

June 6, 2003

Mr. W. E. Cummins, Director  
AP600 & AP1000 Projects  
Westinghouse Electric Company  
P.O. Box 355  
Pittsburgh, PA 15230-0355

Dear Mr. Cummins:

As you are aware, the U.S. Nuclear Regulatory Commission (NRC) staff is preparing the draft safety evaluation report (DSER) for the AP1000 design certification application submitted by Westinghouse Electric Company (Westinghouse) on March 28, 2002. The staff expects to issue the DSER in June, 2003. As of this date, the staff has identified 6 potential open items for DSER Chapter 2, "Site Envelope Characteristics," which are enclosed for your information. Please note that the staff's review of the application will continue during preparation of the DSER, which may result in changes to the potential open items identified in the enclosure, or the addition of other open items.

Five of the potential open items in the enclosure are new issues. The other potential open item in the enclosure has its original request for additional information (RAI) number included for reference. If the staff cannot resolve the potential open items before the issuance of the DSER, these items will be issued as DSER open items and will be tracked with a corresponding open item number.

Previously, Westinghouse committed to provide responses to all identified open items within 9 weeks after the issuance of the DSER. The staff will be prepared to review your responses to the open items and have conference calls and meetings with your staff, as appropriate, after the DSER is issued. If Westinghouse chooses to address some or all of these open items before the issuance of the DSER, the staff may not have sufficient time to evaluate every response to the potential open items that Westinghouse submits to the NRC and make changes to the DSER before the scheduled DSER issuance in June, 2003.

Please contact one of the following members of the AP1000 project management team if you have any questions or comments concerning this matter: Mr. John Segala (Lead Project Manager) at (301) 415-1858 or [jps1@nrc.gov](mailto:jps1@nrc.gov), Mr. Joseph Colaccino at (301) 415-2752 or [jxc1@nrc.gov](mailto:jxc1@nrc.gov), or Ms. Joelle Starefos at (301) 415-8488 or [jls1@nrc.gov](mailto:jls1@nrc.gov).

Sincerely,

/RA/

James E. Lyons, Director  
New Reactor Licensing Project Office  
Office of Nuclear Reactor Regulation

Docket No. 52-006

Enclosure: As stated  
cc: See next page

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**Westinghouse AP1000  
Draft Safety Evaluation Report  
Potential Open Items  
Chapter 2  
Site Envelope Characteristics**

Open Item Number: 2.3.4-1

Original RAI(s): 451.006

Summary of Issue: The hypothetical reference control room  $\chi/Q$  values calculated by the applicant are listed in Table 15.3-9a of this report. A site selected for an AP1000 facility should have control room  $\chi/Q$  values equal to or less than the hypothetical reference  $\chi/Q$  values shown Table 15.3-9a. In the event a site selected for the AP1000 design exceeds the hypothetical reference  $\chi/Q$  values, the COL applicant must demonstrate that the radiological consequences associated with the design-basis accidents, using its site-specific  $\chi/Q$  values, continues to meet the dose reference values given in GDC 19 of 10 CFR Part 50. The staff initially asked the applicant if the methodology and all inputs and assumptions would be evaluated as part of the COL review. The applicant provided a detailed response stating that the methodology, inputs and assumptions would be provided by the COL applicant and also provided additional information about the analysis. The staff issued a second RAI to inquire if the applicant was seeking certification of any of the AP1000 design values used as inputs to the control room  $\chi/Q$  calculations. The applicant subsequently provided certain design-specific information that was used as input to the assessment and for which the applicant was seeking certification. The staff has not completed an evaluation of this response but has identified unresolved issues related to adequate justification for assuming a diffuse release, estimation of initial sigma values, other release assumptions, building cross-sectional areas, and distances between release/receptor pairs. This is Open Item 2.3.4-1 This is also COL Action Item 2.3.4-1 since the resultant  $\chi/Q$  values are also a function of the site-specific meteorology which cannot be reviewed until site selection.

Open Item Number: 2.5.1-1

Original RAI(s): n/a

Summary of Issue: COL applicants referencing the AP1000 certified design, and without an ESP, must be required to provide the following site specific geological, seismological and geophysical information related to tectonic or seismic, non-tectonic deformation, conditions caused by human activities in the region of the site, and areas local to the site. With respect to site

Enclosure

geology, it is necessary to provide engineering significance of geologic features underlying the site as they relate to:

- dynamic behavior during prior earthquakes
- zones of alteration, irregular weathering, or zones of structural weakness
- unrelieved residual stresses in bedrock
- materials that could be unstable because of their mineralogy or unstable physical properties
- effect of human activities in the area

The DCD Tier 2 information, while listing certain site specific aspects of basic geologic and seismic information to be provided by a COL applicant referencing the AP1000 certified design, does not include some of the attributes discussed above. This issue was discussed with the applicant during the April 2-5, 2003 audit. This is Open Item 2.5.1-1.

Open Item Number: 2.5.2-1

Original RAI(s): n/a

Summary of Issue: COL applicants referencing the AP1000 certified design, without an ESP, are required to provide the following site specific information related to seismicity, geologic and tectonic characteristics of site and region, correlation of earthquake activity with seismic sources, probabilistic seismic hazard analysis, controlling earthquakes, seismic wave transmission characteristics of the site, and the safe shutdown earthquake ground motion. The DCD Tier 2 information lists a number of these criteria; however, it must include the requirement of probabilistic seismic hazard analysis, including the definition of controlling earthquakes. This issue was discussed with the applicant during the April 2 through 5, 2003 audit. This is Open Item 2.5.2-1.

Open Item Number: 2.5.4-1

Original RAI(s):

Summary of Issue: In the DSER, the staff requested the applicant to indicate in the DCD Tier 2 information, that the COL applicant provide site specific information related to the geotechnical engineering aspects of the site to demonstrate comparability to the design analyses assumptions given in DCD Tier 2 Table 2-1. The COL applicant's submittal must address the criteria provided in Section 2.5.4 of the SRP. The applicant has discussed its standard design attributes related to the following:

- Excavation
- Bearing capacity
- Settlement
- Liquefaction
- Subsurface uniformity

The DCD describes the need for establishing a vertical face below the grade with lateral support of the adjoining undisturbed soil or rock and suggests the use of soil nailing to stabilize the vertical soil surface as an alternative method for achieving this provision. The stability of the nailed soil surface will depend on the length and depth of the soil anchors or nails. One result of this proposed construction technique is that the soil immediately surrounding the nuclear island (NI) consists of natural in-situ materials only, which have relatively continuous properties in the horizontal and vertical directions. Because this configuration complies with the assumptions made in the seismic analyses performed to assess the seismic responses of the NI structures, the proposed excavation method is considered acceptable to the NRC staff. However, during discussions with the applicant during the November 2002 meeting, it was noted that the COL applicant must also show that the existing in-situ soil must satisfy the minimum conditions (in terms of soil parameters) assumed for the design of the AP1000 foundation and exterior walls. In addition, if the in-situ soils are not appropriate for the use of soil nailing excavation techniques, the COL applicant must show that any other construction method planned for the excavation satisfies the assumptions of the design of the NI. If any other construction technique, which requires excavation and backfill of large areas surrounding the NI is used, the procedures and criteria for installing the backfill must also be submitted by the COL applicants for review and approval. In addition, an evaluation of the effect of any alternative construction procedures on the seismic responses of the NI structures must be performed. The amount of lateral passive pressure used in the design of the NI needs to be specified as an interface requirement for the COL applicant. This issue was discussed with the applicant during the April 2-5, 2003, audit. This is Open Item 2.5.4-1.

Open Item Number: 2.5.4-2

Original RAI(s): n/a

Summary of Issue: The bearing capacity of the subgrade is a fundamental design parameter for this standard design. In the design of the foundation of a large structure it is important to ensure that under normal operating conditions, the average pressure on the subgrade is less than the allowable average bearing capacity of the foundation material, and that the peak subgrade pressure caused by the load combination with the SSE imposing the largest toe pressure at the edge of the foundation is also within the allowable capacity of the subgrade. The allowable bearing capacity of the subgrade is governed by settlement or crushing. Under relatively soft

soil conditions short term soil movement due to water table fluctuation and long term settlement due to the super imposed loading affect the allowable bearing capacity. Under hard rock subgrade conditions, the bedding direction of rock layers and the level of cracking and other discontinuities in the matrix of the rock material can limit the allowable average and allowable peak bearing capacity. The response to the RAIs indicates that the bearing capacity at a hard rock site will exceed 21.55MPa (450,000 pounds per square ft). During the April 2 through 5, 2003 audit, the staff requested the applicant to clearly specify, in the DCD, that this standard design is based on an allowable average and an allowable peak bearing capacity, and should specify what these values are. This is Open Item 2.5.4-2.

Open Item Number: 2.5.4-3

Original RAI(s): n/a

Summary of Issue: As stated in DCD Tier 2 Section 3.2, the nuclear island is the only seismic Category I structure in the AP1000 standard design. Differential settlement between the nuclear island foundation and the foundations of adjacent buildings does not have any adverse effect on the safety-related functions of structures, systems and components. Differential settlement under the nuclear island foundation could cause the basemat and the building to tilt. In the narrow direction, the NI foundation width is 49.8 meters (163 feet and 6 in.) and the height above the bottom of the basemat is 83.3 meters (273 ft 3 in.). Assuming a basemat tilt of 10.2 centimeters (4 in.), the rigid body tilt at the highest point can be between 15 and 18 centimeters (6 and 7 in.). Under seismic excitation there will be an elastic deformation relative to the base. When these two effects are added, the annular space between the shield building and the containment structure will be diminished, the functionality of the crane inside the containment and other sensitive components could also be affected. The DCD does not provide any quantitative justification as to why a basemat tilting of a few inches will not affect functionality of structures, systems and components. This issue was discussed with the applicant during the April 2-5, 2003, audit. This is Open Item 2.5.4-3.

AP 1000

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