



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

SUPPLEMENTAL SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

STATION BLACKOUT RULE (10 CFR 50.63)

VERMONT YANKEE NUCLEAR POWER CORPORATION

DOCKET NO. 50-271

1.0 INTRODUCTION

The NRC staff's Safety Evaluation (SE) pertaining to the Vermont Yankee Nuclear Power Corporation's (the licensee) response to the Station Blackout (SBJ) Rule, 10 CFR 50.63, was transmitted to the licensee by letter dated June 5, 1991. The staff's SE found the licensee's proposed method of coping with an SBJ to be acceptable contingent upon the resolution of several recommendations listed in the SE.

The licensee responded to the staff's SE by letters from Warren P. Murphy and James P. Pelletier dated July 17, 1991 and September 30, 1991, respectively. The staff requested additional information by letter dated February 21, 1992. The licensee responded to this request by letter dated July 31, 1992.

2.0 EVALUATION

The licensee's responses to the staff's concerns are evaluated below.

2.1 Station Blackout Duration

The licensee initially calculated a coping duration of 8 hours (with a 0.95 EDG target reliability) based on an offsite ac power design characteristic of "P2". The "P2" characteristic was based on a severe weather (SW) grouping SW 1, an extremely severe weather (ESW) grouping of ESW 4, and an offsite power system classification of I1/I2. The staff disagreed with the licensee's SW grouping and offsite power system classification, and stated that these values should be SW 3 and I3, respectively; resulting in a "P3" offsite ac power design characteristic, and an 8-hour coping duration (with a 0.975 EDG target reliability).

Licensee Response

The licensee performed a site-specific weather analysis to demonstrate that the plant should be classified as a "P2" site based on SW 2, ESW 2 and I3 classifications; resulting in an 8-hour coping duration (0.95 EDG target reliability). The SW grouping is based on an annual average snowfall of 63 inches, a tornado frequency of  $9.8E-5$  events (f2 or greater severity) per year per square mile, and a storm (winds between 75 and 125 mph) frequency of  $3.87E-2$  events per year. The snowfall is based on Vernon, Vermont data obtained from the National Climatic Data Center. The tornado frequency is based on the tornado data base maintained by and obtained from the National Severe Storms Forecast Center (NSSFC) for a 2,000 square mile box centered on the Vermont Yankee site. The storm frequency was based on fastest mile wind speeds (30 meter elevation)

measured at the Concord, New Hampshire and Albany, New York airport and weather bureau offices.

The ESW grouping is based on a hurricane wind (winds equal to or greater than 125 mph) frequency of  $7.2E-4$  events per year. This, as for the storm frequency, was based on fastest mile wind speeds (30 meter elevation) measured at the Concord, New Hampshire and Albany, New York airport and weather bureau offices.

### Staff Evaluation

Staff calculations indicate that snowfall is the predominant factor in the determination of the SW classification for the Vermont area. The licensee has provided documentation to support an expected average value of 63 inches per year. Staff calculations indicate that even at 70 inches per year the SW classification would remain at SW 2. Therefore, the staff agrees with the SW 2 classification.

The staff has reviewed the data presented in NUREG/CR-2890 for the Albany, New York weather stations, and in NUREG/CR-2639 for the Concord, New Hampshire weather stations. The staff was concerned that an average of the data points may not conservatively represent the conditions at the nuclear site and the surrounding area. However, the staff notes that the wind speeds at Concord, New Hampshire and Albany, New York are of comparable magnitude. Thus, an average of the data would not be significantly different from the extremes. Also, the staff notes that even if the ESW was classified as ESW 4 instead of ESW 2, the site would still be a "P2" site according to NUMARC 87-00, Table 3-6a. Therefore, the staff finds the licensee's classification of the site as a "P2" site to be acceptable. This results in an 8-hour coping requirement (0.95 target reliability).

## 2.2 Alternate AC (AAC) Power Source

### SE Recommendation

The licensee should conduct a test in accordance with Appendix B, Paragraph b.12, of NUMARC 87-00, to demonstrate that the AAC source can power the SBO loads within 10 minutes of the onset of an SBO.

### Licensee Response

The licensee stated that load capacity testing of the Vernon Hydro tie-line is performed in accordance with Vermont Yankee (VY) Procedure OP 4142, "Vernon Tie Surveillance," which requires load testing once every 5 years. This load test was last performed in 1989 and is scheduled to be performed again in February, 1994. Additionally, although demonstration that the AAC source can power the actual SBO loads is not possible without actually creating an SBO event, this ability has been demonstrated during operator training on the plant simulator.

The licensee states that Vermont Yankee is evaluating hardware changes that would allow testing at full load. However, there is no plan to perform increased load

testing until the tie line is modified in conjunction with the Vernon Hydro station upgrade. The licensee states that tests required by 10 CFR 50.63(c)(2) relate to time, not capacity.

In response to questions posed by the staff in its February 21, 1992, request for additional information regarding the availability and capability to supply the SBO loads upon demand, the licensee provided the following information. The Federal Energy Regulatory Commission (FERC) operating licensee for the hydro station requires a minimum river flow of 1250 cfs. This 1250 cfs flow, if passed through the turbine generator wheels, corresponds to an average electrical output of 3.5 MW available to Vermont Yankee. Since the maximum safe shutdown load requirement for Vermont Yankee is 2.3 MW, it is clear that the hydro station always has sufficient capacity to supply all loads required for an SBO event. New England Power has reconfirmed an operating directive requiring a minimum flow of 1250 cfs be directed through the water wheels, thus assuring 3.5 MW is available to Vermont Yankee.

The licensee stated that automatically sequenced loads for either emergency bus are less than 600 kW. The remaining loads will be manually sequenced on in accordance with Vermont Yankee's Procedure No. OT-3122. Preliminary load flow analysis shows that adequate voltage and power can be made available to the 4160V and 480V emergency buses. After the Vernon Hydro station upgrade and concurrent upgrade of the tie-line to Vermont Yankee, the licensee stated that it will be able to analytically show adequate voltage and power availability for all Vermont Yankee loads.

With respect to the staff's question pertaining to a possible extensive grid failure, the licensee stated that the loss of the 345 kV and 115 kV normal offsite power supply, concurrent with the failure of the hydro station is extremely unlikely. The Vernon Hydro station is connected to the 69 kV system which is not directly connected to Vermont Yankee's offsite power sources. Also, the majority of the lines emanating from the hydro station are routed in completely different directions from the lines supplying offsite power to Vermont Yankee. In the highly unlikely event of a regional blackout, the hydro station would separate from the grid. The Vernon Hydro station has the capability to black start, and provide power to Vermont Yankee within an hour.

#### Staff Evaluation

The licensee has performed and has committed to perform load testing of the AAC source using VY procedure OP 4142, as outlined above, and has demonstrated by simulator that the AAC power source can power the SBO loads within 10 minutes. NUMARC 87-00, Section 7.1.2, states that "Available within 10 minutes means that the circuit breakers necessary to bring power to safe shutdown buses are capable of being actuated in the control room within that period." The staff recognizes that this "time test" does not require that the SBO loads be powered within 10 minutes. However, the staff interprets the NUMARC guidance as requiring an ability to load the SBO loads on the bus shortly thereafter. Also, the staff expects that the power would be normally available

(95% of the time). The staff finds, based on the licensee's response, that there is reasonable assurance that these requirements can be met.

NUMARC 87-00, Appendix B, Item B.10 states that "once every refueling outage, a timed start (within the time period specified under blackout conditions) and load capacity test shall be performed." The staff finds that the combination of the simulator time testing and the procedural load testing of the AAC source encompasses the condition of an SBO event and is therefore acceptable. However, the load capacity test should be done initially after the Vernon Hydro upgrade and tie line upgrade is completed and once every refueling outage thereafter, or more often.

### 2.3 Effects of Loss of Ventilation (SE Section 2.3.4)

#### 2.3.1 HPCI, RCIC, Main Steam Tunnel

##### SE Recommendation

In the SE, the staff recommended that the licensee should provide ventilation calculations for the HPCI, RCIC or Main Steam Tunnel areas, or verify that the procedures for coping with an SBO clearly do not depend on the availability of the equipment in these areas.

##### Licensee Response

The licensee indicated that HPCI, RCIC and the main steam tunnel (MST) are not considered as dominant areas of concern due to the availability of the AAC power source. An evaluation, including ventilation calculations, of the availability of HPCI and RCIC is provided in the SBO supporting documentation. However, no ventilation calculation has been performed for the MST. The licensee indicated that the plant EOP OT-3122, "Loss of Normal Power Procedure," will be modified to identify the possibility of isolation of HPCI and RCIC in the event of loss of ventilation in the MST.

##### Staff Evaluation

Based on its review of the licensee's rationale for not performing a heat-up calculation for the MST and review of similar BWR plants, the staff concludes that the operability of equipment located in the MST and required to cope with an SBO event is not a concern. However, the licensee should verify that the MST is accessible for the operator to perform the manual operation if required during an SBO event.

#### 2.3.2 Equipment Operability in Areas Without Ventilation

##### SE Recommendation

In the SE, the staff recommended that for those areas with no ventilation, the licensee should verify the operability of the equipment needed to cope with an SBO.



#### Licensee Response

The licensee indicated that a review of the operability of equipment in areas with no ventilation during an SBO event was completed and included in the SBO documentation.

#### Staff Evaluation

The staff finds the licensee's response acceptable and considers this SE issue resolved.

#### 2.3.3 Areas Needing Ventilation

##### SE Recommendation

In the SE, the staff recommended that for those areas needing ventilation, the licensee should verify that the HVAC loads are included as loads on the AAC source.

#### Licensee Response

The licensee indicated that all HVAC loads required for an 8-hour SBO duration have been verified to be included on the AAC power source.

#### Staff Evaluation

The staff finds the licensee's response acceptable and considers this SE issue resolved.

#### 2.3.4 Control Room Ventilation

##### SE Recommendation

In the SE, the staff recommended that the licensee should verify that the addition of the control room ventilation as an AAC source load will not result in an overload on the AAC source. In addition, the staff recommended that the calculations and affirmations developed in accordance with the ventilation recommendations should be included with the other documentation supporting the licensee's response to the SBO Rule.

#### Licensee Response

The licensee confirmed a review of the DG loading calculations indicate that inclusion of the HVAC load does not result in an overload of the AAC source.

#### Staff Evaluation

The staff finds the licensee's response acceptable and considers this SE issue resolved.

#### 2.4 Reactor Coolant Inventory (SE Section 2.3.6)

##### SE Recommendation

In the SE, the staff reaffirmed that the recommendation of Section 2.3.4 of the SE pertaining to the HPCI and RCIC area ventilation (Section 2.3.1 of this SSE) should be implemented to assure adequate reactor coolant inventory.

##### Licensee Response

The licensee stated that the HPCI/RCIC/Main Steam Tunnel are not considered dominant areas of concern due to the availability of low pressure systems powered from the AAC power source. In the unlikely event that both HPCI/RCIC were isolated due to tunnel temperatures, the operators would follow their EOPs to ensure that inventory is maintained. The licensee stated that the procedures will be modified to ensure that the operators do not depend entirely on HPCI/RCIC operation during an SBO event.

##### Staff Evaluation

The staff finds the licensee's commitment to revise the procedures to ensure that the operators do not depend entirely on the HPCI/RCIC systems to be acceptable.

#### 2.5 Proposed Modifications (SE Section 2.5)

##### SE Recommendation

The licensee should provide a full description including the nature of the required modifications to meet the SBO Rule.

##### Licensee Response

The licensee described three design changes. The first will make the control power source for circuit breaker 3V4 diverse from the control power sources for circuit breakers 3V and 4V to eliminate possible common mode failure of the dc control power for the AAC source breakers (assuming a failure of the dc control power may have contributed to the SBO). The second design change will modify the load shedding circuitry for certain control room air conditioning loads to facilitate restoration of these loads under loss of offsite power conditions. The third design change will be the modification of the overhead portions of the Vernon tie line to meet the requirements of the SBO Rule and to interface with the new configuration of the hydro-electric station after the station is upgraded. The first two design changes are scheduled to be implemented during the 1992 refueling outage. Work associated with the upgrade of the hydro station is scheduled to begin in 1993 and should be completed by the end of 1994. The connection of Vermont Yankee to the new tie line should occur in late 1993.

### Staff Evaluation

The staff finds the proposed modifications to be conceptually acceptable. The licensee should keep the staff informed as to the progress of these modifications and include the documentation associated with these modifications with the other documentation to be retained by the licensee in support of its SBO submissions.

### 2.6 EDG Reliability Program

#### SE Recommendation

It is the staff's position that an EDG reliability program should be developed in accordance with the guidance of RG 1.155, Section 1.2. Confirmation that such a program is in place or will be implemented should be included in the documentation that is to be maintained by the licensee.

#### Licensee Response

The licensee stated that confirmation of an EDG reliability program which assures that the target reliability established for the SBO Rule is maintained, and which meets the intent of RG 1.155, Section 1.2, will be available at Vermont Yankee.

### Staff Evaluation

The staff finds the licensee's commitment to be acceptable.

### 3.0 SUMMARY AND CONCLUSION

The staff has reviewed the licensee's responses to the staff's June 5, 1991, SE and February 21, 1992, request for additional information pertaining to the SBO Rule (10 CFR 50.63).

We find the licensee's responses to be acceptable except that the licensee should increase the frequency of the load capacity testing of the AAC source (Section 2.2) and verify that the main steam tunnel is habitable for the operator to perform the manual operations if required during an SBO event (Section 2.3.1).

The staff considers the two-year clock for implementation of the SBO Rule in accordance with 10 CFR 50.63(c)(4) to begin upon receipt by the licensee of this SSE. Therefore, the licensee should keep the staff informed of the progress of the modifications it has committed to, and complete the modifications within the two year time frame, or request an extension for good cause.

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