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Your ref: Docket No. 52-006
Our ref: DCP_NRC_003113

February 23, 2011

Subject: AP1000 Containment Cleanliness – DCD Markup for Rev. 19

Westinghouse is submitting a response to the U.S. Nuclear Regulatory Commission (NRC) regarding the Advisory Committee on Reactor Safeguards (ACRS) letter to the Chairman, U.S. NRC, dated December 20, 2010. This letter is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in these responses is generic and is expected to apply to all Combined Operating License (COL) applicants referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

The recent ACRS letter, dated December 20, 2010, on acceptability of long term core cooling performance for AP1000 concluded that any future relaxation of cleanliness requirements will require substantial data and analysis and requested a licensing path be identified for future regulatory approval of any increase in the containment debris limits.

Westinghouse has reviewed the potential application of the specific cleanliness limits as information to be contained in the AP1000 Technical Specifications (TS). Westinghouse does not believe the debris limits meet the appropriate level of safety impact to be included in the TS. Our interpretation is based on review of 10 CFR 50.36, and is consistent with the operating plants TS, which have detailed evaluations of long term cooling (including debris limits) and do not include the specific debris limits in their TS.

The containment debris limits identified for the operating fleet vary significantly with regard to the ease of compliance, i.e., some limits are closer to the expected debris findings; however, it is not the difficulty of compliance that determines the need to include the debris limits in the TS. These limits do not meet the criteria for including limiting conditions for operations as provided in 10 CFR 50.36.

10 CFR 50.36 criterion (c)(2)(ii)(B) is as follows:

- *Criterion 2.* A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

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The impact of not meeting this operating restriction has not previously been considered to meet this criterion, as evidenced by it not being included in any of the NRC approved Standard Technical Specifications NUREGs.

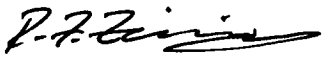
Therefore, Westinghouse is proposing to make a change to the Design Control Document (DCD), Revision 18 to identify the total amount of resident debris and fiber limits as Tier 2* information.

Tier 2* is defined in the regulations (10 CFR Part 52 Appendix D) as: "*Tier 2** means the portion of the Tier 2 information, designated as such in the generic DCD, which is subject to the change process in Section VIII.B.6 of this appendix."

Westinghouse believes that the inclusion of the containment debris limits as Tier 2* information, as well select general screen design criteria (See Enclosure 1 for specific DCD markups), meets the intent of the ACRS for receiving prior NRC approval prior to any departure from these limits.

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,



R. F. Ziesing
Director, U.S. Licensing

/Enclosure

1. DCD Markups for Rev. 19 – Intro Table 1-1, Tier 2 Section 6.3.2.2.7.1, and Tier 2 Section 6.3.8.1

cc:

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Enclosure 1

DCD Markups for Rev. 19 – Intro Table 1-1, Tier 2 Section 6.3.2.2.7.1, and Tier 2 Section 6.3.8.1

Table 1-1 (Cont.)
Index of AP1000 Tier 2 Information Requiring NRC Approval for Change

Item	Expiration at First Full Power	Tier 2 Reference
Maximum Fuel Rod Average Burnup	No	4.3.1.1.1
Reactor Core Description (First Cycle)	Yes	Table 4.3-1
Nuclear Design Parameters (First Cycle)	Yes	Table 4.3-2
Reactivity Requirements for Rod Cluster Control Assemblies	Yes	Table 4.3-3
ASME Code Piping Design Restrictions	Yes	5.2.1.1
Reactor Coolant Pump Design	No	5.4.1.2.1
MOV Design and Qualification	Yes	5.4.8.1.2
Other Power-Operated Valves Design and Qualification	Yes	5.4.8.1.3
Motor Operated Valves	Yes	5.4.8.5.2
Power Operated Valves	Yes	5.4.8.5.3
ASME Code Cases	Yes	Table 5.2-3 Table 3.9-9 Table 3.9-10 5.2.1.2
General Screen Design Criteria	No	6.3.2.2.7.1
WCAP-17201-P, "AC160 High Speed Link Communication Compliance to DI&C-ISG-04 Staff Position 9, 12, 13, and 15," Rev 0, February 2010	Yes	Table 1.6-1 7.1.7
WCAP-15927 (Non-Proprietary), "Design Process for AP1000 Common Q Safety Systems," Rev 2	Yes	Table 1.6-1 7.1.2.14.1 7.1.7
WCAP-17179, "AP1000 Component Interface Module Technical Report"	Yes	Table 1.6-1 7.1
WCAP-16097-P-A, "Common Qualified Platform," Rev 0	Yes	Table 1.6-1 7.1
WCAP-16096-NP-A, "Software Program Manual for Common Q Systems," Rev 01A	Yes	Table 1.6-1 7.1
Verification and Validation	Yes	7.1.2.14
Hard-wired DAS manual actuation	No	7.7.1.11
Nuclear Island Fire Areas	No	Figure 9A-1
Turbine Building Fire Areas	No	Figure 9A-2
Annex I & II Building Fire Areas	No	Figure 9A-3
Radwaste Building Fire Areas	No	Figure 9A-4

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Deleted: WCAP-14605, "Westinghouse Setpoint Methodology for Protection Systems, AP600," Rev 0

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3. *[Metal reflective insulation is used on ASME class 1 lines because they are subject to loss-of-coolant accidents. Metal reflective insulation is also used on the reactor vessel, the reactor coolant pumps, the steam generators, and on the pressurizer because they have relatively large insulation surface areas and they are located close to large ASME class 1 lines. As a result, they are subject to jet impingement during loss-of-coolant accidents.]** A suitable equivalent insulation to metal reflective may be used. A suitable equivalent insulation is one that is encapsulated in stainless steel that is seam welded so that LOCA jet impingement does not damage the insulation and generate debris. Another suitable insulation is one that may be damaged by LOCA jet impingement as long as the resulting insulation debris is not transported to the containment recirculation screens, to the IRWST screens, or into a direct vessel injection or a cold leg LOCA break that becomes submerged during recirculation. In order to qualify as a suitable equivalent insulation, testing must be performed that subjects the insulation to conditions that bound the AP1000 conditions and demonstrates that debris would not be generated. If debris is generated, testing and/or analysis must be performed to demonstrate that the debris is not transported to an AP1000 screen or into the core through a flooded break. It would also have to be shown that the material used would not generate chemical debris. In addition, the testing and/or analysis must be approved by the NRC.

*[In order to provide additional margin, metal reflective insulation is used inside containment where it would be subject to jet impingement during loss-of-coolant accidents that are not otherwise shielded from the blowdown jet.]** As a result, fibrous debris is not generated by loss-of-coolant accidents. Insulation located within the zone of influence (ZOI), which is a spherical region within a distance equal to 29 inside diameters (for Min-K, Koolphen-K, or rigid cellular glass insulation) or 20 inside diameters (for other types of insulation) of the LOCA pipe break is assumed to be affected by the LOCA when there are intervening components, supports, structures, or other objects.

*[The ZOI in the absence of intervening components, supports, structures, or other objects includes insulation in a cylindrical area extending out a distance equal to 45 inside diameters from the break along an axis that is a continuation of the pipe axis and up to 5 inside diameters in the radial direction from the axis.]** A suitable equivalent insulation to metal reflective may be used as discussed in the previous paragraph.

*[Insulation used inside the containment, outside the ZOI, but below the maximum post-DBA LOCA floodup water level (plant elevation 110.2 feet), is metal reflective insulation, jacketed fiberglass, or a suitable equivalent.]** A suitable equivalent insulation is one that would be restrained so that it would not be transported by the flow velocities present during recirculation and would not add to the chemical precipitates. In order to qualify as a suitable equivalent insulation, testing must be performed that subjects the insulation to conditions that bound the AP1000 conditions and demonstrates that debris would not be generated. If debris is generated, testing and/or analysis must be performed to demonstrate that the debris is not transported to an AP1000 screen or into the core through a flooded break. It would also have to be shown that the material used would not generate chemical debris. In addition, the testing and/or analysis must be approved by the NRC.

[Insulation used inside the containment, outside the ZOI, but above the maximum post-design basis accident (DBA) LOCA floodup water level, is jacketed fiberglass, rigid cellular

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*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

glass, or a suitable equivalent]. A suitable equivalent insulation is one that when subjected to dripping of water from the containment dome would not add to the chemical precipitates; suitable equivalents include metal reflective insulation.

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4. Coatings are not used on surfaces located close to the containment recirculation screens. The surfaces considered close to the screens are defined in subsection 6.3.2.2.7.3. Refer to subsection 6.1.2.1.6. These surfaces are constructed of materials that do not require coatings.

5. The IRWST is enclosed which limits debris egress to the IRWST screens.

6. Containment recirculation screens are located above lowest levels of containment.

7. Long settling times are provided before initiation of containment recirculation.

8. Air ingestion by safety-related pumps is not an issue in the AP1000 because there are no safety-related pumps. The normal residual heat removal system pumps are evaluated to show that they can operate with minimum water levels in the IRWST and in the containment.

9. A commitment for cleanliness program to limit debris in containment is provided in subsection 6.3.8.1.

10. *[Other potential sources of fibrous material, such as ventilation filters or fiber-producing fire barriers, are not located in jet impingement damage zones or below the maximum post-DBA LOCA floodup water level].**

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11. Other potential sources of transportable material, such as caulking, signs, and equipment tags installed inside the containment are located:

    - Below the maximum flood level, or
    - Above the maximum flood level and not inside a cabinet or enclosure.

    Tags and signs in these locations are made of stainless steel or another metal that has a density ≥100 lbm/ft^3. Caulking in these locations is a high density (≥100 lbm/ft^3).

    The use of high-density metal prevents the production of debris that could be transported to the containment recirculation screens, to the IRWST screens, or into a direct vessel injection or a cold leg LOCA break location that is submerged during recirculation. If a high-density material is not used for these components, then the components must be located inside a cabinet or other enclosure, or otherwise shown not to transport; the enclosures do not have to be watertight, but need to prevent water dripping on them from creating a flow path that would transport the debris outside the enclosure. For light-weight (< 100 lb$_m$/ft^3) caulking, signs or tags that are located outside enclosures, testing must be performed that subjects the caulking, signs, or tags to conditions that bound the AP1000 conditions and demonstrates that debris would not be transported to an AP1000 screen or into the core through a flooded break. Note that in determining if there is sufficient water flow to transport these materials, consideration needs to be given as to whether they are within the ZOI (for the material used) because that determines whether they are in their original geometry or have been reduced to

*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

smaller pieces. It would also have to be shown that the material used would not generate chemical debris. In addition, the testing must be approved by the NRC.

12. An evaluation consistent with Regulatory Guide 1.82, Revision 3, and subsequently approved NRC guidance, has been performed (Reference 3) to demonstrate that adequate long-term core cooling is available considering debris resulting from a LOCA together with debris that exists before a LOCA. As discussed in subsection 6.3.2.2.7.1, a LOCA in the AP1000 does not generate fibrous debris due to damage to insulation or other materials included in the AP1000 design. The evaluation considered resident fibers and particles that could be present considering the plant design, location, and containment cleanliness program. The determination of the characteristics of such resident debris was based on sample measurements from operating plants. The evaluation also considered the potential for the generation of chemical debris (precipitants). The potential to generate such debris was determined considering the materials used inside the AP1000 containment, the post-accident water chemistry of the AP1000, and the applicable research/testing.

    The evaluation considered the following conservative considerations:

    - *[The COL cleanliness program will limit the total amount of resident debris inside the containment to ≤130 pounds and the amount of the total that might be fiber to ≤6.6 pounds.]** Formatted: Font: Italic Comment [rmk7]: 28 Formatted: Font: Italic

    - In addition to the resident debris, the LOCA blowdown jet may impinge on coatings and generate coating debris fines, which because of their small size, might not settle. The amount of coating debris fines that can be generated in the AP1000 by a LOCA jet will be limited to less than 70 pounds for double-ended cold leg and double-ended direct vessel injection LOCAs. In evaluating this limit, a ZOI of 4 IDs for epoxy and 10 IDs for inorganic zinc will be used. A DEHL LOCA could generate more coating debris; however, with the small amount of fiber available in the AP1000 following a LOCA, the additional coating debris fines that may be generated in a DEHL LOCA are not limiting.

    - The total resident and ZOI coating debris available for transport following a LOCA is ≤ 193.4 pounds of particulate and ≤ 6.6 pounds of fiber. The percentage of this debris that could be transported to the screens or to the core is as follows:

        – Containment recirculation screens is ≤100 percent fiber and particles

        – IRWST screens is ≤50 percent fiber and 100 percent particles

        – Core (via a direct vessel injection or a cold leg LOCA break that becomes submerged) is ≤90 percent fiber and 100 percent particles

    - Fibrous insulation debris is not generated and transported to the screens or into the core as discussed in item 3.

*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

6.3.7.6.2.2 In-Containment Refueling Water Storage Tank Injection Motor-Operated Valve Controls

The motor-operated valves in each in-containment refueling water storage tank injection line are normally open during all modes of normal plant operation. Power to these valves is locked out. Redundant valve position indication and alarms are provided to alert the operator if a valve is inadvertently closed. The technical specifications specify surveillances to show that these valves are open. These valves also receive a safeguards actuation signal to confirm that they are open in the event of an accident. As a result of the power lock out, the redundant position indication and alarms and the technical specifications the valve controls are nonsafety-related.

6.3.7.6.2.3 Passive Residual Heat Removal Heat Exchanger Inlet Motor-Operated Valve Control

The motor-operated valve in the passive residual heat removal heat exchanger inlet line is normally open during normal plant operation. Power to this valve is locked out. Redundant valve position indications and alarms are provided to alert the operator if the valve is open. This valve also receives an actuation signal to confirm that it is open in the event of an accident.

6.3.7.7 Automatic Depressurization System Actuation at 24 Hours

A timer is used to automatically actuate the automatic depressurization system if offsite and onsite power are lost for about 24 hours. This prevents discharging the Class 1E dc power sources such that they are no longer able to operate the automatic depressurization system valves. If power becomes available to the dc batteries and they are no longer discharging prior to activation of the timer, then the automatic depressurization system actuation would be delayed. If the plant does not need actuation of the automatic depressurization system based on having stable pressurizer level, full core makeup tanks, and high and stable in-containment refueling water storage tank levels, the operators are directed to de-energize all loads on the 24-hour batteries. This action will block actuation of the automatic depressurization system and allow for its actuation later should the plant conditions unexpectedly degrade.

6.3.8 Combined License Information

6.3.8.1 Containment Cleanliness Program

The Combined License applicants referencing the AP1000 will address preparation of a program to limit the amount of debris that might be left in the containment following refueling and maintenance outages. The cleanliness program will limit the storage of outage materials (such as temporary scaffolding and tools) inside containment during power operation to items that do not produce debris (physical or chemical), which could be transported to the containment recirculation screens, to the IRWST screens, or into a direct vessel injection or a cold leg LOCA break that becomes submerged during recirculation. The cleanliness program shall limit the amount of latent debris and fibrous material located within the containment, as identified in subsection 6.3.2.2.7.1, item 12.

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