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Your ref: Docket No. 52-006
Our ref: DCP/NRC2257

September 9, 2008

Subject: AP1000 Response to Request for Additional Information (SRP12)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 12. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in the response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

A response is provided for RAI-SRP12.1-CHPB-01 and RAI-SRP12.2-CHPB-01 and -02, as sent in an email from S.K. Mitra to Sam Adams dated May 16, 2008. This response completes all requests received to date for SRP Section 12.

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

D.A. Lindgren /FOR

Robert Sisk, Manager
Licensing and Customer Interface
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/Enclosure

1. Response to Request for Additional Information on SRP Section 12

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NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 12

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP12.1-CHPB-01
Revision: 0

Question:

Describe specific examples of the design and operational considerations which demonstrate compliance with 10CFR20.1406? Please identify add these considerations to the appropriate DCD sections in the AP1000DCD and provide the basis for these considerations.

The staff has developed Regulatory Guide 4.21 (issued in draft as DG-4012) in order to provide guidance to the industry on how to meet the requirements of 10 CFR 20.1406 with respect to minimizing, 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.

Included in this guidance are design and operational objectives, such as the following:

1. Minimize leaks and spills and provide containment in areas where such events may occur,
2. Provide for adequate leak detection capability to provide prompt detection of leakage for any structure, system, or component which has the potential for leakage,
3. Use leak detection instrumentation capable of detecting minor leaks in areas where it is difficult or impossible to conduct regular inspections (such as for spent fuel pools, tanks that are in contact with the ground, and buried, embedded, or subterranean piping) to avoid release of contamination from undetected leaks,
4. Reduce the need to decontaminate equipment and structures by decreasing the probability of any release, reducing any amounts released, and decreasing the spread of the contaminant from the source,
5. Provide for early detection of leakage and contamination migration to minimize contamination of the environment,
6. Periodically review operational practices to ensure that, operating procedures are revised to reflect the installation of new or modified equipment, personnel qualification and training are kept current, and facility personnel are following the operating procedures,
7. Facilitate decommissioning by a) maintenance of records relating to facility design and construction, facility design changes, site conditions before and after construction, onsite waste disposal and contamination and results of radiological surveys, b) minimizing embedded and buried piping, and c) designing the facility to facilitate the removal of any equipment and/or components that may require removal and/or replacement during facility operation or decommissioning,
8. Minimize the generation and volume of radioactive waste both during operation and during decommissioning (by minimizing the volume of components and structures that become contaminated during plant operation)

9. Develop a conceptual site model (based on site characterization and facility design and construction) which will aid in the understanding of the interface with environmental systems and the features that will control the movement of contamination in the environment,
10. Evaluate the final site configuration after construction to assist in preventing the migration of radio-nuclides offsite via unmonitored pathways,

a) Using the guidance provided by Appendix A of RG 4.21, for all of the listed design objectives (numbers 1-5, 7 b & c, and 8), provide (in Section 12.3 or other appropriate section of the DCD) several examples of AP1000 design features that illustrate how each of these objectives are met by the AP1000 design. For those objectives which are more operational (numbers 6 and 7 a) or procedural (numbers 9 and 10) in nature, describe how these will be addressed in the DCD as COL action items.

b) The information presented in DCD Tier 2, Rev. 16, Section 12.1-12.5, identifies some AP1000 general design features that would minimize the contamination of the facility and environment and would minimize the generation of radioactive waste. However, this information does not address design features that are unique to system designs or their locations in the plant warranting more technical details, and do not identify those that should be addressed as COL action items. For each of the systems listed below (and for any other plant systems which may generate radioactive waste), describe specific design features which are incorporated into the AP1000 design to comply with the requirements of 10 CFR 20.1406.

Nuclear Steam Supply
Fuel Storage and Handling
Condensate Storage and Transfer System
Process Sampling System
Equipment, Floor, Chemical, and Detergent Drain Systems
Building heating, ventilating and air conditioning systems used to process radioactive process and effluent streams
Turbine Main Steam System
Other Features of Steam and Power Conversion System

List these specific design features in the appropriate section of the DCD where the system is described and include a reference to these sections in Chapter 12.1 of the DCD.

1) Describe any design features to detect leakage (large acute or small, long term) from the piping in the radwaste trenches.

2) Describe the criteria which govern the frequency of performing periodic visual inspections of the piping in the radwaste pipe trenches to check for leaks and of the floor/wall expansion joints in the radwaste pipe trenches to ensure that no spills or leaks on the floors enter unmonitored areas beneath the floors and foundations.

3) Verify that there are no piping runs containing contaminated fluids that will be buried in the ground and not routed through one of the radwaste trenches.

Westinghouse Response:

Numbering of the following major sections (a, b, then 1), 2), 3)) corresponds to the RAI text above.

a) In an effort to ensure compliance of the standard AP1000 plant design with 10CFR20.1406, Westinghouse provided Reference 1 in advance of issuance of regulatory guidance. Table TR98-1 of that reference provides specific examples of AP1000 compliance with 10CFR20.1406. Specific examples in that table include:

Table RAI-SRP12.1-CHPB-01-1

Item above		Item in Table TR98-1
Design Items		
1	Minimize leaks and spills and provide containment in areas where such events may occur,	2, 5, 6, 14, 15, 22, 25, 26
2	Provide for adequate leak detection capability to provide prompt detection of leakage for any structure, system, or component which has the potential for leakage,	11, 15, 22, 23, 24, 25, 26, 27, 28
3	Use leak detection instrumentation capable of detecting minor leaks in areas where it is difficult or impossible to conduct regular inspections (such as for spent fuel pools, tanks that are in contact with the ground, and buried, embedded, or subterranean piping) to avoid release of contamination from undetected leaks,	15, 23, 24, 26, 27
4	Reduce the need to decontaminate equipment and structures by decreasing the probability of any release, reducing any amounts released, and decreasing the spread of the contaminant from the source,	1, 2, 3, 4, 6, 8, 9, 10, 12, 21
5	Provide for early detection of leakage and contamination migration to minimize contamination of the environment,	6, 15, 22, 23, 24, 26, 27
7b	Facilitate decommissioning by… b) minimizing embedded and buried piping	11, 23, 26, 27
7c	Facilitate decommissioning by… c) designing the facility to facilitate the removal of any equipment and/or components that may require removal and/or replacement during facility operation or decommissioning,	10, 16

Table RAI-SRP12.1-CHPB-01-1		
	Item above	**Item in Table TR98-1**
8	Minimize the generation and volume of radioactive waste both during operation and during decommissioning (by minimizing the volume of components and structures that become contaminated during plant operation)	1, 2, 3, 6, 7, 13, 16, 17
Operational and Procedural Items		
6	Periodically review operational practices to ensure that, operating procedures are revised to reflect the installation of new or modified equipment, personnel qualification and training are kept current, and facility personnel are following the operating procedures,	32
7a	Facilitate decommissioning by a) maintenance of records relating to facility design and construction, facility design changes, site conditions before and after construction, onsite waste disposal and contamination and results of radiological surveys	32
9	Develop a conceptual site model (based on site characterization and facility design and construction) which will aid in the understanding of the interface with environmental systems and the features that will control the movement of contamination in the environment,	30
10	Evaluate the final site configuration after construction to assist in preventing the migration of radio-nuclides offsite via unmonitored pathways,	30, 31

b) Specific features of systems can be found in the following items of Reference 1 Table TR98-1:

Table RAI-SRP12.1-CHPB-01-2	
System	**Item in Table TR98-1**
Nuclear Steam Supply	1, 2, 3, 10, 12, 14
Fuel Storage and Handling	1, 3, 4, 15
Condensate Storage and Transfer System	1, 3, 25; not anticipated to be a significant area of contamination in a PWR
Process Sampling System	1, 2, 3; DCD Section 9.3.3
Equipment, Floor, Chemical, and Detergent Drain Systems	1, 2, 16, 17, 18, 22, 23, 26, 28, 29
Building heating, ventilating and air conditioning systems used to process radioactive process and effluent streams	1, 2; DCD Section 9.4

Table RAI-SRP12.1-CHPB-01-2	
System	**Item in Table TR98-1**
Turbine Main Steam System	1, 2; not anticipated to be a significant area of contamination in a PWR
Other Features of Steam and Power Conversion System	1, 2; not anticipated to be a significant area of contamination in a PWR

1) Three areas of the AP1000 might be considered "radwaste trenches":
    - The radwaste discharge piping to the environment, which is discussed in Reference 1 Table TR98-1 item 27. This piping is largely site-specific
    - The drain piping between the Annex Building hot sinks, hot showers, and decontamination basin and the Auxiliary Building. This piping is discussed in Reference 1 Table TR98-1 item 26.
    - The process and drain piping between the Radwaste Building mobile equipment connections and floor drains and the Auxiliary Building. This piping is discussed in Reference 1 Table TR98-1 item 26.
2) The development of inspection program to detect and record leakage into the radwaste trenches will be developed as discussed in DCD section 12.3.5.4.
3) No piping containing radioactive fluid is directly buried in the ground. Floor drain piping for the lowest elevation of the buildings is embedded in the basemat, and to the extent practical this piping is normally empty as it is sloped to drain to the sump.

Reference:

1. APP-GW-GLN-098 Rev. 0, "Compliance with 10CFR20.1406", April 5, 2007

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP12.2-CHPB-01
Revision: 0

Question:

In its review of DCD Section 12.2, the staff identified areas in which additional information was necessary to complete its evaluation of the applicant's change. In tier 2 DCD Section 11.2, the staff noted that a potential exists for the quantity of the radionuclides in the radwaste building portion of the liquid waste management system to exceed the A_1 value., The description of the sources listed for liquid waste tanks does not indicate an increase in volume approximately 45,000 gallons and hence increase the overall radioactivity which would thereby be a larger source of occupational radiation to personnel in the radwaste building. The Westinghouse TR-116, Document APP-GW-GLN-116, "*Additional Liquid Radwaste Monitor Tanks and Radwaste Building Extension*," Revision 0, describes the changes to the radwaste building and the addition of the three liquid radwaste monitor tanks. In Tier 2, Figure 12.3-1 (Sheet 14 of 16), Radiation Zones, Normal Operation/Shutdown Radwaste Bldg EL 100'-0" indicates that the room (Rm No. 50355) that the tanks will be located in are Plant Radiation Zone 1, which is defined by Figure 12.3-1 (Sheet 1 of 16) as *Very Low or No radiation Sources: "Inside Controlled Area" and Outside "Restricted Area"*. There are no supporting calculations to show that the tanks when full, will result in a dose rate of less than or equal to 0.25 millirem per hour.

Provide a complete description of the how the placement of three additional liquid waste monitor tanks and associated equipment in the radwaste building meets the acceptance criteria of SRP 12.2.

Describe the effect on occupational exposures in and adjacent to the radwaste building. Include this information in the DCD and provide a markup of the text and appropriate revised radiation zone maps in your response.

Westinghouse Response:

The monitor tanks were added to the radwaste building in order to provide flexibility in timing of discharges for varying environmental conditions. As such, the primary use of these tanks is to contain processed water, which will normally have very low radionuclide content.

However, it is acknowledged that the potential for these tanks to contain sufficient radionuclide content for the area to exceed Plant Radiation Zone I exists.

We have therefore reassessed the radiological content of these tanks, assuming design basis RCS coolant activities as provided in DCD Table 11.1-2, and assuming decontamination factors accepted for use in our previous GALE code analysis as provided in DCD Table 11.2-5. Under these assumptions, the room containing the tanks is considered Plant Radiation Zone III.

The position of the tanks and the shielding provided in the radwaste building will be established to ensure that the radiological conditions in adjacent areas are acceptable, such that no other DCD changes are anticipated.

Design Control Document (DCD) Revision:
On Tier 2 Figure 12.3-1, Sheet 14 of 16, room number 50355 changes from Zone I to Zone III. This change will be incorporated into DCD Revision 17.

PRA Revision:
None

Technical Report (TR) Revision:
APP-GW-GLN-116 will be revised to show the change discussed above.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP12.2-CHPB-02
Revision: 0

Question:

In DCD Section 9.1.2.1, Design Basis, the applicant increased the overall capacity of the Spent Fuel Storage from the proposed storage locations for 619 fuel assemblies to storage locations for 884 fuel assemblies. The staff noted that the additional fuel assemblies were not addressed in DCD Section 122.1.2.3, "Spent Fuel," nor included in Table 12.2-25, "Fuel Handling Area Airborne Radioactivity Concentrations." The addition of potentially 265 fuel assemblies with 0.25% fuel defects would increase the airborne radioactivity. Moreover, in Table 12.2-25, the applicant did not identify the basis of its parameters included in Table 12.2-24 for the number of Fuel assemblies or burn-up assumptions used in its calculations.
Provide a complete description of the potential radiological effects associated with the addition of 265 additional fuel assemblies in the spent fuel pool and its associated airborne radioactivity. Include this information in the DCD and provide a markup in your response.

Westinghouse Response:

The spent fuel discussion in DCD section 12.2.1.2.3 is a general discussion of fuel assembly characteristics, and is not affected by increasing the amount of fuel stored in the spent fuel pool.

The evaluation of the airborne radioactivity concentrations in the fuel handling area, discussed in Table 12.2-24 and with associated concentrations provided in Table 12.2-25, assumed a full core offload, with the offloaded core having 0.25% fuel defects. The newly offloaded fuel with this high fuel defect level dominates the releases to the pool water and therefore the airborne concentration.

Most of the key parameters and assumptions for the evaluation of the fuel handling area are given in DCD table 12.2-24. Other inputs to the evaluation were:

- full core offload. As shown in the DCD table, reactor vessel head removal was assumed at 100 hours after shutdown, and completion of core offload at 10 days (i.e., 340 hours after shutdown),
- spent fuel pool purification rate of 250 gpm.

The evaluation of the concentrations in the spent fuel water conservatively assume instantaneous and complete mixing of the primary coolant activity (at 100 hours after shutdown) with the refueling water and spent fuel pit water. That is, no credit was taken for purification or cleanup of the primary coolant prior to cavity flooding and dilution.

Removal of activity from the spent fuel water by the SFP demineralizers, evaporation from the spent fuel pit, and radioactive decay are considered in arriving at the concentrations throughout the refueling period and during subsequent power operation.

The maximum airborne activity concentrations in the fuel handling area are listed in Table 12.2-25 of the DCD. These values are based on only the fuel from the recent full core offload, and thus that table was not impacted by the increase in number of fuel assemblies to the spent fuel pit.

In general, evaluating only the recent full core offload and ignoring the fuel accumulated from previous outages is a good assumption, because isotopes are either effectively removed by the spent fuel pool demineralizers or have half-lives sufficiently short as to have negligible contribution. The one exception is considered to be the long-lived Kr-85, for which the activity concentrations may build up with subsequent refueling outages, since the dominant removal mechanism is decay rather than demineralization or evaporation. However, for this effect to be significant, it would be necessary to assume long term operation (many fuel cycles) with 0.25% fuel defects. Since this degree of fuel defects challenges the Technical Specification limit, such long-term operation is not considered a reasonable assumption.

However, we will perform a detailed review to ensure that the values published in the DCD remain conservative with this assumption. This review will be completed by January 31, 2009. If necessary we will revise this response at that time.

Design Control Document (DCD) Revision:
Table 12.2-24 will be expanded to provide additional information as shown below.

Table 12.2-24

PARAMETERS AND ASSUMPTIONS USED FOR CALCULATING FUEL HANDLING AREA AIRBORNE RADIOACTIVITY CONCENTRATIONS

Parameter/Assumption	Value
<u>Assumed fuel load</u>	<u>Full core offload</u>
Ventilation flow through fuel handling area(1)	17,000 cfm(2)
Iodine filter efficiency	0
Particulate filter efficiency	0.99
Fuel handling area free air volume	200,000 ft^3
Fuel defects	0.25%
Time from shutdown to reactor vessel head removal	100 hours
Refueling time	10 days
<u>Spent fuel pool purification flowrate</u>	<u>250 gpm</u>
Decontamination factors of mixed-bed demineralizer for spent fuel pool purification system:	
Iodines	100
Cs and Rb	2
Others	50
Spent fuel pool temperature	120°F
Evaporation rate of spent fuel pool water	486 lbs/hr
Spent fuel pool tritium concentration	1.0 μCi/g

<u>Notes:</u>
1. This flow rate is defined as the sum of the fuel area exhaust fan flows minus the rail car bay/solid radwaste system exhaust flow.
2. This is the nominal expected ventilation flow rate. For conservatism, the calculated airborne radioactivity concentrations are based on a 10% lower flow rate.

Changes to Table 12.2-25 are not anticipated but will be considered after more detailed review.

PRA Revision:
None

Technical Report (TR) Revision:
None