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Your ref: Docket No. 52-006
Our ref: DCP/NRC2408

March 23, 2009

Subject: AP1000 Response to Request for Additional Information (SRP 15)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 15. This RAI response is are submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI:

RAI-SRP15.6.5-RSAC-02 R1

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,

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Request for Additional Information on SRP Section 15

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 15

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP15.6.5-RSAC-02
Revision: 1

Question:

In Chapter 15, "Accident Analyses," of the AP1000 DCD, you provided the radiological consequence doses for the design basis accidents in various sections of Chapter 15. Provide the revised radiological consequence doses for all design basis accidents listed in the AP1000 DCD that are based on the atmospheric dispersion factors provided in DCD Revision 17.

Westinghouse Response:

Offsite Doses

The AP1000 certified design is based on Revision 15 of the AP1000 DCD. Included in Revision 15 were a set of atmospheric dispersion factors (X/Qs). As part of the amendment request for the AP1000 certified design reflected in DCD Revision 16 Westinghouse proposed to take credit for activity removal via aerosol impaction in the containment leakage pathway in the LOCA dose analysis. Taking credit for aerosol impaction allowed for an increase in the X/Qs, which was reflected in the X/Qs used in Revision 16 of the AP1000 DCD. The NRC's rejection of the credit for aerosol impaction necessitated changes to the X/Qs used in the LOCA dose analysis to demonstrate acceptable results. As a result, Westinghouse used the lower X/Qs consistent with values in DCD Revision 15 for the LOCA Dose analysis documented in Revision 17 of the AP1000 DCD. In Revision 17 of the AP1000 DCD; revised LOCA doses are presented in Section 15.6.5.3. The more restrictive offsite X/Qs used in Revision 17 for the LOCA doses are included in tier 1 Table 5.0-1 as the acceptable site atmospheric dispersion factors.

The reported doses for events other than LOCA continue to be based on the DCD Revision 16 X/Qs since the elimination of credit for aerosol impaction did not affect these dose analyses and the results are still within the dose limits with the higher, more restrictive X/Qs. For comparison, the X/Qs modeled in the dose analyses are presented below:

AP1000 DCD EAB X/Qs (sec/m^3)		
Event	DCD Rev.	Limiting 2 hours
LOCA	15, 17	5.1E-4
Other Events	16, 17	1.0E-3

AP1000 DCD LPZ X/Qs (sec/m^3)					
Event	DCD Rev.	0-8 hr	8-24 hr	24-96 hr	96-720 hr
LOCA	15, 17	2.2E-4	1.6E-4	1.0E-4	8.0E-5
Other Events	16, 17	5.0E-4	3.0E-4	1.5E-4	8.0E-5

In a conference call regarding Westinghouse's initial response to RAI-SRP15.6.5-RSAC-02 the NRC staff requested information with respect to potential impact to the resulting offsite doses if Westinghouse were to use the lower, less restrictive X/Qs in the analysis of the events other than LOCA. The potential reduction in calculated dose due to X/Q reductions on the doses may be evaluated by reducing the reported doses by the ratio of the X/Qs.

Table 15A-5 was updated to include the offsite X/Qs used for events other than LOCA.

Control Room Doses

In the amendment request for the AP1000 certified design reflected in DCD Revision 16, the control room X/Qs were increased from the certified values to reflect credit taken for activity removal via aerosol impaction in the containment leakage pathway for the LOCA. With the removal of the aerosol impaction credit, a change in the control isolation logic was made such that the increased X/Qs could be maintained with two exceptions. X/Qs for the HVAC intake at the ground level containment release points in the 2-8-hour and 8-24-hour intervals were reduced for the analysis of the LOCA event with the VBS in supplemental filtration mode.

For Revision 17, the control room isolation was modified to include switching to VES on the pressurizer low pressure s-signal. In the LOCA dose analysis, this results in the control room being on VES by the time core activity releases start at 10 minutes. This change in logic only impacts the LOCA control room doses presented in DCD Section 15.6.5.3.

Control room doses are presented in Chapter 15 only for the LOCA. Control room doses for the other events are summarized in Section 6.4.4, for both cases with VES in operation and with the normal HVAC system (VBS) operating in a supplemental filtration mode. To demonstrate acceptable doses for the LOCA event with the VBS in supplemental filtration mode, X/Qs for the HVAC intake at the ground level containment release points in the 2-8-hour and 8-24-hour intervals were reduced. The reduced X/Qs are found in Table 15A-6. Below is a table showing the changes.

AP1000 DCD HVAC Intake X/Qs (sec/m^3)		
Event	DCD Rev. 16 Value	DCD Rev. 17 Value
2 - 8 hours	4.5E-3	3.6E-3
8 -2 4 hours	2.0E-3	1.4E-3

As with the offsite doses, events other than LOCA are acceptable and bounding when using the DCD Revision 16 X/Qs, and Westinghouse chose not to take the benefit of the DCD Revision 17 X/Qs. (Note that only the rod ejection accident doses would be affected.)

Table 15A-6 was updated to include the containment leakage HVAC intake X/Qs used for events other than LOCA.

As with the offsite doses, the more restrictive control room X/Qs used in Revision 17 for the LOCA doses are included in tier 1 Table 5.0-1 as the acceptable site atmospheric dispersion factors.

Design Control Document (DCD) Revision:

See attached DCD markups

PRA Revision:

None

Technical Report (TR) Revision:

None

Table 15A-5

OFFSITE ATMOSPHERIC DISPERSION FACTORS (χ/Q) FOR ACCIDENT DOSE ANALYSIS[1]

Dose Location	LOCA Dose Analysis	Other Dose Analyses[2]
Site boundary χ/Q (s/m^3)		
0 – 2 hours[1,2]	5.1×10^{-4}	1.0×10^{-3}
Low population zone χ/Q (s/m^3)		
0 – 8 hours	2.2×10^{-4}	5.0×10^{-4}
8 – 24 hours	1.6×10^{-4}	3.0×10^{-4}
24 – 96 hours	1.0×10^{-4}	1.5×10^{-4}
96 – 720 hours	8.0×10^{-5}	8.0×10^{-5}

Notes:

1. ~~The LOCA dose analysis models the bounding atmospheric dispersion factors listed above. Other analyses model more conservative values.~~
2. ~~Nominally defined as the 0- to 2-hour interval but is applied to the 2-hour interval having the highest activity releases in order to address 10 CFR Part 50.34 requirements.~~
2. For all design basis accidents analyzed in Chapter 15 other than LOCA.

Table 15A-6

CONTROL ROOM ATMOSPHERIC DISPERSION FACTORS (χ/Q) FOR ACCIDENT DOSE ANALYSIS

χ/Q (s/m^3) at HVAC Intake for the Identified Release Points[1]						
	Plant Vent or PCS Air Diffuser[3]	Ground Level Containment Release Points[4,8]	PORV and Safety Valve Releases[5]	Steam Line Break Releases	Fuel Handling Area[6]	Condenser Air Removal Stack[7]
0 – 2 hours	3.0E-3	6.0E-3	2.0E-2	2.4E-2	6.0E-3	6.0E-3
2 – 8 hours	2.5E-3	3.6E-3[8]	1.8E-2	2.0E-2	4.0E-3	4.0E-3
8 – 24 hours	1.0E-3	1.4E-3[8]	7.0E-3	7.5E-3	2.0E-3	2.0E-3
1 – 4 days	8.0E-4	1.8E-3	5.0E-3	5.5E-3	1.5E-3	1.5E-3
4 – 30 days	6.0E-4	1.5E-3	4.5E-3	5.0E-3	1.0E-3	1.0E-3
χ/Q (s/m^3) at Annex Building Door for the Identified Release Points[2]						
	Plant Vent or PCS Air Diffuser[3]	Ground Level Containment Release Points[4]	PORV and Safety Valve Releases[5]	Steam Line Break Releases	Fuel Handling Area[6]	Condenser Air Removal Stack[7]
0 – 2 hours	1.0E-3	1.0E-3	4.0E-3	4.0E-3	6.0E-3	2.0E-2
2 – 8 hours	7.5E-4	7.5E-4	3.2E-3	3.2E-3	4.0E-3	1.8E-2
8 – 24 hours	3.5E-4	3.5E-4	1.2E-3	1.2E-3	2.0E-3	7.0E-3
1 – 4 days	2.8E-4	2.8E-4	1.0E-3	1.0E-3	1.5E-3	5.0E-3
4 – 30 days	2.5E-4	2.5E-4	8.0E-4	8.0E-4	1.0E-3	4.5E-3

Notes:

1. These dispersion factors are to be used 1) for the time period preceding the isolation of the main control room and actuation of the emergency habitability system, 2) for the time after 72 hours when the compressed air supply in the emergency habitability system would be exhausted and outside air would be drawn into the main control room, and 3) for the determination of control room doses when the non-safety ventilation system is assumed to remain operable such that the emergency habitability system is not actuated.
2. These dispersion factors are to be used when the emergency habitability system is in operation and the only path for outside air to enter the main control room is that due to ingress/egress.
3. These dispersion factors are used for analysis of the doses due to a postulated small line break outside of containment. The plant vent and PCS air diffuser are potential release paths for other postulated events (loss-of-coolant accident, rod ejection accident, and fuel handling accident inside the containment); however, the values are bounded by the dispersion factors for ground level releases.
4. The listed values represent modeling the containment shell as a diffuse area source, and are used for evaluating the doses in the main control room for a loss-of-coolant accident, for the containment leakage of activity following a rod ejection accident, and for a fuel handling accident occurring inside the containment.

5. The listed values bound the dispersion factors for releases from the steam line safety & power-operated relief valves. These dispersion factors would be used for evaluating the doses in the main control room for a steam generator tube rupture, a main steam line break, a locked reactor coolant pump rotor, and for the secondary side release from a rod ejection accident.
6. The listed values bound the dispersion factors for releases from the fuel storage and handling area. The listed values also bound the dispersion factors for releases from the fuel storage area in the event that spent fuel boiling occurs and the fuel building relief panel opens on high temperature. These dispersion factors are used for the fuel handling accident occurring outside containment and for evaluating the impact of releases associated with spent fuel pool boiling.
7. This release point is included for information only as a potential activity release point. None of the design basis accident radiological consequences analyses model release from this point.
8. The LOCA dose analysis models the ground level containment release point HVAC intake atmospheric dispersion factors. The other dose analyses consider atmospheric dispersion factors of 4.5E-3 s/m^3 for the 2-8 hour interval and 2.0E-3 s/m^3 for the 8-24 hour interval. ~~Other analyses model more conservative values.~~