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

ATTENTION: T. R. QUAY

SUBJECT: AP600 RESPONSE TO REQUESTS FOR ADDITIONAL INFORMATION

Dear Mr. Quay:

Enclosed are Westinghouse responses to NRC requests for additional information pertaining to the AP600 internal fire analysis, which is documented in Chapter 57 of the AP600 Probabilistic Risk Assessment report. Specifically, responses are provided for RAIs 720.335, 720.336, and 720.352.

The NRC comments provided during the Westinghouse/NRC December 19, 1996 AP600 internal fire analysis meeting have been addressed in the RAI responses. The responses close, from a Westinghouse perspective, the addressed questions. The NRC should review these responses and inform Westinghouse of the status to be designated in the "NRC Status" column of the OITS.

Please contact Cynthia L. Haag on (412) 374-4277 if you have any questions concerning this transmittal.

C. L. Haag for BAM

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

Enclosure

cc: J. Sebrosky, NRC (enclosure)
N. J. Liparulo, Westinghouse (w/o enclosure)

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Enclosure to Westinghouse
Letter NSD-NRC-97-4943

January 28, 1997

Question: 720.335

One item of concern in the certification of advanced reactor designs is the impact of smoke, hot gases, and fire suppressants on safe shutdown equipment (especially due to sensitive electronics) and on operator actions. The issue is amplified when these elements migrate into other fire areas. Please address this issue in the internal fire PRA.

Response:

The impact of hot gases, fire suppression, and smoke has been addressed in the AP600 internal fire analysis either implicitly or explicitly as follows:

Impact on equipment

In all plant locations other than the control room, the components (of all types) and cabling located in an area where the fire originates or to which it propagates have been assumed lost independent of the hazard (i.e. independent of smoke, formation of hot gas layer, fire suppression activities, etc.). Note that, consistent with BTP CMEB 9.5-1 and NFPA recommendations, the AP600 ventilation systems are designed to confine smoke, hot gases, and fire suppressants within the fire area of fire origin. Each fire area is served by only one ventilation subsystem. The subsystem serving areas with divisions A and C equipment is physically separate from that serving areas with divisions B and D equipment. Most subsystems are recirculation systems with filtration, but each fire area is once through and in parallel with other fire areas on its subsystem. Upon detection of smoke or heat (indicating a fire) in any fire area, smoke, fire or combination smoke/fire dampers automatically close at the boundaries of the affected fire area. This isolates the area and creates a condition where adjacent areas have a slightly higher pressure than that of the affected area. This confines smoke and heat to the affected area. During fire suppression activities, smoke and heat can be vented outside by portable equipment or by manually resetting system dampers to exhaust the space. Failure scenarios of the smoke confinement features include failure of detection of failure of dampers to close completely.

In the control room, based on the available data and the fact the control room would be continuously occupied, it has been judged that the impact of fire-generated or fire-induced hazards (i.e. smoke/heat or water) would be limited if the fire did not, or was not allowed, to fully develop. For fully developed fires, all the equipment in the control room have been assumed lost (due to heat or smoke-induced damage) and no operator action from the control room has been credited. Additionally, in all fire areas, the impact of fire-induced spurious actuation (such as those that can be caused by smoke/soot or cable hot short) have been explicitly modeled.

Impact on Operators

In the AP600 internal fire analysis, other than in the control room, no local manual action has been credited. Therefore, the impact of fire-generated or fire-induced hazards on the local operator action did not need to be addressed. For the control room, the level of smoke which would impair the effectiveness of the operators and the time available to suppress the fire before the smoke concentration reaches the level of visual impairment have been evaluated based on available experimental data, the AP600-design specific control room features and assessments made in other fire PRAs. Note that in addition to the ventilation system features for smoke confinement described above, the control room ventilation system has additional features. Upon the unlikely detection of smoke in the

control room from a fire outside the control room, the operators can manually aline the supplemental air filtration system. This system is designed to be used to reduce radioactive contamination from reaching the operators during a release accident, but can also be used to significantly reduce the amount of smoke reaching them. Since only very localized/small fires have been assessed to have limited impact (i.e. large fires have been assumed to disable all the equipment) and the damage caused by such fires, based on available data, were assessed to be limited, it was judged that fire suppression activities related to such ' fires would not significantly impede or adversely affect operators actions.

PRA Revision: None.

AP600

Question: 720.336

Burning liquids in the AP600 turbine building could fall on the floor at elevation 100 feet. It is not clear where they would go. Is it possible that the oil could enter the Auxiliary Building? Experience (the Vandellos turbine building fire) has shown that burning oil can spread away from the point of origin. Is it possible that an important scenario, which involves damage to other fire areas within the Auxiliary Building, was not analyzed because of the analysis groundrule preventing treatment of scenarios involving fire spread to multiple zones? Please explain and identify the specific design features that prevent this from happening.

Response:

In general terms, in the AP600 internal fire analysis, the ground rules followed in assessing the impact of fire propagation included the following:

a. Fires originating in a fire area (exposing fire area) could only propagate to an adjacent fire area (exposed fire area), and no further propagation beyond the exposed fire area was considered to be credible.

b. Simultaneous fire propagation from the exposing fire area to more than one adjacent fire area was not considered credible.

That is, fire propagation to more than one fire area was considered but sequential fire propagation (from a fire area to an unconnected fire area via an intermediatory fire area) or simultaneous fire propagation to more than one fire area were judged not to be credible.

Where human access is required, fire areas are separated by fire doors. These are not leak tight doors and oil may spread through them. Other penetrations, for pipe, cable and ducting, are sealed with a fire stop material of equivalent rating to the barrier in which it is installed. Where the penetrations are in floors, curbs are provided to minimize flooding challenges to the fire stop material. Specifically, fire propagation from the AP600 turbine building to the auxiliary building has been considered credible where a mechanism to allow for fire propagation (e.g. a door) had been identified. More specifically, fire propagation from the AP600 turbine building (including oil-fueled fires) to fire area 1201 AF 04 located in the auxiliary building was considered to be credible and its consequences has been analyzed in the internal fire analysis.

PRA Revision: None.

Question: 720.352

The Auxiliary Building contains the MCR as well as various I&C, battery and electrical equipment areas. Do any of the later areas share a common ventilation system and/or air intake system with the control room? If the answer is yes, please explain what barriers (including operator actions) prevent smoke, hot gases and fire suppressants from reaching the MCR and how such barriers can be defeated.

Response:

The Nuclear Island Nonradioactive Ventilation System (VBS), as described in AP600 SSAR Section 9.4.1, serves the Class 1E I&C, battery, and electrical equipment areas, the technical support center, and the main control room. The VBS consists of three independent subsystems, including a main control room/technical support center HVAC subsystem and a Class 1E electrical room HVAC subsystem for each of the A and C division rooms and the B and D division rooms. The MCR is a separate fire area from the various electrical equipment room fire areas.

The MCR/TSC subsystem supplies outside air to the main control room and technical support center areas, and the supply and return air ducts that penetrate the MCR envelope include redundant safety-related seismic Category I isolation dampers located within the MCR envelope. The two Class 1E electrical room HVAC subsystems serve the Class 1E electrical rooms, Class 1E instrumentation and control rooms, Class 1E electrical penetration rooms, Class 1E and spare Class 1E battery rooms, remote shutdown area, and reactor coolant pump trip switchgear rooms. The outside supply air intake enclosure for the portion of the Class 1E electrical room HVAC subsystem serving the division A and C electrical equipment areas is common to the MCR/TSC intake, but the intake serving the division B and D equipment is in a separate enclosure.

As noted in AP600 SSAR subsection 9.4.1.2.1.1, the MCR/TSC HVAC subsystem is designed so that smoke, hot gases, and fire suppressant will not migrate from one fire area to another to the extent that they could adversely affect safe shutdown capabilities, including operator actions. Fire or combination fire and smoke dampers are provided to isolate each fire area from adjacent fire areas during and following a fire in accordance with NFPA 90A requirements. These combination smoke/fire dampers close in response to smoke detector signals or in response to the heat from a fire. If the operators in the MCR detect the ingress of smoke through the ventilation system from outside the MCR, they can activate the supplementary filtration system to further filter the incoming air. If smoke continues to build in the MCR, it can be isolated and placed on the control room habitability system.

As noted in SSAR subsection 9.4.1.2.1.2, each Class 1E electrical room HVAC subsystem is designed so that smoke, hot gases, and fire suppressant will not migrate from one fire area to another to the extent that they could adversely affect safe shutdown capabilities, including operator actions. Separate ventilation subsystems are provided to serve the electrical division A and C equipment rooms and the electrical division B and D rooms. The use of separate HVAC distribution subsystems for the redundant trains of electrical equipment prevents smoke and hot gases from migrating from one distribution division to the other through the ventilation system ducts. In addition, combination fire/smoke dampers are provided for Class 1E equipment rooms, including the remote shutdown workstation room, to isolate each fire area and block the migration of smoke and hot gases to or from adjacent fire areas in accordance with NFPA 90A requirements. These combination fire/smoke dampers close in response to smoke detector signals or in response to the heat from a fire.

Separation of ventilation subsystems, as well as, smoke/fire dampers on each Class 1E electrical room and on the MCR, provide sufficient automatic protection against entry of smoke, hot gas, and fire suppressants into the MCR.

The degree of separation and redundancy in ventilation systems makes it unlikely that smoke, hot gases, or fire suppressants from fires outside the MCR would reach the MCR.

PRA Revision: None.