ArevaEPRDCPEm Resource

From:	Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent:	Friday, November 06, 2009 9:58 PM
To:	Tesfaye, Getachew
Cc:	MCINTYRE Brian (AREVA NP INC); DELANO Karen V (AREVA NP INC); SLIVA Dana (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject:	Response to U.S. EPR Design Certification Application RAI No. 273, FSAR Ch. 11, Supplement 1
Attachments:	RAI 273 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided technically correct and complete responses to 10 of the 42 questions of RAI No. 273 on October 14, 2009. The attached file, "RAI 273 Supplement 1 Response US EPR DC.pdf," provides a technically correct and complete response to 17 of the remaining questions and partial responses to 4 of the remaining questions.

Appended to this file are the affected pages of the U.S. EPR Final Safety Analysis Report (FSAR) in redline-strikeout format which support the response to RAI 273 Question 11.02-4, 11.02-5, 11.02-6, 11.02-7, 11.02-8, 11.02-9, 11.02-12, 11.02-13, 11.02-15, 11.03-4, 11.03-5 , 11.03-8, 11.04-7, 11.04-8, 11.04-10, 11.04-14, 11.04-15, and 11.05-3.

Also included are related markups to AREVA NP's document, ANP-10292, Revision 1, "U.S. EPR Conformance with Standard Review Plan (NUREG-0800) Technical Report."

A complete FSAR markup is not provided for four of the answered questions. As agreed by NRC staff during an FSAR Chapter 11 audit on October 7, 2009, FSAR markups may be submitted after Phase 2 completion to support Staff review to close confirmatory items. Therefore, a complete FSAR markup for the four questions will be provided as indicated in the following table:

Question #	Supplement Date (providing FSAR Markup)
RAI 273 — 11.02-14	March 31, 2010
RAI 273 — 11.03-12	March 31, 2010
RAI 273 — 11.03-13	March 31, 2010
RAI 273 — 11.04-15	March 31, 2010

The following table indicates the respective page(s) in the response document, "RAI 273 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 273 — 11.02-4	2	2
RAI 273 — 11.02-5	3	4
RAI 273 — 11.02-6	5	5
RAI 273 — 11.02-7	6	6
RAI 273 — 11.02-8	7	7
RAI 273 — 11.02-9	8	9
RAI 273 — 11.02-12	10	10
RAI 273 — 11.02-13	11	11
RAI 273 — 11.02-14	12	12
RAI 273 — 11.02-15	13	14
RAI 273 — 11.03-4	15	15
RAI 273 — 11.03-5	16	16
RAI 273 — 11.03-8	17	18
RAI 273 — 11.03-12	19	19
RAI 273 — 11.03-13	20	20

RAI 273 — 11.04-7	21	22
RAI 273 — 11.04-8	23	24
RAI 273 — 11.04-10	25	25
RAI 273 — 11.04-14	26	26
RAI 273 — 11.04-15	27	27
RAI 273 — 11.05-3	28	28

A complete answer is not provided for 15 of the 42 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 273 — 11.02-14	March 31, 2010
RAI 273 — 11.03-12	March 31, 2010
RAI 273 — 11.03-13	March 31, 2010
RAI 273 — 11.04-15	March 31, 2010
RAI 273 — 11.05-1	November 25, 2009
RAI 273 — 11.05-2	November 25, 2009
RAI 273 — 11.05-4	November 25, 2009
RAI 273 — 11.05-5	November 25, 2009
RAI 273 — 11.05-6	November 25, 2009
RAI 273 — 11.05-7	November 25, 2009
RAI 273 — 11.05-8	November 25, 2009
RAI 273 — 11.05-9	November 25, 2009
RAI 273 — 11.05-10	November 25, 2009
RAI 273 — 11.05-11	November 25, 2009
RAI 273 — 11.05-12	November 25, 2009

Sincerely,

Ronda Pederson
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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, October 14, 2009 5:45 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 273, FSAR Ch. 11

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 273 Response US EPR DC.pdf" provides technically correct and complete responses to 10 of the 42 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 273, Questions 11.02-11, 11.03-7, 11.03-9, 11.03-10, 11.04-10, 11.04-11 and 11.04-12.

The following table indicates the respective pages in the response document, "RAI 273 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 273 — 11.02-4	2	2
RAI 273 — 11.02-5	3	3
RAI 273 — 11.02-6	4	4
RAI 273 — 11.02-7	5	5
RAI 273 — 11.02-8	6	6
RAI 273 — 11.02-9	7	7
RAI 273 — 11.02-10	8	8
RAI 273 — 11.02-11	9	9
RAI 273 — 11.02-12	10	10
RAI 273 — 11.02-13	11	11
RAI 273 — 11.02-14	12	12
RAI 273 — 11.02-15	13	13
RAI 273 — 11.03-4	14	14
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RAI 273 — 11.03-7	17	17
RAI 273 — 11.03-8	18	18
RAI 273 — 11.03-9	19	19
RAI 273 — 11.03-10	20	21
RAI 273 — 11.03-11	22	22
RAI 273 — 11.03-12	23	23
RAI 273 — 11.03-13	24	24
RAI 273 — 11.04-7	25	25
RAI 273 — 11.04-8	26	26
RAI 273 — 11.04-10	27	28
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RAI 273 — 11.05-6	41	41
RAI 273 — 11.05-7	42	42
RAI 273 — 11.05-8	43	43
RAI 273 — 11.05-9	44	44
RAI 273 — 11.05-10	45	45
RAI 273 — 11.05-11	46	47
RAI 273 — 11.05-12	48	48

A complete answer is not provided for 32 of the 42 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 273 — 11.02-4	November 6, 2009
RAI 273 — 11.02-5	November 6, 2009
RAI 273 — 11.02-6	November 6, 2009
RAI 273 — 11.02-7	November 6, 2009
RAI 273 — 11.02-8	November 6, 2009
RAI 273 — 11.02-9	November 6, 2009
RAI 273 — 11.02-12	November 6, 2009
RAI 273 — 11.02-13	November 6, 2009
RAI 273 — 11.02-14	November 6, 2009
RAI 273 — 11.02-15	November 6, 2009
RAI 273 — 11.03-4	November 6, 2009
RAI 273 — 11.03-5	November 6, 2009
RAI 273 — 11.03-8	November 6, 2009
RAI 273 — 11.03-12	November 6, 2009
RAI 273 — 11.03-13	November 6, 2009
RAI 273 — 11.04-7	November 6, 2009
RAI 273 — 11.04-8	November 6, 2009
RAI 273 — 11.04-10 (Part 3)	November 6, 2009
RAI 273 — 11.04-14	November 6, 2009
RAI 273 — 11.04-15	November 6, 2009
RAI 273 — 11.05-1	November 6, 2009
RAI 273 — 11.05-2	November 6, 2009
RAI 273 — 11.05-3	November 6, 2009
RAI 273 — 11.05-4	November 6, 2009
RAI 273 — 11.05-5	November 6, 2009
RAI 273 — 11.05-6	November 6, 2009
RAI 273 — 11.05-7	November 6, 2009
RAI 273 — 11.05-8	November 6, 2009
RAI 273 — 11.05-9	November 6, 2009
RAI 273 — 11.05-10	November 6, 2009
RAI 273 — 11.05-11	November 6, 2009
RAI 273 — 11.05-12	November 6, 2009

Sincerely,

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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Monday, September 14, 2009 3:12 PM
To: ZZ-DL-A-USEPR-DL
Cc: Dehmel, Jean-Claude; Frye, Timothy; Jennings, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 273 (3450, 3459,3460, 3462), FSAR Ch. 11

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 11, 2009, and discussed with your staff on August 25, 2009. Draft RAI Question 11.04-9 was deleted, and Draft RAI Questions 11.02-4, 11.02-14, 11.03-4, 11.03-12, 11.03-13, 11.04-7, 11.04-12, 11.05-1, 11.05-4, and 11.05-5 were modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 948

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Subject: Response to U.S. EPR Design Certification Application RAI No. 273, FSAR Ch. 11, Supplement 1
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Received Date: 11/6/2009 9:58:16 PM
From: Pederson Ronda M (AREVA NP INC)

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Response to

Request for Additional Information No. 273, Supplement 1

9/14/2009

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 11.02 - Liquid Waste Management System
SRP Section: 11.03 - Gaseous Waste Management System
SRP Section: 11.04 - Solid Waste Management System
SRP Section: 11.05 - Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems

Application Section: Chapter 11

QUESTIONS for Health Physics Branch (CHPB)

Question 11.02-4:

In Section 11.2.1, the FSAR describes the design basis of the LWMS. However, a review indicates that the design basis does not acknowledge SRP acceptance criteria, such as IE Bulletin 80-10 and industry standards. Also, the design basis does not consistently acknowledge the related commitments described in U.S. EPR Conformance with Standard Review Plan (NUREG-0800) Technical Report (AREVA, ANP-10292, Rev. 1). Accordingly, the applicant is requested to review the commitments made in ANP-10292 (Rev, 1) and Section 11.2 of the SRP, and confirm that the design basis is consistent with applicable SRP criteria and Regulatory Guide 1.206, and, if not, provide the justification that the alternate approach provides acceptable methods of compliance with NRC regulations.

Response to Question 11.02-4:

The design basis in U.S. EPR FSAR Tier 2, Section 11.2.1 will be revised to add additional commitments to regulatory guidance consistent with the SRP acceptance criteria, RG 1.206, and Technical Report ANP-10292, Revision 1.

Calculations of doses and radioactive releases are performed consistent with the methodologies described in BTP-11-6 and RG 1.109, RG 1.112, and RG 1.113. A cost-benefit analysis of the liquid waste management system (LWMS) is presented in U.S. EPR FSAR Tier 2, Section 11.2.4 using the guidance of RG 1.110.

The LWMS also incorporates design features which address NRC concerns identified in IE Bulletin 80-10.

Technical Report ANP-10292, Revision 1 will be revised to add an additional reference to the design basis in U.S. EPR FSAR Tier 2, Section 11.2.1 as the source for the documentation of the SRP acceptance criteria basis for the SRP acceptance criteria discussed in this response.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.1 and Technical Report ANP-10292, Revision 1 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-5:

In Sections 11.2.2.1.3, 11.2.2.1.6, and 11.2.2.2.3, the FSAR states that aerobic bacteria, chelating and anti-foaming agents will be used as chemical additives in treating some types of radwastes and for removing encrusted solids in the evaporator. Distillate discharges from the evaporator may be sent to the demineralizer system for further processing in removing radioactivity. The introduction of such chemical additives does not address NRC concerns on the generation of explosive gas mixtures (e.g., hydrogen and methane) and possibility of chelating and antifoaming agents causing exothermic reactions when coming in contact with ion-exchange resins. For example, IE Information Notices 83-14, 84-72, 88-08, and 90-50 and NUREG/CR-4601 caution power plant operators and waste generators about the introduction of microbial organisms and organic chemicals in waste streams that would come in contact with ion-exchange resins. Also, the introduction of chemical agents may reduce ion-exchange capacity and decontamination factors of ion-exchange resins; thereby, resulting in higher discharges of radioactivity levels. Accordingly, the description of this operational concept should acknowledge prior NRC information notices, identify measures that will be implemented in avoiding the inadvertent generation of explosive gas mixtures, monitoring system overpressures and temperature rises before exothermic reactions compromise the integrity of LWMS subsystems, and identify related operational requirements for consideration by COL applicants and holders.

Response to Question 11.02-5:

NRC concerns about chemical additions documented in prior information notices are addressed in the U.S. EPR design by including the measures described in this response.

The aerobic bacteria are added to the liquid waste storage tank to consume any organics that may be contained in the waste. The U.S. EPR addresses IE Information Notice 84-72 by continuously venting the liquid waste storage tanks to the radioactive waste processing building ventilation system (RWBVS) to remove any gases produced by the bacteria. The ventilation system is equipped with high efficiency particulate air (HEPA) and activated carbon filters to maintain plant radioactive releases as low as reasonably achievable (ALARA). Once the organics in the storage tank have been consumed, the bacteria will die and settle on the bottom of the tank and collected as sludge.

The U.S. EPR addresses IE Information Notice 90-50 by employing the tactics described in this response to prevent organic substances from interacting with the demineralizer ion-exchange resins. The waste water is drawn from the top of the tank for processing, reducing the potential of organic sludge entering the processing systems. If the waste water is sent to the demineralizer system directly, the pre-filters and ultra-filters trap any solids that are entrained in the waste stream. If the waste water is first sent to the evaporator, any organics are retained in the evaporator column bottom.

The anti-foaming agent is used to collapse any foam that forms in the evaporator sump, which prevents foam from entering the evaporator distillate column. If evaporator distillate is sent to the demineralizer for polishing, the anti-foaming agent does not impact the demineralizer because the anti-foaming agent is retained in the evaporator sump by the design of the evaporator distillate column.

The U.S. EPR addresses IE Information Notice 88-08 by not adding the anti-foaming agent to the waste stream that is sent directly to the demineralizer system.

The chelating agent is used to clean the evaporator column of encrusted solids after a processing cycle. The U.S. EPR addresses IE Information Notice 83-14 by not forwarding such wastes to the demineralizers. When the solids have been cleaned from the vessel, they are forwarded to the concentrate tanks of the liquid waste storage system for further processing in the solid waste processing system.

The U.S. EPR FSAR Tier 2, Section 11.2.2.1.3 will be revised to include a discussion of how the U.S. EPR design addresses NRC concerns about chemical additions documented in these information notices.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.2.1.3 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-6:

In Section 11.2.2, the FSAR states that the radwaste processing building has spare space for the optional use of vendor-provided mobile waste processing equipment. A review of FSAR Figures 11.2-1 to 11.2-3 reveals that there are no connection points into existing LWMS subsystems to which mobile or skid-mounted processing equipment would be connected to. Accordingly, the LWMS drawings should be reviewed and evaluated as to whether such connections should be shown or footnoted in the appropriate subsystem drawings. In addition, the discussion should be expanded to address connections for support services (e.g., compressed air, water, radwaste ventilation, etc.), contamination controls in the context of IE Bulletin 80-10 and Part 20.1406 and RG 4.21, and address the need for the use of permanent or temporary radiation shielding in keeping ambient radiation exposure rates ALARA.

Response to Question 11.02-6:

In U.S. EPR FSAR Tier 2, Section 11.2.2, the phrase that mentions “optional, site-specific mobile or vendor-supplied processing equipment” will be removed.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.2 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-7:

In Section 11.2.2.3, the FSAR describes a process by which radioactive process and effluent samples will be collected from various segments of the LWMS. However, a review of FSAR Figures 11.2-1 to 11.2-3 reveals that there are no sampling points identified in LWMS subsystems. A review of FSAR Tier 1, Figure 1.3-1 and FSAR Tier 2, Figure 1.7-1 indicates that there are no P&ID symbols for sampling points. Accordingly, the LWMS P&ID drawings and supporting legends in FSAR Tier 1 and 2 figures should be revised to include the locations and identification of sampling points in all associated LWMS subsystems.

Response to Question 11.02-7:

U.S. EPR FSAR Tier 2, Figure 11.2-1 and Figure 11.2-2 will be revised to show the location of sampling points (KUB connectors) in the liquid waste management system (LWMS), which denote local grab samples.

FSAR Impact:

U.S. EPR FSAR Tier 2, Figure 11.2-1 and Figure 11.2-2 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-8:

In Section 11.2.2.2.3 and Figure 11.2-3, the FSAR describes the demineralizer subsystem and states that the inlet to the subsystem is equipped with prefilters to remove fine particles. A review of the drawing indicates that there are no filters to remove resin fines out of the demineralizers before sending process waste streams to the monitoring tanks for release to the discharge canal. Without resin traps in the outlet stream of the demineralizer, there is the possibility that high radioactivity resin fines could be discharged in the environment. Accordingly, the applicant should review the design and consider the installation of resin traps on the discharge line after the last demineralizer column so as to not exceed effluent concentration limits of Appendix B to Part 20 during releases via the LWMS discharge line.

Response to Question 11.02-8:

The design has been modified to add a resin trap in the outlet stream of the demineralizer. U.S. EPR FSAR Tier 2, Section 11.2.2.2.3 and Figure 11.2-3 will be revised to reflect this addition.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.2.2.3 and Figure 11.2-3 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-9:

In Section 11.2.2.4, the FSAR provides description of LWMS subsystem components. A review of the discussions indicates that the text does not match the details in the corresponding subsystem figures. For example:

1) The liquid radwaste storage tanks are described as having connections to the radwaste building ventilation system, but the drawing does not show such connections for any of the tanks. In contrast, the drawing for the evaporator does show a connection to the radwaste building ventilation system (see "KLF" point).
2) The drawing for the concentrate tanks shows two connections to the tank while the text states that there are nine connections, four on the top, four on the side, and one at the bottom.
3) The drawing for the centrifuge shows that two tanks are connected to the system for the collection of solids and sludge, but the text refers to drums being used for that purpose. The drums or connections to replaceable drums are not shown in the drawing.
4) The level of details and description of components for the demineralizer system is inconsistent with the corresponding drawings for the other subsystems. The drawing also shows components that are not described in the text, e.g., chemical additive system, and the text describes components that are not shown in the drawing, e.g., spent resin drying subsystem.
5) The description of the distillate tank, evaporator system, states that "… the distillate tank is treated waste water with little or no contamination." This statement is incorrect since the evaporator removes only radioactive materials suspended in particulate forms, while the presence and concentration of tritium in the collected distillate remains unchanged as compared to initial concentrations of influent streams to the evaporator.

Collectively, such types of observations apply to nearly all LWMS subsystems and should be reviewed and corrected accordingly.

Response to Question 11.02-9:

1) Ventilation lines will be added to U.S. EPR FSAR Tier 2, Figure 11.2-1 to show connections to the radioactive waste building ventilation system (RWBVS) (system identifier of KLF) from the liquid radwaste storage tanks, as described in U.S. EPR FSAR Tier 2, Section 11.2.3.6.

2) U.S. EPR FSAR Tier 2, Section 11.2.2.4.1 will be revised to remove the number and types of connections for the storage tanks, concentrate tanks, and monitoring tanks. This will provide consistency between the text and the figures.

3) No "drum" symbol is available in the simplified list of symbols in U.S. EPR FSAR Tier 2, Figure 1.7-1. Equipment tag KPF58 BZ001 is the drum discussed in U.S. EPR FSAR Tier 2, 11.2.2.4. The word "DRUM" will be added to the label for this equipment in U.S. EPR FSAR Tier 2, Figure 11.2-2 for clarity.

4) See the Response to Question 11.02-8 and Question 11.02-15, which will revise the demineralizer sections, table, and figure.

5) This statement identified in the question, which describes the distillate tank in the evaporator system in U.S. EPR FSAR Tier 2, Section 11.2.2.4.2.1, will be revised to indicate that "the distillate that collects in the distillate tank is treated wastewater with little or no non-volatile radioactive and chemical contamination. The concentration of tritium is unchanged since it is part of the water molecule. "

FSAR Impact:

1) U.S. EPR FSAR Tier 2, Figure 11.2-1 will be revised as described in the response and indicated on the enclosed markup.
2) U.S. EPR FSAR Tier 2, Section 11.2.2.4.1 will be revised as described in the response and indicated on the enclosed markup.
3) U.S. EPR FSAR Tier 2, Figure 11.2-2 will be revised as described in the response and indicated on the enclosed markup.
4) The U.S. EPR FSAR will not be changed as a result of this question.
5) U.S. EPR FSAR Tier 2, Section 11.2.2.4.2.1 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-12:

In Table 11.2-1, the FSAR provides estimates of processing rates for LWMS subsystems. A review of the discussion presented in Section 11.2.1.2.3 indicates that one operational option is to wait for "…natural radioactive decay…" to reduce activity level below release limits. Given that most of the radioactivity present in liquid radwaste is associated with long-lived radionuclides, the processing rates described in Table 11.2-1 should be qualified as to whether radioactive decay is being considered for specific waste streams and reflected in the stated processing rates of Section 11.2.1.2.1 and Table 11.2-1 and applied input rates for the GALE code analysis described in FSAR Table 11.2-3 in assessing offsite releases and doses to members of the public.

Response to Question 11.02-12:

Natural radioactive decay is not an operational option. The sentence referring to "the wastewater may be held in the monitoring tank while waiting for natural decay processes to reduce the activity below the release limits" in U.S. EPR FSAR Tier 2, Section 11.2.1.2.3 will be deleted.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.1.2.3 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-13:

In Section 11.2.2.4.1, the FSAR states that the activity measurement tank, containing two radiation detectors, is located downstream of the release isolation valves. However, a review of FSAR Figure 11.2-1 indicates that two radiation detectors are located before the two isolation valves and not after. Also, the figure does not show the "activity measurement tank." Accordingly, these inconsistencies should be reconciled and the descriptions of this portion of the system and figure depictions should match.

Response to Question 11.02-13:

The activity measurement tank is upstream of the two isolation valves. Two radiation sensors are mounted in the release line to continuously measure and record activity discharged during wastewater releases to the environment. The description of the activity-measurement tank in U.S. EPR FSAR Tier 2, Section 11.2.2.4.1 will be revised and U.S. EPR FSAR Tier 2, Figure 11.2-1 will be revised to show the tank.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.2.4.1 and Figure 11.2-1 will be revised as described in the response and indicated on the enclosed markup.

Question 11.02-14:

In Section 11.2.4, the FSAR presents the results of a cost-benefit analysis (CBA) in justifying that no system augmentation is needed given the requirements of Appendix I to Part 50. A review of the assumptions indicates that a 60-year life cycle was applied in the analysis for the selected radwaste processing equipment, while RG 1.110 applies a 30-year life cycle. Given the heavy duty operational cycle of such equipment, the CBA should provide the technical justification for an expected operational life of 60 years. Also, the CBA should provide the processing capacity rate of the supplemental demineralizer subsystem. The applicant is requested to provide sufficient information to enable the staff to conduct an independent confirmation of the CBA results.

Response to Question 11.02-14:

The liquid waste cost benefit analysis (CBA) supplemental demineralizer assumes a processing capacity rate of 400 gallons per minute.

The liquid waste CBA will be revised to use a 30 year life cycle consistent with RG 1.110 and updated population doses for a fresh water site consistent with the Response to RAI 301, Question 11.02-17. U.S. EPR FSAR Tier 2, Section 11.2.4 will be revised to include the results of the liquid waste CBA using a 30 year life cycle.

A complete response will be provided by March 31, 2010.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.4 will be updated as discussed in the response and the FSAR markups provided by March 31, 2010.

Question 11.02-15:

A review of FSAR Table 11.2-2 and Figures 11.2-1 to 11.2-3 indicates that the listing of components in Table 11.2-2 is inconsistent with system descriptions. For example, Table 11.2-2 does not list components for the demineralizer system. Similarly, Table 12.2-2 lists components that are not shown in related drawings, e.g., the activity measurement tank. Accordingly, the text, tables, and figures should be reviewed and updated to include a complete and consistent presentation of the information for each LWMS subsystem.

Response to Question 11.02-15:

U.S. EPR FSAR Tier 2, Table 11.2-2 will be revised to add the vendor-supplied demineralizer system components (demineralizer booster pump, pre-filter, ultra-filter, demineralizer resin beds, resin trap, solids collection system, spent resin dewatering system, and chemical addition system). However, design parameters such as design pressure, temperature, flow rate, and material composition will be developed later in the design process and are thus not included in the U.S. EPR FSAR.

The description of the demineralizer system in U.S. EPR FSAR Tier 2, Section 11.2.2.2.3 will be revised to indicate that the contaminants are forwarded to the solids collection system, where they are stored until ready for disposal. A chemical tank treats the contaminants as required. U.S. EPR FSAR Tier 2, Section 11.2.2.2.3 and Section 11.2.2.4.2.3, which discuss the spent resin dewatering system in the demineralizer system, will be revised to indicate that water removed from the high integrity container (HIC) is sent back through the demineralizer system via a water booster pump for further processing.

The following component descriptions will also be added to U.S. EPR FSAR Tier 2, Section 11.2.2.4.2.3 for the resin trap, the solids collection system, and the demineralizer booster pump:

> “***Resin Trap***
>
> The Resin Trap removes resin fines from the demineralizer outlet stream. These resin fines would have the potential to contaminate the cleaned waste water. The filter media can be accessed easily for replacement or cleaning.
>
> **Solids Collection System**
>
> The solids collection system serves to collect contaminates from the ultrafilter. These contaminates are forwarded to the solids collection system via backwashing of the filters. The collected solids will be chemically treated as necessary and sent to an off-site disposal facility.
>
> **Demineralizer Booster Pump**
>
> The demineralizer booster pump serves to provide the vendor supplied demineralizer system with enough flow to ensure proper waste treatment.”

A footnote will be added to U.S. EPR FSAR Tier 2, Figure 11.2-3 to indicate that the demineralizer package consists of the following major components: demineralizer booster pump, pre-filter, ultra-filter, demineralizer resin beds, spent resin dewatering system (including water booster pump), and a solids collection system (including chemical treatment).

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.2.2.2.3, 11.2.2.4.2.3, Table 11.2-2 and Figure 11.2-3 will be revised as described in the response and indicated on the enclosed markup.

Question 11.03-4:

In Section 11.3.1, the FSAR describes the design basis of the GWMS. However, a review indicates that the design basis does not acknowledge SRP acceptance criteria, such as Regulatory Guide 1.140 and IE Bulletin 80-10. Also, the design basis does not consistently acknowledge the related commitments described in U.S. EPR Conformance with Standard Review Plan (NUREG-0800) Technical Report (AREVA, ANP-10292, Rev. 1). Accordingly, the applicant is requested to review the commitments made in ANP-10292 (Rev, 1) and Section 11.3 of the SRP and Regulatory Guide 1.206 and confirm that the design basis is consistent with applicable SRP criteria and, if not, provide the justification that the alternate approach provides acceptable methods of compliance with NRC regulations.

Response to Question 11.03-4:

The design basis in U.S. EPR FSAR Tier 2, Section 11.3.1 will be revised to add additional commitments to regulatory guidance consistent with the SRP acceptance criteria, RG 1.206, and Technical Report ANP-10292, Revision 1.

Calculations of doses and radioactive releases are performed consistent with the methodologies described in BTP-11-5 and RG 1.109, RG 1.111, and RG 1.112. A cost-benefit analysis of the gaseous waste processing system (GWPS) is presented in U.S. EPR FSAR Tier 2, Section 11.3.4.2 using the guidance of RG 1.110.

The gaseous waste management system (GWMS) is designed in compliance with RG 1.140 because it addresses the design, testing, and maintenance of normal ventilation exhaust system air filtration, and adsorption units. U.S. EPR FSAR Tier 2, Section 9.4 discusses how the U.S. EPR design complies with RG 1.140. The GWMS also incorporates design features consistent with the applicable guidance of RG 4.21 and which address NRC concerns identified in IE Bulletin 80-10. Technical Report ANP-10292, Revision 1 will be revised to add an additional reference to the design basis in U.S. EPR FSAR Tier 2, Section 11.3.1 as the source for the documentation of the SRP acceptance criteria basis for the SRP acceptance criteria addressed in this response.

U.S. EPR FSAR Tier 2, Section 11.3.2.3.15 will be revised to acknowledge compliance with the SRP and to clarify that the measurement cabinets contain non-sparking gas analyzers that measure the concentration of hydrogen and oxygen in the sample of purge gas.

FSAR Impact:

U.S. EPR Tier 2, Section 11.3.1 and Section 11.3.2.3.15 and Technical Report ANP-10292, Revision 1 will be revised as described in the response and as indicated on the enclosed markup.

Question 11.03-5:

In Section 11.3.2.3, the FSAR describes the various components of the GWMS. However, a review of FSAR Figures 11.3-1 and 11.3-2 reveals that there are no sampling points identified in GWMS subsystems. A review of FSAR Tier 1, Figure 1.3-1 and FSAR Tier 2, Figure 1.7-1 indicates that there are no P&ID symbols for sampling points. Accordingly, the GWMS P&ID drawings and supporting legends in FSAR Tier 1 and 2 figures should be revised to include the locations and identification of sampling points in all associated GWMS subsystems.

Response to Question 11.03-5:

U.S. EPR FSAR Tier 2, Figure 11.3-1 will be revised to show the location of sampling points in the gaseous waste management system (GWMS). They are indicated by connectors to the nuclear sampling system (KUF). U.S. EPR FSAR Tier 2, Figure 11.3-1 will also be revised to show the location and routing of drains (KTA connectors) from the important gaseous waste processing system (GWPS) coolers (see the Response to Question 11.03-8).

FSAR Impact:

U.S. EPR FSAR Tier 2, Figure 11.3-1 will be revised as described in the response and indicated on the enclosed markup.

Question 11.03-8:

In Section 11.3.2.3, the FSAR describes the various components of the GWMS. However, a review of FSAR Figures 11.3-1 and 11.3-2 reveals that there are no connections from cooler condensers drains to the LWMS. The drawings should be reviewed and revised to identify such connections to ensure that there are no unmonitored and uncontrolled releases of radioactive materials and that the design complies with the requirements of Part 20.1406 and guidance of RG 4.21.

Response to Question 11.03-8:

U.S. EPR FSAR Tier 2, Figure 11.3-1 will be revised to show the location and routing of drains from the important gaseous waste processing system (GWPS) coolers (See the Response to Question 11.03-5). Further description of these drains is provided below.

Condensate from the gas drier, gas cooler, and pre-drier is not routed directly to the liquid waste processing system (LWPS) but rather to the nuclear island drain/vent system (NIDVS). Condensate from the measuring gas driers is routed back to the GWPS upstream of the waste gas compressors.

The primary effluents subsystem of the NIDVS and the GWPS are both contaminated systems, so the prevention of water incursion rather than radioactive contamination of the GWPS is the primary concern. Routing the drains to the primary effluents subsystem of the NIDVS prevents uncontrolled/unmonitored releases. The guidance of RG 4.21 has been followed and the GWPS design complies with 10 CFR Part 20.1406.

The means to prevent contamination or backflow from the NIDVS is as follows:

Gas drier: The drain line from the gas drier includes a water lock and a motor operated valve. The motor operated valve (MOV) periodically allows condensate to be drained from the gas drier to the NIDVS. The water lock in the drain line from the gas drier prevents backflow to the GWPS caused by differing pressures in the GWPS and NIDVS. A blown seal can be re-established through a connection with the demineralized water system.

Gas cooler: Condensate is carried to the waste gas compressors to be removed through downstream drain connections. Additionally, the filter downstream of the recombiner is equipped with a drain line, which routes any collected condensate to the NIDVS.

Pre-drier: Condensate from the pre-drier is collected in the condensate collecting tank and is released to the NIDVS via a drain line with a motor operated valve. This valve allows for level control in the condensate collecting tank. Backflow to the tank is prevented by the static head of fluid in the tank and because this portion of the gaseous waste processing system is at a positive pressure.

Measuring gas driers: Condensate from the measuring gas driers is routed to the upstream side of the waste gas compressors of the GWPS. This condensate can be released to the NIDVS through downstream drain connections. The measuring gas driers are protected from backflow by floating ball type check valves installed on their drain lines.

Routing condensate back to the GWPS reduces the connections required to the NIDVS and the possibility for contamination. Drains that route condensate to the NIDVS are equipped with the means to prevent backflow.

FSAR Impact:

U.S. EPR FSAR Tier 2, Figure 11.3-1 will be revised as described in the response. See the enclosed markup in the Response to Question 11.03-5.

Question 11.03-12:

In Section 11.3.4, the FSAR presents the results of a cost-benefit analysis (CBA) in justifying that no system augmentation is needed given the requirements of Appendix I to Part 50. A review of the assumptions indicates that a 60-year life cycle was applied in the analysis for the selected GWMS processing equipment, while RG 1.110 applies a 30-year life cycle. Given the heavy duty operational cycle of such equipment and possibility for the contamination of charcoal by chemicals or water damage, the CBA should provide the technical justification for an expected operational life of 60 years. The applicant is requested to provide sufficient information to enable the staff to conduct an independent confirmation of the CBA results.

Response to Question 11.03-12:

The gaseous waste cost benefit analysis will be revised to use a 30 year life cycle consistent with RG 1.110. U.S. EPR FSAR Tier 2, Section 11.3.4 will be revised to include the results of the gaseous waste cost benefit analysis using a 30 year life cycle.

A complete response will be provided by March 31, 2010.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.3.4 will be updated as discussed in the response and the FSAR markups provided by March 31, 2010.

Question 11.03-13:

In Section 11.3.2.4, the FSAR presents a failure analysis of the GWMS. However, a review indicates that for each type of failure or event identified, the discussion does not address the associated radiological consequences, such as potential for radioactive releases, system or facility contamination, unmonitored releases to the environment, etc. Also, the analysis should identify an event associated the ~~failure~~ malfunction of GWMS radiation monitoring system and detectors located before and after the charcoal delay beds given that they have different radiation response characteristics, and one involving an operator error that include an estimate of the duration of the event and mitigating measures applied in terminating the event to a safe end point. For example, the equipment malfunction analysis should identify equipment assumed to fail (e.g., radiation monitor), describe the postulated malfunction (e.g., fails to indicate high radioactivity levels), describe the results (e.g., reading lost), and identify alternate or mitigating actions (e.g., conduct manual sampling and restore operability of instrumentation).

Response to Question 11.03-13:

An updated equipment malfunction evaluation will be performed and documented in U.S. EPR FSAR Tier 2, Section 11.3.2.4.

U.S. EPR FSAR Tier 2, Section 11.3.3.6 describes a bounding analysis for a hypothetical event where an operator error leads to the bypass of the delay beds and the exhaust from the coolant degasification to the environment. The one hour event duration leads to a dose less than 100 mrem at the exclusion area boundary.

A complete response will be provided by March 31, 2010.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.3.4 will be updated as discussed in the response and the FSAR markups provided by March 31, 2010.

Question 11.04-7:

In Section 11.4.1, the FSAR describes the design basis of the SWMS. However, a review indicates that the design basis does not acknowledge SRP acceptance criteria, such as Part 20.2006, 20.2007, and 20.2108, and IE Bulletin 80-10. Also, the design basis does not consistently acknowledge the related commitments described in U.S. EPR Conformance with Standard Review Plan (NUREG-0800) Technical Report (AREVA, ANP-10292, Rev. 1). Accordingly, the applicant is requested to review the commitments made in ANP-10292 (Rev, 1) and Section 11.4 of the SRP and Regulatory Guide 1.206 and confirm that the design basis is consistent with applicable SRP criteria and, if not, provide the justification that the alternate approach provides acceptable methods of compliance with NRC regulations.

Response to Question 11.04-7:

U.S. EPR FSAR Tier 2, Section 11.4 will be revised to address items consistently with Technical Report ANP-10292. The design basis discussion in U.S. EPR FSAR Tier 2, Section 11.4.1 will be revised to add the following:

- "The solid waste management system incorporates design features which address NRC concerns identified in SRP Appendix 11.4-A. This information can be found in Section 11.4.2.4.
- The solid waste management design includes items, identified in 10 CFR 50 Appendix I, that have demonstrated clean-up technology. This information can be found in Section 11.4.4.
- The solid waste management system also incorporates design features which address NRC concerns identified in IE Bulletin 80-10 as it relates to cross contamination."

The SRP acceptance criteria related to the requirements for transferring and manifesting radioactive material shipments to authorized facilities and maintenance of waste disposal records, as required by 10 CFR 20.2006 and 10 CFR 20.2108, will be added to U.S. EPR FSAR Tier 2, Section 11.4.2.4. The COL item in U.S. EPR FSAR Tier 2, Section 11.4.3 that describes the requirements to describe fully the Process Control Program (PCP) will be revised to add the requirement to meet the toxic or hazardous waste requirements in federal, state, and local regulations per 10 CFR 20.2007. The corresponding COL item (No. 11.4-1) in U.S. EPR FSAR Tier 2, Table 1.8-2 will also be revised.

Technical Report ANP-10292, Revision 1 will be revised to reference additional U.S. EPR FSAR sections where compliance with the SRP acceptance criteria is addressed. One change will be made to the U.S. EPR compliance assessment for SRP Criterion 11.4-AC-13 (10 CFR Part 71 and 49 CFR Parts 171-180 as they relate to the use of approved containers and packaging methods for the shipment of radioactive materials). The "U.S. EPR Assessment" will be changed from "N/A-COL" to "Y" because this is part of the design basis in U.S. EPR FSAR Tier 2, Section 11.4.1 and is also discussed in U.S. EPR FSAR Tier 2, Section 11.4.2.4 and Section 11.4.3.

FSAR Impact:

U.S. EPR Tier 2, Table 1.8-2, Section 11.4.1, Section 11.4.2.4, Section 11.4.3, and Technical Report ANP-10292, Revision 1 will be revised as described in the response and indicated on the enclosed markup.

Question 11.04-8:

In Section 11.4.1, the FSAR states that both storage areas (drum storage and tubular storage) have a combined storage capacity of "several years" volume of solid waste." However, a review of the data shown in Table 11.4-1 indicates that the storage capacity is less than 3 years for Class B and C wastes when the six-month decay-in-storage option is applied, as noted in the FSAR, and that all Class A wastes are being shipped as rapidly as they are being generated in providing storage space for Class B and C wastes. This approach and assumptions need to be evaluated for the purpose of confirming whether they are operationally feasible and can provide a storage capacity for several years.

Response to Question 11.04-8:

U. S. EPR FSAR Tier 2, Section 11.4.1.2.1 will be revised to clarify that the storage capacity is a minimum of 7.5 years. When off-site disposal options for Class B and C wastes are not available, the U.S. EPR solid waste processing system provides flexibility to treat potential Class B and C waste types so that the final container for these wastes are 55-gallon waste drums. The drum storage areas of the Radioactive Waste Building (RWB) (comprised of the drum store room with a capacity of approximately 350 waste drums and the tubular shaft storage area with a capacity of approximately 200 waste drums) will provide at least 7.5 years of waste drum storage capacity under these conditions.

As indicated in U.S. EPR FSAR Tier 2, Table 11.4-1, 55-gallon drums (waste drums) will be utilized to contain the following types of waste at the following maximum annual quantities:

1) Evaporator concentrates at 19.2 drums per year.
2) Centrifuge sludge at 1.1 drums per year.
3) Mixed waste at 0.3 drums per year.

The flexibility of the solid waste processing system allows for other types of waste to be treated and placed in 55-gallon drums before subsequently being stored in the drum storage area or tubular shaft storage area. This response lists the maximum number of 55-gallon drums that could be produced from these waste streams. The maximum annual number of drums was calculated using the maximum annual shipping volume of each waste stream shown in U.S. EPR FSAR Tier 2, Table 11.4-1.

1) Spent coolant purification resins and spent fuel pool purification resins at 12.3 drums per year.
2) Spent resins from the radwaste demineralizer system at 19.1 drums per year.
3) Wet waste from the demineralizers at 1.1 drums per year.
4) Spent filter cartridges at 15 drums per year.
5) Liquid waste storage tank sludge at 4.8 drums per year.

Conservatively assuming that all of the waste is stored in 55-gallon drums and must be placed in the drum storage area or tubular shaft storage area, 72.9 drums would need to be stored annually. The drum store area and tubular shaft storage area can store approximately 550 drums, allowing for approximately 7.5 years of storage capacity.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.4.1.2.1 will be revised as described in the response and indicated on the enclosed markup.

Question 11.04-10:

In Section 11.4.2, the FSAR describes the various components of SWMS subsystems. A review of the description indicates that the information is presented inconsistently. Several components described in the text and Table 11.4-14 and Figure 11.4-1 are discussed in the text and not shown in a corresponding figure, or are not discussed in the text but shown in a figure. For example:

1) The interface between the LWMS and SWMS for the concentrate buffer tank is not shown in a corresponding P&ID drawing, see "KPC" connections for the chemical tank and concentrate tanks from LWMS Figure 11.2-1, and note lack of a KPC connection from the demineralizer subsystem to the SWMS.
2) The shredder and compactor systems and cementation station are not listed in Table 11.4-14.
3) Provisions for connecting mobile skid-mounted radwaste processing subsystems are not shown, while the FSAR states that it is an option.
4) There is no indication as to where within SWMS subsystems waste samples will be collected for radiological and chemical analyses in demonstrating compliance with Part 20 and Part 61 waste form classification and characteristics, and waste disposal acceptance criteria of disposal sites.
5) The location of the Drum Storage Facility and Tubular Shat Storage Facility are shown "On-Site" in Figure 11.4-1 as out of the Radwaste Processing Building, but the text in Section 11.4 implies that that they are located within the Radwaste Processing Building.

Collectively, such these observations apply to nearly all SWMS subsystem descriptions and should be reviewed and corrected accordingly in FSAR text and tables and figures.

Response to Question 11.04-10:

3) U.S. EPR FSAR Tier 2, Section 11.4.1.2.5 will be deleted because an optional mobile or vendor-supplied system is a site-specific design feature outside the scope of the design certification.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.4.1.2.5 will be deleted as described in the response and indicated on the enclosed markup.

Question 11.04-14:

In Section 11.4.3, the FSAR does not acknowledge NEI 07-10A PCP Template as an alternate means of demonstrating compliance with GL 89-01 and SECY-05-0197 until a plant-specific PCP is developed under a license condition. Note that FSAR Section 13.4 does not list the PCP as a mandated operational program under a license condition contrary to the SRP and RG 1.206. In addition to the above, add the PCP operational program to FSAR Section 13.4.

Response to Question 11.04-14:

U.S. EPR FSAR Tier 2, Section 11.4.3 will be revised to acknowledge NEI 07-10A as an alternate means of demonstrating compliance with GL 89-01 and SECY-05-0197. In addition, U.S. EPR FSAR Tier 2, Section 13.4 and Section 1.8 will be revised to include the PCP as an additional operational program for which the COL applicant must provide an implementation schedule.

The process and effluent monitoring and sampling program discussed in U.S. EPR FSAR Tier 2, Section 13.4 (and identified in U.S. EPR FSAR Tier 2, Section 11.5.2 as a COL item) will be identified as being described by the COL applicant rather than in the U.S. EPR FSAR.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 1.8, Section 11.4.3, and Section 13.4 will be revised as described in the response and indicated on the enclosed markup.

Question 11.04-15:

FSAR Table 11.4-1 presents estimates of yearly waste volumes and activity levels of radwaste shipped for disposal or processing by waste brokers. A review indicates that some entries show radioactivity levels being shipped in packages that are greater than predicted as yearly estimates. For example, the expected activity level for non-compressible DAW is 0.297 Ci per year, while the average activity shipped is 2.97 Ci per package. The factor of 10 is presumed to be associated with the assumed number of containers (shown as 0.1), but as tabulated the data imply that the average activity level per package is 10 times that of the total expected annual estimate. This inconsistency should be addressed and the header of the last column of Table 11.4-1 should be revised and explained with appropriate footnotes. The waste stream listed in Table 11.4-1 should be expanded to include waste volumes estimates for spent charcoal and dessicant and HEPA filters.

Response to Question 11.04-15:

In U.S. EPR FSAR Tier 2, Table 11.4-1, the column heading for the average curies per package will be revised to reflect the curie content per container, which corrects inconsistencies. The table will also expand the waste volumes to include spent charcoal, desiccant, and high efficiency particulate air (HEPA) filter media.

A complete response will be provided by March 31, 2010.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 11.4-1 will be revised to correct the column heading as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Table 11.4-1 will be updated to include spent charcoal, desiccant, and HEPA filter media waste volumes as discussed in the response and the FSAR markups provided by March 31, 2010.

Question 11.05-3:

In Sections 11.5.3.1 and 11.5.3.2, the FSAR does not acknowledge NEI 07-09A ODCM Template as 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.

Response to Question 11.05-3:

U.S. EPR FSAR Tier 2, Section 11.5.3.1 and Section 11.5.3.2 will be revised to acknowledge NEI 07-09A as an alternate means of demonstrating compliance with GL 89-01 and SECY-05-0197. U.S. EPR FSAR Tier 2, Section 1.8 will be revised to include NEI 07-09A as an alternate means.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 1.8, Section 11.5.3.1, and Section 11.5.3.2 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action Required by COL Applicant	Action Required by COL Holder
10.4-7	A COL applicant that references the U.S. EPR design certification will provide information to address the potential for flooding of safety-related equipment due to failures of the site-specific CWS,	10.4.5.3	Y	
11.2-1	A COL applicant that references the U.S. EPR design certification will confirm that the liquid waste management system cost-benefit analysis for the typical site is applicable to their site; if it is not, provide a site-specific cost-benefit analysis.	11.2.4	Y	
11.3-1	A COL applicant that references the U.S. EPR design certification will confirm that the gaseous waste management system cost-benefit analysis for the typical site is applicable to their site; if not, provide a site-specific cost-benefit analysis.	11.3.4	Y	
11.4-1	A COL Applicant that references the U.S. EPR design certification 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 61 licensed low level 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 Branch Technical Position 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.	11.4.3	Y	

11.04-7

11.04-14

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action Required by COL Applicant	Action Required by COL Holder
11.5-1	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 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.	11.5.2 11.05-3	Y	
12.1-1	A COL applicant that references the U.S. EPR design certification will fully describe, at a functional level, elements of the ALARA program for ensuring that occupational radiation exposures are ALARA. This program will comply with provisions of 10 CFR 20 and be consistent with the guidance in RGs 1.8, 8.2, 8.7, 8.8, 8.9, 8.10, 8.13, 8.15, 8.27, 8.28, 8.29, 8.34, 8.35, 8.36, and 8.38, and the applicable portions of NUREG-1736.	12.1.3	Y	
12.2-1	A COL applicant that references the U.S. EPR design certification will provide site-specific information for required radiation sources containing byproduct, source, and special nuclear material that may warrant shielding design considerations. This site-specific information will include a listing of isotope, quantity, form, and use of all sources in this latter category that exceed 100 millicuries.	12.2.1.13	Y	
12.3-1	A COL applicant that references the U.S. EPR design certification will provide site-specific information on the extent to which the guidance provided by RG 1.21, 1.97, 8.2, 8.8, and ANSI/HPS-N13.1-1999 is employed in sampling recording and reporting airborne releases of radioactivity.	12.3.4.5	Y	

RG 1.143 acknowledges that although the impact of the liquid waste storage and processing systems on safety is limited, the design for these systems includes some functions to limit the uncontrolled releases of radioactivity to the environment. The guidance identifies a radwaste classification for differentiation of applicable radwaste system design requirements based on the total design basis unmitigated radiological release (considering the maximum inventory of a given radwaste system) at the boundary of the unprotected area. Based on calculation of the total design basis unmitigated radiological release from either the liquid waste storage or liquid waste processing systems, these systems are assigned to RG 1.143 classification RW-IIa (High Hazard).

11.02-4

Calculations of doses and radioactive releases are performed consistent with the methodologies described in BTP-11-6 and RGs 1.109, 1.112, and 1.113. A cost-benefit analysis of the liquid waste management system (LWMS) is presented in Section 11.2.4 using the guidance of RG 1.110.

Design features are provided to control and collect radioactive material spills from liquid tanks outside containment. The tanks are housed in rooms with drains to collect any spills and to prevent any uncontrolled release to the environment. In addition, these rooms have no doors leading directly to the outside environment.

Consistent with the requirements of 10 CFR 20.1406, the U.S. EPR, including the liquid waste management system, is designed to minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste. The LWMS design also incorporates features which address NRC concerns identified in IE Bulletin 80-10. Minimization of contamination and radioactive waste generation is described in Section 12.3.6.

11.2.1.1 Design Objectives

In addition to fulfilling their primary design functions, the liquid waste storage and liquid waste processing systems meet the following design objectives:

- Selectively segregate influent liquid wastes according to chemical composition and radioactivity of the source stream.
- Allow analysis of the contents of each liquid waste storage tank.
- Discharge sludge and concentrated wastes to the radioactive concentrates processing system. The radioactive concentrates processing system is an element of solid waste management and is addressed in Section 11.4.
- Prevent unintentional discharge of clean wastewater. Locked discharge valves subject to administrative control prevent discharge of treated wastewater from the

Release Monitoring

The liquid waste storage system uses two monitoring tanks to aid in measuring the activity of processed liquid wastes. If the measured activity is too high for immediate release, the system returns the wastewater in the affected monitoring tank to the five liquid waste storage tanks. This wastewater is subsequently returned to the liquid waste processing system for additional removal of radioactive constituents.

11.02-12 → ~~Alternatively, if the measured activity is only slightly over the release limits, the wastewater may be held in the monitoring tank while waiting for natural decay processes to reduce the activity below the release limits.~~ If the measured activity of a monitoring tank is within release limits, the water in that tank is discharged to the release line.

A locked, closed valve normally shuts the liquid waste storage system release line. Administrative controls preclude unlocking the valve until activity measurements of the liquid waste held in the monitoring tank are below the concentration limits for release. The release line contains an activity-measurement tank. Radiation sensors are mounted in the activity-measurement tank, and flow sensors are mounted in the liquid waste release piping downstream of the activity-measurement tank; together these sensors continually measure and record the total actual activity and activity release rate during each release of processed liquid waste effluents to the environment. Each radiation sensor can generate control signals that stop the discharge pump and isolate the release path if the sensor detects activity in excess of the anticipated level or release rate. Discrepancies between the two radiation sensors or between the two flow sensors also result in control signals that terminate the discharge and isolate the release line.

Operator Error or Malfunction

The radiation sensors in the liquid waste storage system release line generate alarm signals in the main control room and signal interlocks that close the release line isolation valves to prevent further releases if an operator error or equipment malfunction occurs during release. If these isolation valves are closed, the liquid waste management system is designed with enough redundancy and capacity to operate without discharging until the alarm condition is resolved. Although the evaporator, centrifugal separator, and demineralizer are each separate subsystems in the liquid waste processing system, the configuration of that system provides sufficient redundancy that a failure to one subsystem is covered by another subsystem. Also, sufficient storage capacity exists in the five liquid waste storage tanks and two monitoring tanks to collect up to a week's volume of liquid wastes without processing and release. Operator actions are required to align different liquid waste storage tanks to the various liquid waste processing systems, to align the system for recirculation of a given tank, or to return the contents of a monitoring tank or concentrate tank for additional processing. Administrative control of the locked closed release path adds

- The centrifuge, shown in Figure 11.2-1, employs both a decanter and a centrifugal separator to separate organic and inorganic contaminants from the wastewater. The contaminant sludge is collected in a waste drum for collection and processing as solid waste. The treated wastewater is sent to the demineralizer, if required, for further treatment before it is returned to the liquid waste storage system. Solids collected in the ultrafilter are backwashed off the media and sent to a solids collection tank.

- The demineralizer, shown in Figure 11.2-3—Liquid Waste Processing, Demineralizer System, includes a demineralizer and an ultrafiltration unit. The demineralizer receives treated wastewater from both the evaporator and the centrifuge waste processing subsystems or directly from the liquid waste storage tanks. Piping and control valves allow liquid wastes to be passed through either unit, or through both units consecutively. Contaminants are retained in the filter media and resin and the treated wastewater is returned to the liquid waste storage system.

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Both the liquid waste storage and liquid waste processing systems are located entirely within the Radioactive Waste Processing Building. Interfacing system piping delivers influent liquid wastes from the adjacent Nuclear Auxiliary Building. ~~The Radioactive Waste Processing Building is also sized to provide space and support services to optional, site-specific mobile or vendor-supplied processing equipment. However, such optional mobile or vendor-supplied systems are site-specific design features and are outside design certification scope.~~

Table 11.2-1—Liquid Waste Management System Design Parameters, lists the key design parameters for the liquid waste storage and processing systems. Table 11.2-2—Liquid Waste Management System Component Data, lists specific component data for the major components of the liquid waste storage and processing systems.

Section 11.4 provides additional information on the expected volumes, activity levels, and processing of wet and solid wastes produced throughout the plant.

Refer to Section 12.3.6.5.4 for radioactive waste management system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

11.2.2.1 Liquid Waste Storage System Operation

11.2.2.1.1 Waste Input Streams

Group I wastes are those wastes expected to contain radioactivity and boron, but little or no organic substances or solids. Sources of Group I liquid wastes include the following:

- Wastewater from the fuel pool cooling and fuel pool purification systems.

- Wastewater from decontamination systems, for apparatus and vessels, and for small machine components.

11.2.2.1.2 Storage

The liquid waste storage tanks have sufficient capacity to store the liquid waste generated under normal modes of plant operation. In the event of a design basis accident (DBA), these tanks are not affected directly because they are located in the Radioactive Waste Processing Building and thus isolated from the high hazard sources in the Reactor Building. For both Groups I and II wastes, only one of the two liquid waste storage tanks is configured to receive wastes at a given time. When this tank fills, control valves in the liquid waste storage collection piping automatically place the other tank in that group in service and isolate the full tank. The full tank is sampled for activity, pH, and chemical contents. Chemicals are added to this tank to balance the pH and to precipitate those radionuclides that react to form an insoluble solid; adsorption and mixed crystal formation helps to remove other impurities such as corrosion products.

The full storage tank is then connected to one of the three liquid waste processing system operations, and the pretreated wastewater in the tank is pumped through the selected processing operation. The treated wastewater is subsequently returned to the liquid waste storage system; the concentrates are directed to the concentrate tanks, and treated wastewater is directed to the monitoring tanks. Treated wastewater decanted from the concentrate tanks can be returned for further processing to the Group I liquid waste storage tanks. Treated water in the monitoring tanks that still has radioactivity in excess of release limits can be returned to the Group I or II liquid waste storage tanks. Precipitates, corrosion products, and other solids that settle out on the conical bottoms of the liquid waste storage tanks are periodically pumped to one of the concentrate tanks.

Control valve interlocks prevent simultaneous filling and draining of each liquid waste storage tank, except when a tank is configured for recirculation. During tank recirculation, control valves block other routes connected to the recirculation piping for that subgroup.

11.2.2.1.3 Chemical Addition

The wastewater collected in the storage tanks must be pretreated to prevent the precipitation of solids by pH corrections or other inherent chemical changes that may occur during treatment processes. The pH adjustment of wastewater in the Group I liquid waste storage tanks and of the treated wastewater in the monitoring tanks also significantly reduces or eliminates the discharge of boric acid to the environment. The Group II liquid waste storage tanks also include provisions for the introduction of aerobic bacteria to consume the organic compounds that collect in these tanks. The U.S. EPR design considers IE Information Notice 84-72 by continuously venting the liquid waste storage tanks to the radioactive waste processing building ventilation system to remove any gases produced by the bacteria. The ventilation system is

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equipped with HEPA and activated carbon filters to maintain plant radioactive releases ALARA. After decomposing the organic compounds in these tanks, the bacteria die and settle out as part of the sludge that collects on the bottom of the tanks. These bacteria can only be treated in the centrifuge system.

Three of the four chemical addition tanks are piped to the liquid waste storage tanks via the liquid waste storage recirculation system. The first tank supplies an acidic solution to reduce wastewater pH. The second tank supplies an alkaline solution to raise wastewater pH. The third tank supplies an anti-foaming agent, which promotes the settling of precipitates. The anti-foaming agent prevents foam from entering the evaporator distillate column. The U.S. EPR design considers IE Information Notice 88-08 by not adding the anti-foaming agent to the waste stream that is to be sent directly to the demineralizer system. These three chemical addition tanks are also piped to the concentrate tank recirculation header and to the evaporator column in the liquid waste processing system and can be used to adjust the pH and prevent foaming in the drum drying stations of the radioactive concentrates processing system or the evaporator column. The two pH adjustment tanks are also piped to the monitoring tank recirculation header, and can be used to balance the pH of clean treated wastewater that is otherwise ready to be released. The fourth chemical addition tank delivers a chelating agent to the evaporator column in the liquid waste processing system to aid in column cleaning after a processing cycle. Adding the chelating agent to the evaporator column helps to remove the encrusted solids. The U.S. EPR design considers IE Information Notice 83-14 by not forwarding wastes with encrusted solids to the demineralizers. When the solids have been cleaned from the vessel, they are forwarded to the concentrate tanks of the liquid waste storage system for further processing in the solid waste processing system. A dedicated chemical proportioning pump is provided for each of the four chemical addition tanks to permit precise metering of chemical additions for wastewater treatment.

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The U.S. EPR design also considers IE Information Notice 90-50 by employing tactics to prevent organic substances from interacting with the demineralizer ion-exchange resins. The waste water is drawn from the top of the tank for processing, thus reducing the potential for organic sludge to enter the processing systems. If the waste water is sent to the demineralizer system directly, the pre-filters and ultra-filters trap any solids that are entrained in the waste stream. If the waste water is first sent to the evaporator, any organics are retained in the evaporator column bottom.

11.2.2.1.4 Recirculation

The liquid waste storage system has two recirculation pumps that are used to recirculate the contents of a given liquid waste storage tank, to move wastewater from one liquid waste storage tank to another, or to move wastewater from a liquid waste storage tank to the monitoring tanks. Recirculation is performed as needed to promote mixing the contents of a liquid waste storage tank for sampling and to promote the

Wastewater routed to the demineralizer is first passed through a prefilter, which removes large particles. The waste stream is then routed through the demineralizer alone, the ultrafilter alone, or through both devices in either sequence. ~~The treated wastewater~~ Once the treated wastewater passes through a resin trap, which removes any entrained resin fines, it is returned to the monitoring tanks in the liquid waste storage system via the distillate return piping from the evaporator system.

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The contaminants screened out by the prefilter are removed by filter media replacement when the differential pressure across the prefilter reaches its setpoint. The contaminants collected by the ultrafilter are removed by backflushing when the differential pressure across the ultrafilter exceeds predetermined levels. These contaminants are forwarded to the solids collection system where they are stored until ready for disposal. A chemical tank is provided to treat the contaminants as necessary. The resin beds are replaced when the resin in the demineralizer is spent based on plant criteria. The spent resin is pumped to a HIC for dewatering. Alternately, the spent resin can be sent to the liquid waste storage system for further processing and transfer to the solid waste management system. Water removed from the high integrity container (HIC) is sent back through the demineralizer system via a water booster pump for further processing.~~Water removed from the high integrity container (HIC) is returned to the liquid waste processing system for treatment.~~ The dried spent resin may be stored onsite or sent to an offsite disposal facility.

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The liquid waste processing system may be aligned so that treated distillate from the evaporator and treated wastewater from the centrifuge are routed to the demineralizer system for further processing. This serial processing configuration allows very high decontamination factors to be achieved and minimizes the radioactivity ultimately discharged to the environment. This serial processing configuration is particularly important when high concentrations of radioactivity are present in the liquid waste input stream.

11.2.2.3 Sampling

Samples of the wastewater held in the liquid waste storage system are collected at three sample boxes that are part of the nuclear sampling system-slightly active liquid samples. Samples are drawn from the various tanks in the liquid waste storage system while they are aligned for recirculation. Stirrers are also provided in the liquid waste storage tanks and the concentrate tanks to promote the mixing of tank contents.

The sample piping forms a loop that connects to both the suction and discharge piping of each pump used for recirculating a set of liquid waste storage system tanks. Pump differential pressure drives flow through the sample loop. A tap from each sample loop extends to the respective sample box, which contains an isolation valve and nozzle. Samples of the liquid waste storage tanks are collected at one of the sample boxes; samples from the concentrate tanks and the evaporator column sump are collected at a second sample box; samples from the monitoring tanks are collected at a third sample box. This separation of sample points prevents the acquisition of misleading results either by dilution of contaminated wastes with residual treated wastewater or by the contamination of treated wastewater with residual contaminants in the sample lines. Samples are analyzed, and the results are used to determine the specific quantities and types of chemicals required for treatment of the sample source.

11.2.2.4 Component Description

This section provides detailed descriptions of the individual components that make up the systems described in Section 11.2.2.1 and Section 11.2.2.2.

11.2.2.4.1 Liquid Waste Storage System Components

Liquid Waste Storage Tanks

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The five liquid waste storage tanks are vertical, cylindrical tanks with conical bottoms for sludge collection and draining. The tanks are constructed of stainless steel. ~~Each liquid waste storage tank has four connections mounted on its head. One connection is for influent wastewater. The second connection is for return flow from the recirculation pumps. The third connection is to a common overflow header shared by the five liquid waste storage tanks; this header connects to a sump in the Radioactive Waste Processing Building. The fourth connection has two purposes. First, this connection contains a flanged fitting for a temporary connection from the decontamination equipment for the apparatus and vessels system. Second, this connection vents the tank to a common vent header shared by the five liquid waste storage tanks, the two monitoring tanks, and the three concentrate tanks. This common vent header vents the tanks to the radioactive waste processing building ventilation system.~~

~~Each liquid waste storage tank has two outlets mounted on its conical bottom. One of these outlets is located at the low point of the tank and connects to the suction header for the sludge pump. The other outlet is located above the conical bottom of the tank and has several branches. For the five tanks, this second outlet connects to both the recirculation pump suction header and the evaporator feed pump suction header. For the Group II and III liquid waste storage tanks an additional branch connects to the centrifuge feed pump suction header.~~

Each liquid waste storage tank has a motor-operated stirrer mounted in the tank. The stirrer is used (in conjunction with the recirculation pumps) to achieve a homogeneous mixture of the wastewater in the tank and to facilitate the mixing of chemicals (acidic solution, alkaline solution, and anti-foaming agent) injected. This tank configuration allows the use of the liquid waste storage tanks for chemical pretreatment of wastewater to adjust pH and to collect precipitates. The Group II liquid waste storage tanks also have a sparger for the injection of air into the wastewater. Sparging

Sludge Pump

The sludge pump is a centrifugal pump that draws the precipitates and sludge from the bottom of the liquid waste storage tanks and discharges it to the concentrate tanks for further processing.

Concentrate Tanks

The three concentrate tanks are vertical cylindrical tanks with dished heads. The tanks are made of stainless steel. The concentrate tanks collect and hold concentrated wastes that have been separated from wastewater in the liquid waste storage tanks or in one of the liquid waste processing systems for batch processing in the radioactive concentrates processing system.

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~~Each concentrate tank has four connections mounted to the upper head. One connection is for influent sludge from the liquid waste storage tanks and concentrated wastes from the evaporator column. The second connection is for return of recirculation flow from the concentrate pump. The third connection is to a common overflow header shared by the three concentrate tanks; this header connects to a sump in the Radioactive Waste Processing Building. The fourth connection contains a flanged fitting for a temporary connection from the decontamination equipment for apparatus and vessels system.~~

~~Each concentrate tank has four outlets mounted at progressive elevations on the side wall of the tank. The lowest outlet is used to draw concentrates and sludge from the tank for batch discharge to the radioactive concentrates processing system. The three upper outlets are used for decanting clean wastewater from the concentrate tank; this wastewater can be recirculated to the concentrate tank to provide dilution or it can be directed to the Group I liquid waste storage tanks for further processing. An additional outlet at the bottom of each concentrate tank is provided for connection to the decontamination equipment for apparatus and vessels system, but is not used for liquid waste processing.~~

Each concentrate tank has a motor-operated stirrer mounted in the tank. The concentrate tanks are vented to the radioactive waste processing building ventilation system by piping that connects to the sleeve around the drive shaft for the stirrer. The stirrer is used in conjunction with the concentrate pump to achieve a homogeneous mixture of the wastewater in the tank for sampling, to facilitate the mixing of chemicals (i.e., acidic solution, alkaline solution, and anti-foaming agent) injected for treatment, and to promote the batch transfer of concentrates to the radioactive concentrates processing system. Each concentrate tank also has a sparger mounted in the bottom of the tank, to facilitate agitation by sparging the tank contents with air from the compressed air distribution system.

Concentrate Pump

The concentrate pump is a centrifugal pump that draws batches of sludge and concentrates from the concentrate tanks and discharges it to the radioactive concentrates processing system. The concentrate pump is also used to recirculate wastewater in the concentrate tanks for sampling and chemical additions. The concentrate pump can be used to draw clean wastewater from the upper portions of the concentrate tanks and return that water to the Group I liquid waste storage tanks for additional processing. The concentrate pump is fabricated from stainless steel with high resistance to corrosion and abrasion

Monitoring tanks

The two monitoring tanks are vertical cylindrical tanks with conical bottoms. The tanks are made of stainless steel. The monitoring tanks collect and hold treated wastewater from the liquid waste processing system. One tank can also receive Group III wastes directly from the steam generator blowdown demineralizing system. The monitoring tanks are sampled via the piping that connects them to the recirculation and discharge pumps to determine whether the activity and chemistry of treated wastewater is within limits for release. If it is not, the treated wastewater can be returned to the liquid waste storage tanks for treatment. If the wastewater in the monitoring tanks meets activity limits, but not chemistry (pH) criteria for release, chemical additions of either acidic or alkaline solutions can be injected as needed to balance the pH of the wastewater for release.

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~~Each monitoring tank has five connections mounted to the upper head. One connection is for treated wastewater from the evaporator, centrifuge, or demineralizer and for one of the monitoring tanks, clean influent Group III wastes. The second connection is for chemically treated wastewater from the liquid waste storage tanks and the return of recirculation flow from the recirculation and discharge pumps. The third connection is to a common overflow header shared by the two monitoring tanks; this header connects to a sump in the Radioactive Waste Processing Building. The fourth connection is to a common vent header shared by the five liquid waste storage tanks, the two monitoring tanks, and the three concentrate tanks; this vent header connects to the radioactive waste processing building ventilation system. The fifth connection is normally flanged off, but when open allows for coupling the monitoring tank to the decontamination equipment for apparatus and vessels system.~~

~~Each monitoring tank has one outlet mounted at the lowest point on the conical bottom head to facilitate complete draining. This outlet connects to the suction header for the recirculation and discharge pumps. A branch from the outlet allows the tanks to connect to the decontamination equipment for apparatus and vessels system, but it is flanged off and isolated during normal operation of the liquid waste storage system.~~

Recirculation and Discharge Pumps

The recirculation and discharge pumps are centrifugal pumps configured in parallel for redundancy. The recirculation and discharge pumps are used to recirculate treated wastewater in the monitoring tanks for sampling and to facilitate the injection and mixing of chemicals. These pumps also return treated wastewater back to the liquid waste storage tanks (via the recirculation pumps discharge header) if sample analysis results indicate that further processing is required.

Activity-Measurement Tank

The activity-measurement tank is a small stainless steel tank located
11.02-13 ~~downstream~~upstream of the release line isolation valves. Two radiation sensors are mounted in the ~~tank~~release line to continuously measure and record activity discharged during wastewater releases to the environment. Flow sensors are located in the release line downstream of the activity-measurement tank.

Control Valves

The liquid waste storage system employs motor-operated control valves in the influent lines to and effluent lines from the liquid waste storage tanks, the concentrate tanks, the monitoring tanks, and the release line. These valves allow operation of the liquid waste storage system in automatic mode, group or subgroup control mode, interlocked manual mode, and manual mode.

11.2.2.4.2 Liquid Waste Processing System Components

11.2.2.4.2.1 Evaporator System Components

Evaporator Feed Pumps

The evaporator feed pumps are centrifugal pumps that draw wastewater from the liquid waste storage tanks and discharge to the pre-heater. One evaporator feed pump is normally aligned to take suction from the Group I liquid waste storage tanks while the other is normally aligned to take suction from the Groups II and III liquid waste storage tanks; however, either pump can be aligned to draw suction from any of the liquid waste storage tanks.

Pre-Heater

The pre-heater is a tube-and-shell heat exchanger, which transfers heat from the treated distillate that is leaving the evaporator system to the wastewater that is entering. The pre-heater is stainless steel. The incoming wastewater is routed through the tube side, while the departing distillate is routed through the shell side.

Evaporator Column

The lower part of the evaporator column is made from stainless steel with high corrosion resistance; the upper part is stainless steel. Sensors for pressure, temperature, sump level, and differential pressure are mounted on the evaporator column. The evaporator column has connections for the injection of chemicals in both the sump and sieve plate areas. The demineralized water distribution system connects to the evaporator column in both the sump and sieve plate areas.

Forced Recirculation Pump

The forced recirculation pump is mounted horizontally and draws suction on the evaporator column sump and discharges to the evaporator. The forced recirculation pump is made of stainless steel with high corrosion resistance.

Evaporator

The evaporator is a tube-and-shell heat exchanger in which the wastewater is heated to change phase from liquid to vapor. The tube side of the evaporator is fabricated from stainless steel that is highly resistant to corrosion, while the shell side is fabricated from a standard grade of stainless steel.

Vapor Compressor

The vapor compressor is a horizontal rotary type that compresses the cleaned vapor from the evaporator column so that it may be routed to either the evaporator or the distillate tank. The vapor compressor is fabricated of stainless steel.

Distillate Tank

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The distillate tank collects the water that condenses from the compressed vapor due to the transfer of heat in the evaporator. The nonvolatile radioactive and chemical contaminants are concentrated by boiling in the evaporator and separated from the vapor in the evaporator column, so the distillate that collects in the distillate tank is treated wastewater with little or no ~~contamination~~non-volatile radioactive and chemical contamination. Concentration of tritium is unchanged since it is part of the water molecule. The distillate tank is stainless steel.

Distillate Pump

The distillate pump is a horizontally configured centrifugal pump that draws distillate from the distillate tank and pumps it through the pre-heater and distillate cooler, and to the demineralizer subsystem for further processing, if required. The distillate may be sent directly to the monitoring tanks. A small portion of the distillate is diverted from this path and divided for use as wash water on the sieve plates of the evaporator column or as cooling water injected into the vapor stream entering the vapor

Decanter Feed Pump

The decanter feed pump is an eccentric screw pump that moves the agglomerated sludge from the sludge tank back to the decanter. In the decanter, the agglomerated sludge is decanted again to reduce its moisture content, and then discharged to the waste drum. The solids removed from the wastewater in the centrifuge system are collected in waste drums, which can be sealed and sent to the drum-drying stations of the radioactive concentrates processing system, stored onsite, or transported to offsite storage.

Control Valves

The centrifuge system of the liquid waste processing system has two motor-operated control valves, which direct the sludge separated by the decanter to either the sludge tank for further agglomeration or to the waste collection drum at the filling station.

11.2.2.4.2.3 Demineralizer System Components

Prefilter

The prefilter removes suspended solids from the wastewater stream to minimize the potential for flow obstructions in the demineralizer and the ultrafilter. The filter media can be accessed easily for replacement or cleaning.

Demineralizer

The demineralizer beds include varying combinations of anion resins, cation resins, and mixed anion and cation resins. As wastewater passes through the stainless steel demineralizer, ionic contaminants react with the anionic or cationic resins, become chemically bonded to them, and remain fixed on the resin. Treated wastewater discharged from the demineralizer is either returned to the monitoring tanks in the liquid waste storage system or routed to the ultrafilter for further processing.

Ultrafilter

The ultrafilter provides ultra-high-efficiency filtration of wastewater. The ultrafilter retains most contaminants small enough to pass through the prefilter. Treated wastewater discharged from the ultrafilter may be returned to the monitoring tanks in the liquid waste storage system or routed to the demineralizer for further processing.

Spent Resin Drying

The spent resin drying subsystem is provided for receiving, drying, and packaging spent resin from the demineralizer. This equipment consists of a concrete cask into which a HIC for radioactive waste is placed. Spent resins are pumped into the container and dewatered. The water removed from the HIC is sent back through the

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demineralizer for further processing.~~The evaporated wastewater is directed to the evaporator system of the liquid waste processing system for additional treatment.~~ When the HIC is full of dried spent resin wastes, the HIC is sealed and either stored onsite or shipped to an offsite facility.

Resin Trap

The Resin Trap removes resin fines from the demineralizer outlet stream. These resin fines would have the potential to contaminate the cleaned waste water. The filter media can be accessed easily for replacement or cleaning.

Solids Collection System

The solids collection system serves to collect contaminates from the ultrafilter. These contaminates are forwarded to the solids collection system via backwashing of the filters. The collected solids will be chemically treated as necessary and sent to an off-site disposal facility.

Demineralizer Booster Pump

The demineralizer booster pump serves to provide the vendor supplied demineralizer system with enough flow to ensure proper waste treatment.

11.2.2.5 Inspection and Testing Requirements

11.2.2.5.1 Preoperational Testing

The U.S. EPR liquid waste storage and processing systems incorporate features that are subject to performance validation by preoperational testing. Preoperational testing examines proper detection of setpoints by the relevant sensors and proper response by system components. Specifically, the following components and functions receive preoperational testing:

- Automatic control functions of control valves on the liquid waste storage tank influent and effluent lines.
- Chemical proportioning pumps delivery of precisely metered quantities of chemical additives.
- Automatic termination and isolation of the release path from the monitor.
- Automatic control functions that govern evaporator system operation.
- Vapor compressor compression ratios.
- Pressure integrity of liquid waste processing system piping and components for pressure transients expected during system operation.

Table 11.2-2—Liquid Waste Management System Component Data
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Components / Parameters	Value
Vendor Supplied Demineralizer System	
Demineralizer Booster Pump	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified
Pre-Filter	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified
Ultra-Filter	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified
Demineralizer Resin Beds	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified

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Table 11.2-2—Liquid Waste Management System Component Data
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Components / Parameters	Value
Resin Trap	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified
Solids Collection System	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified
Spent Resin De-Watering System	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified
Chemical Addition System	
Number	1
Type	Vendor Specified
Design Pressure	Vendor Specified
Design Temperature	Vendor Specified
Design Flow Rate	Vendor Specified
Material	Vendor Specified

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11.02-13

Figure 11.2-1—Liquid Waste Storage System

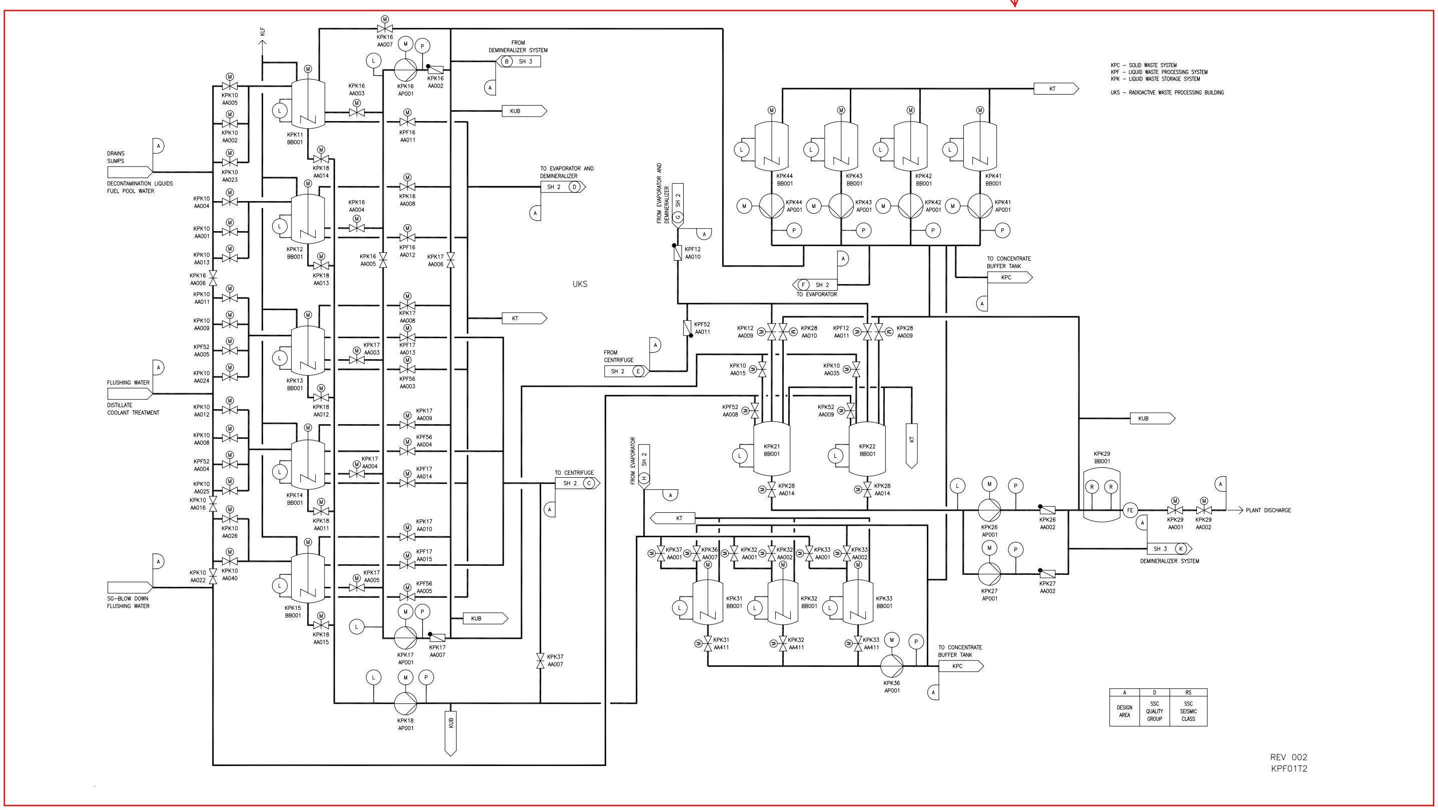

Figure 11.2-2—Liquid Waste Processing System, Evaporator System

11.02-7 & 11.02-9

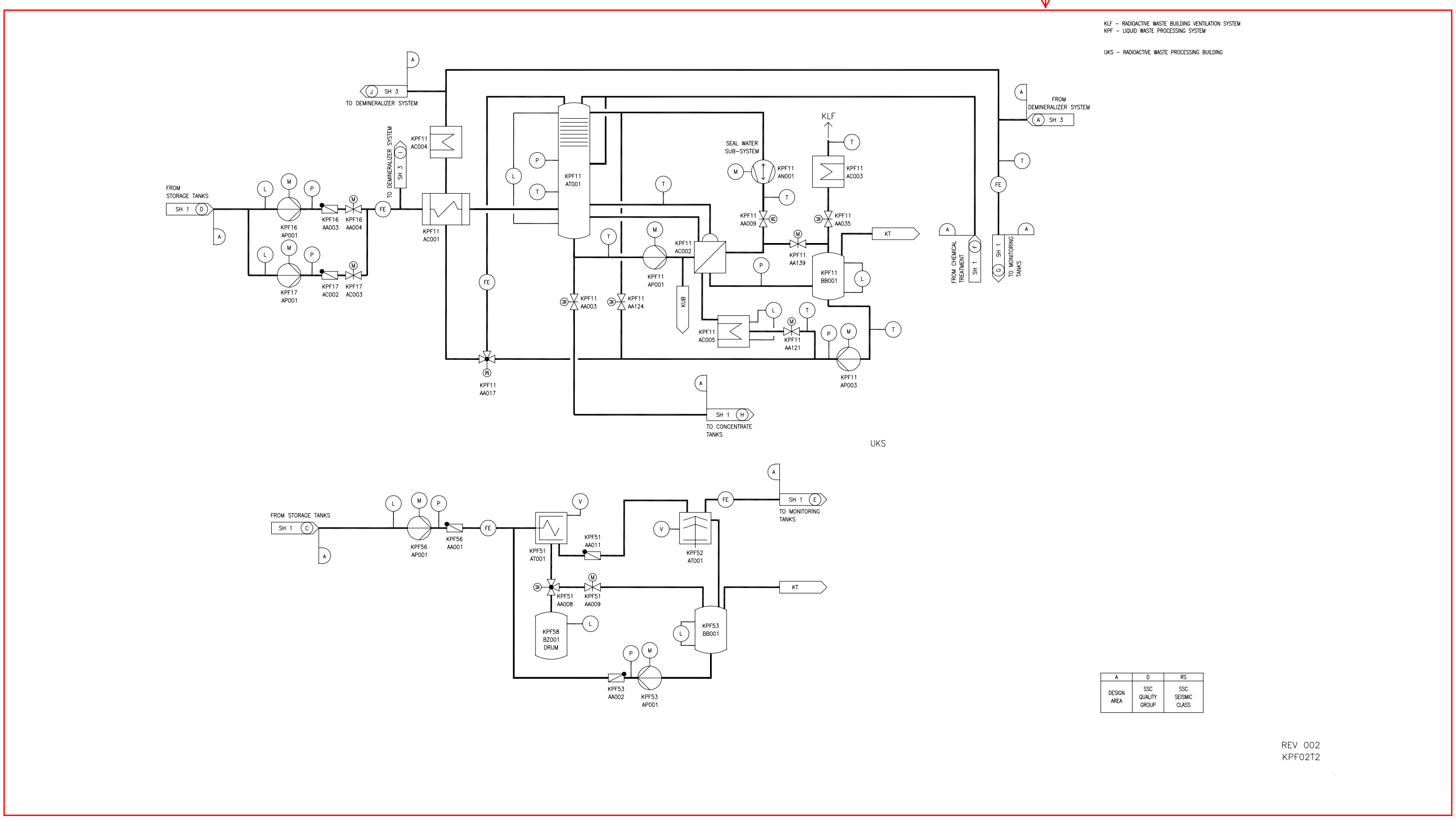

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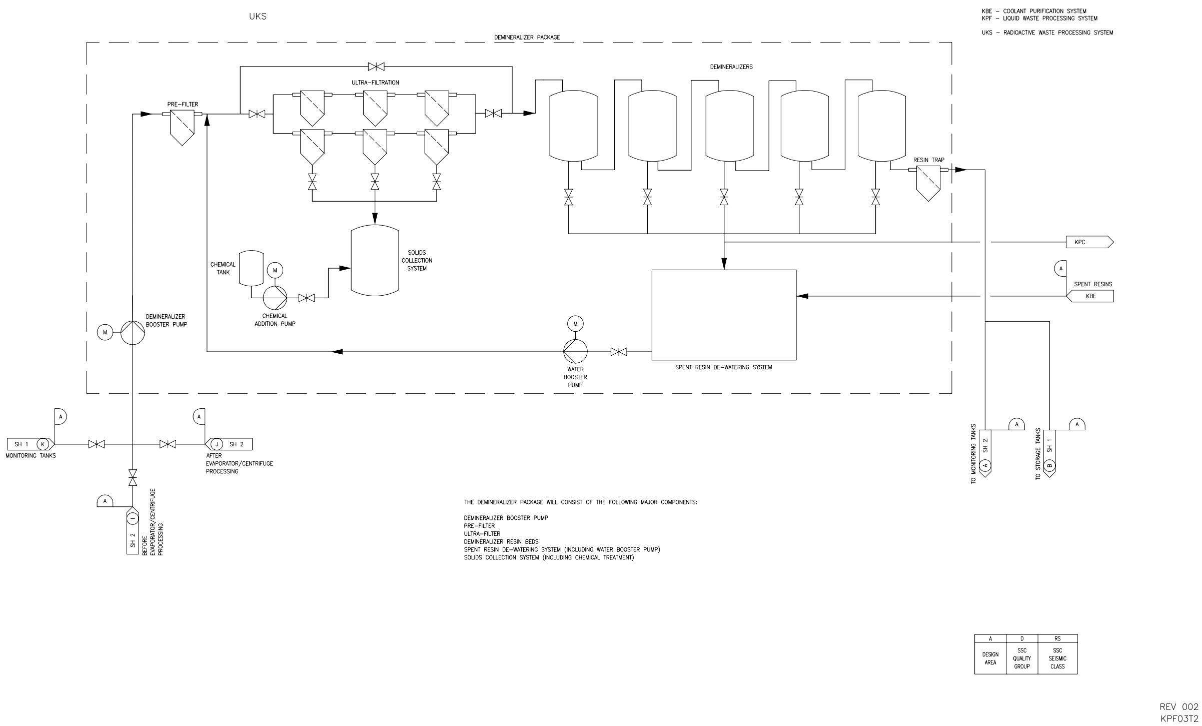
Figure 11.2-3—Liquid Waste Processing, Demineralizer System



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waste processing system is designed to fulfill these primary design functions under modes of normal plant operation. The gaseous waste processing system is not designed to mitigate DBAs.

Using the methodology contained in RG 1.143, the gaseous waste processing system is classified as RW-IIa (High Hazard). This classification is based on calculation of the limiting total design basis unmitigated radiological release and considers the maximum inventory of a given radwaste system at the boundary of the unprotected area.

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Calculations of doses and radioactive releases are performed consistent with the methodologies of BTP-11-5 and of Regulatory Guides 1.109, 1.111, and 1.112. A cost-benefit analysis of the GWPS is presented in Section 11.3.4.2 and utilizes the guidance of RG 1.110.

The GWMS is designed in compliance with the regulatory position contained in RG 1.140 as it pertains to the design, testing, and maintenance of normal ventilation exhaust system air filtration and adsorption units. Further description of the U.S. EPR design as it relates to RG 1.140 can be found in Section 9.4.

Consistent with the requirements of 10 CFR 20.1406, the U.S. EPR, including the gaseous waste management system, is designed, to the extent practicable, to minimize contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, the generation of radioactive waste. The GWMS design also incorporates features consistent with the applicable guidance of RG 4.21 and which address NRC concerns identified in IE-BL-80-10. Minimization of contamination and radioactive waste generation is described in Section 12.3.6.

11.3.1.1 Design Objectives

In addition to fulfilling its primary design functions, the gaseous waste processing system meets the following design objectives:

- Compensate for level deviations in the free gas atmosphere of tanks that are connected to the system by adding or removing the free gas.
- Maintain a negative system pressure to prevent the escape of radioactive gases from components connected to the building air.
- Limit the hydrogen and oxygen concentrations in the system and connected systems to less than the flammability limits of the respective gas mixtures.
- Minimize the release of radioactive gases to the environment by injecting the processed purge gas back into the quasi-closed loop.
- Handle excess gas flow rates due to the movement of reactor coolant during plant startup and shutdown.

11.3.2.3.12 Release Radiation Sensor

The waste gas processing system release radiation sensor is located downstream of the release isolation valve, and monitors the activity of processed waste gas that is released to the nuclear auxiliary building ventilation system.

11.3.2.3.13 Measuring Gas Compressors

The measuring gas compressors draw batch gas samples from the purge gas process stream for analysis of the hydrogen and oxygen concentrations in the purge gas. The measuring gas compressors are double diaphragm compressors; the first diaphragm compresses the gas, and the second diaphragm provides a gas-tight seal in the event of a working membrane failure. A negative pressure is maintained between the two membranes and is monitored and alarmed to detect possible membrane failure.

11.3.2.3.14 Measuring Gas Drier

The measuring gas driers remove moisture from the sample gas by condensation. The measuring gas driers are stainless steel tubes that use a refrigeration cycle to cool the sample gas. Each measuring circuit upstream and downstream of the recombiner has one measuring gas drier capable of cooling the total measuring gas flow delivered by the measuring gas compressors.

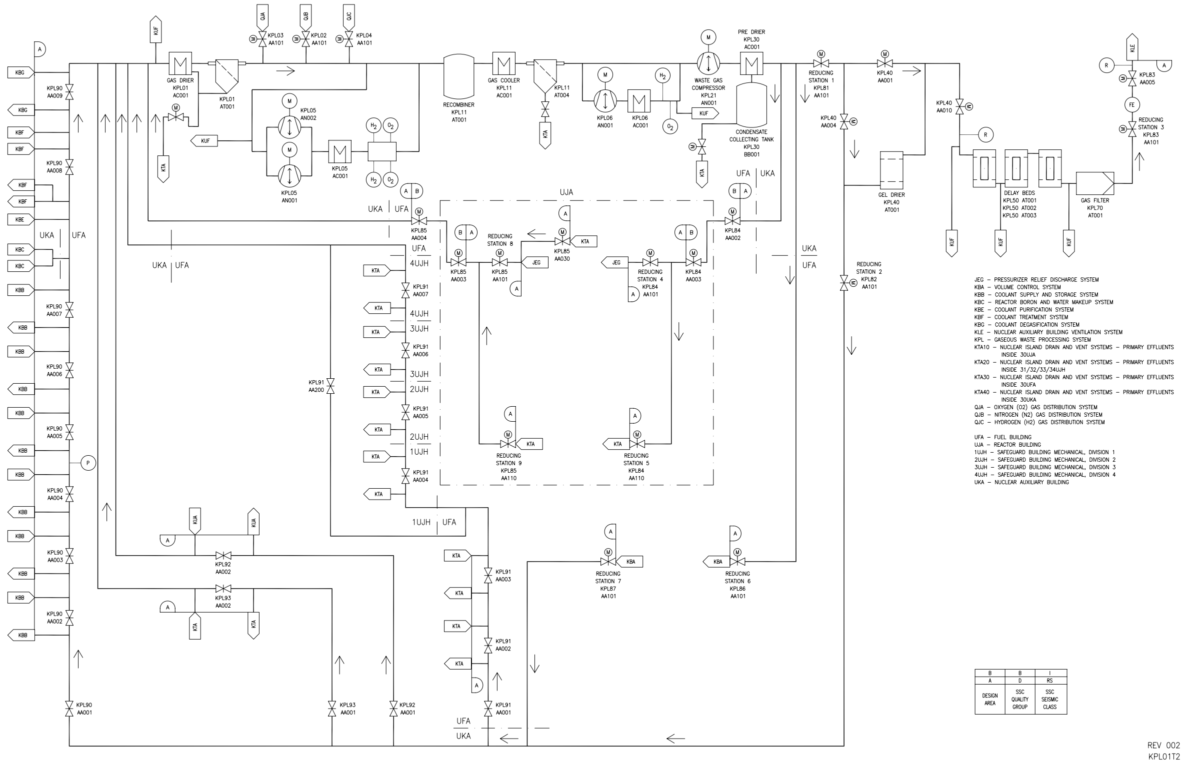
11.03-4

11.3.2.3.15 Measurement Cabinets

The measurement cabinets ~~are~~contain non-sparking gas analyzers that measure the concentration of hydrogen and oxygen in the sample of purge gas cooled by the measuring gas drier. The measuring circuit upstream of the recombiner has two measurement cabinets configured in parallel; the downstream measuring circuit has a single measurement cabinet. Each measurement cabinet contains one hydrogen sensor and one oxygen sensor. The hydrogen sensors and oxygen sensors in the upstream measurement cabinets each signal several different interlocks. The sensors provide a control signal that varies the position of the hydrogen and oxygen supply gas control valves to adjust the ratio of gases in the influent to the recombiner. Each sensor has an interlock with the hydrogen and oxygen supply gas quick-closing isolation valves to isolate these supplies of potentially explosive gases from the gaseous waste processing system. Each sensor also has an interlock with isolation valves from, or nitrogen blanket supply valves to, those connected components that are major sources of hydrogen (e.g., pressurizer relief tank, reactor coolant drain tank, coolant degasification system). Finally, each sensor has an interlock to shut down the recombiner. Each sensor also generates two warning signals, corresponding to the "high" and "high-high" setpoints for hydrogen or oxygen concentration. These signals annunciate both locally and in the main control room. The interlocks actuate when the hydrogen concentration exceeds four percent by volume, or when the oxygen concentration exceeds two percent by volume.

11.03-5 & 11.03-8

Figure 11.3-1—Gaseous Waste Processing System - Normal Operation



11.4 Solid Waste Management Systems

The solid waste management system treats both dry and wet solid radioactive wastes. This system consists of three subsystems: the solid waste processing and storage system (which treats dry solid wastes) and the radioactive concentrates processing system (which treats wet solid wastes). These subsystems provide the equipment and devices necessary for the collection, handling, treatment, and storage of the various forms of solid radioactive waste produced during operation of the plant, including anticipated operational occurrences (AOO). The solid waste management system reduces the total volume of waste material by compaction, shredding, and evaporation processes and provides temporary storage of waste materials prior to shipment offsite to licensed radioactive waste disposal facilities.

11.4.1 Design Basis

The function of the solid waste management system is to collect, treat and store various solid radioactive wastes produced in the plant. The solid waste management system is designed to meet RG 1.143 and NUREG-0800, BTP 11-3 (Reference 1). This system is designed to handle and process solid waste generated in the radiological controlled areas during power operation, maintenance, and refueling and to store this collected waste in selected storage rooms or areas in the Radioactive Waste Processing Building until shipment offsite. The Radioactive Waste Processing Building is designed to provide adequate shielding of stored waste to meet the dose rate criteria of 40 CFR Part 190 and 10 CFR 20.1302. Radioactive waste is packed and shipped in Department of Transportation (DOT)-approved containers in accordance with the requirements of 10 CFR Part 71, 49 CFR Part 173, and applicable state regulations. The collection, solidification, packaging, and storage of radioactive waste is performed to maintain potential radiation exposure to plant personnel during system operation or during maintenance to levels consistent with as low as reasonable achievable (ALARA) requirements, in accordance with NRC RG 8.8 and 10 CFR Part 20. The solid waste management system incorporates design features which address NRC concerns identified in SRP Appendix 11.4-A. This information can be found in Section 11.4.2.4. Additional information on the administrative and operational controls and surveillance requirements associated with the processing of radioactive solid waste is provided in the Process Control Program (See Section 11.4.3).

11.04-7

Consistent with the requirements of 10 CFR 20.1406, the U.S. EPR, including the solid waste management system, is designed to minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste. The solid waste management design includes items, identified in 10 CFR 50 Appendix I, that have demonstrated clean-up technology. This information can be found in Section 11.4.4. The solid waste management system also incorporates design features which address NRC concerns identified in IE Bulletin 80-10 as it

11.04-7 relates to cross contamination. Minimization of contamination and radioactive waste generation is described in Section 12.3.6.

11.4.1.1 Design Objectives

In addition to fulfilling its primary design functions, the solid waste management system meets the following design objectives:

- Collect radioactive concentrates from the liquid waste management system, ion exchange resins from the coolant purification system, and the spent resins from the liquid waste management system.
- Store coolant purification system spent resins until the activity level is reduced to a certain level. The resins are subsequently mixed with solid waste concentrates to reduce the overall activity level and then pumped into 55-gallon drums.
- Store solid wastes both before and after processing.
- Separate wet solid wastes and dry active wastes to avoid wetting dry active waste.
- Shred larger solid wastes before placing them into drums for compaction.
- Segregate storage of lower activity waste from storage of higher activity waste. Drums of solid waste are stored until the radioactivity is low enough for the waste to be transported offsite.

11.4.1.2 Design Criteria

The solid waste management system is subject to the following GDC in 10 CFR Part 50, Appendix A:

- GDC 60, which requires that nuclear power unit design include means to suitably control the release of radioactive materials in liquid effluents from the solid waste management system and to handle solid wastes produced during normal reactor operation, including AOOs. GDC 60 also requires that the design provide sufficient holdup capacity for retention of gaseous effluents containing radioactive materials.
- GDC 61, which requires in part that radioactive waste systems be designed to provide adequate safety under normal and postulated accident conditions. Radioactive waste systems must be designed with a capability to permit appropriate periodic inspection and testing of components important to safety; with suitable shielding for radiation protection; and with appropriate containment, confinement, and filtering systems.
- GDC 63, which requires that appropriate means be provided in radioactive waste systems and associated handling areas to detect conditions that may result in excessive radiation levels and to initiate appropriate safety actions.

11.4.1.2.1 Capacity

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The facilities in the Radioactive Waste Processing Building have the capacity to store ~~several years~~a minimum of 7.5 years' volume of solid waste (excluding dry active waste) resulting from plant operation. The solid wastes can be stored in one of two onsite storage areas in the Radioactive Waste Processing Building (see Figure 12.3-52). One area is a tubular shaft store for the higher activity drums and the other is a drum store for low activity drums. The storage area has a capacity of approximately 200 drums in the tubular shaft storage and approximately 350 drums in the drum store. When off-site disposal options for Class B and C wastes are not available, the U.S. EPR solid waste processing system provides the flexibility necessary to treat potential Class B and C waste types such that the final container for these wastes are 55-gallon waste drums. The normal container for some of these waste types is high-integrity container (HIC), however the solid waste management system is able to store these wastes in drums if necessary. Assuming that all of the waste (with the exception of dry active waste) is stored in 55-gallon drums and must be placed in the drum storage area or tubular shaft storage area, there would be 72.9 drums annually that would need to be stored. This results in a storage capacity of approximately 7.5 years.

Storage and offsite shipping of solid radioactive waste maintains exposure ALARA to personnel onsite or offsite under normal conditions or extreme environmental conditions, such as tornados, floods, or seismic events. The solid waste management system is designed with sufficient waste accumulation capacity and redundancy to allow temporary storage of the maximum generated waste during normal plant operation and AOOs.

The estimated annual volume of solid waste generated in the plant and shipped offsite is provided in Table 11.4-1—Estimated Solid Waste Annual Activity and Volume.

11.4.1.2.2 Quality Group Classification

Design criteria pertinent to systems classified as RG 1.143 safety classification RW-IIa (High Hazard) and tabulated in RG 1.143, Table 2 (Natural Phenomena and Internal/External Man-Induced Hazard), Table 3 (Design Load Combinations), and Table 4 (SSC Design Capacity Criteria) are used in design analyses of the solid waste management system. The quality classification of solid waste management system components is Quality Group D, as defined and described in Section 3.2.

11.4.1.2.3 Seismic Design Classification

The solid waste management system is classified as radwaste seismic (RS). Structures, systems, and components composing the solid waste management system that are classified as RG 1.143 safety classification RW-IIa (High Hazard) are designed to withstand a seismic loading equivalent to one-half the amplitude of the safe shutdown earthquake (SSE).

11.4.1.2.4 Controlled Releases

The radioactivity of the influents to the solid waste management system is based on estimated expected annual activity of primary influents as listed in Table 11.4-1. The activity values for concentrates, filters, spent resins, and sludge represent six months of decay to conservatively account for processing time and inprocess storage and handling time. The source terms and concentrations are consistent with Section 11.1.

The collection, solidification, packaging, and storage of radioactive waste are to be performed to maintain potential radiation exposure to plant personnel during system operation or during maintenance to as low as is reasonably achievable (ALARA) levels, in accordance with the intent of RG 8.8 in order to maintain personnel exposures well below 10 CFR Part 20 requirements. Design features include remote or semi-remote operations and shielding of equipment and storage areas to keep exposures within ALARA limits.

The radioactive concentrates processing system is designed to receive, prepare, and process radioactive concentrates and sludges. The evaporator concentrates and sludge generated in the liquid waste processing and storage system, as well as spent resins generated in the coolant purification system and the liquid waste processing system are treated in the radioactive concentrates processing system. After treatment, the waste are dried in the drums and stored in the drum store or the tubular shaft store. The system also has the capacity to pump resins to the demineralizer system for processing and disposal in a high integrity container (HIC). Those portions of the radioactive concentrates processing system that contain slurries are supplied with demineralized water connections for system flushing in accordance with NUREG-0800, BTP 11-3 (Reference 1).

Process monitors installed on the drum drying system detect in-process radiation levels to keep the operator informed of the process radiation levels, in accordance with GDC 61. In addition, area radiation monitors throughout the Radioactive Waste Processing Building detect excessive radiation levels and alert the operators to this condition, in accordance with GDC 63. Area radiation monitoring is addressed in detail in Section 12.3.4. The dried, filled solid waste drums are stored for a sufficient time to allow the short lived radionuclides to decay before shipping offsite in accordance with NUREG-0800, BTP 11-3 (Reference 1) and 10 CFR 61.55 and 61.56.

11.04-10

11.4.1.2.5 ~~Mobile Systems~~

~~The Radioactive Waste Processing Building is sized to provide space and support services for optional site-specific mobile or vendor-supplied processing equipment. Flexible hose or pipe used with site-specific mobile or vendor-supplied solid waste processing systems is subject to the hydrostatic test requirements in accordance with NUREG-0800, BTP 11-3 (Reference 1) and RG 1.143. However, such an optional~~

11.04-10 → ~~mobile or vendor-supplied system is a site-specific design feature that is outside the scope of the design certification.~~

11.4.2 System Description

11.4.2.1 Solid Waste Processing and Storage System (Dry Solid Waste)

The solid waste processing and storage system handles the waste generated in the different controlled areas of the plant independent from the plant operating conditions. Solid radioactive wastes consist of paper, plastic, cloth, wood, metal parts, worn-out items, concrete, glass, electrical parts, spent charcoal from the gaseous waste management system, and other potentially contaminated discarded materials generated throughout the controlled area. These wastes are collected, segregated, and treated according to their properties. The wastes are placed in different containers to simplify handling, storage, and transport of the waste in the plant. Typical waste containers used are plastic bags, drums, or bins, which are transferred and placed in interim storage areas of the Radioactive Waste Processing Building. Solid waste treatment facilities include the sorting box for sorting waste. This sorting box contains a shredder and a compactor for in-drum compaction of compressible waste.

Wastes are initially classified as combustible, compressible or noncombustible and noncompressible. Compressible waste is compacted to reduce its volume. The wastes are further segregated based on properties, sizes, materials, and activity of the waste material. Waste containing moisture is collected and stored separately to avoid wetting dry active waste and to allow short-term treatment to prevent decomposition and hydrogen formation.

The combustible and compressible wastes are transferred from the storage rooms to the treatment area (e.g., compaction and compression), placed into storage drums, and compacted for temporary storage. The noncombustible and noncompressible wastes (thick metal parts, for example) are transported to the hot workshop, fragmented, and transferred into a drum.

Drums containing low-level radioactive waste are stored in the drum store area of the Radioactive Waste Processing Building until they are ready to be transported to offsite disposal. Drums stored in the drum store area have an activity level low enough that they meet ALARA dose criteria. Tubular shaft storage is provided for higher-level radioactive waste such as filter cartridges and treated resin waste.

The solid waste management processing and storage system is shown in Figure 11.4-1—Solid Waste Management Flow Diagram. Table 11.4-14—Solid Waste Management System Component Data lists the major equipment ~~and corresponding nominal design parameters.~~ designed to comply with the codes and standards referenced in RG 1.143, Table 1. Tables are provided showing the expected and maximum annual activities by nuclide for the noncompressible, compressible, and waste brokers or specialized facilities and whether such wastes will be returned to the plant for disposal or shipped directly by the processor for disposal.

The waste characteristics shipped for disposal meet the requirements specified in 10 CFR 61.56. For the transfer and manifesting of radioactive waste shipped offsite, the requirements of Appendix G, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests," to 10 CFR Part 20, 10 CFR 20.2006, and 10 CFR 20.2108 will be met. Based on industry experience, the radioactive waste shipped offsite for disposal is expected to consist of 79 percent Class A, 11 percent Class B, and 10 percent Class C waste.

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The containers used for solid waste shipments meet the requirements of 49 CFR Parts 171-180 (Department of Transportation Radioactivity Material Regulations) and 10 CFR Part 71 (Packaging of Radioactive Materials for Transport). The solid waste system is designed to allow for the use of 55-gallon drums for shipment of evaporator concentrates, wastes collected from the centrifuge portion of the liquid waste processing system, sludge from the bottom of the liquid waste storage system storage tanks, spent resins from the coolant purification system, spent resins from the demineralizer system, spent filter cartridges, wet solid wastes, DAW (including spent charcoal, gel desiccants from the GWPS, and HEPA filters), and mixed wastes. Alternatively, DAW may be shipped in transportable cargo (e.g., SeaLand) containers, and HICs may be used for the shipment of spent resins from the coolant purification system, spent resins from the demineralizer system, wet wastes from the demineralizers, mixed wastes, spent filter cartridges, drummed evaporator concentrates, and drummed sludges.

Untreated solid waste is stored near its generating area until it is ready to be processed. If provisions for additional onsite storage become necessary (i.e., due to disposal site temporary unavailability), the guidance in NUREG-0800, Appendix 11.4-A, "Design Guidance for Temporary Storage of Low-Level Radioactive Waste" of Reference 2 is followed. Once treated, the solid waste, along with the treated concentrates, is shipped offsite in a HIC, transportable cargo container, or is stored in one of two onsite drum storage areas. One area is a tubular shaft store for the higher activity drums and the other is a temporary drum store for lower activity drums. Once the activity has reduced to a low enough level, the drums are transported to an NRC-licensed offsite disposal facility. Layout drawings of the packaging, storage, and shipping areas are provided in the radiation zone maps on Figures 12.3-52 through 12.3-58.

The vehicle entrance area of the Radioactive Waste Processing Building is provided with a 20-ton crane used for loading and removal of drums and other containers from a transport truck. A 2-ton capacity drum store crane serves to transfer the drums containing solid or dried liquid radioactive waste from the drum transfer position to the various storage places in the drum store and tubular shaft store or back. The drum

The radioactive concentrate processing system is subject to preoperational testing as described in Section 14.2. This testing confirms the design adequacy and performance of the radioactive concentrates processing system.

11.4.2.8 Instrumentation Requirements

The dose rate and nuclide content of a filled drum are measured by the drum measuring device of the radioactive waste concentrates processing system. Level instrumentation on the processing tanks in the solid waste management system provides accurate indications of tank volumes. High tank levels alarm locally and in the main control room to alert the operators of an abnormal system condition.

11.4.3 Radioactive Effluent Releases

Solid wastes are shipped offsite for burial at an NRC-licensed (per the requirements of 10 CFR Part 61) radioactive waste burial site. The containers used for solid waste shipments meet the requirements of 49 CFR Parts 171-180 (Department of Transportation Radioactivity Material Regulations) and 10 CFR Part 71 (Packaging of Radioactive Materials for Transport). Table 11.4-1 summarizes the annual total solid radioactive waste processed. The processes used to demonstrate compliance with GDC 13, GDC 63, and GDC 64, as they relate to monitoring and controlling radioactive releases during routine operations and accident conditions are described in Section 11.5.

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) 11.04-7 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 (Reference 1), ANSI/ANS-55.1-1992 (Reference 3) and Generic Letters 80-09 (Reference 4), 81-38 (Reference 5), and 81-39 (Reference 6). 11.04-14 NEI 07-10A PCP Template (Reference 10) 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.

11.4.4 Solid Waste Management System Cost-Benefit Analysis

In addition to meeting the numerical ALARA design objective dose values for effluents released from a light water reactor, 10 CFR Part 50, Appendix I, also requires that plant designs include additional items based on a cost benefit analysis. Specifically, the design must include items of reasonably demonstrated cleanup technology that, when added to the solid waste processing system sequentially and in order of diminishing

4. Generic Letters 80-09, "Low Level Radioactive Waste Disposal," U.S. Nuclear Regulatory Commission, January 1980.

5. Generic Letters 81-38, "Storage of Low Level Radioactive Wastes at Power Reactor Sites," U.S. Nuclear Regulatory Commission, November 1981.

6. Generic Letters 81-39, "NRC Volume Reduction Policy," U.S. Nuclear Regulatory Commission, November 1981.

7. NUREG/CR-2907, "Radioactive Materials Released from Nuclear Power Plants, Annual Report," Vol. 14, U.S. Nuclear Regulatory Commission, December 1995.

8. ANS/ANSI-18.1-1999, "American National Standard-Radioactive Source Term for Normal Operation of Light Water Reactors," American Nuclear Society/American National Standards Institute, September 21, 1999.

9. NUMARC/NESP-006, "The Management of Mixed Low-Level Radioactive Waste in the Nuclear Power Industry," Nuclear Management Resources Council, Inc., Washington, D.C., January 1990.

10. NEI 07-10A, "Generic FSAR Template for Process Control Program," Nuclear Energy Institute.

11.04-14

11.04-15

Table 11.4-1—Estimated Solid Waste Annual Activity and Volume
Sheet 1 of 2

Waste Type	Quantity (ft³)	Activity (Ci)		Shipping Volume (ft³)		Average Curies per ~~Package~~Container		Maximum Number of Containers
		Expected	Maximum	Expected	Maximum	Expected	Maximum	
Wet Solid Waste								
Evaporator Concentrates	710	1.50E+02	9.12E+03	-	140	7.81E+00	4.75E+02	19.2[1]
Coolant purification and spent fuel pool spent resins	90	1.07E+03	5.23E+04	90	90	1.07E+03	5.23E+04	1.0[2]
Demineralizer spent resins	140	2.96E+01	1.80E+03	140	140	1.85E+01	1.13E+03	1.6[2]
Demineralizer wet waste	8	1.69E+00	1.03E+02	8	8	1.69E+01	1.03E+03	0.1[2]
Centrifuge sludge	8	1.69E+00	1.03E+02	-	8	1.54E+00	9.36E+01	1.1[1]
Spent cartridge filters	120 (3.40 m³)	6.86E+02		120	120	5.28E+02		1.3[2]
Storage tank sludge	70	1.48E+01	9.00E+02	-	35	3.70E+01	2.25E+03	0.4[2]
Total Solid Waste (stored in drums)	1146	1.95E+03	6.50E+04	358	541			
Mixed Waste	2	4.00E-02	2.43E+00	2	2	0.13	8.10	0.3[1]

11.04-15

Table 11.4-1—Estimated Solid Waste Annual Activity and Volume
Sheet 2 of 2

Waste Type	Quantity (ft³)	Activity (Ci)		Shipping Volume (ft³)		Average Curies per ~~Package~~Container		Maximum Number of Containers
		Expected	Maximum	Expected	Maximum	Expected	Maximum	
Dry Active Waste								
Noncompressible DAW	70	2.97E-01	1.81E+01	70	70	2.97E+00	1.81E+02	0.1[3]
Compressible DAW	1415	6.01E+00	3.66E+02	707	707	4.29E+00	2.61E+02	1.4[3]
Combustible DAW	5300	3.19E+01	1.94E+03	5300	5300	6.02E+00	3.66E+02	5.3[3]
Total Dry Active Waste	6785	3.82E+01	2.32E+03	varies	varies	varies	varies	varies
Total								
Overall Totals	7933	1.99E+03	6.73E+04	varies	varies	varies	varies	varies

Notes:

1. 55 gal drum.
2. 8-120 HIC.
3. SEALAND.

Process and Effluent Radiation Monitors, as well as Figure 11.3-1—Gaseous Waste Processing System - Normal Operation, and Figure 11.3-2—Gaseous Waste Processing System - Gaseous Waste Sources.

The ODCM (see Section 11.5.2) includes the following information for each location subject to routine gaseous effluent sampling: the sampling frequency and the analytical process and sensitivity for selected radioanalytical methods and types of sampling media.

The gaseous effluent monitoring and sampling system has the following general characteristics:

- Noble gas activity is monitored with gamma and beta-sensitive detectors. The gross output of the monitor is periodically normalized to the radionuclide composition by performing a gamma-spectroscopic analysis on a representative grab sample.
- Aerosol activity is monitored with the use of an aerosol filter through which sample flow is continuously maintained. Aerosol particles are removed by the filter, which is monitored by a gamma-sensitive detector.
- Iodine activity is monitored by a dual filter for organic and inorganic iodine. Gamma-sensitive detectors monitor each filter.

For both aerosol and iodine monitoring, the gross outputs of the monitors are normalized by laboratory analysis of a duplicate set of filters installed in parallel with the primary ones. Measurement ranges of noble gas, aerosol, and iodine monitors are shown in Table 11.5-1—Radiation Monitor Detector Parameters. The gaseous effluent radiological monitoring and sampling for the vent stack does not perform automatic actions. The system monitors, records, and alarms in the control room if monitored radiation levels increase beyond specified setpoints.

The ODCM (see Section 11.5.2) contains the standard radiological gaseous effluent controls for the plant. This includes a description of how effluent release rates will be derived and parameters used in setting instrumentation alarm setpoints to control or terminate effluent releases in unrestricted areas that are above the effluent concentrations in Table 2 of Appendix B to 10 CFR Part 20. In addition, the ODCM describes how the guidance of NUREG-1301 (Reference 8) and NUREG-0133 (Reference 9) were used in developing the bases of alarm setpoints. NEI 07-09A (Reference 10) 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.

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11.5.3.2 Liquid Effluents

The liquid effluent radioactive waste monitoring and sampling system measures the concentration of radioactive materials in liquids released to the environment. Liquid radionuclide concentration levels are designed to comply with 10 CFR Part 20 and dose requirements specified in 10 CFR Part 50. Liquid radioactive waste is discharged in batches from waste monitoring tanks. Prior to release of a liquid radioactive waste from a monitoring tank, the system obtains a representative sample and the sample is radiochemically analyzed. The ODCM (see Section 11.5.2) includes the following information for each location subject to routine liquid effluent sampling: (1) the sampling frequency, and (2) the analytical process and sensitivity for selected radioanalytical methods and types of sampling media. Results of this analysis are used in conjunction with dilution factor data to determine a release setpoint for the liquid waste monitoring system. Two continuously operating radiation sensors monitor the release line from the monitoring tanks. If a set limit is exceeded or if the monitoring system is inoperable, the release is automatically terminated. To terminate a release, one of the radiation sensors closes both isolation valves.

The liquid effluent radioactive waste monitoring system functional location is shown on Figure 11.2-1. Measurement ranges of the liquid radioactive waste monitoring system are shown in Table 11.5-1. The ODCM contains the plant's standard radiological effluent controls. This includes a description of how liquid effluent release rates are derived and parameters used in setting instrumentation alarm setpoints to control or terminate effluent releases in unrestricted areas that are above the effluent concentrations in Table 2 of Appendix B to 10 CFR Part 20. In addition, the ODCM describes how the guidance of NUREG-1301 (Reference 8) and NUREG-0133 (Reference 9) were used in developing the bases of alarm setpoints. 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.

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11.5.4 Process Monitoring and Sampling

Process radiation monitoring detects, at an early stage, the escape of radioactive materials from radioactivity-containing systems into systems that are normally free of activity. Process radiation monitors generally operate continuously and provide both local and control room indication and alarm. Certain systems automatically initiate isolation actions along with control room alarm upon the detection of high radiation levels.

11.5.4.1 Main Steam Radiation Monitoring System

Radioactivity releases from the reactor coolant system (RCS) to the main steam system (nitrogen-16, noble gases) can occur because of steam generator tube leakage. Radioactivity in the main steam system is monitored over a wide power range by four redundant measuring arrangements per main steam line, for a total of 16 detectors for prevents radioactivity from escaping to the chilled water system except in the event of coincident failure of both of these barriers. The sampling point for extracting samples from this system for radiochemistry laboratory evaluation is provided in the return manifold of the chilled water system.

11.5.5 References

1. ANSI/HPS N13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," American National Standards Institute/Health Physics Society, 1999.

2. ANSI N42.18-2004, "Specifications and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents," American National Standards Institute, 2004.

3. NUREG-0800, BTP 7-10, "Guidance on Application of Regulatory Guide 1.97," Revision 5, U.S. Nuclear Regulatory Commission, March 2007.

4. NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, November 1980.

5. NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits and Manufacturing Licenses," U.S. Nuclear Regulatory Commission, March 1981.

6. Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program," U.S. Nuclear Regulatory Commission, January 1989.

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

8. NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors," U.S. Nuclear Regulatory Commission, April 1991.

9. NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, October 1978.

11.05-3

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

13.4 Operational Program Implementation

A COL applicant that references the U.S. EPR design certification will provide site-specific information for operational programs and schedule for implementation.

The following operational programs are described in the FSAR, and the COL applicant will verify or provide the implementation schedule:

- Inservice inspection program (refer to Section 5.2.4 and Section 6.6).
- Inservice testing program (refer to Section 3.9.6 and Section 5.2.4).
- Environmental qualification program (refer to Section 3.11).
- Preservice inspection program (refer to Section 5.2.4 and Section 6.6).
- Reactor vessel material surveillance program (refer to Section 5.3.1).
- Preservice testing program (refer to Section 3.9.6 and Section 5.2.4).
- Containment leakage rate testing program (refer to Section 6.2.6).
- Fire protection program (refer to Section 9.5.1).
- ~~Process and effluent monitoring and sampling program (refer to Section 11.5).~~ 11.04-14
- Motor-operated valve testing (refer to Section 3.9.6).
- Initial Test Program (refer to Section 14.2).

The following operational programs are described by the COL applicant, and the COL applicant will provide the implementation schedule:

- Non-licensed plant staff training program (refer to Section 13.2).
- Reactor operator training program (refer to Section 13.2).
- Reactor operator requalification program (refer to Section 13.2).
- Emergency planning (refer to Section 13.3).
- Security program (refer to Section 13.6).
- Quality assurance program–operation (refer to Section 17.5).
- Radiation protection program (refer to Section 12.5).
- Maintenance rule (refer to Section 17.6).
- Cyber security plan (refer to Section 13.6).

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- Process and effluent monitoring and sampling program (refer to Section 11.5).
- Process Control Program (PCP) (refer to Section 11.4).

Next File

CHAPTER 11 Radioactive Waste Management			
SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's regulations.		
11.2-AC-10	For an ESP application, the relevant requirement is limited to **Appendix I to 10 CFR Part 50**, such that the guidelines in Section II.A can be met.	N/A-ESP	N/A
11.2-SAC-01	The LWMS should have the capability to meet the dose design objectives and include provisions to treat liquid radioactive wastes such that the following is true:		
	A. The calculated annual total quantity of all radioactive materials released from each reactor at the site to unrestricted areas will not result in an estimated annual dose or dose commitment from liquid effluents for any individual in an unrestricted area from all pathways of exposure in excess of 0.03 millisievert (mSv) (3 millirem (mrem)) to the total body or 0.1 mSv (10 mrem) to any organ. **Regulatory Guides 1.109, 1.112, and 1.113** provide acceptable methods for performing this analysis.	Y	11.2.1 11.2.3.4 Table 11.2-6 11.02-4
	B. In addition to 1.A, the LWMS should include all items of reasonably demonstrated technology that, when added to the system sequentially and in order of diminishing cost-benefit return for a favorable cost-benefit ratio, can effect reductions in doses to the population reasonably expected to be within 80 kilometers (km) (50 miles (mi)) of the reactor. **Regulatory Guide 1.110** provides an acceptable method for performing this analysis.	Y	11.2.1 11.2.4 Tables 11.2-10 & 11.2-11

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	C. The concentrations of radioactive materials in liquid effluents released to unrestricted areas should not exceed the concentration limits in **Table 2, Column 2, of Appendix B, to 10 CFR Part 20**	Y 11.02-4	11.2.1 11.2.3.5 Table 11.2-7
11.2-SAC-02	The LWMS should be designed to meet the anticipated processing requirements of the plant. Adequate capacity should be provided to process liquid wastes during periods when major processing equipment may be down for maintenance (single failures) and during periods of excessive waste generation. Systems that have adequate capacity to process the anticipated wastes and that are capable of operating within the design objectives during normal operation, including anticipated operational occurrences, are acceptable. To meet these processing demands, interconnections between subsystems, redundant equipment, mobile equipment, and reserve storage capacity will be considered.	Y	11.2.1
11.2-SAC-03	The seismic design of structures housing LWMS components, the quality group classification of liquid radwaste treatment equipment, and provisions to prevent and collect spills from indoor and outdoor storage tanks should conform to the guidelines of **Regulatory Guide 1.143** for liquids and liquid wastes produced during normal operation and anticipated operational occurrences. For the purpose of this SRP, the dose limit cited in **Section 5 of Regulatory Guide 1.143**, addressing unmitigated releases of radioactive materials, is revised to be consistent with that of **10 CFR Part 20.1301**. The annual dose limit of Part 20.1301 is 100 mrem for members of the public located in unrestricted areas.	Y	11.2.1 11.2.1.2.2
11.2-SAC-04	System designs should contain provisions to control leakage and facilitate operation and maintenance in accordance with the guidelines of **Regulatory Guide 1.143** and industry standards cited in this regulatory	Y	11.2.2.5.2

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	guide for liquids and liquid wastes produced during normal operation and anticipated operational occurrences.		
11.2-SAC-05	System designs should describe features that will minimize, to the extent practicable, contamination of the facility and environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste, in accordance with the guidelines of **Regulatory Guide 1.143**, for liquids and liquid wastes produced during normal operation and anticipated operational occurrences, and the requirements of **10 CFR 20.1406**, or the DC application, update in the SAR, or the COL application, to the extent not addressed in a referenced certified design.	Y	11.2.1 12.3.6
11.2-SAC-06	For an ESP application, the dose estimates to a hypothetical maximally exposed member of the public from liquid effluents using radiological exposure models are developed based on **Regulatory Guides 1.109, 1.111, and 1.113**, and appropriate computer codes, such as the LADTAP II computer code (NUREG/CR-4013) for liquid effluents.	N/A-ESP	N/A
11.2-SAC-07	The relevant regulatory guides and Branch Technical Position are as follows:		
	1. **Regulatory Guide 1.110**, as it relates to performing a cost-benefit analysis for reducing cumulative dose to the population by using available technology.	Y 11.02-4	11.2.1 11.2.4 Tables 11.2-10 & 11.2-11
	2. **Regulatory Guide 1.112**, as it relates to the use of acceptable methods for calculating annual average releases of radioactive materials in liquid effluents.	Y	11.2.1 11.1.2.1

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	3. **Regulatory Guide 1.109**, as it relates to the use of acceptable methods for calculating annual doses to the maximally exposed individual in demonstrating compliance with **10 CFR Part 50, Appendix I** dose objectives.	Y 11.02-4	11.2.1 11.2.3.4 Table 11.2-6
	4. **Regulatory Guide 1.113**, as it relates to the use of acceptable methods for estimating aquatic dispersion and transport of liquid effluents in demonstrating compliance with **10 CFR Part 50, Appendix I** dose objectives.	Y	11.2.1 11.2.3.4 Table 11.2-6
	5. **Regulatory Guide 1.143**, as it relates to the seismic design and quality group classification of components used in the LWMS and structures housing the systems and the provisions used to control leakages of liquids and liquid wastes produced during normal operation and anticipated operational occurrences.	Y	11.2.1 11.2.1.2.2
	6. **Regulatory Guide 1.143**, as it relates to the definition of the boundary of the LWMS beginning at the interface from plant systems to the point of controlled discharge to the environment, as defined in the ODCM, or at the point of recycling to the primary or secondary water system storage tanks for liquids and liquid wastes produced during normal operation and anticipated operational occurrences.	Y	11.2.2 Figures 11.2-1, 11.2-2, & 11.2-3
	7. **Branch Technical Position BTP 11-6** as it relates to the assessment of a potential release of radioactive liquids following the postulated failure of a tank and its components, located outside of containment, and impacts of the release of radioactive materials at the nearest potable water supply, located in an unrestricted area, for direct human consumption or indirectly through animals, crops, and food processing.	Y	11.2.3.7 Table 11.2-8

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SRP Criterion	Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)	U.S. EPR Assessment	FSAR Section(s)
	A. The calculated annual total quantity of all radioactive materials released from each reactor to the atmosphere will not result in an estimated annual external dose from gaseous effluents to any individual in unrestricted areas in excess of 0.05 mSv (5 mrem) to the total body or 0.15 mSv (15 mrem) to the skin. **Regulatory Guides 1.109, 1.111, and 1.112** provide acceptable methods for performing this analysis.	Y 11.03-4	11.3.1 11.3.3.4 Table 11.3-5
	B. The calculated annual total quantity of radioactive materials released from each reactor to the atmosphere will not result in an estimated annual air dose from gaseous effluents at any location near ground level which could be occupied by individuals in unrestricted areas in excess of 0.01 cGy (10 millirads) for gamma radiation or 0.02 cGy (20 millirads) for beta radiation. **Regulatory Guides 1.109, 1.111, and 1.112** provide acceptable methods for performing this analysis.	Y	11.3.1 11.3.3.4 Table 11.3-5
	C. The calculated annual total quantity of radioiodines, carbon-14, tritium, and all radioactive materials in particulate form released from each reactor at the site in effluents to the atmosphere will not result in an estimated annual dose or dose commitment from such releases for any individual in an unrestricted area from all pathways of exposure in excess of 0.15 mSv (15 mrem) to any organ. **Regulatory Guides 1.109, 1.111, and 1.112** provide acceptable methods for performing this analysis.	Y 11.03-4	11.3.1 11.3.3.4 Table 11.3-5
	D. In addition to 1.A, 1.B, and 1.C, above, the GWMS should include all items of reasonably demonstrated technology that, when added to the system sequentially and in order of diminishing cost-benefit return, for a favorable cost-benefit ratio, can effect reductions in dose to the	Y	11.3.1 11.3.4 Tables 11.3-8 & 11.3-9

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	population reasonably expected to be within 80 km (50 mi) of the reactor. **Regulatory Guide 1.110** provides an acceptable method for performing this analysis.		
	E. The concentrations of radioactive materials in gaseous effluents released to an unrestricted area should not exceed the limits specified in **Table 2, Column 1, of Appendix B to 10 CFR Part 20**.	Y	11.03-4 11.3.1 11.3.3.5 Table 11.3-6
	F. The regulatory position contained in **Regulatory Guide 1.140** is met, as it relates to the design testing and maintenance of normal ventilation exhaust system air filtration and adsorption units at nuclear power plants	Y	11.3.1 9.4 11.3
	G. The regulatory position contained in **Regulatory Guide 1.143** is met; as it relates to the seismic design and quality group classification of components used in the structures housing the GRS and the provisions used to control leakages of gaseous wastes produced during normal operation and anticipated operational occurrences	Y	11.3 11.3.1.2.1 11.3.1.2.2
	H. The regulatory position contained in **Regulatory Guide 1.143** is met, as it relates to the definition of the boundary of the GWMS, beginning at the interface from plant systems to the point of controlled discharges to the environment as defined in the ODCM, or at the point of storage in holdup tanks or decay beds for gaseous wastes produced during normal operation and anticipated operational occurrences.	Y	11.3 Figures 11.3-1 & 11.3-2
11.3-SAC-02	The GWMS should be designed to meet the anticipated processing requirements of the plant. Adequate capacity should be provided to process gaseous wastes during periods when major processing	Y	11.3.1.2 11.3.2.2.2

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	gas analyzer which is continuously on stream is required. The continuous gas analyzer should be located at a point common to streams and measured sequentially (i.e., the analyzer should be sampling the combined stream).		
	Gas analyzers should have daily sensor checks, monthly functional checks, and quarterly calibrations. Gas analyzers installed in systems designed to withstand a hydrogen explosion should be capable of withstanding a hydrogen explosion; gas analyzers installed in the systems not designed to withstand a hydrogen explosion need not be capable of withstanding a hydrogen explosion (similar requirements apply to radiation monitors which are internal to lines containing potentially explosive mixtures). All gas analyzer instrumentation systems shall be non-sparking.	Y	11.3.2.3.15
11.3-SAC-07	**Branch Technical Position (BTP) 11-5**, as it relates to potential releases of radioactive materials (noble gases) as a result of postulated leakage or failure of a waste gas storage tank or off-gas charcoal delay bed.	Y	11.3.3.6
11.3-SAC-08	For an ESP application, the dose estimates to a hypothetical maximally exposed member of the public from gaseous effluents using radiological exposure models are developed based on **Regulatory Guides 1.109 and 1.111**, and appropriate computer codes, such as the GASPAR II computer code (NUREG/CR-4653) for gaseous effluents.	N/A-ESP	N/A
SRP 11.4	**Solid Waste Management System (R3, 03/2007)**		
11.4-AC-01	**10 CFR 20.1302** and **10 CFR 20.1301(e)**, as they relate to radioactive materials released in gaseous and liquid effluents to unrestricted areas.	Y 11.04-7 →	11.4.1

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	These criteria apply to releases resulting from SWMS operation during normal plant operations and anticipated operational occurrences.		11.5.1.2 11.5.3.1 11.5.3.2 Tables 11.2-7 & 11.3-6
11.4-AC-02	**10 CFR 20.1406**, as it relates to the design and operational procedures (for applications other than license renewals, after August 20, 1997) for minimizing contamination, facilitating eventual decommissioning, and minimizing the generation of radioactive waste.	Y	11.4.1 12.3.6
11.4-AC-03	**10 CFR 50.34a**, as it relates to the provision of sufficient information to demonstrate that design objectives for equipment necessary to control releases of radioactive effluents to the unrestricted areas are kept as low as reasonably achievable.	Y	11.4.1.2.1 11.4.1.2.4 11.4.2.4
11.4-AC-04	**10 CFR Part 50, Appendix I, Sections II.A, II.B, II.C, and II.D**, as they relate to the numerical guides for dose design objectives and limiting conditions for operation to meet the ALARA criterion.	Y 11.04-7	11.4.1 11.4.4 Tables 11.2-6 & 11.3-5 Tables 11.2-10 & 11.3-8
11.4-AC-05	**40 CFR Part 190** (the U.S. Environmental Protection Agency (EPA), generally applicable environmental radiation standards, as implemented under **10 CFR 20.1301(e)**), as it relates to limits on total annual doses from all sources of radioactivity and radiation from the site (with single or multiple units).	Y	11.4.1 11.5.1.2 Tables 11.2-6 & 11.3-5

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
11.4-AC-06	**Appendix A to 10 CFR Part 50, General Design Criterion (GDC) 60**, as it relates to the design of the SWMS to control the release of radioactive materials in liquid effluents from the SWMS and to handle solid wastes produced during normal plant operation, including anticipated operational occurrences.	Y	11.4.1.2
11.4-AC-07	**GDC 61**, as it relates to the ability of systems that may contain radioactivity to assure adequate safety under normal and postulated accident conditions.	Y	11.4.1.2
11.4-AC-08	**GDC 63**, as it relates to the ability of the SWMS to detect conditions that may result in excessive radiation levels and to initiate appropriate safety actions.	Y	11.4.1.2 11.4.1.2.4
11.4-AC-09	**10 CFR 61.55** and **10 CFR 61.56**, as they relate to classifying, processing, and disposing of dry solid and wet wastes at approved low-level radioactive waste disposal sites.	N/A-COL	11.4.1.2.4 11.4.3
11.4-AC-10	**10 CFR 20.2006** and **Appendix G to 10 CFR Part 20**, as they relate to the requirements for transferring and manifesting radioactive materials shipments to authorized facilities (e.g., disposal sites, waste processors).	N/A-COL 11.04-7	11.4.2.4 11.4.3
11.4-AC-11	**10 CFR 20.2007**, as it relates to compliance with other applicable Federal, State, and local regulations governing any other toxic or hazardous properties of radioactive wastes, such as mixed wastes characterized by the presence of hazardous chemicals and radioactive materials, that may be disposed under 10 CFR Part 20.	N/A-COL	11.4.3
11.4-AC-12	**10 CFR 20.2108**, as it relates to the maintenance of waste disposal records until the NRC terminates the pertinent license requirements.	N/A-COL	11.4.2.4 11.4.3

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
11.4-AC-13	**10 CFR Part 71 and 49 CFR Parts 171–180**, as they relate to the use of approved containers and packaging methods for the shipment of radioactive materials. 11.04-7 →	~~N/A-COL~~Y	11.4.1 11.4.2.4 11.4.3
11.4-AC-14	**49 CFR 173.443**, as it relates to methods and procedures used to monitor for the presence of removable contamination on shipping containers, and **49 CFR 173.441**, as it relates to methods and procedures used to monitor external radiation levels for shipping containers and vehicles.	N/A-COL	11.4.3
11.4-AC-15	**10 CFR 52.47(b)(1)**, which requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations;	ITAAC	Tier 1 FSAR 14.3
11.4-AC-16	**10 CFR 52.80(a)**, which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's regulations.	N/A-COL	N/A
11.4-SAC-01	The SWMS design parameters are based on expected radionuclide distributions and concentrations consistent with reactor operating	Y	11.4.1.2.4 Table 11.4-1

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	experience for similar designs, as evaluated under SRP Section 11.1.		
11.4-SAC-02	Processing equipment is sized to handle the design SWMS inputs, that is, the types of liquid, wet, and solid wastes; radionuclide distributions and concentrations; radionuclide removal efficiencies and decontamination factors; waste volume reduction and increase factors; waste volumes; and waste generation rates.	Y	11.4.1.2.1 Table 11.4-1
11.4-SAC-03	All liquid and wet wastes will be stabilized in accordance with a PCP before offsite shipment, or provisions will be made to verify the absence of free liquid in each container and procedures to reprocess containers in which free liquid is detected in accordance with the requirements of **Branch Technical Position (BTP) 11-3**.	Y	11.4.1 11.4.2.4
		N/A-COL	11.4.3
11.4-SAC-04	Other forms of wet wastes will be stabilized or dewatered (subject to the licensed disposal facility's waste acceptance criteria) in accordance with a PCP, or provisions will be made to verify the absence of free liquid in each container and procedures to reprocess containers in which excess water is detected in accordance with the requirements of **BTP 11-3**.	Y	11.4.1
		N/A-COL	11.4.3
11.4-SAC-05	SWMS design objectives, design criteria, treatment methods, expected effluent releases, process and effluent radiation monitoring and control instrumentation, and methods for establishing process and effluent instrumentation control set points, as they relate to the PCP and ODCM under this SRP Section and SRP Section 11.5.	Y	11.4.1 11.5.1 11.5.2
		N/A-COL	11.4.3 11.5.2
11.4-SAC-06	Waste containers, shipping casks, and methods of packaging wastes meet all applicable Federal regulations (e.g., **10 CFR Part 71**, addressing the packaging and transportation of radioactive materials; **10 CFR**	Y 11.04-7 →	11.4.1 11.4.2.6 11.4.2.4

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	20.2006 and **Appendix G to 10 CFR Part 20**, addressing the transfer and manifesting of radioactive waste shipments; and **49 CFR Parts 171–180**, addressing U.S. Department of Transportation (DOT) regulations for the shipment of radioactive materials); and **10 CFR Part 61** or corresponding State regulations addressing applicable waste acceptance criteria of the disposal facility or waste processors.	N/A-COL	11.4.3
11.4-SAC-07	Onsite waste storage facilities provide sufficient storage capacity to allow time for shorter lived radionuclides to decay before shipping in accordance with the requirements of **BTP 11-3**. The SAR should give the bases for determining the duration of the storage.	Y	11.4.1.2.1 11.4.1.2.4 11.4.2.3.1
11.4-SAC-08	SWMS components and piping systems, as well as structures housing SWMS components, are designed in accordance with the provisions of **Regulatory Guide 1.143**, as it relates to the seismic design and quality group classification of components, and **BTP 11-3** for wastes produced during normal operation and anticipated operational occurrences.	Y	11.4.1 11.4.1.2.2 11.4.1.2.3
11.4-SAC-09	The SWMS contains provisions to reduce leakage and facilitate operations and maintenance in accordance with the provisions of **Regulatory Guide 1.143** and **BTP 11-3**, as they relate to wastes produced during normal operation and anticipated operational occurrences.	Y	11.4.1
11.4-SAC-10	For long-term onsite storage (e.g., for several years, but within the operational life of the plant), the storage facility should be designed to the guidelines of **Appendix 11.4-A** to this SRP section, including updated guidance from **SECY 93-323** and **SECY 94-198**.	Y 11.04-7 →	11.4.1 11.4.2.4
		N/A-COL	11.4.3
11.4-SAC-11	Liquid, wet, and dry solid wastes will be processed and disposed of in	N/A-COL	11.4.3

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SRP Criterion	**Description (AC – Acceptance Criteria Requirement, SAC – Specific SRP Acceptance Criteria)**	**U.S. EPR Assessment**	**FSAR Section(s)**
	accordance with **10 CFR 61.55** and **10 CFR 61.56** requirements for waste classification and characteristics and with the waste acceptance criteria of the chosen licensed radioactive waste disposal site. The PCP should present the process and methods used to meet these **10 CFR Part 61** requirements.		
11.4-SAC-12	Mixed wastes (characterized by the presence of hazardous chemicals and radioactive materials) will be processed and disposed in accordance with **10 CFR 20.2007**, as it relates to compliance with other applicable Federal, State, and local regulations governing any other toxic or hazardous properties of radioactive wastes.	N/A-COL	11.4.3
11.4-SAC-13	All effluent releases (gaseous and liquid) associated with the operation (normal and anticipated operational occurrences) of the SWMS will comply with **10 CFR Part 20** and **Regulatory Guide 1.143**, as they relate to the definition of the boundary of the SWMS beginning at the interface from plant systems, including multiunit stations, to the points of controlled liquid and gaseous effluent discharges to the environment or designated onsite storage locations, as defined in the PCP and ODCM.	N/A-COL 11.04-7 →	11.4.3 11.5.2
11.4-SAC-14	Operational Programs. For COL reviews, the description of the operational program and proposed implementation milestone for the PCP aspect of the Process and Effluent Monitoring and Sampling Program are reviewed in accordance with **10 CFR 20.1301** and **10 CFR 20.13.2**, **10 CFR 50.34a**, **10 CFR 50.36a**, and **10 CFR 50, Appendix I, section II and IV**. Its implementation is required by a license condition.	N/A-COL	11.4.3
SRP 11.5	**Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems (R4, 03/2007)**		