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NSD-NRC-96-4956
DCP/NRC0715
Docket No. STN-52-003

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: T. R. Quay
SUBJECT: Site Conditions-Shallow Soil Sites

Dear Mr. Quay:

The NRC letter of November 4, 1996 provided the staff position on three issues. This letter provides a formal Westinghouse response to **Issue 1 - Site Conditions - Shallow Soil Site**.

Westinghouse finds the position stated by the NRC in the November 4 letter, as reported below, acceptable. Verbal discussions with the NRC staff in meetings and in telephone conversations indicate that either there is a misunderstanding by Westinghouse of the position stated in the letter or the staff has modified the position stated in the letter. The purpose of this letter is to communicate the Westinghouse position on shallow soil sites in writing and to request that the NRC provide any clarifications or comments in writing.

Staff Position: "The staff position is that AP600 seismic design capacity could be established through the use of a sufficient and necessary set of minimum seismic design response spectra, including the free field and in-structure response spectrum envelopes, by the combined license applicant to its seismic design within the scope of certified design."

Westinghouse Response:

The AP600 design as documented in the SSAR satisfies the NRC staff position regarding establishing design capacity. The AP600 seismic design capacity is established through the use of a sufficient and necessary set of minimum seismic design response spectra, including the free field and in-structure response spectrum envelopes. The free field response spectrum envelopes are provided in SSAR Figures 3.7.1-1 and 3.7.1-2 for the horizontal and the vertical components, respectively. The in-structure response spectrum envelopes for 5 percent damping, at representative locations of the coupled auxiliary and shield buildings, the steel containment vessel, and the containment internal structures, are presented in SSAR Figures 3.7.2-15 through 3.7.2-17. These spectra are results of AP600 seismic analyses which have been reviewed by the NRC staff.

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Staff Position: "Suitability of a future site would then have to be established by demonstrating that the seismic demand spectra for the site are lower than the capacity spectra."

Westinghouse Response:

The suitability of a future site, including any Shallow Soil Site, is established by the COL applicant as described in SSAR Section 2.5. Subsection 2.5.2.1 requires the Combined License applicant to demonstrate that a proposed site meets the following interface requirements:

- The free field peak ground acceleration at the finished grade level is less than or equal to a 0.30g safe shutdown earthquake, and,
- The site design response spectra at the finished grade level in the free-field are less than or equal to those given in Figures 3.7.1-1 and 3.7.1-2.

Subsection 2.5.4.5.5 requires that the site dynamic soil properties be compared to the assumptions made in the standard design regarding the variation of shear wave velocity and material damping. For sites where the soil characteristics are outside the range considered in Appendix 2A.2 and Appendix 2B.2, site-specific soil structure interaction analyses may be performed by the Combined License applicant to demonstrate acceptability by comparison of floor response spectra at specified key locations (SSAR Figures 3.7.2-15 through 3.7.2-17).

Westinghouse has thus complied exactly with the written staff position. The site demand spectra is obtained using the site specific safe shutdown earthquake and the site specific soil conditions. Suitability is established by demonstrating that the seismic demand spectra are lower than the capacity spectra.

Staff Position: "As with other design acceptance criteria, the result will be non-standard seismic design for certain systems (e.g. piping)"

Westinghouse Response:

Westinghouse has established only a single set of in-structure response spectra envelopes and has designed the systems, buildings and equipment using this envelope. Therefore site specific piping design is not required when the response spectrum envelope is satisfied.

Staff Position: "There are three options for Westinghouse to consider for resolving the issue.

- a. Westinghouse AP600 could adopt the design site specific response spectrum (DSSRS) approach used for the System 80+ reactor design. The suitability of a future site would then be established through a simple comparison of DSSRS and the site specific response spectrum.
- b. The standard safety analysis report (SSAR) could state that the AP600 is not designed for shallow soil sites, i.e., the approved site parameter excludes shallow soil sites.
- c. The SSAR could specify a separate design parameter for shallow soil sites and evaluate the design against that parameter, e.g., 0.2 g with Regulatory Guide (RG) 1.60 design response spectra."

Westinghouse Response:

The AP600 is discussed below relative to the three options identified in the NRC letter.

- a. The design site specific response spectrum (DSSRS) Option (a) is not easily understood. It is assumed to be the free field motion established for System 80+ and designated CMS1, CMS2 and CMS3. For AP600 a single design response spectrum has been established at the surface. (SSAR Figures 3.7.1-1 and 3.7.1-2) For sites other than shallow soil sites, the AP600 position states that the suitability of the future site would be established through a simple comparison of the site specific ground response spectrum and the AP600 design ground response spectra as suggested by Option (a).

For shallow soil sites, and for those sites where soils may not be directly comparable to those analyzed by Westinghouse, a site specific analysis would be performed and acceptance would be based on the floor response spectra at the four key locations specified in the SSAR. This is the same approach as described for the System 80+ reactor design.

- b. The AP600 has not been analyzed specifically for shallow soil sites. There are shallow soil sites where the AP600 would not be acceptable. However, there are also shallow soil sites where the AP600 could be demonstrated acceptable by site specific analyses and comparison against the floor response spectra at the four key locations.
- c. Acceptability at shallow soil sites is dependent on the relative soil properties of the shallow soil and competent soil as well as on the site specific response spectra at the competent outcrop. Due to the large number of variations of soil and response spectra, Westinghouse has decided that all shallow soil sites should be evaluated by site specific analyses rather than attempting to establish separate design parameters for shallow soil sites.

Since shallow soil site characteristics are generally outside the range considered in SSAR Appendix 2A.2 and Appendix 2B.2, the site suitability is established as outlined above and as described in AP600 SSAR Subsection 2.5.4.5.5. The suitability is established by developing a site demand spectra using the site specific safe shutdown earthquake and the site specific soil conditions. A simple comparison is then made to the floor response spectra at the four key locations. While this approach does not specifically fit into the three options identified in the NRC letter, it exactly matches the staff position from which the options were derived.

Comparison with Systems 80+:

Westinghouse has reviewed the position taken by the staff in the certification of the evolutionary plants.

The AP600 proposed method of dealing with site conditions different from the analyzed condition is essentially the same as that approved by the staff in the System 80+ FSER (NUREG 1462 page 3-43).

The following is a quote from NUREG 1462:

"For a soil-site, site-specific response spectra at 5 percent damping in the horizontal and vertical directions at the free-field ground surface will be developed and compared to the envelope of the CMS1 spectra and the surface spectra from CMS2 and CMS3 control motions. If the site-specific ground surface response spectra are enveloped by the envelope of the CMS1 spectra and the surface spectra from CMS2 and CMS3, the site will be considered acceptable for construction. If the site-specific ground response spectra exceed the envelope of the CMS1 spectra and the surface spectra from CMS2 and CMS3 at any frequency, a site-specific evaluation will be performed. In this evaluation, in-structure response spectra at six critical locations, defined above for rock site evaluation, obtained from the site-specific evaluation will be compared to the respective design response spectra, which are the envelope of all generic rock and soil cases. If the in-structure response spectra from the site-specific evaluation are within 10 percent of the in-structure design response spectra for each of the six locations, the site is considered acceptable."

This approach by the System 80+ is equivalent to the following approach taken in the AP600 SSAR Subsection 2.5.4.5.5. quoted below.

"For sites where the soil characteristics are outside the range considered in Appendix 2A.2 and Appendix 2B.2, site-specific soil structure interaction analyses may be performed by the Combined License applicant to demonstrate acceptability by comparison of floor response spectra at the following locations. These analyses would use the site specific soil conditions and site specific safe shutdown earthquake. The three components of the site specific ground motion time history must satisfy the enveloping criteria of Standard Review Plan 3.7.1 for the response spectrum for damping values of 2, 3, 4, 5 and 7 percent and the enveloping criterion for power spectral density function. Comparison of the floor response spectra at these locations is sufficient demonstration that the site seismic conditions are within the AP600 design basis."

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| ● Reactor Vessel Support | Figure 3.7.2-17, Sheets 1-3 |
| ● Containment Operating Floor | Figure 3.7.2-17, Sheets 4-6 |
| ● Shield Building Roof | Figure 3.7.2-15, Sheets 7-9 |
| ● Control Room Floor | Figure 3.7.2-15, Sheets 1-3 |

Summary:

Westinghouse clearly understands that the verbal position of the NRC staff is that AP600 SSAR Subsection 2.5.4.5.5. is not an approved approach. Westinghouse strongly believes that the approach taken in 2.5.4.5.5. is consistent with the written position in the November 4, 1996 NRC staff letter. It is also consistent with the approved approach for the System 80+. Westinghouse believes that the approach taken in 2.5.4.5.5. is acceptable and should be approved by the NRC staff. Westinghouse is not aware of any recent research or information which would justify a change in the NRC staff position from the position taken for the System 80+. We request a written explanation of the apparent inconsistency in position between the accepted System 80+ position and the verbal position taken by the staff.

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We request that comments by the staff on the acceptability of this position be made in writing and be approved by the same level of NRC management that approved the November 4, 1997 letter.

BAH for CAM
Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

/jwh

cc: D. Jackson, NRC
N. J. Liparulo, Westinghouse