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

July 3, 1980

Docket No. 50-271

Mr. Robert L. Smith
Licensing Engineer
Vermont Yankee Nuclear Power
Corporation
25 Research Drive
Westboro, Massachusetts 01581

Dear Mr. Smith:

The Vermont Yankee fire protection SER, issued January 13, 1978, accompanying License Amendment No. 43, indicated that you would provide the details of certain proposed modifications for our review. In addition, certain issues were left open pending further staff review. Enclosure 1 summarizes the status of the open issues. Enclosure 2 provides our evaluation of the safe shutdown capability at Vermont Yankee facility following a fire in three plant areas. This issue was identified as item 3.2.8 "Shutdown Capability" of the fire protection SER.

In the SER, we requested that an analysis be provided to demonstrate that adequate shutdown capability would exist after a fire in the switchgear room, cable spreading room and control room. You provided this information in a letter dated January 30, 1978. Our evaluation of the Vermont Yankee safe shutdown analysis concludes that adequate shutdown capability has not been demonstrated for fires in the areas of concern. Enclosure 2 describes our evaluation and the requirement for alternate shutdown capability to be independent of fire damage in the areas of concern. The criteria for the required alternate shutdown systems are provided in Enclosure 3.

Please modify your provision for adequate shutdown capability to meet the enclosed criteria, and provide your response within 30 days of receipt of this letter.

Sincerely,

Thomas A. Ippolito, Chief
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Enclosures:
As stated

cc: See next page

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ENCLOSURE 1

VERMONT YANKEE

RESOLUTION OF INCOMPLETE ITEMS - STATUS

Item		Staff Evaluation	Licensee Response Due
3.1.3	Hose Station Calculations	Complete	
3.1.5	Foam Suppression Systems	Complete	
3.1.6	Gas Suppression Systems	Complete	
3.1.13	Portable Ventilation Equipment	Complete	
3.2.1	Protection of Essential Power Sources	Complete	
3.2.2	Flame Retardant Coatings	Complete	
3.2.5	Gas Suppression Systems	Complete	
3.2.6	Radiological Consequences of Fires	Complete	
3.1.4	Water Suppression Systems	Requirement	
3.1.14	Air Breathing Apparatus	Requirement	
3.2.3	Fire Water Loop	Requirement	
3.2.4	Primary Containment Analysis	Requirement	
3.2.7	Administrative Controls	Requirement	
3.2.8	Shutdown Capability	Requirement	30 days
3.1.1	In-Situ Tests a) Acceptance Criteria b) Bench Tests	Ongoing	
3.1.8	Fire Barrier Penetrations	Ongoing	

ENCLOSURE 2

VERMONT YANKEE
FIRE PROTECTION REVIEW
EVALUATION OF INCOMPLETE ITEMS

3.0 EVALUATION

The following provides our evaluation of the incomplete items. Numbers in parentheses following each heading refer to the sections of our previously issued SER which addressed these incomplete items.

3.1 Shutdown Capability (3.2.8, 4.1)

The fire protection SER for Vermont Yankee was transmitted to the licensee by letter dated January 13, 1978. Section 4.1 of the SER noted that there are three areas of the plant wherein the physical separation between redundant divisions of shutdown systems and the fire protection for these systems do not provide assurance that redundant safe shutdown systems would not be damaged by a fire. These areas are the control room, cable spreading room and switchgear room. As noted in Section 3.2.8 of the SER, the licensee agreed to provide a summary of an analysis demonstrating that safe shutdown systems can be placed in operation independent of fire damage to electrical circuits in any of these three areas. The procedures for local operation of valves and equipment, including the use of any measurements required to effect local manual safe shutdown would be provided for staff review.

By letter dated January 30, 1978, the licensee provided their analysis of the safe shutdown capability available after a fire in the switchgear room. Their analysis showed that core damage could be prevented after such an event. An analysis was not provided for the other two areas of the control building, i.e., cable spreading room and control room, because: "Fires in any other areas of the control building can be considered less damaging because of their early discovery and prompt suppression and because the ability to manually operate equipment is not impaired."

We have evaluated the licensee's safe shutdown analysis for the switchgear room and find that the following assumptions which form the basis of the licensee's analysis are unacceptable and/or unsupported:

1. The licensee assumes that all operations such as changing valve positions, closing electrical circuit breakers, etc. can be accomplished locally and manually. Because the analysis does not identify the circuits located in the switchgear room, and whether redundant control cables are also located there, we infer that the licensee only considered damage to pump power cables in their analysis. The licensee has not demonstrated that there would be time and manpower available for the manual operations necessitated by fire damage to control and valve motor cables. NRC requirements for acceptable alternate shutdown methods specify that safe hot shutdown operations must be performed by the minimum required number of onsite personnel exclusive of fire brigade members. Where fire damage precludes control of safe hot shutdown operations from the control room, sufficient time and manpower must be available to perform hot shutdown operations manually outside the control room.

2. The licensee assumes that no cable damage will occur to prevent safe shutdown for the first 30 minutes of a fire in the switchgear room. It is further assumed that 30 minutes after discovery of the fire, all functions will be lost whose power supply is routed through the room. The first of these assumptions is unsupported and, therefore, unacceptable; the licensee has not demonstrated that functions could not be lost in the first 30 minutes of the fire. Where cables for redundant safe shutdown systems are located in the same fire area, it should be

assumed that loss of function occurs at the inception of the fire unless it can be demonstrated that adequate separation and fire protection features exist to prevent loss of redundant divisions or systems. Further, damage effects should consider loss of control cables and valve motor cables as well as pump motor cables.

3. Local manual control of the reactor core isolation cooling (RCIC) pump is assumed by the licensee to demonstrate safe shutdown capability. This assumption is unsupported; the licensee has not demonstrated that sufficient time and manpower are available to accomplish this operation. See item 1 above.

4. The licensee assumes that in the event of a switchgear fire, the plant could be controlled during safe hot shutdown operations by the use of non-electrical indications located outside the room. This assumption is unsupported; the licensee has not demonstrated that plant control could be accomplished by the available manpower on loss of reactor pressure and level in the control room. Also, the availability of suppression pool temperature indication was not addressed. It is unacceptable to rely on instrumentation readout at locations outside the control room, unless it is demonstrated that sufficient time and manpower are available to perform hot shutdown functions with the minimum onsite shift personnel, exclusive of fire brigade members.

As noted above, assumptions used in the licensee's analysis did not support the conclusion that adequate alternate shutdown capability exists. In addition, the licensee proposes to achieve safe shutdown, in the event of a switchgear room fire, using methods which we find unacceptable. A

switchgear room fire could damage cables for redundant residual heat removal (RHR) pumps and redundant RHR service water pumps. The RHR and RHR service water systems are required to remove heat from the suppression pool during hot shutdown. In the event of fire damage to redundant divisions of RHR pump cables, the licensee would replace the cables before suppression pool cooling is required. The licensee states, without verification, that 48 hours would be available after scram before suppression pool cooling is required. If the RHR service water cables were damaged by fire, the licensee proposes to use the fire water system to cool the RHR heat exchangers in place of the RHR service water system. The shutdown cooling methods proposed as alternatives for normal RHR and RHR service water system operation do not meet the NRC requirements for safe shutdown capability in the event of a fire. That is, at least one division of safe hot shutdown systems should be undamaged after a fire in any one fire area; replacement of cables is only permitted for safe cold shutdown. Also, use of the fire water system for safe shutdown is not acceptable. The fire water system is not a normal shutdown system and cannot be relied upon for long-term suppression pool cooling.

As noted above, the licensee has not demonstrated that safe shutdown capability would be maintained in the event of a fire in the switchgear room. Although the licensee states that a fire in the control room or cable spreading room would be less damaging than a fire in the switchgear room, no basis has been provided for this assertion. Therefore, we require that the licensee provide an alternate method of safe shutdown that would be free of damage in the event of a fire in the switchgear room, control room or cable spreading

room. The criteria for the alternate shutdown system are provided in the enclosed staff position (Enclosure 3) and are partially addressed in our comments above. In addition, NRC requirements for Alternate Shutdown Capability is set forth in the proposed Appendix R to 10 CFR 50, Section II L.

STAFF POSITION
SAFE SHUTDOWN CAPABILITY

Staff Concern

During the staff's evaluation of fire protection programs at operating plants, one or more specific plant areas may be identified in which the staff does not have adequate assurance that a postulated fire will not damage both redundant divisions of shutdown systems. This lack of assurance in safe shutdown capability has resulted from one or both of the following situations:

* Case A: The licensee has not adequately identified the systems and components required for safe shutdown and their location in specific fire areas.

* Case B: The licensee has not demonstrated that the fire protection for specific plant areas will prevent damage to both redundant divisions of safe shutdown components identified in these areas.

For Case A, the staff has required that an adequate safe shutdown analysis be performed. This evaluation includes the identification of the systems required for safe shutdown and the location of the system components in the plant. Where it is determined by this evaluation that safe shutdown components of both redundant divisions are located in the same fire area, the licensee is required to demonstrate that a postulated fire will not damage both divisions or provide alternate shutdown capability as in Case B.

For Case B, the staff may have required that an alternate shutdown capability be provided with is independent of the area of concern or the licensee may have proposed such a capability in lieu of certain additional fire protection modifications in the area. The specific modifications associated with the area of concern along with other systems and equipment already independent of the area form the alternate shutdown capability. For each plant, the modifications needed and the combinations of systems which provide the shutdown functions may be unique for each critical area; however, the shutdown functions provided should maintain plant parameters within the bounds of the limiting safety consequences deemed acceptable for the design basis event.

Staff Position

Safe shutdown capability should be demonstrated (Case A) or alternate shutdown capability provided (Case B) in accordance with the guidelines provided below:

1. Design Basis Event

   The design basis event for considering the need for alternate shutdown is a postulated fire in a specific fire area containing redundant safe shutdown cables/equipment in close proximity where it has been determined that fire protection means cannot assure that safe shutdown capability will be preserved. Two cases should be considered: (1) offsite power is available; and (2) offsite power is not available.

2. Limiting Safety Consequences and Required Shutdown Functions

2.1 No fission product boundary integrity shall be affected:

a. No fuel clad damage;
b. No rupture of any primary coolant boundary;
c. No rupture of the containment boundary.

2.2 The reactor coolant system process variables shall be within those predicted for a loss of normal ac power.

2.3 The alternate shutdown capability shall be able to achieve and maintain subcritical conditions in the reactor, maintain reactor coolant inventory, achieve and maintain hot standby* conditions (hot shutdown* for a BWR) for an extended period of time, achieve cold shutdown* conditions within 72 hours and maintain cold shutdown conditions thereafter.

* As defined in the Standard Technical Specifications.

3. Performance Goals

3.1 The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions.

3.2 The reactor coolant makeup function shall be capable of maintaining the reactor coplant level above the top of the core for BWR's and in the pressurizer for PWR's.

3.3 The reactor heat removal function shall be capable of achieving and maintaining decay heat removal.

3.4 The process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control the above functions.

3.5 The supporting function shall be capable of providing the process cooling, lubrication, etc. necessary to permit the operation of the equipment used for safe shutdown by the systems identified in 3.1 - 3.4.

3.6 The equipment and systems used to achieve and maintain hot standby conditions (hot shutdown for a BWR) should be (1) free of fire damage; (2) capable of maintaining such conditions for an extended time period longer than 72 hours if the equipment required to achieve and maintain cold shutdown is not available due to fire damage; and (3) capable of being powered by an onsite emergency power system.

3.7 The equipment and systems used to achieve and maintain cold shutdown conditions should be either free of fire damage or the fire damage to such systems should be limited such that repairs can be made and cold shutdown conditions achieved within 72 hours. Equipment and systems used prior to 72 hours after the fire should be capable of being powered by an onsite emergency power system; those used after 72 hours may be powered by

offsite power.

3.8 These systems need not be designed to (1) seismic category I criteria; (2) single failure criteria; or (3) cope with other plant accidents such as pipe breaks or stuck valves (Appendix A BTP 9.5-1), except those portions of these systems which interface with or impact existing safety systems.

4. PWR Equipment Generally Necessary For Hot Standby

(1) Reactivity Control

Reactor trip capability (scram). Boration capability e.g., charging pump, makeup pump or high pressure injection pump taking suction from concentrated borated water supplies, and letdown system if required.

(2) Reactor Coolant Makeup

Reactor coolant makeup capability, e.g., charging pumps or the high pressure injection pumps. Power operated relief valves may be required to reduce pressure to allow use of the high pressure injection pumps.

(3) Reactor Coolant System Pressure Control

Reactor pressure control capability, e.g., charging pumps or pressurizer heaters and use of the letdown systems if required.

(4) Decay Heat Removal

Decay heat removal capability, e.g., power operated relief valves (steam generator) or safety relief valves for heat removal with a water supply and emergency or auxiliary feedwater pumps for makeup to the steam generator. Service water or other pumps may be required to provide water for auxiliary feed pump suction if the condensate storage tank capacity is not adequate for 72 hours.

(5) Process Monitoring Instrumentation

Process monitoring capability e.g., pressurizer pressure and level, steam generator level.

(6) Support.

The equipment required to support operation of the above described shutdown equipment e.g., component cooling water service water, etc. and onsite power sources (AC, DC) with their associated electrical distribution system.

5. PWR Equipment Generally Necessary For Cold Shutdown*

(1) Reactor Coolant System Pressure Reduction to Residual Heat Removal System (RHR) Capability

Reactor coolant system pressure reduction by cooldown using steam generator power operated relief valves or atmospheric dump valves.

(2) Decay Heat Removal

Decay heat removal capability e.g., residual heat removal system, component cooling water system and service water system to removal heat and maintain cold shutdown.

(3) Support

Support tapability e.g., onsite power sources (AC & DC) or offsite after 72 hours and the associated electrical distribution system to supply the above equipment.

* Equipment necessary in addition to that already provided to maintain hot standby.

6. BWR Equipment Generally Necessary For Hot Shutdown

(1) Reactivity Control

Reactor trip capability (scram).

(2) Reactor Coolant Makeup

Reactor coolant inventory makeup capability e.g., reactor core isolation cooling system (RCIC) or the high pressure coolant injection system (HPCI).

(3) Reactor Pressure Control and Decay Heat Removal

Depressurization system valves or safety relief valves for dump to the suppression pool. The residual heat removal system in steam condensing mode, and service water system may also be used for heat removal to the ultimate heat sink.

(4) Suppression Pool Cooling

Residual heat removal system (in suppression pool cooling mode) service water system to maintain hot shutdown.

(5) Process Monitoring

Process monitoring capability e.g., reactor vessel level and pressure and suppression pool temperature.

(6) Support

Support capability e.g., onsite power source (AC & DC) and their associated distribution systems to provide for the shutdown equipment.

7. BWR Equipment Generally Necessary For Cold Shutdown*

At this point the equipment necessary for hot shutdown has reduced the primary system pressure and temperature to where the RHR system may be placed in service in RHR cooling mode.

(1) Decay Heat Removal

Residual heat removal system in the RHR cooling mode, service water system.

(2) Support

Onsite sources (AC & DC) or offsite after 72 hours and their associated distribution systems to provide for shutdown equipment.

* Equipment provided in addition to that for achieving hot shutdown.

8. Information Required For Staff Review

(a) Description of the systems or portions thereof used to provide the shutdown capability and modifications required to achieve the alternate shutdown capability if required.

(b) System design by drawings which show normal and alternate shutdown control and power circuits, location of components, and that wiring which is in the area and the wiring which is out of the area that required the alternate system.

(c) Verification that changes to safety systems will not degrade safety systems. (e.g., new isolation switches and control switches should meet design criteria and standards in FSAR for electrical equipment in the system that the switch is to be installed; cabinets that the switches are to be mounted in should also meet the same criteria (FSAR) as other safety related cabinets and panels; to avoid inadvertent isolation from the control room, the isolation switches should be keylocked, or alarmed in the control room if in the "local" or "isolated" position; periodic checks should be made to verify switch is in the proper position for normal operation; and a single transfer switch or other new device should not be a source for a single failure to cause loss of redundant safety systems).

(d) Verification that wiring, including power sources for the control circuit and equipment operation for the alternate shutdown method, is independent of equipment wiring in the area to be avoided.

(e) Verification that alternate shutdown power sources, including all breakers, have isolation devices on control circuits that are routed through the area to be avoided, even if the breaker is to be operated manually.

(f) Verification that licensee procedure(s) have been developed which describe the tasks to be performed to effect the shutdown method. A summary of these procedures should be reviewed by the staff.

(g) Verification that spare fuses are available for control circuits where these fuses may be required in supplying power to control circuits used for the shutdown method and may be blown by the effects of a cable spreading room fire. The spare fuses should be located convenient to the existing fuses. The shutdown procedure should inform the operator to check these fuses.

(h) Verification that the manpower required to perform the shutdown functions using the procedures of (f) as well as to provide fire brigade members to fight the fire is available as required by the fire brigade technical specifications.

(i) Verification that adequate acceptance tests are performed. These should verify that: equipment operates from the local control station when the transfer or isolation switch is placed in the "local" position and that the equipment cannot be operated from the control room; and that equipment operates from the control room but cannot be operated at the local control station when the transfer or isolation switch is in the "remote" position.

(j) Technical Specifications of the surveillance requirements and limiting conditions for operation for that equipment not already covered by existing Tech. Specs. For example, if new isolation and control switches are added to a service water system, the existing Tech. Spec. surveillance requirements on the service water system should add a statement similar to the following:

"Every third pump test should also verify that the pump starts from the alternate shutdown station after moving all service water system isolation switches to the local control position."

(k) Verification that the systems available are adequate to perform the necessary shutdown functions. The functions required should be based on previous analyses, if possible (e.g., in the FSAR), such as a loss of normal a.c. power or shutdown on a Group I isolation (BWR). The equipment required for the alternate capability should be the same or equivalent to that relied on in the above analysis.

(1) Verification that repair procedures for cold shutdown systems are deve oped and material for repairs is maintained on site.