December 8, 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: OPEN ITEMS ASSOCIATED WITH THE AP600 SAFETY EVALUATION REPORT (SER) ON THE AP600 MAIN CONTROL ROOM HABITABILITY SYSTEM

Dear Mr. Liparulo:

The Plant Systems Branch of the U.S. Nuclear Regulatory Commission (NRC) has provided the SER input to the Standardization Project Directorate on the AP600 main control room habitability system, SER Section 6.4. The input has open items which have been extracted and designated as final safety evaluation report (FSER) open items in the enclosure to this letter. Open items from the Radiation Protection Branch concerning the radiological consequence assessment of the main control room habitability system have already been forwarded to Westinghouse under FSER Open Items 470.41F through 470.44F, 440.46F, and NRC letter to Westinghouse dated July 23, 1997.

If you have any questions regarding this matter, you may contact me at (301) 415-1141.

Sincerely,

original signed by:

William C. Huffman, Project Manager
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

cc w/encl: See next page

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Mr. Nicholas J. Liparulo
Westinghouse Electric Corporation

Docket No. 52-003
AP600

cc: Mr. B. A. McIntyre
Advanced Plant Safety & Licensing
Westinghouse Electric Corporation
Energy Systems Business Unit
P.O. Box 355
Pittsburgh, PA 15230

Ms. Cindy L. Haag
Advanced Plant Safety & Licensing
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15230

Mr. Sterling Franks
U.S. Department of Energy
NE-50
19901 Germantown Road
Germantown, MD 20874

Mr. Frank A. Ross
U.S. Department of Energy, NE-42
Office of LWR Safety and Technology
19901 Germantown Road
Germantown, MD 20874

Mr. Charles Thompson, Nuclear Engineer
AP600 Certification
NE-50
19901 Germantown Road
Germantown, MD 20874

Mr. Russ Bell
Senior Project Manager, Programs
Nuclear Energy Institute
1776 I Street, NW
Suite 300
Washington, DC 20006-3706

Ms. Lynn Connor
Doc-Search Associates
Post Office Box 34
Cabin John, MD 20818

Dr. Craig D. Sawyer, Manager
Advanced Reactor Programs
GE Nuclear Energy
175 Curtner Avenue, MC-754
San Jose, CA 95125

Mr. Robert H. Buchholz
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

Barton Z. Cowan, Esq.
Eckert Seamans Cherin & Mellott
600 Grant Street 42nd Floor
Pittsburgh, PA 15219

Mr. Ed Rodwell, Manager
PWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94303

SER SECTION 6.4 OPEN ITEMS ASSOCIATED WITH THE AP600 CONTROL ROOM HABITABILITY SYSTEM

410.366F

In accordance with TMI Action Plan Item III.D.3.4, COL applicants referencing the AP600 design must demonstrate that control room operators are adequately protected against the effects of the release of toxic substances either on or off site, and that the plant can be safely operated or shut down under conditions created by any design-basis accident. The COL applicant must also determine the amounts and locations of any possible sources of toxic substances near the plant using the methods in RG 1.78 and RG 1.95. The COL applicant must provide toxic gas detectors where necessary to permit automatic isolation of the control room. This was a DSER COL Action Item 6.4-1. In the text of SSAR Section 6.4.7, Westinghouse states that COL applicants referencing the AP600 design are responsible for the amount and location of possible sources of toxic chemicals in or near the plant and toxic gas monitoring as required, and that RGs 1.78 and 1.95 address control room protection for toxic chemicals.

(a) Westinghouse needs to state specifically that COL applicants referencing the AP600 certified design are responsible for the amount and location of possible sources of toxic chemicals in or near the plant and for seismic Category 1 Class 1E toxic gas monitoring as required, and is also responsible for evaluating and off site toxic releases in accordance with the guidelines of RGs 1.78 and 1.95 in order to meet the requirements of TMI Action Plan Item III.D.3.4 and GDC 19.

(b) In the unlikely event that power to the VBS is unavailable for more than 72 hours, MCR habitability is maintained by operating one of two MRC ancillary fans to supply outside air to the MRC. Westinghouse believes that the outside air will be acceptable for use within 72 hours following a radiological release. However, Westinghouse needs to provide additional information in the SSAR on the Post-72 hour toxic gas actions. Since Westinghouse has stated that this is the responsibility of the COL applicant, Westinghouse needs to state specifically that COL applicants referencing the AP600 certified design are responsible for evaluating the Post-72 hour on and off site toxic releases in accordance with the guidelines of RGs 1.78 and 1.95 in order to meet the requirements of TMI Action Plan Item III.D.3.4 and GDC 19.

410.367F

Westinghouse needs to state in SSAR Section 6.4.7 specifically that the COL applicants referencing the AP600 certified design are responsible for verifying that the as-built design, procedures, and training are consistent with the licensing basis documentation and the intent of Generic Issue 83.

410.368F

The use of noncombustible construction and heat and flame resistant materials throughout the plant to reduce the likelihood of fire and consequential impact on the MCR envelop atmosphere are evaluated in SER Section 9.5.1. Westinghouse previously listed the fire protection system (FPS) as one of the systems that collectively provide the habitability functions for the plant. This

list was in SSAR Revisions up to and including Revision 4, it was subsequently deleted in later SSAR revisions. Westinghouse needs to list and describe the FPS function as part of the habitability systems.

410.369F

The MCR envelop (MCRE) is shown in Figures 6.4-1, 1.2-8, 12.3-1 and areas adjacent to the MCRE are shown in Figures 1.2-25 through 1.2-31 of the SSAR. SSAR Table 3.2-3 indicates that the VES is located in the auxiliary building, which is a missile-protected seismic Category I building. However, in SSAR Section 6.4.2.1, Westinghouse needs to describe, the enveloping areas of the MCRE and the MCRE location including Elevation.

410.370F

SSAR Figure 6.4-2 shows a single pressure instrument (PT001) located outside the MCR envelop. This pressure instrumentation was redundant in previous revisions of the SSAR. The VES is a safety-related system that must meet the requirements of GDC 19, therefore the post-accident pressure instrumentation must be redundant to meet the single-failure criteria, it must be Class 1E and conform with RG 1.97-1983, Revision 3, and it must be seismic Category I. Therefore, Westinghouse needs to revise the text of the SSAR, Figure 6.4-2 and Table 7.5-1 to reflect these changes.

410.371F

Westinghouse needs to provide the following to clarify the VES flow design, temperature, and relative humidity criteria:

(a) Revise SSAR Section 6.4.3.2 to provide specific minimum and maximum temperatures with the corresponding relative humidities for the MCRE during the 72 hour period following the onset of a postulated design basis accident. Also, provide (for NRC staff review) the results of the evaluation performed (based on Gothic methodology or similar methodologies employed) and associated assumptions made to arrive at these temperatures and humidities.

(b) State in the text of the SSAR that the VES flow capacity conforms to: (1) the MCRE flow design "Table 1, and Appendix C Table C-1," of ASHRAE Standard 62-1989, "Ventilation for Acceptable Indoor Air Quality," and (2) 1993 ASHRAE Handbook, "Fundamentals SI Edition," Chapter 23.2, "Ventilation and Indoor Air Quality," since these references provide the appropriate guidelines for maintaining the carbon dioxide concentration limits below one-half percent by volume for a maximum occupancy of eleven persons inside the MCRE.

(c) Justify why the above flow capacity is adequate enough to meet the prescribed limits of the contaminants described in Table 1, and Appendix C Table C-1, of ASHRAE Standard 62-1989, "Ventilation for Acceptable Indoor Air Quality."

(d) Provide a revision designation letter to MIL-HDBK-759, 31 July 1995, "Human Engineering Guidelines," which is listed as a reference in SSAR Section 6.4.8.

410.372F

Westinghouse needs to provide following:

1. Provide data in SSAR Section 6.4 2.3 for the VES pressure regulating valves, flow metering orifices, remotely operated isolation valves, manual isolation valves, pressure relief isolation valves, pressure relief dampers, and breathing apparatus. The data should include the specific ASME code class, AP600 classification and seismic category. In addition provide a functional description of the manual isolation valves and list these as references in SSAR Section 6.4.8.

2. Provide a description and data in SSAR Section 6.4.2.3 for the VES piping and penetrations such as specific ASME code class, AP600 classification and seismic category and list these references in SSAR Section 6.4.8. Additionally, provide consistency in the text of the SSAR for the use of terminology such as "air Bottles" and "air storage tanks," i.e., are they air bottles or are they air storage tank ?

3. Provide an evaluation of the air piping material that is alloy steel except piping from tanks to sub-headers is stainless steel, as shown in Figure 6.4-2, as to its suitability without any degradation such as corrosion or any other degradation which may degrade the quality of breathing air during the life of the plant and revise the text of the SSAR accordingly. Also, provide clarification concerning the "loop" shown at the discharge side of each emergency air storage tank and revise SSAR Figure 6.4-2 accordingly.

4. Verify that the above components are included in Table 3.2-3 of the SSAR with the proper code classification data.

5. SSAR Section 6.4.2.2 state that the VES air storage vessels have a combined minimum volume of 41.77 m^3/sec (1475 cubic feet) while it is stated in SSAR Section 6.4.2.3 that the storage tanks collectively contain a minimum storage capacity of 8895.3 m^3/sec (314,132 standard cubic feet). Clarify this storage capacity data with the appropriate pressure values and revise the text of the SSAR Sections accordingly. Also, provide a breakdown of air flow and corresponding design and operating pressures at various points of the VES including the outlet of the air storage tanks, outlet of pressure regulating valves, inlet to flow metering orifice in each train, and outlet to air flow metering orifice in each train, in order to show that the system can provide a total of 0.0306 m^3/sec (65 scfm) of airflow, at a given time during accident conditions, as stated in SSAR Section 6.4.4. Revise the text of the SSAR and Figure 6.4-1 to include this information.

6. SSAR Section 6.4.4 states that 60 scfm of ventilation flow is sufficient to pressurize the control room to at least 1/8-in water gauge differential pressure. This statement should be revised to state that 60 scfm of ventilation flow is sufficient to pressurize the control room to at least positive 1/8-in water gauge differential pressure with respect to the surroundings spaces.

410.373F

Westinghouse needs to state specifically in the SSAR that no silicone sealant or any other patching material shall be used on VBS filters, housing, mounting frame, ducts, or penetrations and VES piping, valves, dampers, or penetrations forming the MCR pressure boundary.

410.374F

Westinghouse needs to revise SSAR Section 6.4.2.4 to specifically state that there will be no adverse environmental effects to the MCR sealant materials from the spent fuel pool boiling events, as evaluated.

410.375F

Westinghouse should revise the SSAR to include the following:

(a) Revise SSAR Section 9.4.1 (VBS) to state the VES carbon dioxide concentration limit and air flow criteria for normal and maximum occupancy of the areas served by VBS.

(b) Revise SSAR Table 14.3-7 (Sheet 1 of 4), "Radiological Analysis", to reflect the VES flow rate 65 scfm +/- 5 scfm.

410.376F

In response to RAI Question 450.10.g, Westinghouse states that AP600 does not have an onsite chlorine or other toxic chemicals storage facility, and offsite chlorine or toxic release is site specific. However, SSAR Table 6.4-1, "Onsite Chemicals," shows various chemicals. Additionally, in a letter dated October 10, 1997, Westinghouse states, in response to a staff's concern for onsite chemicals, that chemicals listed in SSAR Table 6.4-1 were evaluated using the methodology in NUREG-0570, "Toxic Vapor Concentrations in the Control Room Following A Postulated Accidental Release," and concluded that these chemicals do not represent a toxic hazard to control room operators. Also, SSAR Section 6.4.4 states that analysis of onsite chemicals as described in SSAR Table 6.4-1 and their locations as shown in SSAR Figure 1.2-2 are in accordance with RG 1.78 and shows that these sources do not represent a toxic hazard to MCRE personnel. Therefore, Westinghouse needs to update the response to RAI Question 450.10.g and provide the results of these evaluations (conformance with NUREG-0570 and RG 1.78) and associated assumptions to meet the requirements of GDC 19 with the following details:

1. Amount and name of chemicals stored in individual storage cylinders and number of cylinders

2. Overall dimensions and locations of cylinders

3. Pressure of each cylinder

410.377F

The non-safety-related VBS subsystem (MCR/technical support center HVAC subsystem) isolates the MCRE and/or TSC area from the normal outdoor air intake. It provides filtered outdoor air to pressurize the MCRE and TSC areas to a positive pressure of at least 3.2 mm (1/8-in) water gauge, with respect to the surrounding areas, when "high" gaseous radioactivity is detected in the MCRE supply duct. As described in SSAR Section 6.4.3.2, in the event of a "high-high" signal for particulate or iodine radioactivity in the MCRE supply duct or loss of ac power sources, the redundant safety-related VBS supply and return isolation valves, located in the MCRE, close and at the same time safety-related VES begins to deliver air from the emergency air storage tanks to the MCRE by automatically opening the isolation valves located

in the supply line to protect the MCR occupants from a potential radiation release. After a slight time delay, in which the MCRE pressure increases slightly due to the addition of air, the isolation valves open, allowing the pressure relief dampers to function. However, Westinghouse needs to state in specific terms exactly what amount of time delay and MCRE pressure increase is required to open these isolation valves.

410.378F

Air samples from the emergency air storage tanks are taken quarterly and analyzed to conform with the guidelines of Table C-2 of ASHRAE Standard 62. The staff has determined that reference to C-2 is not acceptable. However, conformance with both, Appendix C, Table C-1 and Table 1 of ASHRAE Standard 62, is acceptable. Additionally, Westinghouse must include the above criteria as part of the Surveillance Requirements of Chapter 16 Technical Specifications to validate the VES air quality of the emergency air storage tanks and air quality of the air supplied from the compressed and instrument air system (CAS) and revise SSAR Sections 6.4.5.1, 6.4.5.3 and 9.4.1, and the VES Surveillance Requirements of Chapter 16 Technical Specifications.

410.379F

SSAR Table 15.6.5-2 provides the MCRE volume and maximum unfiltered air in-leakage (infiltration) rates as follows. The main control room envelope (MCRE) volume is 1010.91 m^3 (35,700 ft^3). The maximum unfiltered air in-leakage (infiltration) into the MCRE under accident conditions is 0.00117-0.00233 m^3/sec (2.5-5.0 cfm) when the VES is operating. The maximum unfiltered air in-leakage (infiltration) into the MCRE during a "high" gaseous radioactivity signal while the VBS is operating is 0.066 m^3/sec (140 cfm). The AP600 design features such as a vestibule style entrance preventing contaminated air from entering the MCR envelope as a result of egress and ingress, and maintaining the MCRE at positive pressure, with respect to surrounding areas, are not uncommon. This design is quite prevalent at operating reactors and those reactors show comparatively much larger amounts (i.e., hundreds of cfm) of unfiltered in-leakages as has been determined by a tracer gas testing method. Non-safety-related ductwork and associated equipment routed through the MCRE, such as the AP600 VBS design, can provide pathways for unfiltered in-leakage of contaminated air from outside the MCR envelope, and can also helps to provide a false indication of pressurization of the MCRE. Pressurization testing measurements do not assure that the MCRE is at a uniform positive pressure with respect to adjacent areas because pockets in the MCRE may be at a negative or lower positive pressure with respect to adjacent areas and thus provide pathways for relatively larger amounts of additional unfiltered in-leakage than assumed in dose calculations for postulated design basis accident conditions. Therefore, Westinghouse should validate the VES design. One of the acceptable methods of validation is testing in accordance with ASTM E741, "Standard Test Method for Determining Air Leakage Rate by Tracer Dilution." Westinghouse needs to validate the VES design for the MCRE by tracer testing or its equivalent and revise SSAR Sections 6.4 and 9.4.1, and the VES Surveillance Requirements of Chapter 16 Technical Specifications.

410.380F

Pre-operational testing is discussed in Chapter 14 of this report. The staff has determined that the air quality reference to Appendix C, Table C-2 of ASHRAE Standard 62, is not acceptable. However, conformance with both, Appendix C, Table C-1 and Table 1 of ASHRAE Standard 62,

is acceptable. Therefore, Westinghouse needs to revise pre-operational inspection and testing requirements of Chapter 14 for the VES and VBS to include the above criteria to validate the VES air quality of the emergency air storage tanks and air quality of the air supplied from the CAS.