UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 18, 1997

Mr. Nicholas J. Liparulo, Manager
Nuclear Safety and Regulatory Analysis
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, PA 15230

SUBJECT: AP600 PROPOSED DESIGN CHANGES TO ADDRESS POST 72 HOUR ACTIONS

Dear Mr. Liparulo:

In SECY-96-128, dated June 12, 1996, the staff recommended for Commission approval that the AP600 be capable of sustaining all design basis events with onsite equipment and supplies for the long term. After 7 days, replenishment of consumables such as diesel fuel oil from offsite suppliers can be credited. The equipment required after 72 hours need not be in automatic standby response mode, but must be readily available for connection and be protected from natural phenomena including seismic events (per GDC 2). In the staff requirements memorandum on SECY-96-128, dated January 15, 1997, the Commission approved the staff's position on post-72 hour actions. On February 4, 1997, Westinghouse presented the staff with an overview of proposed changes to the AP600 design to comply with the NRC policy on post-72 hour actions.

The proposed design changes include increasing the size of the passive containment cooling system (PCS) to accommodate an additional 150,000 gallons of water (from 400,000 gallons to 550,000 gallons). This change will provide 7 days of sustained cooling water to the containment shell and will ensure 7 days of cooling water to the spent fuel pool. The spent fuel pool (SFP) cooling system design will be modified to provide seismically qualified makeup water lines from the PCS water storage tank and cask washdown pit. In addition, cross connections between the spent fuel pool and the normal residual heat removal system (RNS) are proposed to provide backup cooling to the spent fuel pool when the RNS is not in use for RCS cooling. Two small (15 KW) diesel generators will be located permanently onsite to provide a seven day power source to 1E post accident monitoring instrumentation and emergency lighting. The main control room post-72 hour habitability philosophy was also changed. Following exhaustion of control room bottled air, the main control room access door will be opened to permit natural circulation of air from adjacent areas within the auxiliary building. This would eliminate the current need for portable cooling and ventilation units for the main control room and instrumentation and control room areas after 72 hours. Operator doses are stated to be well below 10 CFR Part 20 dose limits. (The staff believes that GDC 19 is the applicable regulation for this assessment.)

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Based on a preliminary assessment of the proposed AP600 design changes, the staff has several concerns.

(a) Although the addition of a seismically qualified 7 day supply of makeup water for the spent fuel pool along with backup cooling protection from the RNS appears to represent an improvement to the current AP600 spent fuel pool cooling system design, and may meet the staff's post-72 hour action policy, it is still less robust than many operating plant designs. In addition, the spent fuel pool ventilation and filtration (HVAC) system is not seismically qualified as recommended in the Standard Review Plan (SRP) in order to meet the requirements of GDC 2. Westinghouse considers that this is acceptable since no credit is taken for the SFP HVAC system in mitigating the offsite dose rates which Westinghouse believes will be a small fraction of 10 CFR Part 20. This will need to be verified.

(b) Of particular concern to the staff is the proposal by Westinghouse to open the main control room doors after 72 hours and rely on natural circulation ventilation and cooling for plant operators and instrumentation and control systems. This could result in exposing plant operators to a potentially harmful environment generated by the boiling of the spent fuel pool (e.g., steam, radiological elements). In addition, opening the control room doors compromises any protection from toxic gas releases which the control room is designed to protect against. Consequently, the staff cannot conclude that the Westinghouse proposal meets the requirements of GDC 19 for protection of control room operators from environmental hazards. Westinghouse will need to provide additional justification for its current position, addressing the concerns identified above, or an alternative approach for assuring adequate protection of control room personnel.

(c) In order to contain the additional 150,000 gallons of water in the PCS storage tank, Westinghouse proposed to change the design of the PCS tank by (1) increasing the maximum water level from Elevation 298 ft to 303 ft, (2) raising the top of the tank by one foot, (3) reducing the thickness of the tank roof from 24 inches to 15 inches, (4) decreasing the thickness of the inner tank wall from 24 inches to 18 inches, and (5) adding a 9 inch deep fire water tank composed of two stainless steel plates underneath the PCS tank roof. From these design changes, Westinghouse estimated that the affected mass decreases by 2 percent in the horizontal direction and increases by 5 percent in the vertical direction. From this estimated effect, Westinghouse concludes that these changes are small enough that they will have negligible effect on the global seismic analyses of the nuclear island structures, and will only have small effects on the structural design of the shield building roof. The design calculations for the shield building roof for the local seismic analyses are currently being updated by Westinghouse. These new design calculations will include, (1) a 3D finite element analysis of the roof used to develop the equivalent stick model used in the global nuclear island seismic analysis, (2) a dynamic sloshing analysis with increased inventory, (3) a design calculation of the

shield building roof, (4) a concrete outline and reinforcement drawings, and, (5) a seismic margin evaluation of roof structures, which will be available for staff review when complete.

Based on the presentation by Westinghouse and the staff's discussion with Westinghouse during the February 4, 1997 meeting, Westinghouse needs to justify its conclusion that the global effect of the design change is negligible by appropriate calculations and evaluation. From the staff's engineering judgement, the design changes of the PCS tank will raise the height of the roof structure centroid and, in turn, will affect the rocking and translational responses (seismic shear forces, bending moments and in-structure response spectra) during a seismic event. The staff also believes that the design changes to the roof structures will affect the design of the nuclear island foundation mat.

In addition to these concerns, the staff has some other comments which Westinghouse should be prepared to answer prior to performing the detailed design calculations and documentation modifications associated with implementing the staff's post-72 hour policy. These comments are attached as an enclosure to this letter.

If you have any questions on this matter, please contact Bill Huffman at (301) 415-1141.

Sincerely,

original signed by:
Thomas T. Martin, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

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Docket No. 52-003
AP600

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Staff Comments on Proposed AP600 Design Changes
to Address Post-72 Hour Action Policy

Containment Systems Comments

There are two areas related to post-72 hour action design changes that affect the containment systems branch review: (a) the PCCSWT capacity was increased by 150,000 gallons (from its current 400,000 gallon capacity), and (b) an additional stand pipe was added to provide four periods of flow, instead of the current three periods. The fourth and final phase (72 hours to 7 days) provides about 18 gpm flow to cool containment.

Westinghouse needs to address the following questions:

(1) There is no known data at 18 gpm to support a water coverage fraction for use in WGOTHIC. The minimum known test data is for an equivalent value of about 50 gpm, from the cold water distribution tests.

(2) A preliminary WGOTHIC prediction indicates that after 24 hours with the 18 gpm flow rate, the pressure will rise above the 24 hour criteria used by Westinghouse (50 percent of design pressure). It is not clear if this represents a change in the Westinghouse acceptance criteria for the PCCS performance.

Reactor Systems Branch Comments

(3) Are any changes to the at power or shutdown ERGs necessary in light of these design changes?

Radiation Protection Branch Comments

(4) In addition to the offsite radiological consequence assessment, Westinghouse should also assess the main control room operator doses due to the spent fuel pool boiling after 72 hours and up to 30 days. Iodine partition factor of 100 used by Westinghouse for the offsite radiological consequence assessment is not acceptable to the staff since pool water level (could be as low as 2 feet) does not warrant such a partition factor. Westinghouse should provide the offsite and control room radiological consequence analyses for our review.

(5) Westinghouse stated that the radiological consequence analysis is currently being performed for design basis accidents in Chapter 15 for opening the control room after 72 hours into the accident. Westinghouse should provide the offsite and control room operator dose assessment for the entire period of the accident (30 days) for our review. The staff notes that Westinghouse cited 10CFR20 limits when discussing operator doses in the main control room. The staff believes that GDC 19 is the applicable regulation in this instance. Westinghouse should also clarify the regulatory bases being applied to the radiological releases associated with spent fuel pool boiling.

Enclosure

Plant Systems Branch Comments

In consideration of possible spent fuel pool boiling and its relationship to main control room habitability, the Plant Systems Branch has some additional concerns regarding the main control room habitability system.

(6) Current operating reactors have comparatively much larger unfiltered in-leakage problems than assumed for the AP600. The VES design in-leakages are not verified through periodic testing in accordance with ASTM E741, "Standard Test Method for Determining Air Leakage Rate by Tracer Dilution."

(7) AP600 assumed single failure design flow of 25 SCFM per train will support only 5 people within the MCR envelope and remain within the OSHA regulations of maintaining carbon dioxide levels at less than 0.5 percent. However, the current Westinghouse proposal is to permit up to 11 occupants into the main control room during a DBA. The staff has still not accepted the higher control room occupancy number which would result in carbon dioxide levels exceeding OSHA regulations. In addition, it is unclear what control room occupancy number is assumed when performing heat load calculations in the main control room for post-72 hour actions.

(8) Westinghouse has not established the environmental qualification for main control room sealing materials.

(9) The methodology used to calculate the passive heat removal capability of the natural circulation ventilation of the main control room needs to be clarified.

(10) Westinghouse should address the habitability requirements of the technical support center (TSC) under accident and post-72 hour conditions.

Civil Engineering and Geosciences Branch Comments

In order to resolve the major seismic concerns discussed in the cover letter to this enclosure from the Civil Engineering and Geosciences Branch, Westinghouse should:

(11) Revise the seismic roof structure model to reflect the design changes of PCS tank structures and the increased amount of water,

(12) Perform seismic analysis for each of the design site conditions and evaluate the impact (both global and local) of these design changes to the design of the PCS tank, shield building roof structures and nuclear island foundation mat, and in-structure response spectra which are to be used for the design of subsystems such as piping,

(13) evaluate the adequacy of the 39 inches of free board distance above the water surface to ensure there will not be any water splashing to the bottom of the fire wate tank, and

(14) complete the design details of the fire water tank and make the design calculations available for staff review.

Miscellaneous Comments

(15) Westinghouse should provide additional details on the availability controls that will be placed on the COL applicant to ensure that the post-72 hour diesel generators will be functional when needed. This should include how the quarterly testing requirements will be implemented and a description of the testing specifics. Westinghouse should also clarify what the 10 year IST system testing program is and how it differs from the quarterly testing.

(16) The electrical connections between the 15 KW post-72 hour diesel generators and the 480 volt regulating transformers is being made into a permanent connection. How will the cable run be protected to GDC 2 requirements.

(17) The staff notes that the I&C equipment is qualified to a worst case environmental temperature of 120°F for 12 hours based on information in SSAR Section 7.1.4.1.6 and WCAP-13382. Westinghouse should confirm that the I&C temperature and humidity qualification is adequate under the proposed revisions to post-72 hour actions and design changes.

(18) Westinghouse should confirm that the applicable 1E safety related electrical systems within the auxiliary building are qualified to the steam and humidity environmental conditions that may result from boiling of the spent fuel pool or explain why this is not a concern.

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