,000	7,910,000	11,100,000	15,100,000
ESE	0	0	0	0	0	325,000	1,620,000	4,450,000	5,740,000	21,700,000
SE	0	0	0	323,000	55,300	38,600	153,000	255,000	3,520,000	6,540,000
SSE	0	0	0	0	0	38,600	153,000	598,000	2,910,000	10,700,000

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-204 (Sheet 1 of 2)
Milk Production

Milk Production (l/yr)	**Distance (mi.)**									
Direction	1	2	3	4	5	10	20	30	40	50
S	0	0	0	0	0	6,840	24,600	1,170,000	3,560,000	4,530,000
SSW	0	0	0	0	0	6,830	7,400	615	0	0
SW	0	0	0	0	0	5,830	7	0	0	0
WSW	0	0	0	0	0	1,490	1	0	0	0
W	0	0	0	0	0	823	201	85	0	0
WNW	0	0	0	0	0	983	2,050	4,650	3,270	557
NW	0	0	0	0	0	0	3,910	6,490	11,800	17,400
NNW	0	0	67	93	119	983	3,910	6,490	8,090,000	33,900,000
N	0	0	0	0	0	983	3,910	47,400	10,300,000	21,300,000
NNE	0	0	0	0	0	985	3,920	60,000	1,730,000	2,450,000
NE	0	0	0	0	0	1,090	4,250	7,570	660,000	1,650,000

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-204 (Sheet 2 of 2)
Milk Production

Milk Production (l/yr)	**Distance (mi.)**									
Direction	1	2	3	4	5	10	20	30	40	50
ENE	0	0	0	0	0	1,140	4,580	7,620	10,700	13,700
E	0	0	0	0	0	1,210	4,580	7,620	10,700	14,700
ESE	0	0	0	0	0	5,730	20,000	13,300	7,660	24,900
SE	0	0	0	0	0	6,840	27,200	45,200	368,000	1,400,000
SSE	0	0	0	0	0	6,840	27,200	696,000	4,910,000	6,480,000

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-205 (Sheet 1 of 2)
Meat Production

Meat Production (kg/yr)	**Distance (mi.)**									
Direction	1	2	3	4	5	10	20	30	40	50
S	0	0	0	0	0	104,000	374,000	761,000	1,380,000	3,310,000
SSW	0	0	20,800	26,000	12,700	104,000	113,000	9,360	0	0
SW	0	0	0	0	0	88,700	1,090	0	0	0
WSW	0	0	0	0	0	181,000	349	0	0	0
W	0	0	0	0	0	255,000	62,100	26,300	0	0
WNW	0	0	0	0	0	304,000	636,000	1,440,000	518,000	19,200
NW	0	0	20,800	28,800	36,800	304,000	1,210,000	2,010,000	1,410,000	601,000
NNW	0	0	20,800	28,800	36,800	304,000	1,210,000	2,010,000	3,020,000	3,780,000
N	0	0	0	28,800	36,800	304,000	1,210,000	2,020,000	3,470,000	4,780,000
NNE	0	0	0	0	0	303,000	1,200,000	1,930,000	3,280,000	4,400,000
NE	0	0	0	0	0	239,000	990,000	1,330,000	2,370,000	3,530,000
ENE	0	0	0	0	36,800	205,000	780,000	1,300,000	1,810,000	2,330,000

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-205 (Sheet 2 of 2)
Meat Production

Meat Production (kg/yr)	**Distance (mi.)**									
Direction	1	2	3	4	5	10	20	30	40	50
E	0	0	0	0	36,800	197,000	780,000	1,300,000	1,810,000	2,340,000
ESE	0	0	0	28,800	35,100	125,000	530,000	2,560,000	5,310,000	4,210,000
SE	0	0	0	0	15,400	104,000	413,000	687,000	3,850,000	6,260,000
SSE	0	0	20,800	20,500	13,800	104,000	413,000	824,000	1,980,000	3,550,000

LNP COL 11.5-3

Table 11.3-206 (Sheet 1 of 2)
Individual Dose Rates[(a)]

Dose (mrem/yr)										
Pathway		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin	Location
Plume		9.85E-01	9.85E-01	9.85E-01	9.85E-01	9.85E-01	9.85E-01	1.08	6.32	EAB(b)
Ground		1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.33E-01	EAB
Cow Milk	ADULT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	No Milk Cow in 5 mi
	TEEN	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	CHILD	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	INFANT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Goat Milk	ADULT	2.53E-02	2.36E-02	7.70E-02	2.60E-02	2.48E-02	1.55E-01	2.37E-02	2.34E-02	Nearest Goat Milk(c)
	TEEN	4.04E-02	3.88E-02	1.41E-01	4.30E-02	4.10E-02	2.46E-01	3.90E-02	3.85E-02	
	CHILD	8.67E-02	8.50E-02	3.47E-01	9.24E-02	8.89E-02	4.97E-01	8.55E-02	8.48E-02	
	INFANT	1.70E-01	1.67E-01	6.73E-01	1.82E-01	1.74E-01	1.17E+00	1.68E-01	1.67E-01	
Vegetables	ADULT	5.30E-01	5.32E-01	2.08E+00	5.30E-01	5.26E-01	1.43E+00	5.19E-01	5.18E-01	Nearest Garden(d)
	TEEN	8.04E-01	8.06E-01	3.40E+00	8.10E-01	8.03E-01	1.98E+00	7.93E-01	7.91E-01	
	CHILD	1.80E+00	1.80E+00	8.16E+00	1.82E+00	1.80E+00	4.05E+00	1.79E+00	1.78E+00	
Inhalation	ADULT	5.98E-02	6.05E-02	8.63E-03	6.11E-02	6.20E-02	5.21E-01	7.64E-02	5.82E-02	Nearest Residence(e)
	TEEN	6.05E-02	6.10E-02	1.04E-02	6.26E-02	6.39E-02	6.49E-01	8.61E-02	5.87E-02	
	CHILD	5.36E-02	5.29E-02	1.27E-02	5.57E-02	5.68E-02	7.53E-01	7.46E-02	5.18E-02	
	INFANT	3.09E-02	3.02E-02	6.37E-03	3.32E-02	3.30E-02	6.73E-01	4.57E-02	2.98E-02	
Meat	ADULT	1.28E-02	1.36E-02	5.64E-02	1.28E-02	1.28E-02	1.80E-02	1.27E-02	1.27E-02	Nearest Meat Cow(f)
	TEEN	1.04E-02	1.09E-02	4.76E-02	1.05E-02	1.04E-02	1.42E-02	1.04E-02	1.04E-02	
	CHILD	1.89E-02	1.91E-02	8.74E-02	1.90E-02	1.89E-02	2.46E-02	1.89E-02	1.89E-02	
Total w/o plume	ADULT	7.42E-01	7.44E-01	2.34E+00	7.44E-01	7.40E-01	2.24E+00	7.46E-01	7.45E-01	
	TEEN	1.03E+00	1.03E+00	3.71E+00	1.04E+00	1.03E+00	3.00E+00	1.04E+00	1.03E+00	
	CHILD	2.07E+00	2.07E+00	8.72E+00	2.10E+00	2.08E+00	5.44E+00	2.08E+00	2.07E+00	
	INFANT	3.15E-01	3.11E-01	7.93E-01	3.29E-01	3.21E-01	1.96E+00	3.28E-01	3.30E-01	
	Max	2.07E+00	2.07E+00	8.72E+00	2.10E+00	2.08E+00	5.44E+00	2.08E+00	2.07E+00	
Total with plume	ADULT	1.73E+00	1.73E+00	3.32E+00	1.73E+00	1.72E+00	3.22E+00	1.83E+00	7.07E+00	

LNP COL 11.5-3

Table 11.3-206 (Sheet 2 of 2)
Individual Dose Rates[(a)]

Dose (mrem/yr)										
Pathway		Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin	Location
	TEEN	2.01E+00	2.02E+00	4.70E+00	2.03E+00	2.02E+00	3.99E+00	2.12E+00	7.35E+00	
	CHILD	3.06E+00	3.06E+00	9.71E+00	3.09E+00	3.06E+00	6.42E+00	3.16E+00	8.39E+00	
	INFANT	1.30E+00	1.30E+00	1.78E+00	1.31E+00	1.31E+00	2.94E+00	1.41E+00	6.65E+00	
	Max	3.06E+00	3.06E+00	9.71E+00	3.09E+00	3.07E+00	6.43E+00	3.16E+00	8.39E+00	

a) 10 CFR 50 Appendix I: Total Body Dose Limit = 5 mrem/yr, Skin Dose = 15 mrem/yr and Dose to Any Organ = 15 mrem/yr
b) EAB 0.83 mi WSW
c) Nearest Goat Milk 2.4 mi NNW
d)Nearest Garden 1.7 mi WSW
e)Nearest Residence 1.7 mi WSW
f) Nearest Meat Cow 2.8 mi SSW

LNP COL 11.5-3

Table 11.3-207
Dose in Millirads at Special Locations

Special Location	Beta Air Dose	Gamma Air Dose
EAB[(a)]	9.35	1.67
Nearest Residence/Garden	3.62	0.67
Nearest Goat Milk	0.43	0.075
Nearest Meat Animal	0.35	0.062

a) 10 CFR 50 Appendix I Design Objective: Gamma Air Dose = 10 mrad and Beta Air Dose = 20 mrad.

LNP COL 11.3-1
LNP COL 11.5-3

Table 11.3-208
Population Doses from Gaseous Effluents

	Dose (person-rem/year)							
Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.22E+00	1.24E+01
Ground	9.87E-02	9.87E-02	9.87E-02	9.87E-02	9.87E-02	9.87E-02	9.87E-02	1.16E-01
Inhalation	3.69E-01	3.71E-01	6.01E-02	3.75E-01	3.76E-01	2.58E+00	4.95E-01	3.60E-01
Vegetable Ingestion	3.10E+00	3.09E+00	1.28E+01	3.10E+00	3.08E+00	3.11E+00	3.07E+00	3.07E+00
Cow Milk Ingestion	2.77E-01	2.75E-01	1.16E+00	2.78E-01	2.77E-01	5.41E-01	2.75E-01	2.75E-01
Meat Ingestion	8.78E-01	8.91E-01	3.95E+00	8.78E-01	8.77E-01	9.79E-01	8.75E-01	8.75E-01
Total	5.74E+00	5.75E+00	1.91E+01	5.75E+00	5.73E+00	8.33E+00	6.04E+00	1.71E+01

LNP COL 11.5-3

Table 11.3-209
Maximum Individual Doses
Compared to 10 CFR 50 Appendix I

Type of Dose	Appendix I Criteria Design Objective	Levy Unit 1 and 2 Calculated Dose	Highest Offsite Dose Location
Gaseous Effluents (Noble Gases)			
Gamma Air	10 mrad	1.7 mrad	EAB
Beta Air	20 mrad	9.4 mrad	EAB
Total Body	5 mrem	0.99 mrem	EAB
Skin	15 mrem	6.32 mrem	EAB
Radioiodines and Particulates			
Dose to any Organ from all pathways	15 mrem	9.71 mrem (Child - bone)	

11.4 SOLID WASTE MANAGEMENT

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

Add the following after DCD Subsection 11.4.2.4.2:

11.4.2.4.3 Alternatives for B and C Wastes

LNP COL 11.4-1

It is expected that Class B and C wastes will constitute approximately 5 percent by volume of the low level radioactive waste (LLRW) that will be generated by the plant with the balance being Class A waste. The volume of wet Class B and C waste is approximately 100 percent of the total Class B and C waste. As of July 1, 2008, the LLRW disposal facility in Barnwell, South Carolina is no longer accepting Class B and C waste from sources in states that are outside of the Atlantic Compact. Class A wastes are disposed of off-site. The disposal facility in Clive, Utah is still accepting Class A waste from out of state. Should there be no disposal facilities that will accept the Class B and C wastes after the plant begins operation, there are several options available for storage of such waste:

- As provided in referenced DCD Subsection 11.4.2., the Auxiliary Building is designed to have more than a year of spent resin storage capacity at the expected rate, and the spent resin tanks may be mixed to limit the radioactivity concentrations thereby limiting the volume of Class B and C wet waste requiring storage.
- Vendor services are available to process Class A, B, and C waste and transfer for storage of that material until a disposal site is available. Currently, Waste Control Specialists (WCS) of Texas is available to store Class A, B, and C material pending the availability of a licensed disposal site.
- If additional storage capacity were eventually needed, the plant could construct or expand storage facilities onsite or gain access to a storage facility at another licensed nuclear plant.

11.4.5 QUALITY ASSURANCE

Add the following to the end of DCD Subsection 11.4.5:

STD SUP 11.4-1

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

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

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

This COL Item is addressed below.

STD COL 11.4-1

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

LNP COL 11.4-1

When the disposable media is removed from mobile radwaste processing system, the process control program is utilized to move the media from the system and place the media into a package suitable for shipping. The mobile radwaste processing system is not placed back into service until the media that has been removed is packaged and ready for shipment.

STD COL 11.4-1

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

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

Table 13.4-201 provides milestones for PCP implementation.

LNP COL 11.4-1

All packaged and stored radwaste will be shipped to offsite disposal/storage facilities and temporary storage of radwaste is only provided until routine offsite shipping can be performed. Accordingly, there is no expected need for permanent on-site storage facilities at LNP 1 & 2.

If additional storage capacity for Class B and C waste is required, further temporary storage would be developed in accordance with NUREG-0800, Standard Review Plan 11.4, Appendix 11.4-A. To the extent that additional storage could be needed sometime in the future, the existing regulatory framework would allow Duke Energy to conduct written safety analyses under 10 CFR 50.59. If the additional storage does not satisfy 10 CFR 50.59, a license amendment would be required.

11.4.6.1 Procedures

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

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

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

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

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

11.4.6.2 Third Party Vendors

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

11.4.6.3 Long Term On-Site Storage Facility

LNP SUP 11.4-1 Storage space for six-months' volume of packaged waste is provided in the radwaste building. Radioactive waste generated by LNP will normally be shipped to a licensed disposal or off-site storage facility. However, should disposal facilities or off-site storage facilities not be available, storage capacity will be expanded as described below to provide additional on-site storage for LNP.

Additional on-site low-level radioactive waste (LLRW) storage capabilities are available if Class B and C waste cannot be disposed at a licensed disposal facility. An outside storage pad will be utilized to provide this capability. The LNP LLRW storage facility would be located outside the Protected Area (PA) in the Owner Controlled Area (OCA). The storage facility would be enclosed by an eight-foot high fence with locked gates and would be provided with area lighting. The storage of LLRW would be in high integrity containers (HICs) or other suitable containers that will not decay over time, which would be stored within shielded containers. The design of the storage facility will comply with the guidance of documents as identified in this section which is consistent with NUREG-0800, Appendix 11.4A. The design storage capacity is based on the expected generation in DCD Table 11.4-1, industry experience indicates approximately 100% of the Class B and C waste is expected to be in the form of wet waste, and volume minimization/reduction programs. The site waste management plan will include radioactive wet waste reduction initiatives for Class B and C waste.

The storage facility will be sited such that it could be sized to accommodate storage of Class B and C waste over the operating life of the plant and designed to accommodate future expansion as needed. Capacity would be added in phases based on the expected availability of off-site treatment and storage, and disposal facilities.

11.4.6.3.1 Outside Storage Pad Design Considerations

The following design considerations would be applied to the on-site LLRW storage facility: (References 202, 203, and 204):

- The location of the storage pad would meet the dose rate criteria of 40 CFR 190 and 10 CFR 20.1302 for both the site boundary and unrestricted area. The onsite storage will be located such that any additional dose contributes less than 1 mrem per year to the 40 CFR Part 190 limits. Onsite dose limits will be controlled per 10 CFR 20, including the ALARA principle of 10 CFR 20.1101.

- The outside storage pad would be an engineered feature designed to minimize settling and would be constructed of reinforced concrete or engineered gravel.

- The storage pad location would avoid natural or engineered surface drainage and be located at an elevation considering the site's design bases flood level.

- The storage pad would have a fence or other suitable security measures consistent with its location on the site.

- The waste containers (typically high integrity containers) would be stored inside of a shielded container, typically consisting of reinforced concrete containers that provide radiation shielding and weather protection.

- The configuration of the storage shields would be arranged to be accessible from the perimeter road or from a center aisle using a mobile crane (if used).

- Personnel passages would be provided between rows of storage shields for access to the container for inspection.

- Adequate electrical power and lighting would be provided at the storage facility to allow power for tools, analytical equipment, sample pumps, radiation instruments, boroscope lights, etc.

- Fire protection, fire hydrants or fire extinguishers for vehicle fires should be provided.

11.4.6.3.2 Outside Storage Pad Operating Considerations

The following operating considerations for on-site storage pad operations are based on NRC and industry guidance (References 202, 203 and 204) and would be included in operating procedures:

- Identification of the arrangement of storage shields, waste handling, storage methods, safety analysis limitations, accident conditions, and off site dose calculations.

- The use of hold-down devices to secure the waste container during severe environmental events, such as strong wind, would be provided for, unless the waste container and storage shields can be demonstrated to remain in place without restraints during such events.

- The waste container selected for use would be compatible with the waste form stored to ensure waste container integrity.

- Shielding requirements would be determined before the waste container is loaded into a storage shield to eliminate the radiation exposure associated with subsequent addition of supplemental shielding.

- If additional shield walls around the perimeter of the storage pad are required, the shield walls would be easily installed and capable of being moved.

- Periodic inspection and testing requirements for outside storage pad operation would include the following:

  - Dose rate and contamination surveys in accordance with health physics procedures.

  - Sampling of storage shields for water and storage shields containing dewatered resin for explosive gas build-up.

  - Visual inspection of selected waste containers in storage to detect unexpected changes / container integrity. (Remote inspection methods and the use of high integrity containers will allow reduced scope for ALARA practices.)

- Defoliation and general condition of the onsite storage pad.

- Total radioactive material inventory limits would be established to demonstrate compliance with the design limits for the storage area, dose limits for members of the public and safety features or measures provided by the storage module.

- The contents of records for inventory controls, monitoring and inspection and other relevant data would be maintained and retrievable.

- Operational safety features for handling waste containers and storage shields would include the training required for personnel operating cranes, forklifts, tie downs and heavy equipment during any waste container/storage shield transfer activity.

- Criteria for the end of storage period that would include waste container inspection and additional reprocessing as required prior to shipment offsite.

11.4.7 REFERENCES

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

202. Technical Report 1018644 “Guidelines for Operating an Interim On Site Low Level Radioactive Waste Storage Facility,” Revision 1, EPRI, Palo Alto, CA, February 2009.

203. Regulatory Issue Summary 2008-32 “Interim Low Level Radioactive Waste Storage at Reactor Sites,” December 2008.

204. Generic Letter (GL) 81-38, “Storage of Low-Level Radioactive Wastes at Power Reactor Sites,” November 1981.

11.5 RADIATION MONITORING

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

11.5.1.2 Power Generation Design Basis

Revise the fourth bullet in DCD Subsection 11.5.1.2 as follows:

STD COL 11.5-2

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

11.5.2.4 Inservice Inspection, Calibration, and Maintenance

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

STD COL 11.5-2

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

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

11.5.3 EFFLUENT MONITORING AND SAMPLING

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

LNP COL 11.5-2

Duke Energy is extending the existing Duke Energy program for quality assurance of radiological effluent and environmental monitoring that is based on Regulatory Guide 4.15, Revision 1, to apply to Levy Nuclear Plant, Units 1 and 2. Regulatory Guide 4.15, Revision 1, is a proven methodology for quality assurance of radiological effluent and environmental monitoring programs that is acceptable to the NRC staff as a method for demonstrating compliance with applicable requirements of 10 CFR Parts 20, 50, 52, 61, and 72. Use of Revision 2 of Regulatory Guide 4.15 would necessitate conducting two separate programs involving the use of common staff, facilities, and equipment, which will create an undue burden and may lead to an increased possibility for human error. Therefore, Duke Energy commits to use Regulatory Guide 4.15, Revision 1, methodology for Levy Nuclear Plant, Units 1 and 2 for optimal consistency, efficiency, and practicality.

11.5.4 PROCESS AND AIRBORNE MONITORING AND SAMPLING

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

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

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

11.5.4.1 Effluent Sampling

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

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

11.5.4.2 Representative Sampling

Representative samples are obtained from well-mixed streams or volumes of effluent liquid through the use of proper sampling equipment, proper location of sampling points, and the development and use of sampling procedures. The recommendations of ANSI N 42.18 (Reference 203) are considered for the selection of instrumentation specific to the continuous monitoring of radioactivity in liquid effluents.

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

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

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

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

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

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

Analytical Procedures

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

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

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

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

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

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

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

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

11.5.6.5 Quality Assurance

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

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

11.5.8 COMBINED LICENSE INFORMATION

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

Table 13.4-201 provides milestones for ODCM implementation.

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

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

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

Add the following subsection after DCD Subsection 11.5.8.

11.5.9 REFERENCES

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

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

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

STD COL 11.5-2

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

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

STD COL 11.5-2

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

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

STD COL 11.5-2

Table 11.5-202
Minimum Sensitivities

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