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

May 16, 1994

Docket No. 52-003

Mr. Nicholas J. Liparulo
Nuclear Safety and Regulatory Activities
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

Dear Mr. Liparulo:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON THE AP600

As a result of its review of the June 1992, application for design certification of the AP600, the staff has determined that it needs additional information in order to complete its review. The additional information is needed in the area of human reliability analysis (Q720.276-Q720.278).* Enclosed are the staff's questions. Please respond to this request by June 30, 1994, to support the staff's review of the AP600 design.

You have requested that portions of the information submitted in the June 1992, application for design certification be exempt from mandatory public disclosure. While the staff has not completed its review of your request in accordance with the requirements of 10 CFR 2.790, that portion of the submitted information is being withheld from public disclosure pending the staff's final determination. The staff concludes that this request for additional information does not contain those portions of the information for which exemption is sought. However, the staff will withhold this letter from public disclosure for 30 calendar days from the date of this letter to allow Westinghouse the opportunity to verify the staff's conclusions. If, after that time, you do not request that all or portions of the information in the enclosures be withheld from public disclosure in accordance with 10 CFR 2.790, this letter will be placed in the NRC's Public Document Room.

*The numbers in parentheses designate the tracking numbers assigned to the questions.

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This request for additional information affects nine or fewer respondents, and therefore, is not subject to review by the Office of Management and Budget under P.L. 96-511.

If you have any questions regarding this matter, you can contact me at (301) 504-1120.

Sincerely,

Original Signed By:

Thomas J. Kenyon, Project Manager
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and License Renewal
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

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Mr. Nicholas J. Liparulo
Westinghouse Electric Corporation

Docket No. 52-003
AP600

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REQUEST FOR ADDITIONAL INFORMATION
ON THE WESTINGHOUSE AP600 DESIGN

720.276 Based on the September 21, 1993, response to Q720.65, which outlines the task analyses that were performed to support the human error probabilities (HEPs), the HEPs should be revised to address the following items. Any changes to the HEPs should be included in Table D-1 of the PRA, "AP600 HEP Summary Results."

a. Define "time window."

b. Describe in detail how the "estimated actual time" that it takes to perform operator actions was calculated, considering that no emergency operating procedures (EOPs) or emergency response guidelines (ERGs) have been developed for the AP600 design, the control room layout has not been well-defined, and the functional relationship of the senior reactor operator (SRO) and the shift technical advisor (STA) has not been clearly defined.

c. Westinghouse has modelled the failure of the operator to respond to alarms, and the failure of the operator to actuate a system such as the ADS (given that the operator has made the decision to initiate ADS). However, Westinghouse has not modelled the cognitive component of the operator action. THERP recommends using the annunciator model only when no diagnosis is involved in a plant response and the nominal diagnosis model when interpretation, diagnosis, or decision making is required. Therefore, re-evaluate all diagnostic operator actions using the time reliability curves contained in the THERP nominal diagnosis model.

d. Provide references to the corresponding THERP tables for the HEPs for each task presented in the task analyses.

e. Because procedures are not available for the AP600 design, a complete search for potential sources of operator errors-of-commission cannot be performed. Therefore, develop an ITAAC to ensure that the COL holder searches for potential sources of operator misdiagnosis when it develops its procedures, and ensures that the COL holder revises the PRA accordingly.

f. Recovery was double counted (once for SROs and once again for STAs), which reduced the HEPs by a factor of 10 to 100. The EOPs are not available and the functional relationship of the SRO and STA has not been clearly defined for each operator action. In addition, the Westinghouse AP600 Plant Probabilistic Safety Study Guidebooks (WCAP-12699) state as assumptions that (1) the conditional probability that the SRO will fail to recognize the error of the primary system operator is 0.1, and (2) the conditional probability that the STA will fail to recognize the error of the primary system operator and the SRO is 0.081, regardless of the operator action. Justify these two deviations from the THERP process. For each action in the task analyses, define what the

task of the SRO and the STA is to justify the recovery estimates that were used. Describe whether the SRO and the STA will be operating independently of the RO. Describe whether the STA is guaranteed to be in the control room during the accident.

g. The use of "slack time" in conjunction with the recovery added by the presence of the STA to constitute a double recovery factor appears not to be a conventional HRA practice, but an assumption in the analysis, according to the Westinghouse AP600 Plant Probabilistic Safety Study Guidebooks (WCAP-12699). Re-calculate the HEPs removing the credit for "slack time" or describe operating experience applicable to the AP600 design that justifies the use of "slack time."

h. The Westinghouse AP600 Plant Probabilistic Safety Study Guidebooks (WCAP-12699), based on THERP and expert judgment insights, strongly suggest that the HEPs fall **above** 1.0E-5. However, the staff identified two HEPs that were below this value: manual actuation of the automatic depressurization system (ADS) during a multiple steam generator tube rupture (SGTR) event, and operator diversion of the vessel inventory through the normal residual heat removal (RHR) system during shutdown. The staff agrees with the HEP assumption of WCAP-12699 and THERP. Revise the two HEPs identified above to conform with this position and provide the staff with the corresponding task analyses, or provide justification for the values used.

i. The treatment of dependency appears uneven between tasks. For example, in operator action LPM-MAN01, dependency modifiers were applied. However, in operator action LPM-MAN02, dependency modifiers were missing between steps 2 and 3 where there would be some correlation between misreading a limit switch and failing to verify or improperly verify the switch's position. Review and verify that the HEP calculations ensure that dependency between tasks was treated adequately.

j. The HEPs for internal events have been used without modification to support the external events analysis. For example, during fire events, communications will most likely be disrupted; smoke may impair the crew's ability to see indications and retrieve information from various boards and CRT interfaces. In accordance with accepted practices for PRA, adjust the HEPs for external events to more reasonably represent (1) the degree of uncertainty associated with the HEPs for these types of events, and (2) the expected increase in rates usually associated with events where stress is very high, the progression of events is dynamic, the man-machine interface may be degraded, and the task dependency is moderate to high.

720.277 Address the role of the operator in digital control rooms. The top 10 or 15 failures (dominant contributors) in the AP600 analysis involve I&C failures. Software is supposed to isolate the steam generator during a tube rupture event, but if it fails, will the crew

know that they face a steam generator tube rupture, or could the operators misinterpret it as another transient and take actions accordingly? If the digital indications fail, do they fail high, low, or give the last (good) value? Trusting instrumentation could result in the wrong event diagnosis or selection of incorrect actions. Define the role of the operator in terms of the following:

a. Will the RO, SRO, or STA allow the I&C systems to make operating decisions, or is the RO, SRO, or STA expected to intervene following a transient?

b. What kind of instrumentation is available to the operator to allow him to conclude that the I&C systems are working correctly?

c. What kind of instrumentation is available to the operator to assure him that the I&C systems are producing the proper response following an accident (i.e., how the accident is progressing)?

d. How are the operators expected to respond to and diagnose transients induced by I&C failures?

720.278 The September 21, 1993, response to Q720.65 indicated that the time window was 1 minute and the operator response time took 30 seconds for the operator to manually trip the reactor following an ATWS event. The failure rate, HEP=1.36E-2, was indicated for five multiple actions that are to be taken in less than 1 minute. The crew's stress level was modelled as "moderate" instead of "high," which conflicts with HRA procedures in the PRA Guidebook (WCAP-12699). If the crew realize that they have only one minute to take these actions, the crew's stress level would arguably be "high" instead of "moderate." If the crew is distracted or interrupted by events in the control room, the margin (residual time) could be reduced from 30 seconds to 15 seconds. Re-calculate the HEP for this operator action taking these concerns into account.