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Your ref: Docket No. 52-006
Our ref: DCP/NRC2256

September 9, 2008

Subject: AP1000 Response to Request for Additional Information (SRP11.2)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 11.2. 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-SRP11.2-CHPB-01,-02,-03,-06 and -07, 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 11.2.

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
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/Enclosure

1. Response to Request for Additional Information on SRP Section 11.2

DO63
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 11.2

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP11.2-CHPB-01
Revision: 0

Question:

The revision to section 11.2.3.3, Dilution Factor, omitted compliance with the annual offsite dose limits in 10 CFR 50 Appendix I. The DCD states that the plant operator will select dilution flow rates to ensure that the effluent concentration limits of 10 CFR 20 and any local requirements are continuously met. Plant operators must also ensure that the annual releases are within the dose limits of Appendix I which in some situations may be the limiting case. Please revise this section of the DCD to include compliance with 10 CFR 50 Appendix I, Section II.A.

Westinghouse Response:

Although no reference to 10 CFR 50 Appendix I was included in this subsection of the certified DCD Revision 15, there is no objection to including it. This paragraph will be revised as shown below.

Design Control Document (DCD) Revision:

11.2.3.3 Dilution Factor

The dilution factor provided for the activity released is site dependent; the value of 6000 gpm used herein is based on cooling tower blowdown requirements and is expected to be conservatively low. The plant operator will select dilution flow rates to ensure that the effluent concentration limits of 10 CFR Part 20, the annual offsite dose limits in 10 CFR 50 Appendix I, and any local requirements are continuously met. If the available dilution is low, the discharge rate can be reduced to maintain acceptable concentrations.

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP11.2-CHPB-02
Revision: 0

Question:

The revision of section 11.2.3.5 states that the estimated doses from liquid effluents are site specific and discussed in 11.2.5. Section 11.2.5 only states that the combined license applicant will provide a site specific cost-benefit analysis to address the requirements of 10 CFR 50, Appendix I, Section II.D regarding population doses due to liquid effluents. The combined license applicant must also comply to individual dose limits to members of the public in 10 CFR 50 Appendix I and 10 CFR 20.1301(e). Please revise section 11.2.5 to include these individual dose limit requirements.

Westinghouse Response:

DCD Section 11.2.5.2 will be revised as shown below.

Design Control Document (DCD) Revision:

11.2.5.2 Cost Benefit Analysis of Population Doses

The analysis performed to determine offsite dose due to liquid effluents is based upon the AP1000 generic site parameters included in Chapter 1 and Tables 11.2-5 and 11.2-6. The Combined License applicant will provide a site specific cost-benefit analysis to address the requirements of 10 CFR 50, Appendix I, regarding population doses due to liquid effluents.

The Combined License applicant will also comply with individual dose limits to members of the public in 10 CFR 50 Appendix I and 10 CFR 20.1301.

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP11.2-CHPB-03
Revision: 0

Question:

There is an inconsistency between the Estimated Doses sections in section 11.2 (Liquid Waste Management System) and 11.3 (Gaseous Waste Management System). No individual doses were calculated for liquid effluents, but doses were calculated for gaseous releases. Please revise the DCD to include doses from liquid effluents in conformance with Section II.A of Appendix I to Part 50.

Westinghouse Response:

The non-site-specific estimated doses through the gaseous pathway were provided because site atmospheric dispersion (X/Q) generic site information was developed for other purposes.

Estimation of off-site doses through the liquid pathway requires site-specific information. These estimates are being provided by Combined License applicants referencing the AP1000.

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-SRP11.2-CHPB-06
Revision: 0

Question:

In DCD Section 11.2 the staff noted system operation calls for processed water to enter monitor tanks including the three additional liquid waste monitor tanks housed in the radwaste building. The description of system operation calls for the "The contents of the monitor tank are recirculated and sampled. In the unlikely event of high radioactivity, the tank contents are returned to a waste holdup tank for additional processing." Hence, a potential exists for a high radioactivity to be present in the non-seismically designed portion of the liquid waste management system housed in the non-seismically designed radwaste building.

The staff concluded that the description of the design provided in DCD Section 11.2 did not meet the SRP Section 11.2 acceptance criterion 3, which states in part "The seismic design of structures housing LWMS components, the quality group classification of liquid radwaste treatment equipment should conform to the guidelines of Regulatory Guide 1.143 for liquids and liquid wastes produced during normal operation and anticipated operational occurrences." The regulatory position proved in Section C.5.3 of Regulatory Guide 1.143 states in part "Any systems or components in a RW-IIa facility (see Regulatory Position 5.1) that store, process, or handle radioactive waste in excess of the A_1 quantities given in Appendix A, "Determination of A_1 and A_2," to 10 CFR Part 71, "Packaging and Transportation of Radioactive Material," are classified as RW-IIa." Since the proposed design change does not include verification that the radionuclides quantities do not exceed the A_1 values, a potential for exceedance exists. Therefore, portions of the liquid waste management system housed in the radwaste building in order to conform to RG 1.143 should be classified as RW-IIa SSCs and not RW-IIc as stated in DCD Appendix 1A.

Provide a complete description of the how the placement of three additional liquid waste monitor tanks and associated equipment in the radwaste building meets acceptance criterion 3 of SRP Section 11.2. Include this information in the DCD and TR-116 and provide a markup in your response.

Westinghouse Response:

The intent the mention of "high radioactivity" in DCD Section 11.2 is not "high" in an absolute sense, but rather "radioactivity level above operational targets." This text will be clarified as shown below.

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. They are vented tanks which receive input from degasified sources, and from other vented tanks, so there is no potential for them to contain significant quantities of radioactive gas.

A comparison of the anticipated monitor tank contents to the A_2 quantities of 10CFR71 Appendix A has been made and is described herein. The A_2 quantities bound the A_1 quantities mentioned in the question.

Other equipment (pumps, piping, valves) associated with the monitor tanks has very small volumes, so this evaluation of the monitor tanks is considered to be bounding for the associated equipment.

The evaluation of the radiological contents of the monitor tanks was performed based on the PWR-GALE code results previously provided in the AP1000 DCD.

DCD Table 11.2-7 provides discharges in units of Curie per year for the various streams. For the current evaluation, these discharge values were converted to monitor tank concentrations by dividing by the volumetric flows provided in DCD Table 11.2-6. Thus, the "Shim Bleed" column of Table 11.2-7 was divided by 435 gallons per day (per DCD Table 11.2-6), and the "Misc. Wastes" column was divided by 290 plus 1200 gallons per day. Also, the "Combined Release" column of Table 11.2-7 was divided by (435 plus 290 plus 1200) gallons per day. The maximum result of these three values was then selected, and is provided in the "Monitor Tank Contents – Concentration" column (column *a*) of Table 1 below. The shim bleed value was limiting in all cases except for Y-91m, where the combined release value was limiting.

The turbine building drains do not typically enter the WLS monitor tanks and so were excluded from consideration.

Tritium was considered in this fashion, but for conservatism the 3.5 µCi/cc value from DCD section 11.1.1.3 was also considered, and was limiting. This is conservative since some of the tritium will be in gaseous form, and thus not found in the monitor tanks.

Thus, this evaluation provided concentrations of various radionuclide values which are consistent with PWR-GALE. These values were then converted to maximum potential Curie content in a monitor tank by multiplying them by the tank capacity (15,000 gallons), and this result is provided in the "Monitor Tank Contents – Total Content" column (column *b*) of Table 1 below.

Those totals were then used for comparison with the A_2 quantities provided by 10CFR71 Appendix A. The result is shown in column *c* of Table 1. Except for tritium, all radionuclide inventories individually reported in the PWR-GALE results are less 0.1% of the A_2 quantity.

The assumptions discussed above are considered to be appropriate for this evaluation. Furthermore, given that such large margin is provided, there is confidence that any reasonable set of alternate assumptions would still demonstrate that the contents of a monitor tank are well below the A_2 limit. For example, the values for Cesium and Iodine, which are sensitive to fuel defect levels, are several orders of magnitude below the A_2 limit.

The calculated quantity of tritium, conservatively assuming the plant to be operating with the limiting value of tritium in the coolant and that all of this tritium is in liquid form, is still much lower than the A_2 value.

The low anticipated radioactivity contents of each of the monitor tanks in the radwaste building indicate that they are RW-IIc components per position 5.3 of Regulatory Guide 1.143 Revision 2 and do not need to be considered hazardous, and their location in the non-seismic radwaste building is appropriate. An affirmative statement to that effect will be added to section 11.2.1.2.5.1 of the DCD as shown below.

Design Control Document (DCD) Revision:

Revisions are as marked below.

11.2.1.2.5 Equipment Design

11.2.1.2.5.1 Permanently Installed Equipment

The liquid radwaste system equipment design parameters are provided in Table 11.2-2.

The seismic design classification and safety classification for the liquid radwaste system components and structures are listed in Section 3.2. The components listed are located in the Seismic Category I Nuclear Island and in the radwaste building.

The monitor tanks in the non-seismic radwaste building are used to store processed water. The radioactivity content of processed water in each tank will be less than the A_1 and A_2 levels of 10 CFR 71 Appendix A, Table A-1.

11.2.2.1.1 Reactor Coolant System Effluents

[15 paragraphs unchanged]

The contents of the monitor tank are recirculated and sampled. In the unlikely event of ~~high~~ radioactivity in excess of operational targets, the tank contents are returned to a waste holdup tank for additional processing.

[Remaining paragraph in subsection unchanged]

11.2.6 References

[Seven references unchanged]

8. "Appendix A to Part 71 – Determination of A_1 and A_2," 10 CFR 71 Appendix A Table A-1.

PRA Revision:
None

Technical Report (TR) Revision:
None

Table 1
Comparison of AP1000 Monitor Tanks to 10CFR71

		Monitor Tank Contents		
		a	*b*	*c*
Radionuclide	10CFR71 A_2(Ci)	Concentration (uCi/gm)[1]	Total Content (Ci)[2]	% of A_2
Ag-110m	1.1E+01	6.5E-07	3.7E-05	<0.1%
Ba-140	8.1E+00	3.4E-06	1.9E-04	<0.1%
Ce-141	1.6E+01	5.0E-08	2.8E-06	<0.1%
Ce-143	1.6E+01	1.0E-07	5.7E-06	<0.1%
Ce-144	5.4E+00	1.9E-06	1.1E-04	<0.1%
Co-58	2.7E+01	2.1E-06	1.2E-04	<0.1%
Co-60	1.1E+01	2.7E-07	1.5E-05	<0.1%
Cr-51	8.1E+02	1.1E-06	6.2E-05	<0.1%
Cs-134	1.9E+01	6.2E-06	3.5E-04	<0.1%
Cs-136	1.4E+01	3.8E-07	2.2E-05	<0.1%
Cs-137	1.6E+01	8.2E-06	4.7E-04	<0.1%
Fe-55	1.1E+03	6.2E-07	3.5E-05	<0.1%
Fe-59	2.4E+01	1.3E-07	7.4E-06	<0.1%
I-131	1.9E+01	8.5E-06	4.8E-04	<0.1%
I-132	1.1E+01	9.0E-07	5.1E-05	<0.1%
I-133	1.6E+01	3.5E-06	2.0E-04	<0.1%
I-134	8.1E+00	5.0E-07	2.8E-05	<0.1%
I-135	1.6E+01	2.4E-06	1.4E-04	<0.1%
La-140	1.1E+01	4.5E-06	2.6E-04	<0.1%
Mn-54	2.7E+01	8.0E-07	4.5E-05	<0.1%
Mo-99	1.6E+01	4.7E-07	2.7E-05	<0.1%
Na-24	5.4E+00	8.8E-07	5.0E-05	<0.1%
Nb-95	2.7E+01	1.5E-07	8.5E-06	<0.1%
Np-239	1.1E+01	1.3E-07	7.4E-06	<0.1%
Pr-143	1.6E+01	8.3E-08	4.7E-06	<0.1%
Rh-103m	1.1E+03	3.0E-06	1.7E-04	<0.1%
Ru-103	5.4E+01	3.0E-06	1.7E-04	<0.1%
Ru-106	5.4E+00	4.5E-05	2.6E-03	<0.1%

[1] Calculated by using the shim bleed value from DCD Table 11.2-7 divided by shim bleed of 435 gallons per day per DCD Table 11.2-6, except for Y-91m, which used the combined release value divided by combined releases of (435 plus 290 plus 1200) gallons per day.
[2] Calculated by multiplying the concentration of Column *a* by 15,000 gallon tank capacity.

Table 1
Comparison of AP1000 Monitor Tanks to 10CFR71

		Monitor Tank Contents		
		a	*b*	*c*
Radionuclide	**10CFR71 A_2(Ci)**	**Concentration (uCi/gm)[1]**	**Total Content (Ci)[2]**	**% of A_2**
Sr-89	1.6E+01	6.7E-08	3.8E-06	<0.1%
Sr-90	8.1E+00	0.0E+00	0.0E+00	<0.1%
Sr-91	8.1E+00	1.7E-08	9.6E-07	<0.1%
Tritium (H-3) (from GALE)	1.1E+03	3.8E-01	2.2E+01	2%
Tritium (H-3) (from DCD 11.1.1.3)	1.1E+03	3.5E+00	2.0E+02	18%
Tc-99m	1.1E+02	4.5E-07	2.6E-05	<0.1%
Te-129	1.6E+01	1.0E-07	5.7E-06	<0.1%
Te-129m	1.1E+01	6.7E-08	3.8E-06	<0.1%
Te-131m	1.4E+01	5.0E-08	2.8E-06	<0.1%
Te-132	1.1E+01	1.5E-07	8.5E-06	<0.1%
W-187	1.6E+01	6.7E-08	3.8E-06	<0.1%
Y-91m	5.4E+01	3.8E-09	2.2E-07	<0.1%
Y-93	8.1E+00	5.0E-08	2.8E-06	<0.1%
Zn-65	5.4E+01	2.5E-07	1.4E-05	<0.1%
Zr-95	2.2E+01	1.7E-07	9.6E-06	<0.1%

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP11.2-CHPB-07
Revision: 0

Question:

In DCD Section 3.2, Table 3.2-3, Sheets 63 and 64, the staff noted that the three new liquid waste monitor tanks and associated equipment for the liquid radwaste system were not added to this table. Additionally, in Table 3.2-3, the applicant did not identify the new WLS piping interconnecting the auxiliary and radwaste buildings and its classification.

In accordance with 10 CFR 50.34a, the applicant is to provide sufficient design information to demonstrate that design objectives for equipment necessary to control releases of radioactive effluents in the environment. Also, in accordance with 10 CFR 52.47(a)(2), the applicant must include performance requirements and design information sufficiently detailed to permit the preparation of acceptance and inspection requirements by the NRC, and procurement specifications and construction and installation specifications by an applicant.

Provide classification information for the three new liquid waste monitor tanks and associated equipment. Include this information in the DCD and TR-116 and provide a markup in your response.

Westinghouse Response:

The reference to the equipment in the radwaste building was inadvertently omitted from DCD Table 3.2-3 Sheet 63. The heading for the Liquid Radwaste System on Sheet 63 will be revised to include the radwaste building; that is, to say "Liquid Radwaste System (WLS); Location: Containment, Auxiliary, and Radwaste Buildings"

Except for their location, the new monitor tanks are identical to the previous monitor tanks, so no further revision to the text of Table 3.2-3 is required.

No new interconnecting piping was added between the auxiliary and radwaste buildings; the previously existing WLS monitored discharge line to the Waste Water System carries this flow.

Piping associated with the new tanks will be designed identically to the remainder of the system. Radwaste piping is not specifically discussed in Table 3.2-3, but is designed as discussed in DCD Section 3.2.2.6, per ASME B31.1, Quality Group D.

Design Control Document (DCD) Revision:

Revise the Liquid Radwaste System heading in Chapter 3 Table 3.2-3 to include a reference to the radwaste building as described above.

Also, section 12.1.2.4.1 will have text inserted as shown below. The remainder of the section is unchanged:

12.1.2.4.1 Piping

The use of embedded pipes is minimized to the extent possible, consistent with maintaining radiation doses ALARA.

To the extent possible, radioactive piping is located inside the auxiliary building and the containment vessel. This minimizes the potential for leakage to the groundwater from piping or fittings. The few exceptions are as follows:

- Process piping to and from the radwaste building (which can be fully visually inspected from the radwaste building pipe trench to the auxiliary building wall).
- Drain lines from the radwaste building and annex building back to the auxiliary building. These lines are not normally water filled, and can also be fully visually inspected from the annex or radwaste building pipe trench to the auxiliary building wall.
- Piping associated with the waste monitor tanks in the radwaste building. These tanks contain processed water, and they are located within the curbed radwaste building, which drains to the liquid radwaste system.
- Monitored radwaste discharge pipeline as discussed below.

PRA Revision:

None

Technical Report (TR) Revision:

APP-GW-GLN-116 will be revised to show the changes above.