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

ATTENTION: T. R. QUAY

SUBJECT: AP600 DESIGN CERTIFICATION; FIRE PROTECTION OPEN ITEMS; RESUBMITTAL OF INFORMATION

Dear Mr. Quay:

As requested by NRC, this provides a resubmittal of fire protection open items resolution information. The information was originally provided by a March 20, 1997 fax. The attachment to this letter is that provided by the fax, marked up to reflect resolution of comments received from NRC during our joint fire protection meetings.

If you have any questions, please call J. W. Winters (412-374-5290).

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

jml

Attachment: Markup of March 20, 1997 fax (14 pages)

cc: N. J. Liparulo, Westinghouse (w/o Attachment)

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OI-306. **NRC's concerns regarding AP600 safe shutdown capabilities during and/or after a design basis fire.**

I. AP600 Compliance with Regulations for Passive ALWRs

A. Compliance with BTP CMEB 9.5-1

SSAR Table 9.5.1-1, note the following:

Item 16 AP600 uses two levels of damage limits: safe shutdown and design basis accidents *(in contrast to three in App. R; hot shutdown, cold shutdown, and DBAs)*. Safe shutdown capability is protected from damage caused by a single fire.

(AP600 "safe shutdown" is ~~deemed equivalent to~~ used rather than "cold shutdown". In SECY-94-084, it is recognized that Passive ALWR designs are limited by the inherent ability of the passive heat removal processes. EPRI's position is that safe stable shutdown condition is at 420 °F, and that passive safety systems need not be capable of achieving cold shutdown, based on the belief that the passive decay heat removal systems have inherently high long-term reliability.

The NRC Staff position is that an RHR system be able to bring the plant to cold shutdown conditions (with reference to GDC 34 and RG 1.139) was established to enable the licensee to perform inspection and repair at the plant. The Staff believes that other plant conditions may constitute a safe shutdown state as long as reactor subcriticality, decay heat removal, and radioactive materials containment are properly maintained for the long term.

The Staff recommends that the Commission approve the EPRI's proposed 420 degrees F or below, rather than the cold shutdown condition required by RG 1.139, as a safe stable condition which the passive decay heat removal systems must be capable of achieving and maintaining following non-LOCA events. This recommendation is predicated on an acceptable passive safety system performance and an acceptable resolution of the issue of regulatory treatment of non-safety systems.)

The Commission has made determinations on the Staff's recommendations (SECY-94-084) regarding Safe Shutdown Requirements (item C) in the memorandum of June 30, 1994 from John C. Hoyle to James M. Taylor.

Item 25 Safe shutdown systems are protected such that reliance on alternative or dedicated shutdown capability is not necessary *(in contrast with App. R allowed Alternative or Dedicated Shutdown).*

AP600 safe shutdown capabilities include methods for using safety-related systems only, safety-related and nonsafety-related systems, or nonsafety-related systems only. The safe shutdown capabilities using safety-related systems are fully protected to ensure that at least one safe shutdown capability is available in the event of a single fire, without taking any credit for repairs or operator actions in the fire-affected area, and all equipment within the fire area is rendered inoperable by the fire. AP600 does not rely on an alternative or dedicated shutdown capability. This approach is similar to that used for ABWR, an evolutionary advanced light water reactor.

B. SECY-90-016 Evolutionary LWR Certification Issues (Jan. 12, 1990) (re-iterated in SECY-93-087)

"D. Fire Protection"

The evolutionary ALWR designers must ensure that safe shutdown can be achieved, assuming that all equipment in any one fire area will be rendered inoperable by the fire and that re-entry into the fire area for repairs and operator actions is not possible. The control room is excluded from this approach, provided an independent alternative shutdown capability that is physically and electrically independent of the control room is included in the design.	AP600 complies. At least one of safe shutdown capability using safety-related systems (SSAR 7.4.1.1) is available in the event of a single fire, without requiring repairs or operator actions in the fire-affected area.
Evolutionary ALWRs must provide fire protection for redundant shutdown systems in the reactor containment building that will ensure, to the extent practicable, that one shutdown division will be free of fire damage.	AP600 complies. SSAR 9A.3.1.1 provides the FHA and Safe Shutdown Analysis.
Additionally, the evolutionary ALWR designers must ensure that smoke, hot gases, or the fire suppressant will not migrate into other fire areas to the extent that they could adversely affect safe-shutdown capabilities, including operator actions.	AP600 complies. Fire-smoke dampers are utilized to minimize migration of the effects of fire through the shared HVAC. (See attached sketch and response to OI-323 located elsewhere in this letter.)

C. **April 26, 1990 Staff Letter to the Commission, Re. Evolutionary LWR Certification Issues and Their Relationship to Current Regulatory Requirements**

"6. Fire Protection"

Proposed enhancements that represent a significant improvement in physical separation requirements and in the need to consider the effects of smoke, heat, and fire suppressant migration into other areas. In particular, redundant train separation is likely to be the most significant feature leading to reduced fire risk.	AP600 complies. Fire-smoke dampers are utilized to minimize migration of the effects of fire through the shared HVAC.

D. Additionally, in the **NRC Request for Additional Information**, RAI 280.12, it was stated that ....."based on its review of Section 7.4, the staff has determined that safe shutdown as defined above can be achieved within 36 hours following a fire event using only safety-related equipment and can be maintained long-term (i.e., beyond 36 hours after it has been achieved) provided: (1) the safety-related passive systems used for safe shutdown perform their intended function; (2) nonsafety-related equipment are available for long-term maintenance of safe-shutdown; and (3) all staff's concerns identified in the following sections are resolved. For the above reasons, consistent with SECY-94-084 (approved by Commission, see SRMs dated June 30, 1994 and June 28, 1995) position on safe shutdown requirements for passive plant designs, the staff accepts safe shutdown as defined above as a safe stable condition for AP600, subject to an acceptable passive system performance and an acceptable resolution of the issue of regulatory treatment of non-safety systems (RTNSS). ....."

"Response:
Westinghouse concurs with the definition of safe shutdown presented in this Request for Additional Information."

For discussion purposes only, the following AP600 comparison with App. R and other regulations/guidelines for LWRs is presented. No regulations require such comparison as App. R is not applicable to AP600.

A. AP600 short-term safe shutdown capability ~~(to be initiated following a design-basis fire event~~ when using safety-related systems only) includes maintaining the reactor subcritical, the reactor coolant average temperature less than or equal to no load temperature, and adequate coolant inventory and core cooling. The long-term safe shutdown conditions are the same as the short-term safe shutdown conditions except that the coolant temperature shall be less than 420 °F. This long-term condition must be achieved (using safety related equipment) within 36 hours and maintained indefinitely. (SSAR 7.4)

Based on the above:

(1) AP600 long-term safe shutdown condition shall ~~be deemed equivalent to~~ used rather than the cold shutdown discussed in Appendix R of 10CFR50. SECY-94-084 confirms ~~this equivalency~~ the acceptability of this approach.

(2) App.R III.G.1.b. "Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours" is not applicable to AP600.

(3) App.R III.G.3 that provides "Alternate or dedicated shutdown capability" is also not needed for AP600, because on AP600 none of the following App.R conditions exist; a) protection of systems whose function is required for hot shutdown does not satisfy the requirement of III.G.2, and b) where redundant trains of systems required for hot shutdown located in the same fire area may be subject to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems. However, the App.R requirement of "In addition, fire detection and a fixed fire suppression system shall be installed in the area, room, or zone under consideration" has been considered ~~implemented~~ for AP600 Containment fire area. Fire detectors and standpipe and hose coverage are provided.

See also AP600 SSAR Table 9.5.1-1 (Comparison with BTP CMEB 9.5-1 Guidelines) Item 25. Remarks: "Safe shutdown systems are protected such that reliance on alternative or dedicated shutdown capability is not necessary".

GL 86-10 that provides interpretations of App. R regarding the Alternative or Dedicated Shutdown is also not applicable on AP600. And the interpretation of App. R "free of fire damage" is not applicable, because on AP600, all equipment within the fire area ~~are~~ is assumed to be rendered inoperable by the fire, in compliance with SECY-90-016.

(4) App.R.III.L. detailing the requirements of Alternative and dedicated shutdown capability provided for a specific fire area is not applicable to AP600. Item (3) above confirms that AP600 does not require an Alternative or dedicated shutdown capability.

B. App.R Fire Damage Limits for hot shutdown safety function is "One train of equipment necessary to achieve hot shutdown from either the control room or emergency control station(s) must be maintained free of fire damage by a single fire, including an exposure fire", and for cold shutdown is "Both trains of equipment necessary to achieve cold shutdown may be damaged by a single fire, including an exposure fire, but damage must be limited so that at least one train can be repaired or made operable within 72 hours using onsite capability".

AP600 complies with the fire damage limits for hot shutdown safety function, and even better for cold shutdown function, because AP600 safe shutdown systems (using safety-related systems) are fully protected such that reliance on repairs of fire-damaged equipment within 72 hours is not necessary. See also AP600 SSAR Table 9.5.1-1 (Comparison with BTP CMEB 9.5-1 Guidelines) Item 16, Remarks: "AP600 uses two levels of damage limits: safe shutdown and design basis accidents. Safe shutdown capability is protected from damage caused by a single fire."

Also, GL 86-10 that provides interpretations of App. R regarding the allowed repair of cold shutdown equipment is also not applicable on AP600.

C. Based on the discussions above, a major fire involving the Turbine Building with its potential consequences of loss of the nonsafety-related RHR systems should not be a nuclear safety issue on AP600. It may become a property loss prevention issue, especially from the plant underwriter's perspective. However, AP600 turbine building fire protection is consistent with the current industry standards, such as, NFPA 803, 804, 850 and EPRI NP-4144 (July 1985).

OI-314. AP600 Fire Detection and Alarm System

1. Compliance with BTP CMEB 9.5-1 (see SSAR Table 9.5.1-1)

112. Fire detection systems should be provided for areas that contain or present a fire exposure to safety-related equipment.	AP600 complies.
113. Fire detection systems should comply with the requirements of Class A systems as defined in NFPA 72D and Class I circuits as defined in NFPA 70.	AP600 complies, no exception to NFPA 70 & 72D is identified.
114. Fire detectors should be selected and installed in accordance with NFPA 72E.	AP600 complies, no exception to NFPA 72 is identified.
115. Testing of pulsed line-type heat detectors should demonstrate that the frequencies used will not affect the actuation of protective relays in other plant systems.	AP600 complies.
116. Fire detection systems should give audible and visual alarm and annunciation in the main control room.	AP600 complies.
117. Where zoned detection systems are used in a given area, local means should be provided to identify which zone has actuated.	AP600 complies.
118. Local audible alarms should sound in the fire area.	AP600 complies.
119. Fire alarms should be distinctive and unique so they will not be confused with any other plant system alarms.	AP600 complies.
120. Primary and secondary power supplies, which satisfy the provisions of section 2220 of NFPA 72D, should be provided for the fire detection system and for electrically operated control valves for automatic suppression systems.	AP600 complies, no exception to NFPA 72D is identified.

2. Disposition of NRC concerns

1. Fire detection in safety related areas is seismically qualified.	AP600 does not intend to have a seismically qualified fire detection system. There is no requirement to make the fire detection system to withstand design basis earthquake, or to remain functional following a seismic event. However, with microprocessor-based equipment and components the fire detection system can be expected to be unaffected by earthquakes, and the potential of spurious actuation should be minimal.

OI-321. AP600 Fire Pumps

1. Compliance with BTP CMEB 9.5-1 (see SSAR Table 9.5.1-1)

128. A sufficient number of pumps should be provided so that 100 percent capacity will be available assuming failure of the largest pump or loss of offsite power.	AP600 complies, one electric motor-driven and one diesel-driven fire pump, 100% capacity each, are provided.
129. Individual fire pump connections to the yard fire main loop should be separated with sectionalizing valves between connections.	AP600 complies. Fire pump discharge lines are re-arranged so they are individual connections to the yard fire main, with sectionalizing valves between connections.
130. Each pump and its driver and controls should be separated from the remaining fire pumps by a 3-hour rated fire wall.	AP600 complies. Each fire pump and its controller are located in a room enclosed by 3-hour fire barrier.
131. The fuel for the diesel fire pump should be separated so that it does not provide a fire source exposing safety-related equipment.	AP600 complies. Fuel oil day tank is in the diesel engine-driven fire pump room that is enclosed by 3-hour fire barrier. The fuel oil storage tank is located outdoor.
132. Alarms indicating pump running, driver availability, failure to start, and low fire main pressure should be provided in the main control room.	AP600 complies. Refer to P&ID FPS M6-001.
133. The fire pump installation should conform to NFPA 20.	AP600 complies. No exception to NFPA20 is identified. (See Table 9.5.1-3.)

2. Disposition of NRC concerns

1. Can the yard fire main be supplied by the fire pumps if there is fire damage to the yard main extension inside the Turbine Building?	Yes. The fire pumps can still supply the yard main and the yard main extension can be isolated if it is damaged by the fire.
2.Will the air intake of the diesel fire pump be affected by the turbine building fire?	No. The fire pump diesel-engine driver outside air intake is located at the same side of the building with the other HVAC outside air intakes, remote from the discharge points including smoke relief through the roof. Additionally, the intake is located within the envelope of the fire pump fire area.
3. Will the power supply of the electrical motor-driven fire pump survive a fire in the Turbine Building?	Fire pump motor supply is designed and routed in conformance with NFPA 20 and NFPA 70. Since routing from the non-diesel bus is less susceptible to a turbine building fire and a diesel back fire pump is not required if a diesel fire pump is installed, the present SSAR 9.5.1.2.3 wording "The motor-driven fire pump is supplied with power from the diesel-backed non-Class 1E switchgear", will be revised in SSAR Rev. 12 to indicate the motor-driven fire pump is not on the plant diesels.
4. Are the fire tanks too close to the Turbine Building? Could they be damaged by a turbine building fire?	4. As noted in meetings with the NRC, this is not a licensing issue but an insurance issue. Westinghouse is presently reviewing its design in this area to determine its insurance liabilites.

OI-322. AP600 Basis for Selecting NFPA 14, Class II, Standpipe and Hose Stations

BTP 9.5-1 guidelines recommend installation of standpipe and hose stations that meets the requirements of NFPA 14, however, it does not call for a specific class of standpipe system per NFPA 14 to be provided. NFPA 14 provides three classes for a standpipe system based on its intended use (for the manual firefighting efforts), however, it too does not specify specific applications, buildings or facilities where such classes of standpipe systems should be provided.

As stated in SSAR 9.5.1.2.1.5, the AP600 fire protection standpipe and hose systems are provided for each building, for Class II service in accordance with NFPA 14, i.e., primarily intended for use primarily by the building occupants or by the fire department (plant fire brigade) during initial response. Each hose reel or rack contains up to 100 ft. of 1-1/2 in. fire hose.

AP600 fire hazard and protection analyses (SSAR section 9A) showed that in the nuclear island the postulated fires are primarily fires involving electrical equipment and cables or ordinary class A combustibles such as paper or trash. There are no insitu flammable liquids or gases expected to be present within the nuclear island. Consistent with the postulated fire characteristics and manual extinguishing techniques, plus the AP600 fire areas compartmentalization and configurations, a Class II standpipe with 1-1/2" hoses is deemed most practical as it can be safely used by the plant fire brigade without undue damages to nonfire-affected facilities and equipment.

In the Turbine Building, recognizing that the postulated fires may involve flammable liquids or gases, such as, lubricating fluid, hydraulic fluid, hydrogen, etc., the hose stations are provided with a 2-1/2 in. angle valve. A 2-1/2 to 1-1/2 hose coupling is installed at the hose rack, together with the up to 100 ft. of 1-12 in. fire hose. Hence the fire brigade has the option to breakaway the hose coupling, and attached their portable 2-1/2 in. hoseline in order to obtain a greater flow rate.

In either case, the fire brigade can also supplement the interior hosestreams by using the additional 2-1/2 inch hoses that are connected to the nearest hydrant(s), should it become necessary.

Subsequent to the March 20, 1997 tax, Westinghouse processed a design change to provide a Class III system throughout.

OI-323. AP600 Protection from Smoke Spread

1. Compliance with BTP CMEB 9.5-1 (see SSAR Table 9.5.1-1)

99. Smoke and corrosive gases should be discharged directly outside to an area that will not affect safety-related plant areas.	AP600 complies. smoke exhaust outlets are located remote from outside air intake openings to preclude recirculation of smoke into the buildings.
100. To facilitate manual firefighting, separate smoke and heat vents should be provided in certain areas.	AP600 complies. smoke and heat venting capability is provided as described in App.9A. Fire Protection Analysis.
101. Release of smoke and gases containing radioactive materials to the environment should be monitored.	AP600 complies.

2. Compliance with SECY-90-16, Evolutionary LWR Certification Issues (Jan.12, 1990)

Additionally, the evolutionary ALWR designers must ensure that smoke, hot gases, or the fire suppressant will not migrate into other fire areas to the extent that they could adversely affect safe-shutdown capabilities, including operator actions.	AP600 complies. Fire-smoke dampers are utilized to minimize migration of the effects of fire (smoke and hot gases) through the shared HVAC ductwork that serves a single train of safety-related equipment rooms (Div. A&C, or Div. B&D).

3. Disposition of NRC concerns

1. Define the detector to smoke damper logic.	Opening and closing of the combination fire/smoke dampers will be controlled by the fire detection system that comprises of area detectors and in-duct detectors. The area smoke detectors will initiate the closing of the fire/smoke dampers. A high temperature override will close the damper when the in-duct secondary high temperature sensor senses a temperature higher than the fire damper's fusible link rating.
2. Define the location of smoke detectors used for damper control.	Area smoke detectors will be used for controlling the opening/closing of the combination fire/smoke dampers. The concept is to close the smoke damper and to isolate the fire-affected room at the early stage of the fire, and as soon as smoke is developed and detected by the area detector(s), while allowing the HVAC system to continue running and providing pressurization of the non-affected rooms.
3. Describe overall smoke control philosophy, logic and implementation.	Smoke control logic will be integrated with the corresponding HVAC control logic. Upon detection of smoke in a room, that room will be immediately isolated by using the combination fire/smoke dampers. Meanwhile, the HVAC is designed to continue running to serve the other non-affected rooms and to provide ambient pressurization that will help confine smoke and hot gases within the fire-affected room. For post-fire recovery the fire/smoke damper will be reopened and smoke removal will be accomplished by running the HVAC system in a once-through mode.

4. Describe in details the re-opening of fire and smoke dampers.	Reopening the combination fire/smoke dampers can be accomplished from a remote location, i.e. from the fire alarm and control panel(s). However, when the damper is closed due to high temperature, resetting the high temperature sensor needs to be made at the damper. Therefore, on AP600 the damper actuators and controller will be located outside of the fire-affected areas, either in the corridor ceiling or in the mechanical equipment room