



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

August 30, 1989

MEMORANDUM FOR: Ashok Thadani, Assistant Director For Systems
Division of Engineering & Systems Technology

FROM: Faust Rosa, Chief
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SUBJECT: STATION BLACKOUT AUDIT REVIEW VISITS (TAC 40577)

The staff has completed audit reviews of the documentation supporting the station blackout (SBO) submittals for Maine Yankee; Brunswick 1,2; Millstone 1,2,3; Crystal River 3; and Point Beach 1,2. These audits were conducted at the sites and corporate offices, and included a plant walk-through to view design features of major relevance to the SBO submittal. Based on these five audits, we believe the following general observations and conclusions are warranted:

- ° The supporting documentation packages required by the SBO rule that were audited were not in full conformance with the guidance of R.G. 1.155 and NUMARC 87-00. The deficiencies noted were not identifiable from a review of the SBO "generic" response submitted by the licensees.
- ° Two licensees proposed evacuation of the main control room and transfer of control to the remote shutdown panel because battery capacity was unavailable for powering control room loads for the specified SBO duration. The staff considers this unacceptable.
- ° One licensee (3 units) proposed using existing emergency diesel generators as the AAC source. However, the interconnecting circuits and switchgear are located outdoors within about 100 yards of the ocean, and are vulnerable to a weather related event or a single failure in the non-blackout unit. This does not meet the guidance of R.G. 1.155 and NUMARC 87-00 and is not considered acceptable.
- ° One licensee proposed using an existing gas turbine generator as the AAC source. However, he is still considering installing a new EDG that would be used as an AAC source when not being used as a spare for one of the existing EDGs (the two units at this site presently share two EDGs). A decision on which way to go should be made by the licensee and the SBO response and supporting documentation revised accordingly before the NRC review can be completed.

More detailed summaries of the five audits are provided in the Enclosure.

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It is difficult at best to assess from the SBO generic response submittal whether the licensees in their coping evaluation have fully addressed the baseline assumptions, analyses and information guidance contained in the R.G. 1.155 and NUMARC 87-00. Deficiencies regarding the completeness and accuracy of the supporting documents were identified at all five audits. This was particularly evident at Crystal River which had received only a one week advance notice of the audit. The other four licensees had received a minimum of four weeks notice, and three of them had availed themselves of a prior independent audit review by the "NUMARC SBO clearing house contractor", and this was reflected in improved, i.e., less deficient, documentation packages as compared to Crystal River. The fact that such measures were taken to prepare for NRC audits of the SBO supporting documentation which should have been completed over three months prior is not an encouraging forecast of licensee conformance to the SBO rule.

Three additional audits are planned during the SBO submittal review process. It was intended that any additional audits would be conducted after completion of the reviews, if that appeared necessary to assure conformance to the rule. It may be necessary to reconsider this approach.

Deficiencies in the SBO supporting documentation identified during the audits include the lack of completeness, analytical rigor and organization, and the tendency of the licensees to interpret or extend the guidance provided in R.G. 1.155 and NUMARC 87-00 in a manner intended to justify minimum design changes rather than improved protection against SBO. The fact that these deficiencies were not apparent from a review of the licensee submittals using the agreed upon generic response format raises the question of the effectiveness of our review process, which relies principally on review of these submittals, for verifying conformance with the SBO rule. This aspect of the issue is being reassessed; we expect to provide specific recommendations addressing this by September 1989.

Original signed by
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Enclosure:
 As stated

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NA	i. Gill:jm	:J. Knight	:C. McCracken	:F. Rosa	:	:
DATE	:8/29/89	:8/29/89	:8/30/89	:8/29/89	:	:

SUMMARY OF SBO AUDIT REVIEW VISITS:

Maine Yankee:

The licensee has calculated a minimum acceptable station blackout duration of 4 hours for the Maine Yankee site. The licensee has indicated that no modification is necessary to attain the proposed coping duration. Maine Yankee is going to use an alternate ac (AAC) power source (Appendix R diesel generator) which is available within one hour. The AAC power source powers the Appendix R safe shutdown equipment.

The class 1E battery capacity is adequate for only one hour. After one hour from the inception of SBO, the licensee will evacuate the main Control Room and move to the Remote Shutdown Panel for achieving a safe shutdown. The remote shutdown panel is powered from the AAC power source and has its own dedicated battery and 125V dc and 120V ac buses. The licensee has not verified by test that the AAC has sufficient capacity to start and power the SBO shutdown equipment. The licensee has identified several SBO related procedures that have been revised.

Based on staff review of the licensee's submittal, the supporting documents and discussions with licensee's, Maine Yankee conforms to the guidance of R.G. 1.155 and NUMARC 8700 with the exception of testing of AAC source per NUMARC 8700, the adequacy of ventilation calculations, an evaluation for excluding an isolation valve on a 4 inch auxiliary steam line, and compilation of a list of operating valves needed to maintain RCS level without class 1E power supplies. It should be noted that the voluntary evacuation of the main control due to a lack of battery capacity was not apparent from the Maine Yankee SBO submittal. The voluntary evacuation of the main control room is unacceptable.

Brunswick 1&2:

The licensee has calculated a minimum acceptable station blackout duration of 4 hours for the Brunswick 1&2 site. The class 1E batteries have sufficient capacity for 1 hour. Therefore the licensee has identified modifications and procedural revisions to permit the blacked out unit's battery chargers to be powered from the non-blackout unit's emergency ac power source (EDG) via the existing cross-connections of the 4kV buses. Connection of power to the black-out unit's battery chargers is expected to be accomplished in about an hour. In addition to the battery chargers, several ac loads of the blacked out unit will be powered from the non-blackout unit EDGs. To accomplish powering of the blacked out units selective loads from the non-blacked out units EDGs, manual load shedding of the 4kV and 480V buses at the blackout unit will be implemented. The licensee has identified modifications to the existing 4kV cross connections to facilitate closing of 4kV breakers from the control room, enhanced battery voltage indication and ac independent containment pressure indication.

Based on staff review of licensee's submittal, the supporting documents and discussion with the licensee's staff, Brunswick 1&2 conforms to the guidance of R.G. 1.155 and NUMARC 87-00 with the exceptions or deficiencies in the areas noted below:

1. The evaluation for adequate capacity of the non-blacked unit EDG for supplying safe shutdown loads of the non-blacked out unit plus the SBO loads of the blacked out unit.
2. The adequacy of calculations for condensate inventory and suppression pool heatup.
3. The evaluation of equipment operability, for loss of ventilation in the control room and switchgear rooms.

Brunswick 1&2 (cont.)

4. The identification of non-safety related equipment required during a SBO.
5. The description of the proposed modifications for the 4kV buses cross-connects between unit 1 and 2.

Millstone Units 1,2 & 3:

The licensee has calculated a minimum acceptable station blackout duration of 8 hours for the Millstone 1,2,3 site. The licensee has indicated that the Millstone site will use existing emergency diesel generators (EDGs) as an AAC power source which will be available within 1 hour. Unit 1 and 2 have an existing above ground 4kV cross connection and the licensee has identified a modification for cross connecting Unit 1 and Unit 3 in order to be able to use existing EDGs as the AAC power source. The existing and proposed cross connections between units do not conform to the R.G. 1.155, section 3.3.5.2 and NUMARC 87-00 section 2.3.1(3)(b) and Appendix C configuration 2B. The cross connections are routed outdoors and through a single outdoor switchgear (bus) which is susceptible to a single-point vulnerability due to a weather-related event or single active failure in the non-blackout unit. The licensee has also identified possible modifications for enhancing the reliability of the existing gas turbine which is used as an EDG for Unit 1. The use of existing EDGs as AAC sources requires manual load shedding in the blackout unit in order for the AAC source to carry the required load. The ventilation calculations performed by the licensee for 8 hour coping duration are also being evaluated by the staff for acceptability since NUMARC 87-00 methodology covers only a 4 hour calculation. The licensee had not completed the SBO equipment list for Units 2 and 3 and the design for the proposed cross connection between Units 1 and 3 at the time of audit review.

Based upon staff's review of the licensee's SBO submittal, the supporting documents and discussion with the licensee's staff, Millstone site conforms to the guidance R.G. 1.155 and NUMARC 87-00 with the exceptions or deficiencies in the areas noted below:

1. The acceptability of the cross-connects between unit 1,2 and 3 for use of existing EDGs as AAC power sources.
2. The acceptability of the methodology used for 8 hour duration calculations for loss of ventilation.

Millstone Units 1,2 & 3 (cont.)

3. The identification of non-safety related equipment required during a SBO.
4. The evaluation of the consequences of shutting down 3 out of 4 invertors due to loss of ventilation in Unit 2.
5. The assessment of battery operability at temperatures 118°F-120°F for units 1,2 and 3.
6. Addressing station blackout response procedures for Units 2 and 3.

Crystal River 3:

The licensee has calculated a minimum acceptable station blackout duration of 4 hours for Crystal River 3. Based on its offsite power group P2 and EDG group C with target reliability of 0.95, Crystal River 3 would have a coping duration of 8 hours. However, according to NIMARC 87-00, plants can take credit for implementation of prehurricane shutdown procedures and reduce their coping duration from 8 hours to 4 hours. A key feature of the prehurricane shutdown procedures is the requirement for shutting down the plant 2 hours prior to the arrival of the hurricane. Crystal River 3 is taking an exception to this key requirement and at the same time taking credit for reducing its coping duration from 8 to 4 hours. Crystal River 3 could have also achieved the 4 hour coping duration category by increasing its EDG target reliability from 0.95 to 0.975.

The licensee has also proposed the voluntary disabling and evacuation of the main control room for the purpose of extending the battery capability from 2 hours to 4 hours. The licensee intends to transfer the control for plant shutdown from the main control room to the Remote Shutdown Panel (Appendix R) after the first half hour. The remote panel equipment does not have an AAC power source. The circumstances under which Crystal River 3 proposes evacuation are foreseen and the actions necessary to unload the battery are numerous and complex requiring a detailed analysis, step by step procedures and operator training to accomplish. The staff does not believe there is adequate time for operators to safely accomplish this intricate transition in the short time available with its inherent potential for human error under the duress of SBO situation. Moreover, the Remote Shutdown Panels were designed for use under unforeseen circumstances of forced evacuation from the control room with no loss of AC power, which is not the case with a SBO situation.

The staff review of the supporting documents for the Crystal River 3 SBO submittal indicated that it lacked supporting information particularly RCS inventory

Crystal River 3 (cont.)

analysis, coping scenario for SBO and description of proposed ADV modifications. It should be noted that the extensive load shedding to unload the battery and voluntary evacuation of the main control room were not identified in the licensee's submittal.

Based on staff review of the licensee's submittal, supporting documents and discussion with the licensee's staff, Crystal River 3 is essentially not in conformance with R.G. 1.155 and NUMAPC 87-00. The deficiencies noted are as follows:

1. The disablement of the control room by selective stripping of battery loads and evacuation of the control room and transference of the plant control to the Remote Shutdown Panel.
2. No RCS inventory analysis and supporting calculations.
3. Questionable ventilation calculations for various dominant areas of concern.
4. Inadequate identification of equipment required during a SBO.
5. No listing of containment isolation valves.
6. No description of proposed modifications for the ADVs.
7. Inadequate evaluation of emergency lighting during a SBO.
8. No evaluation of staffing needs for operator actions during a SBO.

Crystal River 3 (cont.)

9. No EDG reliability calculations per NJMARC 87-00 for 50 and 100 demands.
10. No description of coping scenario for a SBO event.

Point Beach Units 1&2:

The Point Beach plant requires an 8 hour coping duration and a 0.975 EDG reliability, primarily because of extremely severe weather (ESW) group 4 and emergency AC (EAC) group D. The licensee is currently studying the possibility that the ESW classification should be group 3, which would reduce their EDG reliability requirement to 0.95.

The Point Beach plant currently has a 20MW gas turbine which would be available within one hour as the AAC source. It has adequate capacity to power all of the emergency loads, including air conditioning and ventilation. However, the NRC staff questions whether it can obtain a 0.95 reliability because its recent (last 5 year) historical reliability is only 0.91 which does not include the impact of the auxiliary diesel generator required to power the gas turbine auxiliaries during SBO conditions. The auxiliary diesel generator was not included in the tests used for deriving the 0.91 reliability because offsite power was available during those tests. As a result, the NRC staff left as an open item the demonstration within two years that the gas turbine can achieve a 0.95 reliability. If the 0.95 reliability cannot be obtained, the licensee would be required to present an alternative resolution to this issue. The licensee is currently considering the feasibility of another EDG to serve as an AAC source except during times it would be used as an installed spare for one of the two existing EDGs. The gas turbine would then be used as an AAC source when the EDG is replacing one of the existing EDGs.

Based on staff review of licensee's submittal, the supporting documents and discussion with the licensee's staff, Point Beach 1&2 conforms to the guidance of R.G. 1.155 and NUMARC 87-00 with the exception or deficiencies in the areas noted below:

1. Development of a reliability program for the gas turbine.
2. Completion of the ventilation calculations and equipment operability verification for the dominant areas of concern.

Point Beach Units 1&2 (cont.)

3. Description of the quality assurance program for the non-safety equipment.
4. Modifications, if necessary, to the EDG reliability program, consistent with Generic Issue B-56.
5. Demonstration that the gas turbine can power the SBO loads within one hour by an initial test.
6. Implementation of the necessary technical specifications for the SBO equipment.