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REPLY TO
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November 4, 1996
BVY 96-139

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

References: (a) License No. DPR-28 (Docket No. 50-271)
(b) Letter, VYNPC to USNRC, BVY 96-43, dated April 4, 1996
(c) Letter, VYNPC to USNRC, BVY 96-67, dated May 21, 1996
(d) Letter, USNRC to VYNPC, NVY 96-146, dated September 20, 1996
(e) Letter, USNRC to VYNPC, NVY 86-240, dated December 1, 1986
(f) Letter, A. Thadani to D. Grace, "Safety Evaluation of BWR Owner's Group - Emergency Procedure Guidelines, Revision 4, NEDO-31331, March 1987," dated September 12, 1988

Subject: Response to Request for Additional Information Regarding 10CFR50, Appendix R Exemptions

The purpose of this letter is to provide the NRC with additional information requested in Reference (d) to support certain exemption requests related to 10CFR50, Appendix R. Attachment 1 provides our response.

We trust that this submittal provides the requested information. However, should you have questions or require additional information, please contact this office.

Sincerely,
VERMONT YANKEE NUCLEAR POWER CORPORATION

James J. Duffy

James J. Duffy
Licensing Engineer

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Attachment 1

c: USNRC Region I Administrator
USNRC Project Manager - VYNPS
USNRC Resident Inspector - VYNPS

Response to Request for Additional Information

1.0 General

Question 1.0

Do Vermont Yankee (VY) Nuclear Power Station procedures currently call for the use of ADS SRVs in conjunction with either the CS or RHR system in the LPCI mode for post-fire safe shutdown for any area, room, or zone? If so, is this use of ADS/LPCI/CS post-fire safe shutdown recognized in an approved NRC exemption or NRC licensing safety evaluation report (SER)?

Response 1.0

Procedural References to Use of Depressurization and Low Pressure Injection Systems
VY procedures for fire safe shutdown consist of OP 3126 for responses to postulated fires in the Control Room and Cable Vault (which includes the battery rooms), which are identified as 10CFR50 Appendix R Section III.G.3 alternative shutdown locations. OP 3126 identifies that high pressure injection systems are available for fires in alternative shutdown locations. OP 3126 also identifies that depressurization and low pressure injection systems would be available as a back up to the high pressure injection systems.

For other, non-alternative shutdown plant areas, safe shutdown strategies are addressed in OP 3020 and the Emergency Operating Procedures (EOPs). This is consistent with the guidance of Generic Letter 86-10, Section 5.2.3, which identifies that shutdown with one train unavailable due to a fire in non-alternative shutdown locations should be covered by operator training and emergency operating procedures.

When a fire results in a condition that requires entry into the EOPs, the operators take the actions specified to shutdown the reactor, control reactor pressure and water level, control containment parameters, and sustain electrical power. The EOPs contain a hierarchy of preferred systems to perform each function. If normal inventory makeup and pressure control systems are available the operators are directed to use those systems. If normal systems are not available, the operators are directed to use high pressure emergency makeup sources first, if available, and then reactor depressurization and the use of low pressure systems. In the unlikely event all high pressure sources of injection fail, then the operators are directed by the EOPs to depressurize the reactor and use low pressure systems to maintain reactor inventory.

NRC References to Use of Depressurization and Low Pressure Injection Systems at VY
Reference to the availability of depressurization and low pressure injection systems as a back up to high pressure injection systems for fires in alternative shutdown locations is contained in NRC's letter dated January 13, 1983 (NVY 83-5). This letter transmitted the SER for alternative shutdown compliance given a fire in the Control Room, Cable Spreading Room and the Switchgear Rooms. The SER identified that the RCIC system would be used to provide makeup water. The SER also stated that a number of other systems including HPCI, Core Spray, and LPCI (in conjunction with ADS valve operation) can be used for shutdown.

Presently, the Control Room and Cable Vault (including Battery Room) require implementation of alternative shutdown strategies. The Switchgear Rooms meet Appendix R, Section III.G.2 separation requirements.

NRC Inspection No. 50-271/88-04 evaluated VY's compliance with Appendix R Sections III.G, III.J, and III.L fire safe shutdown requirements. The inspection report identified the documentation reviewed during the course of the inspection. One of the documents reviewed was VY's exemption request dated 4/24/85 (FVY 85-38), which included a copy of the VY Safe Shutdown Capability Analysis (SSCA). This analysis identified the ADS/CS strategy for Reactor Building fire zone RB-4. Although a separate SER was not issued for the SSCA, this analysis was submitted in support of the exemption requests which were subsequently approved by the NRC in Reference (e).

The use of ADS/LPCI/CS is recognized and accepted by NRC in the NRC's Safety Evaluation Report (SER) prepared for the BWR Owners Group Emergency Procedures Guidelines, Revision 4 [Reference (f)]. As discussed above, the EOPs are symptom based procedures which govern post-fire safe shutdown strategies as well as non-fire safe shutdown strategies.

2.0 Use of Vernon Tie Line

Question 2.1

An NRC inspection of VY conducted during October 23-27, 1995, identified areas requiring alternative shutdown as Fire Zones CB-1 (Control Room), CB-2 (Cable Vault and Battery Room), CB-3 (Switchgear Rooms), RB-1, and RB-2. However, page 1 of the VY submittal of April 4, 1996 ("Background"), indicates that VY utilizes alternative shutdown for fires in Control Room and Spreading Rooms only. Please explain.

Response 2.1

As stated in response to Question 1, only the Control Room and Cable Vault (including Battery Rooms) require alternative shutdown strategies.

For a West Switchgear Room fire, the normal dc power source for the RCIC system may be lost. RCIC may be operated from the Control Room with simple manual action to transfer its power source to an Alternative Shutdown battery. AC power is provided from switchgear in the East Switchgear Room, supplied from the "A" Emergency Diesel Generator controlled from the Control Room. In addition, RHR is operable from the Control Room.

For an East Switchgear Room fire, the HPCI and RHR systems are available and operated from the Control Room. AC power is provided from the switchgear in the West Switchgear Room, supplied from the "B" Emergency Diesel Generator controlled from the Control Room.

See response to Question 3.2 for explanation of RB-1 and RB-2 Safe Shutdown strategies.

Question 2.2

Exemption request (page 1, last paragraph) states that the Vernon Tie Line "originates from the adjacent Vernon Hydroelectric Station." This statement infers that the Vernon Tie relies solely on the electrical generating capacity of the Vernon Hydroelectric Station. However, page 2, paragraph 2, states that the power may be drawn from the 69 kV system "if generation at the hydroelectric station were not sufficient to supply VY's emergency needs." There is confusion between the terms Vernon Station, Vernon Tie and Vernon Hydroelectric Station. The Vernon Station appears to be comprised of several generating units, of which one is the Vernon Hydroelectric Station. All "Vernon Station" generating units have a total capacity of between 3 and 30 MW and feed the 69 kV transmission system. The Vernon Tie is the 4160 V line that connects the 69 kV transmission system to the VY plant. The exemption for use of the Vernon Tie Line would, therefore, appear to include the 69 kV transmission system and all of its available sources (i.e., not limited to the hydroelectric station only). Please clarify, and describe other sources of ac power to the 69 kV distribution system.

Response 2.2

The Vernon Tie originates from the 13.2 kV section of the Vernon Hydroelectric Station Switchyard. The Switchyard is supplied by as many as eight hydroelectric generating units at the station and five 69 kV transmission lines at the Hydroelectric Station switchyard. The Hydroelectric Station is a "run of the river" station, normally generating between 3 to 20 MW. Note: Reference (b) identified the maximum capacity of Vernon Station as 30MW. Station output is currently limited to 20MW while being upgraded and modernized. In the unlikely event that sufficient generation is not available from the Hydroelectric Station generating units, the Vernon Tie would be supplied from the 69 kV Switchyard which is supplied by five 69 kV transmission lines; two from Pratts Junction near Fitchburg, MA, two from Shelburne Falls, MA, and one from Brattleboro, VT. None of the protective relaying for the Hydroelectric Station, the 69 kV Switchyard or 69 kV transmission lines interfaces with the Vermont Yankee Plant.

Question 2.3

Quantify the maximum electrical loading of shutdown systems and the minimum Vernon Tie Line capacity.

Response 2.3

The Vernon Tie capacity is limited to 3750 kVA, (3200 kW at 0.85 pf), the rating of the 13.2 kV / 4160 V Vernon Tie Line transformer. A calculation has been completed to establish the maximum anticipated electrical loading of the Vernon Tie Line when used as an Appendix R Alternative Shutdown power supply. The calculation concludes that the maximum Appendix R loading is 2705 kW, well within the 3200 kW capacity of the Vernon Tie.

Question 2.4

Provide simplified schematic diagrams that depict the configuration of the Vernon Tie distribution system and connection to the Vermont Yankee Nuclear Power Corporation.

Response 2.4

A simplified one line drawing depicting this configuration is attached.

Question 2.5

Control switches located in the Control Room operate circuit breakers necessary to connect the Vernon Tie to the emergency buses. Consequently, as stated in the VY submittal (page 2, paragraph 3), normal control of the Vernon Tie could be lost as a result of a Control Room fire. To assure availability, and allow control during implementation of Alternative Shutdown procedures, modifications are planned to provide electrical isolation capability and transfer of control to a remote plant location (i.e., Switchgear Room). With regard to this issue, provide a detailed discussion of the planned modifications. This discussion should also include: (1) the VY evaluation of a potential for spurious closure of the Vernon Tie breaker prior to actuation of the isolation device; (2) the effect this spurious action may have on Safe Shutdown Capability should it occur, and (3) the potential adverse effects of a postulated Switchgear Room (location of new transfer switches) fire on ac power availability and shutdown capability.

Response 2.5

Vermont Yankee has modified the controls for the Vernon Tie line circuit breakers to isolate control room cables and transfer control of the Vernon Tie breakers to local control switches at the switchgear. New transfer switches isolate control room wiring for breakers 3V4 and 4V. Redundant fuses, which are automatically switched into the circuit upon operation of the transfer switches, have also been installed. Local control switches at the switchgear room permit the operator to operate breakers 3V4 and 4V to align the Vernon Tie to 4160V Bus 4.

As described in FSAR Section 8.5.5., breakers 3V, 4V, and 3V4 are normally open and can only be closed by manual operation. The breaker control circuits are interlocked to ensure that the Vernon Tie Line cannot be connected to a live emergency bus. The control circuit for breaker 3V4 is interlocked so breakers 3V and 4V must both be open before 3V4 can be closed. Once 3V4 is closed, in order to close breaker 4V and energize emergency bus 4, the breaker for Diesel Generator 1A and breaker 4T2 must both be open. Similar logic applies to the closing of breaker 3V to energize Bus 3.

For fires in the Control Room and Cable Vault, it is possible that breaker 3V4 may spuriously close prior to operation of the electrical isolation switches. Closure of breakers 3V or 4V is prevented by the interlocks from the Diesel Generator breaker and the bus tie breakers described above. These breaker position interlocks originate within the switchgear lineup and are wired into the close circuit of the Vernon Tie breakers just prior to the breaker close coil.

Therefore, they will not be bypassed by a Control Room or Cable Vault fire even prior to actuation of the isolation switches..

Similar interlocks exist in the control circuit for the tie breakers and the Diesel Generator breakers to prevent inadvertent closing when either bus is being supplied by the Vernon Tie. In addition, the Alternative Shutdown procedure pulls the closing circuit fuses for these breakers.

The Vernon Tie may not be available for a fire in either switchgear room. As described in the response to Question 2.1 for an East Switchgear Room fire AC power is provided from the switchgear in the West Switchgear Room, supplied by the "B" diesel generator, controlled from the Control Room. For a fire in the West Switchgear Room, AC power is provided from the switchgear in the East Switchgear Room supplied by the "A" diesel generator, controlled from the Control Room.

Question 2.6

Page 2, "justification," paragraph 4, states that the availability of the Vernon Station is 99%. Define the term "Vernon Station" as it is used here. Does this definition include the 69 kV transmission system, Vernon Tie Line, and Vernon Hydroelectric Station (and all other generating stations which may feed the 69 kV transmission system)?

Response 2.6

The statement that the Vernon Tie historically has been available greater than 99% of the time is based on our review of known losses of the Vernon Tie Line, resulting from a loss of all power sources to this line.

The Vernon hydroelectric station bus has been unavailable for only four hours over the last thirty years.

The tie line itself has been unavailable for only three days over the last ten years, or equivalent to 99.9% availability. This was due to a lightening strike on the overhead portion of the tie line. Vermont Yankee has since buried the line to comply with SBO requirements.

We have reviewed records associated with the 69 kV transmission systems and determined that there were numerous short outages on individual lines, but disturbances that affected the entire switchyard represent an average unavailability of less than three hours per year (99.96 % available).

Question 2.7

Page 2, last paragraph states that the design change "will not affect the availability of the on site Diesel Generators during Alternate Shutdown fire scenarios...a Diesel Generator will be available to provide backup power in the unlikely event that Vernon Tie is unavailable." Is the EDG and its support systems electrically isolated from

potential effects of the postulated fire scenario? Are operator actions required to provide this capability?

Response 2.7

The Emergency Diesel Generator control circuitry and support systems could be affected by the potential effects of fires requiring Alternative Shutdown capability. The "A" EDG circuitry and its support systems were previously modified to allow electrical isolation of fire damaged control circuitry for Control Room and Cable Vault fires. Local controls are available to isolate and enable the "A" EDG to be used for Alternative Shutdown scenarios.

To place the "A" EDG in service for Alternative Shutdown, the operators would reposition local switches in the "A" EDG Room, to isolate damaged control circuitry, then replace fuses in the local Diesel Control Panels if necessary. The "A" EDG would then be started locally from the "A" EDG Room. Operator actions also occur in the East Switchgear Room to reposition local switches on Bus 4 and Bus 9 to isolate fire damaged circuitry. Fuses are replaced in the "A" EDG output breaker, if necessary. Re-alignment of Service Water valves may also be required.

No provisions have been made to permit isolation of fire damaged circuits to the "B" EDG, since the "B" EDG is not relied on for alternative shutdown compliance strategies.

Question 2.8

Will operators attempt to establish Vernon Tie prior to Control Room evacuation? Describe specific procedural actions. In addition, it is not clear if operators are directed to use the Vernon Tie regardless of the availability of the normal, preferred, source of offsite power.

Response 2.8

Once the decision is reached that a Control Room evacuation is required, the operators will carry out the procedural steps of OP 3126, Shutdown Using Alternate Shutdown Methods. Under Alternate Shutdown methods, OP 3126 does not direct the operators to place the Vernon Tie in service from the Control Room.

Potentially fire damaged control circuits to Bus 4 and Bus 9 would be isolated in the Switchgear Room by transferring Alternative Shutdown Switches to the "Emergency" position. The Buses would then be re-energized using the Vernon Tie.

If Bus 4 was energized from its normal (offsite) or emergency power source and control room evacuation was required, those sources would be isolated and the Vernon Tie would be placed in service. This is done to ensure that the power source supplying Bus 4 and Bus 9 is isolated from the effects of a Control Room or Cable Vault fire.

Question 2.9 (listed as 2.8)

Page 2, "justification," paragraph 4, states, "indication" of voltage and Vernon Station generation output are available in the VY Control Room. The term "indication" may have wide meaning (lamp, meter, etc.). Describe, in detail, the specific types and capabilities of instrumentation provided.

Response 2.9

The "indication" available to the Control Room operators consists of a Voltmeter to indicate Vernon Tie Line voltage, an Ammeter to indicate Vernon Tie line current and a digital Wattmeter which provides Vernon Hydroelectric Station generation output. In addition, there is a direct telephone circuit between the main Control Room and the Vernon Hydroelectric Station to allow immediate communication between the two stations.

3.0 Use of ADS/CS or ADS/LPCI in Certain Fire Zones

Question 3.1

Define proposed method of shutdown (ADS/LPCI or ADS/CS) for each zone. It appears that ADS/CS will be used, but the exemption is for use of either method.

Response 3.1

ADS/CS is proposed for use in Reactor Building fire zones RB-1, RB-2, RB-3, and RB-4 fires. (See Figures 1,2 and 3). The upper RCIC room was considered part of fire zone RB-1, the north side of the torus area, in the previous SSCA. The upper RCIC room contains redundant safe shutdown cables and Appendix R compliance for this room is achieved by meeting Section III.G.2.c of the regulation. Zone RB-1 is separated from RB-2 in the torus area by combustible free zones. Appendix R compliance for the torus area is based on an approved exemption which provides an exemption for lack of suppression in the area and accepts the CFZ as adequate separation between redundant safe shutdown cables. Re-designating the upper RCIC room as zone RB-1S distinguishes it from the balance of zone RB-1and provides clearer definition of fire zones and demonstration of Appendix R compliance.

ADS/LPCI is proposed for Control Room and Cable Vault (Alternative Shutdown) fires as a "defense in depth" backup to the existing RCIC alternative shutdown capability. Unlike LPCI, Core Spray does not have alternative shutdown control that can be isolated from the Control Room and Cable Vault.

Question 3.2

An NRC inspection conducted during October 23-27, 1995, identified areas RB-1 and RB-2 as requiring alternative shutdown capability. It is not clear if this is still valid. If so, an exemption for the use of the proposed approach may not be required for these areas.

Response 3.2
Fire Zones RB-1 and RB-2 are not, and have not been, considered alternative shutdown locations because one train remains free of damage and the control room is not evacuated.

The original safe shutdown strategy for RB-1 included operation of RCIC locally in the RCIC room.. The original safe shutdown strategy for RB-2 included operation of the "A" Emergency Diesel locally in the "A" Emergency Diesel Generator Room. Reference (e) approved exemptions supporting fire zone RB-1 and RB-2 separation under Section III.G.2. The current exemption, requested due to partial short term core uncovery, remains a valid request. Additional detailed discussion on the basis for the exemption request is discussed in Response 3.3 below.

Question 3.3

One reason that the use of low pressure injection systems has been accepted as an alternative shutdown capability is that the regulation (Section III.G.3) requires fire detection and fixed suppression systems in the area under consideration. However, the submittal of April 4, 1996, does not describe the fire safety features, combustible loadings, or fire hazards in the areas for which the exemption is requested. Please provide.

Response 3.3

In Reference (c), VY requested an exemption to allow the use of depressurization and low pressure injection strategies for fires occurring in Reactor Building Fire Zones RB-1, RB-2, RB-3, and RB-4. The bases for evaluating these fire zones under III.G.2 versus III.G.3 were provided in Reference (c). The request was made against the requirements of 10CFR50 Appendix R, Section III.G, paragraph G.1.a, and Section III.L, paragraph L.2.b. VY believes that the fire protection features in the subject fire zones provide adequate protection for the existing fire hazards when assessing compliance against either Section III.G.2 or III.G.3 criteria. The bases for this conclusion are provided below.

Fire Safety Features, Combustible Loadings, and Fire Hazards
Figures 1, 2, and 3 provide plan layouts that depict the locations of fire protection features provided in Fire Zones RB-1, RB-2, RB-3 and RB-4. Fire Zones RB-3 and RB-4 on elevation 252ft are depicted on Figure 1. Fire Zones RB-1 and RB-2 at elevation 232ft and at the ceiling of the torus area are depicted on Figure 2. Fire Zones RB-1 and RB-2 at elevation 213ft are depicted on Figure 3.

The adequacy of fire protection features in the subject zones was previously evaluated under the exemption process and approved by the NRC in Reference (e). The exemptions were requested against the requirements of 10CFR50 Appendix R Section III.G.2 for full detection and suppression systems in the subject fire zones. The bases for approval of the exemption requests were provided to the NRC in VY letters dated 4/24/85 (FVY 85-38), 7/26/85 (VYL 85-47), 8/2/85, and 8/16/85 (FVY 85-73).

The following provides more detailed information on the fire protection features and fire hazards in the subject zones when the exemption requests were approved in 1986 and as they currently exist.

Fire Zones RB-1 and RB-2 (Exemption Request No. 1)

Detection	1986	Numerous smoke detectors
Detection	1996	20 smoke detectors and 16 heat detectors
Suppression	1986	Portable extinguishers and hose stations
Suppression	1996	Portable extinguishers and hose stations
Combustible Load	1986	5,970Btu/ft^2
Combustible Load	1996	under 8,000Btu/ft^2

The automatic smoke and heat detection systems in the torus area of Fire Zones RB-1 and RB-2 were installed to meet the requirements of a general area system that provides essentially full detection coverage. Ionization smoke detectors are provided at ceiling level near the perimeter walls of the torus area above the vicinity where cable trays are routed to detect both floor based fires and cable tray fires. Heat detectors are provided closer in from the perimeter walls of the torus area above the torus itself to detect heat rising up around the back of the torus prior to impacting on the cable trays. Ionization detectors are also located at ceiling level in the HPCI room to meet the requirements of a general area detection system. Manual fire fighting, through the use of portable extinguishers and/or hose stations, have unobstructed access to combustible materials from either floor level and/or from the Torus Catwalk.

Fire Zone RB-3 (Exemption Request No. 4 and 5)

Detection - 1986	Smoke detectors in and adjacent to combustible free zone on east side and in northwest corner in suppression area
Detection - 1996	Smoke detectors near MCCs 89A and 89B (on opposite sides of the combustible free zone) and above the cable penetration area in the northwest corner
Suppression - 1986	Multi-level preaction sprinkler system in northwest corner, hose stations and portable extinguishers
Suppression - 1996	Multi-level preaction sprinkler system in northwest corner, hose stations and portable extinguishers
Combustible Load - 1986	15,000Btu/ft^2
Combustible Load - 1996	under 30,000Btu/ft^2

Smoke detectors and a multi-level preaction sprinkler system have been provided in Fire Zone RB-3 in the northwest corner. Smoke detectors have also been provided on the east side of the elevation adjacent to, and inside of, the CFZ that separates Fire Zone RB-3 from Fire Zone RB-4. The location of detection and suppression capabilities with respect to the safe shutdown capabilities in Fire Zone RB-3 are described below.

Division I safe shutdown cables (RHR, CS) and 2 of 4 SRVs are routed along the west wall of the northwest corner to Fire Zone RB-4. Division II cables (RHR, CS) and 2 of 4 SRVs are

routed along the east side of the suppression area prior to turning east and traveling through the balance of Fire Zone RB-3. HPCI and RCIC motor starters are located along the wall of the steam tunnel in the northwest corner. Redundant divisions of CS, along with ADS safe shutdown capabilities, are separated by a minimum of 18ft, or are protected by a 1-hour rated fire barrier, in the northwest corner. Smoke detection and multi-level pre-action suppression systems are provided in the northwest corner. Smoke detectors are provided in the northwest corner for early detection of postulated floor-based or cable tray fires. Actuation of the detection system will initiate the preaction sprinkler system provided both at ceiling level to suppress cable tray fires and below the cable trays to suppress floor-based fires. Actuation of the detection and suppression systems in the northwest corner limits the size of potential exposure fires that could result in the need to rely on ADS/CS safe shutdown strategies.

A fire in Fire Zone RB-3 to the east of the northwest corner could impact on both Division I and II safe shutdown capabilities in the zone. Division II cables for HPCI, RCIC, RHR, and CS, along with cables for 2 of 4 SRVs, are routed in cable trays near the ceiling. A significant exposure fire would be required to damage both high pressure safe shutdown systems in the zone and result in the need to rely on ADS/CS safe shutdown strategies. Smoke detectors are provided adjacent to, and inside of, the CFZ separating Fire Zones RB-3 and RB-4 on the east side of the 252ft elevation. The smoke detectors are provided to detect floor-based or cable tray fires in Fire Zone RB-3, and to detect fires spreading up to Fire Zone RB-3 through the open stair from the northeast corner room, before the fire spreads out of Fire Zone RB-3 to Fire Zone RB-4. Fire Zone RB-4 and the southeast corner rooms for Fire Zone RB-2 on elevations 213 ft and 232ft contain Division I ADS/CS safe shutdown capabilities that could be used for safe shutdown purposes given a fire in Fire Zone RB-3 that occurs to the east of the northwest corner.

The ceiling area of Fire Zone RB-3 is relatively uncongested in those portions of the fire zone not protected by an automatic suppression system. The northwest corner of Fire Zone RB-3, which contains the highest concentration of cable trays near ceiling level, is provided with automatic suppression system coverage. The ceiling is about 25ft above the floor, and there are no obstructions that would prevent application of a hose stream to postulated fires in combustible materials located near the ceiling. Cable trays above the ceiling of the TIP Room and the Ante Room can be accessed for manual fire fighting by permanent plant ladders installed along the walls of both rooms. OP 3020 provides instructions to the fire brigade on the precautions in application of hose streams in the vicinity of important equipment and energized electrical equipment to ensure that water spray is not inadvertently applied to equipment not involved in the fire.

The detection and suppressions systems provided in the northwest corner, the detection system on the east side of Fire Zone RB-3, and the lack of congestion near the ceiling relative to manual fire fighting activities ensure that Division I safe shutdown capabilities along the west wall of the northwest corner, in Fire Zone RB-4, and on elevations 213ft and 232ft in Fire Zone RB-2 elevations are undamaged by a fire in Fire Zone RB-3.

Fire Zone RB-4

Detection - 1986	Smoke detectors in/adjacent to combustible free zone on east side
Detection - 1996	Smoke detectors in/adjacent to combustible free zone on east side
Suppression - 1986	Hose stations and portable extinguishers
Suppression - 1996	Hose stations and portable extinguishers
Combustible Load - 1986	15,000Btu/ft^2
Combustible Load - 1996	under 30,000Btu/ft^2

A fire in Fire Zone RB-4 could impact on Division I safe shutdown capabilities in the zone. RHR, CS, HPCI and RCIC steam supply isolation and injection valves in the steam tunnel, and 2 of 4 SRV cables are located in the zone. The steam tunnel is a radiologically controlled location with access restricted during normal power operation, limiting the likelihood of transient combustibles and ignition sources in the vicinity of the HPCI and RCIC steam supply isolation and injection valves.

Smoke detectors are provided adjacent to, and inside of, the CFZ separating Fire Zones RB-4 and RB-3 on the east side of Fire Zone RB-4. The smoke detectors are provided to detect floor-based or cable tray fires in the Fire Zone RB-4, and to detect fires spreading up to Fire Zone RB-4 through the open stair from the southeast corner room, before the fire spreads out of Fire Zone RB-4 to Fire Zone RB-3. Fire Zone RB-3 and the northeast corner rooms of Fire Zone RB-1 on elevations 213ft and 232ft contain Division II safe shutdown capabilities.

The combustible loading in Fire Zone RB-4 consists primarily of exposed cable insulation in overhead cable trays. The combustible loading is essentially evenly distributed throughout the fire zone without concentrations of combustible materials in any particular location. The ceiling area of Fire Zone RB-4 is relatively uncongested. The ceiling is about 25ft above the floor and there are no obstructions that would prevent application of a hose stream to postulated fires in combustible materials located near the ceiling. Cable trays above the ceiling of the Ante Room can be accessed for manual fire fighting by permanent ladders installed along the wall of the room. OP 3020 provides instructions to the fire brigade on the precautions in application of hose streams in the vicinity of important equipment and energized electrical equipment to ensure that water spray is not inadvertently applied to equipment not involved in the fire.

Summary of Fire Protection Features and Fire Hazards

In summary, the fire protection features and fire hazards that exist today in Fire Zones RB-1 through RB-4 remain basically unchanged from the features and hazards that existed in 1986. The bases for the full detection and suppression system exemption requests approved by NRC under Section III.G.2 criteria remain unchanged.

While the combustible loading in the zones has risen somewhat, the changes do not represent a dramatic increase in the types and quantities of combustible materials present in the zones. The primary combustible material in all four zones still consists of exposed cable insulation in overhead cable trays which would be expected to propagate slowly once ignited by an exposure fire. The locations containing the majority of combustible materials that could present a hazard to systems relied on for fire safe shutdown are provided with automatic

detection systems at ceiling level. Actuation of the detection systems would result in prompt fire brigade response to initiate manual suppression activities. Hose stations and portable extinguishers are available for fire brigade use in the zones. Automatic preaction sprinklers are also provided in the northwest corner of RB-3, both at ceiling level and below obstructions, to ensure that postulated fires would not impact on more than one train of systems relied on for fire safe shutdown.

VY believes that the existing level of fire protection features (detection, suppression, hose stations and portable extinguishers) provided in Fire Zones RB-1 through RB-4 provide adequate protection for one train of systems required for fire safe shutdown based on the in-situ and transient combustible fire hazards in the zones.

Question 3.4

A review of page 2, paragraph 3, indicates that a fire in Zone RB-3 could cause two SRVs to spuriously actuate (open) and remain open. Provide a detailed discussion of the evaluation performed for this fire area, including the potential effects of this postulated scenario on safe shutdown capability (e.g. , torus temperature limits).

Response 3.4

For Fire Zone RB-3 the primary control location is the Main Control Room. A design change has been completed which reroutes two of the four SRV solenoid cables. This design change also routed all four SRV solenoid cables in dedicated conduits from the control switch in the control room and through to the drywell penetrations. Two of the four solenoid cables are routed in RB-3. These two SRV cables are no longer subject to hot shorts which could cause spurious opening because they are now routed in dedicated conduit throughout RB-3 and through the containment penetration as well. Spurious ADS logic signals may be generated in an RB-3 fire; however, such signals can be mitigated in the control room by operating the ADS bypass or inhibit switches.

The updated safe shutdown circuit analysis has verified that, given the above described design change, one train of Core Spray and two SRVs remain free of fire damage. The safe shutdown strategy, assuming high pressure systems are not available, includes d pressurization and operation of Core Spray consistent with the Emergency Operating Procedures. One train of RHR is available for torus cooling.

Torus temperature has been evaluated for Appendix R fire scenarios in RB-3 and confirmed to be acceptable and not exceed ECCS pump NPSH limits.

Question 3.5

Have CS pumps and associated system valves been included in the evaluation of these areas? Is the CS system operating logic affected by either high Torus level or temperature alarms?

Response 3.5

Both Core Spray pumps and their associated valves have been included in the Safe Shutdown Capability Analysis (SSCA). The necessary components are available in all areas associated with the proposed ADS/CS safe shutdown strategies.

The CS systems have no trips or interlocks affected by Torus water level or temperature. Additionally, a Torus heat up analysis was performed for all Appendix R fire scenarios which confirmed that Torus water temperature will remain below NPSH limits for all areas where the ADS/CS safe shutdown strategy is used.

Question 3.6

Provide a detailed discussion of the assumptions used during RELAP5 thermal-hydraulic analysis.

Response 3.6

The basic analysis assumptions are consistent with 10CFR50.48, 10CFR50 Appendix R and the plant emergency operating procedures. The key input assumptions and initial conditions used in the ADS/CS and ADS/LPCI analysis are summarized below:

1. The reactor is assumed to be operating at full power, and at normal water level (160 inches above top of active fuel) at the time of event initiation.

2. The event initiation occurs concurrently with loss of off-site power (LOOP) (i.e. at time zero)

3. The reactor scrams at event initiation either as a result of the concurrent LOOP or by manual action from the control room.

4. The Main Steam Isolation Valves (MSIVs) begin to close at 60 seconds. Complete closure takes 3 seconds.

5. Feedwater flow is assumed to coast down to zero in 4.5 seconds after event initiation.

6. Decay heat is calculated by the 1979 ANS decay heat standard with 2-sigma uncertainty plus 2% power uncertainty (combined statistically) with a normal full-power of 1593 MWth.

7. 1-inch steam vent and 61 gallons per minute liquid leakage from the reactor vessel boundary exist after event initiation.

8. Reactor pressure is at 1035.5 psia at the event initiation.

9. Safety Relief Valves (SRVs) setpoints assumed in the analysis are:

	Open (psid)	Close (psid)
SRV1	1080	1047.6
SRV2/3	1090	1057.3
SRV4	1100	1067.0

10. The analysis assumed a conservatively low drywell pressure at 16.5 psia that is held constant with time. The wetwell is a sink for the SRVs and the Automatic Depressurization System (ADS) and a source of fluid for CS and LPCI. The initial wetwell temperature is set at a conservatively high value of 165°F. The model assumes the wetwell pressure is constant at 14.7 psia.

11. No high pressure makeup systems (HPCI or RCIC) are available during the fire.

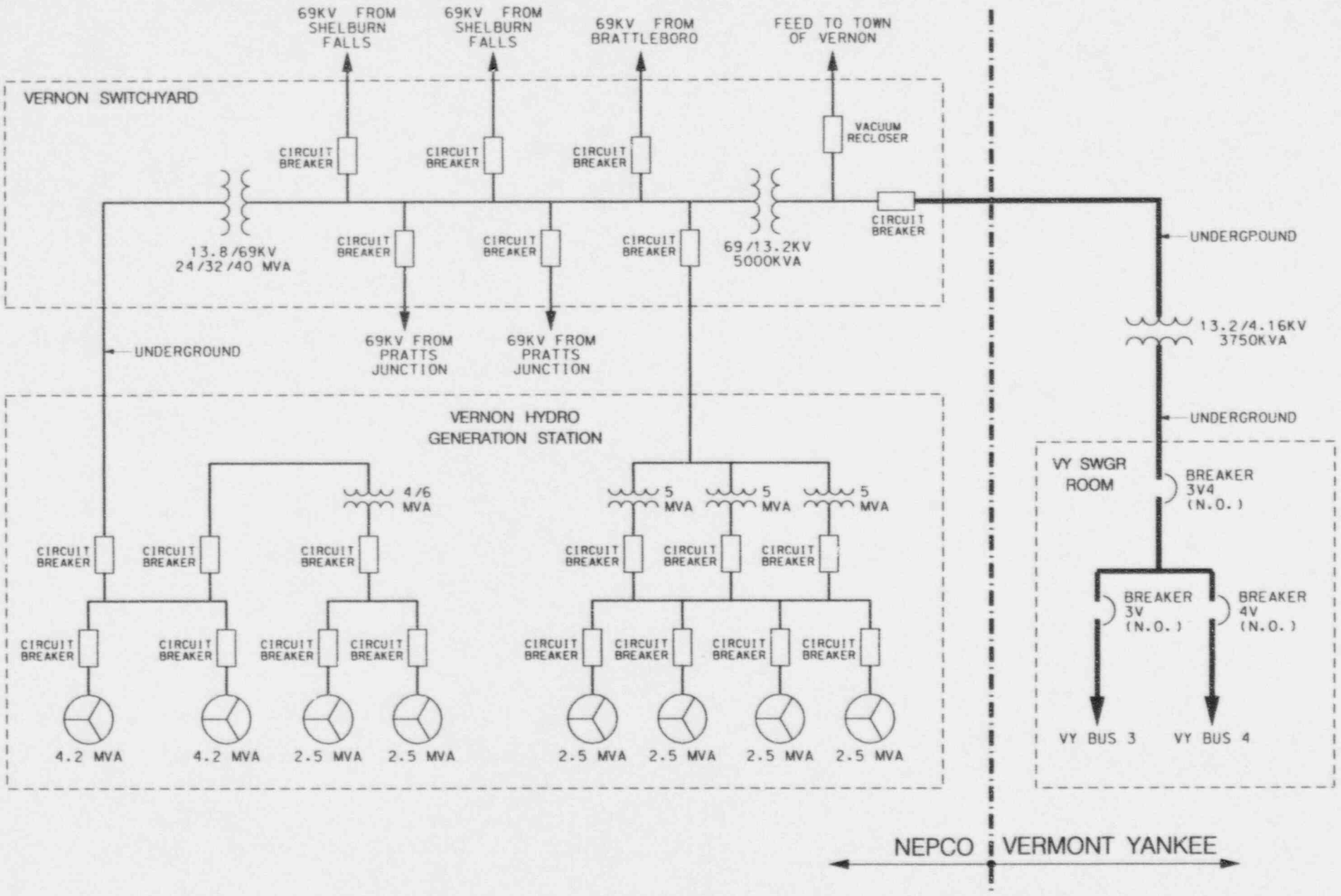
12. Fuel stored energy in the hot bundles corresponds to a peak node power of 14.4 kW/ft plus fuel behavior code uncertainty. For the rest of the core, the fuel stored energy is calculated assuming a power level of 1593 MWth.

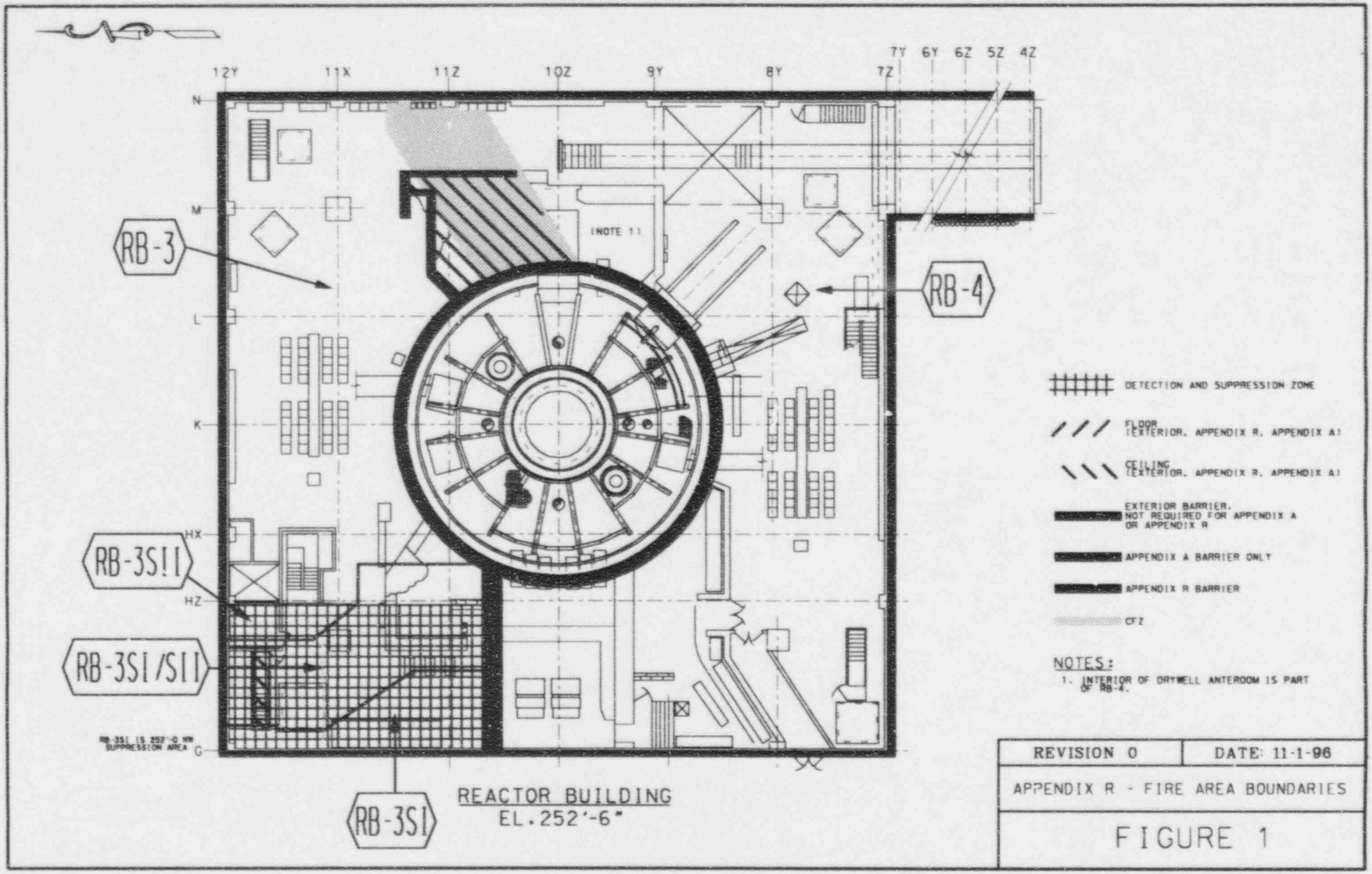
13. Bounding axial power shapes were assumed based on plant data from Cycles 15 through 19. The power shapes used were the ones that produce the maximum kW/ft seen at each axial level. The maximum average planar linear heat generation rate (MAPLHGR) was assumed to be 13.6 kW/ft which is bounding for the GE-9B bundle type presently used by Vermont Yankee. A variable hot bundle power was used depending on the power shape with a maximum of 7.23 MWth which is much higher than the maximum bundle power experienced at the plant.

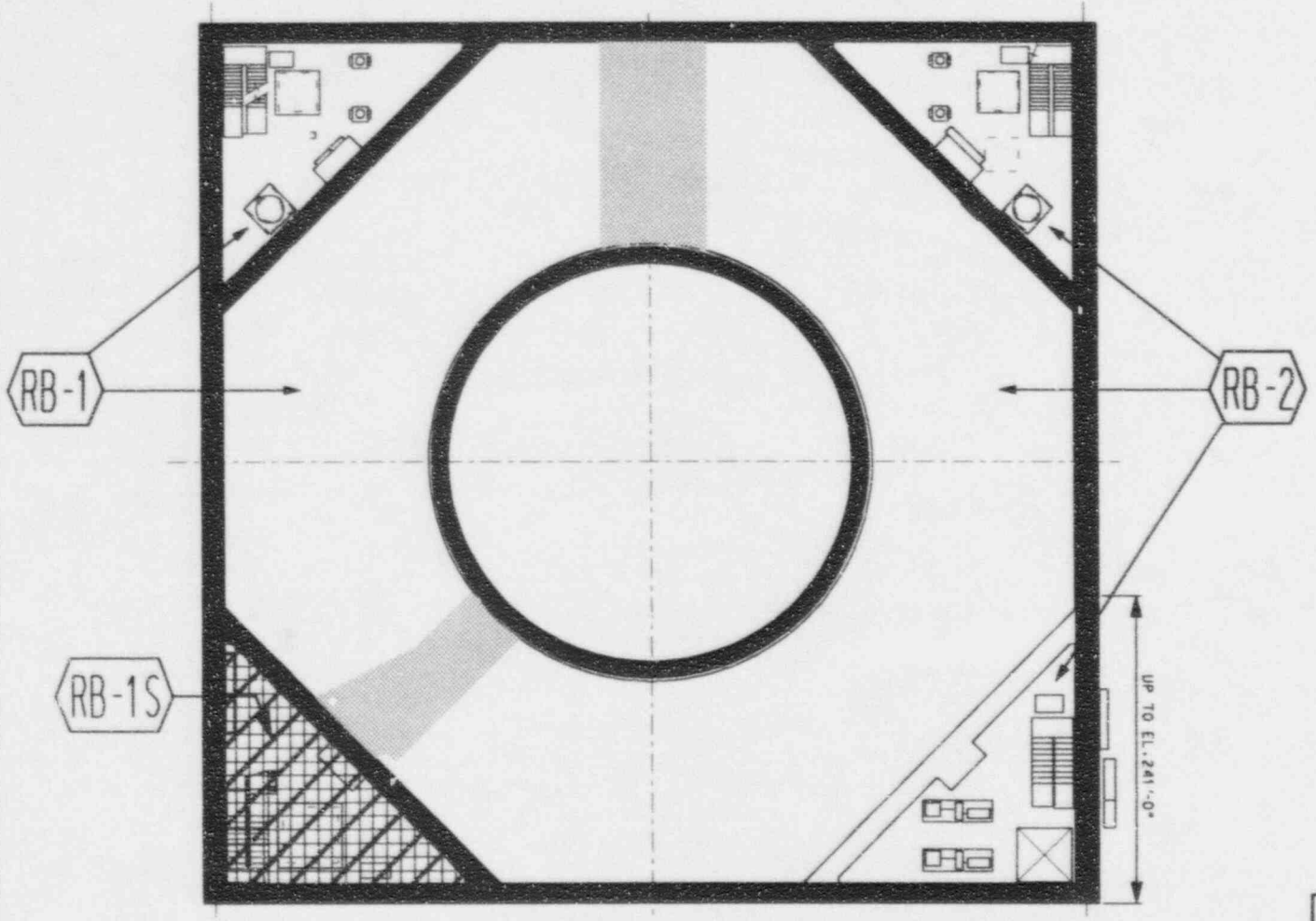
14. The plant model used in the analysis is the same as the model used for Vermont Yankee LOCA licensing analyses.

15. Immediately after scram and isolation, the reactor pressure increase is limited by the SRVs' operating in the pressure actuation mode. Without the high pressure makeup systems, the SRVs actuation result in a gradual loss of reactor water inventory. This boiloff continues with the reactor maintained at high pressure (around 1080 psig) until the SRVs are actuated to depressurize the reactor. The analysis included sensitivities assuming either two or four SRVs available for depressurization. The analysis assumed that depressurization occurs when the reactor water level reaches the top of active fuel in accordance with the plant emergency operating procedures.

SIMPLIFIED ONE LINE DIAGRAM
VERNON HYDRO / VERNON TIE LINE




12Y
11X
11Z
10Z
9Y
8Y
7Z
7Y
6Y
6Z
5Z
4Z
N
M
L
K
HX
HZ
G
RB-3
RB-4
RB-3S11
RB-3S1/S11
RB-3S1
(NOTE 1)
RB-3S1 IS 252'-0 YH SUPPRESSION AREA
DETECTION AND SUPPRESSION ZONE
FLOOR (EXTERIOR, APPENDIX R, APPENDIX A)
CEILING (EXTERIOR, APPENDIX R, APPENDIX A)
EXTERIOR BARRIER, NOT REQUIRED FOR APPENDIX A OR APPENDIX R
APPENDIX A BARRIER ONLY
APPENDIX R BARRIER
CFZ
NOTES:
1. INTERIOR OF DRYWELL ANTEROOM IS PART OF RB-4.
REACTOR BUILDING
EL. 252'-6"
REVISION 0
DATE: 11-1-96
APPENDIX R - FIRE AREA BOUNDARIES
FIGURE 1



REACTOR BUILDING
EL. 232'-6"

DETECTION AND SUPPRESSION ZONE

FLOOR
(EXTERIOR, APPENDIX R, APPENDIX A)

CEILING
(EXTERIOR, APPENDIX R, APPENDIX A)

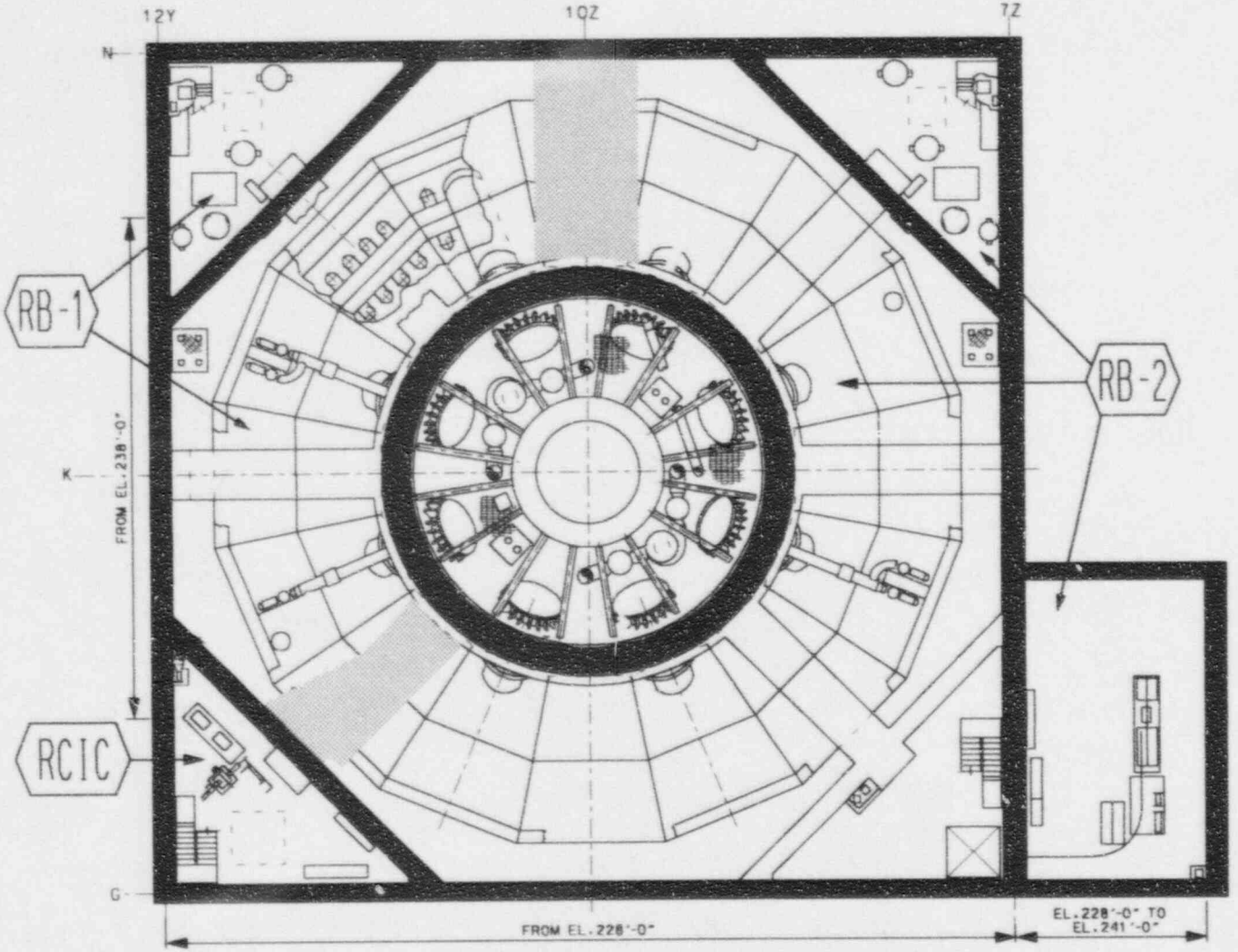
EXTERIOR BARRIER.
NOT REQUIRED FOR APPENDIX A
OR APPENDIX R

APPENDIX A BARRIER ONLY

APPENDIX R BARRIER

CFZ

REVISION 0	DATE: 11-1-96
APPENDIX R - FIRE AREA BOUNDARIES	
FIGURE 2	



REACTOR BUILDING
EL. 213'-9"

DETECTION AND SUPPRESSION ZONE

FLOOR (EXTERIOR, APPENDIX R, APPENDIX A)

CEILING (EXTERIOR, APPENDIX R, APPENDIX A)

EXTERIOR BARRIER, NOT REQUIRED FOR APPENDIX A OR APPENDIX R

APPENDIX A BARRIER ONLY

APPENDIX R BARRIER

CFZ

REVISION 0	DATE: 11-1-86

APPENDIX R - FIRE AREA BOUNDARIES

FIGURE 3