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TECHNICAL EVALUATION REPORT

NINE MILE POINT NUCLEAR POWER STATION UNIT 1

STATION BLACKOUT EVALUATION

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1.0 BACKGROUND

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50 by adding a new section 50.63, "Loss of All Alternating Current Power" (1). The objective of this requirement is to assure that all nuclear power plants are capable of withstanding a station blackout (SBO) and maintaining adequate reactor core cooling and appropriate containment integrity for a required duration. This requirement is based on information developed under the commission study of Unresolved Safety Issue A-44, "Station Blackout" (2-6).

The staff issued Regulatory Guide (RG) 1.155, "Station Blackout," to provide guidance for meeting the requirements of 10 CFR 50.63 (7). Concurrent with the development of this regulatory guide, the Nuclear Utility Management and Resource Council (NUMARC) developed a document entitled, "Guidelines and Technical Basis for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC 87-00 (8). This document provides detailed guidelines and procedures on how to assess each plant's capabilities to comply with the SBO rule. The NRC staff reviewed the guidelines and analysis methodology in NUMARC 87-00 and concluded that the NUMARC document provides an acceptable guidance for addressing the 10 CFR 50.63 requirements. The application of this method results in selecting a minimum acceptable SBO duration capability from two to sixteen hours depending on the plant's characteristics and vulnerabilities to the risk from station blackout. The plant's characteristics affecting the required coping capability are: the redundancy of the onsite emergency AC power sources, the reliability of onsite emergency power sources, the frequency of loss of offsite power (LOOP), and the probable time to restore offsite power.

In order to achieve a consistent systematic response from licensees to the SBO rule and to expedite the staff review process, NUMARC developed two generic response documents. These documents were reviewed and endorsed by the NRC staff (13) for the purposes of plant specific submittals. The documents are titled:

1. "Generic Response to Station Blackout Rule for Plants Using Alternate AC Power," and

2. "Generic Response to Station Blackout Rule for Plants Using AC Independent Station Blackout Response Power."

A plant-specific submittal, using one of the above generic formats, provides only a summary of results of the analysis of the plant's station blackout coping capability. Licensees are expected to ensure that the baseline assumptions used in NUMARC 87-00 are applicable to their plants and to verify the accuracy of the stated results. Compliance with the SBO rule requirements is verified by review and evaluation of the licensee's submittal and audit review of the supporting documents as necessary. Follow up NRC inspections assure that the licensee has implemented the necessary changes as required to meet the SBO rule.

In 1989, a joint NRC, SAIC team headed by an NRC staff member performed audit reviews of the methodology and documentation that support the licensees' submittals for several plants. These audits revealed several deficiencies which were not apparent from the review of the licensees' submittals using the agreed upon generic response format. These deficiencies raised a generic question regarding the degree of licensees' conformance to the requirements of the SBO rule. To resolve this question, on January 4, 1990, NUMARC issued additional guidance as NUMARC 87-00 Supplemental Questions/Answers (14) addressing the NRC's concerns regarding the deficiencies. NUMARC requested that the licensees send their supplemental responses to the NRC addressing these concerns by March 30, 1990.

2.0 REVIEW PROCESS

The review of the licensee's submittal is focused on the following areas consistent with the positions of RG 1.155:

A. Minimum acceptable SBO duration (Section 3.1),

B. SBO coping capability (Section 3.2),

C. Procedures and training for SBO (Section 3.4),

D. Proposed modifications (Section 3.3), and

E. Quality assurance and technical specifications for SBO equipment (Section 3.5).

For the determination of the proposed minimum acceptable SBO duration, the following factors in the licensee's submittal are reviewed: a) offsite power design characteristics, b) emergency AC power system configuration, c) determination of the emergency diesel generator (EDG) reliability consistent with NSAC-108 criteria (9), and d) determination of the accepted EDG target reliability. Once these factors are known, Table 3-8 of NUMARC 87-00 or Table 2 of RG 1.155 provides a matrix for determining the required coping duration.

For the SBO coping capability, the licensee's submittal is reviewed to assess the availability, adequacy and capability of the plant systems and components needed to achieve and maintain a safe shutdown condition and recover from an SBO of acceptable duration which is determined above. The review process follows the guidelines given in RG 1.155, Section 3.2, to assure:

a. availability of sufficient condensate inventory for decay-heat removal,

b. adequacy of the class-1E battery capacity to support safe shutdown,

c. availability of adequate compressed air for air-operated valves necessary for safe shutdown,

d. adequacy of the ventilation systems in the vital and/or dominant areas that include equipment necessary for safe shutdown of the plant,

e. ability to provide appropriate containment integrity, and

f. ability of the plant to maintain adequate reactor coolant system inventory to ensure core cocling for the required coping duration.

The licensee's submittal is reviewed to verify that required procedures (i.e., revised existing and new) for coping with SBO are identified and that appropriate operator training will be provided.

The licensee's submittal for any proposed modifications to emergency AC sources, battery capacity, condensate capacity, compressed air capacity, appropriate containment integrity and primary coolant make-up capability is reviewed. Technical specifications and quality assurance set forth by the licensee to ensure high reliability of the equipment, specifically added or assigned to meet the requirements of the SBO rule, are assessed for their adequacy.

This SBO evaluation is based upon the review of the licensee's submittals dated April 13, 1989 (10), April 3, 1990 (12), and April 16, 1990 (15), a telephone conversation with the licensee on October 9, 1990, the licensee's response to the questions raised during the telephone call (16), information on the licensee's calculations (17), and the information available in the plant Updated Final Safety Analysis Report (UFSAR) (11); it does not include a concurrent site audit review of the supporting documentation. Such an audit may be warranted as an additional confirmatory action. This

determination would be made and the audit would be scheduled and performed by the NRC staff at some later date.

3.0 EVALUATION

3.1 Proposed Station Blackout Duration

Licensee's Submittal

The licensee, Niagara Mohawk Power Corporation (NMPC), calculated (10 and 12) a minimum acceptable station blackout duration of four hours for the Nine Mile Point Nuclear Station Unit 1 (NMP1). The licensee stated that no modifications are required to attain this coping duration.

The plant factors used to estimate the proposed SBO duration are:

1. Offsite Power Design Characteristics

   The plant AC power design characteristic group is "P2" based on:

   a. Independence of the plant offsite power system characteristics of "II/2,"

   b. Expected frequency of grid-related LOOPs of less than one per 20 years,

   c. Estimated frequency of LOOPs due to extremely severe weather (ESW) which places the plant in ESW Group "1," and

   d. Estimated frequency of LOOPs due to severe weather (SW) which places the plant in SW Group "3."

2. Emergency AC (EAC) Power Configuration Group

   The EAC power configuration of the plant is "C." NMP1 is equipped with two emergency diesel generators, one of which is necessary to operate safe-shutdown equipment following a loss of offsite power.

3. Target Emergency Diesel Generator (EDG) Reliability

The licensee has selected a target EDG reliability of 0.975. The selection of this target reliability is based on having an average EDG reliability of greater than 0.90, 0.94, and 0.95 for the last 20, 50, and 100 demands, respectively, consistent with NUMARC 87-00, Section 3.2.4.

Review of Licensee's Submittal

Factors which affect the estimation of the SBO coping duration are: the independence of the offsite power system grouping, the estimated frequency of LOOPs due to ESW and SW conditions, the expected frequency of grid-related LOOPs, the classification of EAC, and the selection of EDG target reliability. The licensee's estimates of the expected frequency of LOOPs due to ESW and SW conditions are consistent with the information provided in NUMARC 87-00.

The licensee stated that the independence of the plant offsite power system grouping is "I1/2." A review of the NMP1 UFSAR indicates that:

1. All offsite power sources are connected to the plant through a single switchyard;

2. During normal power operation, each of the two essential buses are powered from a different independent 115-kV offsite power source, each through an independent reserve station transformer;

3. Both transformers are sized and designed to supply the required load to one essential bus; and

4. Upon loss of power from either transformer, there are no transfers to the remaining offsite source.

Based on these and the criteria stated in Table 5 of RG 1.155, we conclude that the plant independence of offsite power system group is "I3." During the telephone conversation on October 9, 1990, the licensee agreed that NMP1 is in the "I3" grouping. This change in grouping, however, does not affect the offsite power design characteristic group nor the plant's coping duration.

The licensee correctly classified the EAC classification of NMP1 as "C." The plant has two EDGs, either one of which is sufficient to safely shut down the plant.

The licensee selected a target EDG reliability of 0.975 based upon the last 20, 50, and 100 demands. The target EDG reliability which the licensee selected (10) and committed to maintain (12) is in conformance with both RG 1.155 and NUMARC 87-00. Since the information supporting the target EDG reliability is only available on site, we are unable to verify the assignment of the target reliability at this time. We did not receive the statistics for the EDG reliability over the last 20, 50, or 100 demands. The licensee needs to have the analysis showing the EDG reliability statistics for the last 20, 50, and 100 demands in its SBO submittal supporting documents.

The licensee also stated (12) that it intends to establish a program of diesel generator reliability consistent with the resolution of Generic Issue B-56. The licensee stated that, in the mean time, NMP1 diesel generator reliability is being trended and recommendations will be made if reliability falls below the target value.

With regard to the expected frequency of grid-related LOOPs at the site, we can not confirm the stated results. The available information in NUREG/CR-3992 (3), which provides a compendium of information on the loss of offsite power at nuclear power plants in U.S., indicates that NMP1 did not have any symptomatic grid-related LOOP prior to the calendar year 1984. In the absence of any contradictory information, we agree with the licensee's statement.

Based on the above, the offsite power design characteristic of the NMP1 site is "P2" with a minimum required SBO coping duration of four hours.

3.2 Station Blackout Coping Capability

The plant coping capability with an SBO event for the required duration of four hours is assessed based on the following results:

1. Condensate Inventory for Decay-Heat Removal

   Licensee's Submittal

   The licensee stated (10) that 58,700 gallons of water are needed to remove decay heat using the emergency condensers during a four-hour SBO event. The combination of the minimum permissible gravity feed make-up water storage tank (MWST) and emergency-condenser shell-side water level per technical specifications provides 111,720 gallons, which is adequate to provide core cooling for the 4-hour SBO. The licensee added that the emergency condenser control valves (total of two) will fail open upon loss of air. However, no plant modifications or operator actions are required to ensure adequate condensate inventory for decay-heat removal.

   In response to questions regarding reactor cool down or depressurization during an SBO, the licensee provided (17) its calculations on condensate requirements. The licensee's calculations indicate that 48,500 gallons of condensate will be needed to remove decay heat, and that 10,200 gallons will be needed to depressurize the primary system to 260 psia.

   With regard to the ability to control the emergency condenser make-up (the MWSTs) flow control valves upon loss of compressed air, the licensee determined that, if no actions were taken, the MWSTs would be emptied 3.8 hours into the SBO event. However, the

water remaining in the shell side of the emergency condensers would be sufficient to cope with the remaining 0.2 hours of the event. Nevertheless, the licensee is proposing to manually control the emergency condenser level within 30 minutes of the onset of the SBO event. The licensee stated that in the first 30 minutes after the start of the SBO event, 15,000 gallons of water would be drained from the make-up tanks before the operators would manually control the water level in the emergency condensers. After 30 minutes, the total remaining condensate inventory (in the make-up tanks and emergency-condenser shells) was estimated to be at least 90,000 gallons. The licensee stated that it has verified that the flow-control valves are accessible for manual operation during an SBO event.

Review of Licensee's Submittal

We reviewed the licensee's provided back-up documentation for the analysis of the condensate inventory requirement and found the calculations for decay-heat removal to be consistent with the guidance. Our review indicates that if one of the emergency condenser level make-up flow control valves is not closed until one hour, adequate condensate would be available to remove decay heat only. Therefore, we concur with the licensee that operator actions are required to manually control the make-up flow to the emergency condensers within 30 minutes of the onset of the event.

The licensee's calculations of condensate inventory for reactor depressurization only consider cooling the primary water mass down to 404°F (i.e., saturation temperature at 260 psia). Therefore, the calculations do not consider the condensate required to cool down the metal mass (i.e., fuel, vessel internals, piping, reactor vessel, etc.). We performed an independent calculation of the condensate required for cool down to 404°F using the information provided in the licensee's documents and that available for a similar plant, and determined that 17,500 gallons of condensate

would be needed. This is 7300 gallons more than that calculated by the licensee.

With regard to the failure of the emergency condenser make-up flow control valves, we found that the licensee needs to start cooling down and manually control the make-up flow to the emergency condensers within 30 minutes in order to prevent condensate overflow and to ensure sufficient condensate availability during an SBO event. It should be stated that our analysis and review is based on a final reactor pressure of 260 psia. If a lower pressure should be needed to allow the diesel-driven fire pump to supplement the reactor vessel water inventory, make-up water to the shell side of the emergency condensers for additional depressurization may be required. If a lower pressure is required, the licensee should perform an analysis showing that an adequate condensate inventory exists.

2. Class-1E Battery Capacity

Licensee's Submittal

The licensee stated (10) that the class-1E batteries do not have sufficient capacity to meet station blackout loads for four hours. Therefore, the licensee has installed two new class-1E batteries that are larger (2320 ampere-hours vs. 1500 ampere-hours) (15). The licensee stated that the new batteries have the capacity to cope with a 4-hour SBO provided that load shedding occurs within the first 30 minutes of the onset of the event. The licensee stated that it will shed two motor-generator (MG) sets from each battery.

Review of Licensee's Submittal

The licensee provided information (16) on the loads and on the battery calculations. Our review of the information provided

covers the methodology used by the licensee. It does not, however, include a review of the loads specified by the licensee. We assume that the loads provided by the licensee are accurate and that the stated current and the minimum battery terminal voltage accurately reflect that which is required by the equipment.

The licensee's analysis contained a 12-part sensitivity study for each battery. For each battery, the licensee provided evaluations of the batteries with load shedding beginning at 15 and 30 minutes into the SBO event, for final terminal voltages of 105 and 106 VDC, and with 58, 59, and 60 cells available. We reviewed the 30-minute load shedding scenario; the 15-minute load shedding scenario is not consistent with the guidance provided in NUMARC 87-00, and therefore, it was not reviewed.

The licensee identified that two MG sets will be shed from each of the station batteries. From battery #11, MG sets 161 and 167 will be shed after 30 minutes; MG set 162 will be powered. From battery #12, MG sets 167 and 171 will be shed after 30 minutes; MG set 172 will be powered. We received no specific information on the equipment which will not be available due to the shedding of the MG sets, although the licensee stated (16) that it will maintain instrumentation and indications required to monitor the reactor and primary containment conditions with power from MG sets 162 and 172.

Based on the licensee's analysis, station battery #11 has sufficient margin only if all 60 cells are available and the final terminal voltage is assumed to be 105 VDC. If fewer than 60 cells are available or if the final terminal voltage must be held to a voltage greater than 105 VDC to provide adequate voltage at the loads, then the battery is inadequate to meet the SBO loads. Station battery #12 has sufficient capacity to cope with SBO loads following load stripping with only 58 of its 60 cells available and a final terminal voltage of 106 VDC.

Upon review of this information, we conclude that, with 30-minute load shedding, the station batteries appear to have sufficient capacity to cope with a 4-hour SBO event. However, we have three concerns that require a response from the licensee:

a. Time-load assignment

The licensee has divided the loads that usually occur in the first minute into two one-minute segments. By this it has lowered the total current drawn within the first minute. For example, on the EDG start, the licensee put the load required for the governor circuit and the field flashing circuit in the 1 to 2 minute segment and others in the 0 to 1 and 1 to 2 minute segments. In reality, all of these loads occur in the 0 to 1 minute segment. The EDG needs to start up and be on line within 10 seconds of the detection of low voltage after a LOOP, which occurs within the first few seconds.

b. Last-minute loads

During an SBO event, it is expected that an offsite power source will be available before the EDGs. Therefore, the last-minute load should include the load needed to close the required circuit breakers to power the emergency buses from the available offsite power source. The licensee, however, assumed that an EDG will be started after an SBO. The licensee needs to verify that the assigned load for the EDG restart bounds the circuit-breaker loads required for connecting the available offsite power source to the emergency buses at the end of the SBO event.

c. Turbine emergency bearing oil pump

The licensee assigned the load for the turbine emergency bearing oil pump to the 2 to 3 minute load segment. The licensee's load profile shows that this load will initiate at one minute into the event. This pump starts on low lube oil pressure upon turbine trip. The licensee needs to determine when this pump will start, and, if it is within the first minute, this load should be added to the 0 to 1 minute segment.

The licensee needs to address the above concerns and either have justifications for their use or re-evaluate the battery calculations taking these concerns into account. In either case, the licensee needs to have the resolution of this issue in its SBO submittal supporting documentation.

3. Compressed Air

Licensee's Submittal

The licensee stated that the air-operated valves relied upon to cope with an SBO for four hours can either be operated manually or have sufficient back-up sources.

Review of Licensee's Submittal

The licensee is planning to cool down and depressurize the reactor using the emergency condensers. However, if there is a need to depressurize the reactor more quickly than is possible by using the emergency condensers [i.e., in order to inject water into the vessel using the fire pump (see paragraph 6, Reactor Coolant Inventory)], it may be necessary to use the automatic depressurization system (ADS) valves. Upon review of the NMP1 UFSAR, we found that there are six solenoid-actuated pressure-

relief valves located on the steam lines and discharge to the pressure suppression pool, any three of which are sufficient to depressurize the reactor vessel. However, we were unable to confirm that there is a sufficient back-up supply of air to cope with a 4-hour SBO event. The licensee needs to verify that the ADS valves have an adequate reserve supply of air to perform any necessary depressurization.

4. **Effects of Loss of Ventilation**

Licensee's Submittal

The licensee stated that calculations were performed to determine the temperature in dominant areas of concern following the loss of the Heating, Ventilation, and Air Conditioning (HVAC) system. The results of the licensee's calculations (10) are as follows:

AREA	TEMPERATURE
Emergency Condenser Condensate Return Isolation Valve (281' El.)	124°F
Emergency Condenser Steam Supply Isolation Valve Room (298' El.)	131°F
Reactor Building, 318' El. (Emergency condenser level transducers)	109°F
Reactor Building, 340' El. (Emergency condensers)	227°F

For the above areas, the licensee did not provide any information regarding the initial temperatures used. The licensee stated that the control room does not exceed 120°F provided that the door between the control room and the instrument shop is opened, and, therefore, it will not be a dominant area of concern (DAC) during an SBO event. The licensee added that the control room and auxiliary control room instrument cabinet doors will be opened to

increase the cooling of the control room equipment by natural convection.

The licensee stated (10) that reasonable assurance of the operability of SBO equipment in the dominant areas of concern has been assessed using Appendix F of NUMARC 87-00. The licensee added that no hardware modifications are required to provide reasonable assurance of equipment operability.

The licensee provided an excerpt of its qualitative analysis of the drywell heat-up. The analysis made a comparison between the heat-up calculations performed by both Oak Ridge National Laboratory (ORNL) and the Tennessee Valley Authority (TVA) for Browns Ferry Nuclear Plant (BFN). Although no formal conclusions were provided as a part of this analysis, it is implied that the NMP1 drywell heat loads are less than that calculated for BFN. ORNL calculated a maximum temperature for the BFN drywell of 320°F and TVA calculated a temperature of 299°F. The licensee noted that the results of these two studies indicate that the NMP1 drywell temperature at the end of the SBO event will be below 281°F, which is below the LOCA peak temperature of 301°F. The licensee stated (16) that it plans to complete a quantitative analysis of the temperature rise in the drywell by the end of February, 1991, using CONTAIN computer code, and that the results are expected to be below the temperature determined based on the qualitative analysis. The licensee also stated that the results of the quantitative analysis will be placed in the SBO auditable file.

Review of Licensee's Submittal

Following the telephone conversation on October 9, 1990, the licensee provided information (16) on its heat-up calculations for the drywell and the control room. For the drywell, the licensee provided a qualitative analysis of the assumptions made about the

initial conditions. For the control room, the licensee provided the initial assumptions and the calculated final temperature of 102°F.

In the drywell analysis, the licensee performed a comparison between NMP1 and BFN. The licensee assumed a leak rate of 25 gpm, which is considerably less than the 115-gpm (18 gpm per recirculation pump and 25 gpm maximum allowable technical specifications leakage) leak rate recommended by NUMARC. Using the 25-gpm leak rate, the licensee concluded that the drywell temperature would not exceed the design temperature. The licensee needs to evaluate the drywell heat up using a higher leak rate consistent with that recommended by NUMARC.

In the control-room analysis, the licensee used a time-dependent computer model, a non-NUMARC 87-00 methodology. The calculation assumes an initial control-room temperature of 75°F, and a heat load of ~18 kW. With regard to the assumed heat load in the control room, the value used is within the range of values used by other licensees. With regard to the control-room initial temperature, the licensee should have performed the heat-up calculations assuming a bounding initial temperature allowed by plant technical specifications during plant operation and documented the results. This is necessary to bound the worst-case situation. We do not believe, however, that the worst-case scenario would result in the control room becoming a dominant area of concern because the calculated final temperature using a 75°F initial temperature is 102°F, as provided in reference 16. If a control-room initial temperature of 90°F were to be assumed, the final temperature would still be below 120°F. However, the licensee needs to open the control room cabinet doors within 30 minutes of the onset of an SBO event in the absence of air conditioning, consistent with the NUMARC 87-00 Supplemental Questions and Answers.

5. Containment Isolation

Licensee's Submittal

The licensee stated that the plant list of containment isolation valves (CIVs) was reviewed and it was determined that all of the valves which must be capable of being closed or operated (cycled) under SBO conditions can be positioned with indication independent of the preferred and blacked-out unit's class-1E power supplies. The licensee also said that although no modifications are necessary to ensure that appropriate containment integrity can be provided under SBO conditions, a procedure was changed to ensure that containment integrity can, if needed, be obtained.

Review of Licensee's Submittal

Upon review of the list of containment isolation valves (UFSAR Tables VI-3a and VI-3b), we found that there are several valves (i.e., core spray pump suction and discharge, containment spray pump suction) which do not meet the exclusion criteria outlined in RG 1.155. The licensee needs to list in an appropriate procedure the CIVs which are either normally closed or open and fail as-is upon loss of AC power and cannot be excluded by the criteria given in RG 1.155, and identify the actions necessary to ensure that these valves are fully closed, if needed. Valve closure needs to be confirmed by position indication (local, mechanical, remote, process information, etc.).

6. Reactor Coolant Inventory

Licensee's Submittal

The licensee stated that the ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed, using a plant-specific analysis, for four hours.

From this assessment, the licensee concluded that the expected rates of reactor coolant inventory loss do not result in core uncovery during a 4-hour SBO event, and therefore, make-up systems in addition to those currently available under SBO conditions are not required to maintain core cooling under natural circulation. The licensee stated (10) that the expected rates of reactor coolant loss are based, in part, on an assumption of limited additional leakage from the reactor recirculation pump seals, and that this assumption is being verified by a program of analysis and testing of the seal leakage under SBO conditions.

During the telephone conversation on October 9, 1990, the licensee stated that it had not assumed a leak rate of 115 gpm as was recommended in NUMARC 87-00. The licensee has performed a sensitivity analysis of the reactor water level versus assumed leakage rate during cooldown with the emergency condenser in operation. The licensee concluded (16) that the core will remain covered for at least four hours with a leak corresponding to 45 gpm if the reactor is depressurized to 175 psia in one hour. In addition, the licensee stated (17) that a scoping analysis was performed which indicates that the core will become uncovered in 1.9 hours if a 115-gpm leak were assumed to occur. The licensee added (16) that if a 115-gpm leak were to occur, the operator action per emergency operating procedure N1-EOP-2 would be to actuate the automatic depressurization system at or before the time the water level reaches the top-of-active-fuel. After the vessel is depressurized, the operator would be expected to initiate reactor vessel make-up using the diesel-driven fire pump. The licensee noted (16) that the use of the fire pump is not presently credited in the NMP1 SBO coping analysis.

Review of Licensee's Submittal

Reactor coolant make-up is necessary to remove decay heat, to compensate for possible RCS cool down, and to replenish the RCS

inventory losses due to the reactor coolant pump seal leakage (18 gpm per pump per NUMARC 87-00 guideline) and the technical specifications maximum allowable leakage (estimated to be 25 gpm). For NMP1, which has five recirculation pumps, the total assumed leak rate is 115 gpm, and we calculated that the core will become uncovered in 1.25 hours. In order to be able to keep the core covered, the licensee needs to revise its station blackout procedure to instruct the operators to depressurize the reactor vessel to a level where the diesel-driven fire pump can be used to inject water into the vessel, should core uncovery become imminent during an SBO event.

NOTE:

The 18-gpm recirculation pump seal leak rate was agreed to between NUMARC and the NRC staff pending resolution of Generic Issue (GI) 23. If the final resolution of GI-23 defines higher recirculation pump seal leak rates than assumed for the RCS inventory evaluation, the licensee needs to be aware of the potential impact of this resolution on its analyses and actions addressing conformance to the SBO rule.

3.5 Proposed Procedures and Training

Licensee's Submittal

The licensee stated that the following plant procedures have been reviewed per guidelines in NUMARC 87-00, Section 4:

1. Station blackout response guidelines,
2. AC power restoration, and
3. Severe weather.

The licensee stated that these procedures have been reviewed and the changes necessary to meet NUMARC 87-00 guidelines will be implemented.

Review of Licensee's Submittal

We neither received nor reviewed the affected SBO procedures. We consider these procedures as plant-specific actions concerning the required activities to cope with an SBO. It is the licensee's responsibility to revise and implement these procedures, as needed, to mitigate an SBO event and to assure that these procedures are complete and correct, and that the associated training needs are carried out accordingly.

3.4 Proposed Modifications

Licensee's Submittal

The licensee stated (15) that it has installed two new class-1E station batteries. As a result of this change, the licensee concluded that the batteries are adequate to meet the required 4-hour SBO loads with no operator actions assumed for the first 30 minutes.

Review of Licensee's Submittal

We did not find the need for any other modifications in order for NMP1 to cope with a 4-hour SBO event.

3.5 Quality Assurance and Technical Specifications

Quality Assurance

The licensee provided (16) a copy of its SBO equipment list. This list identified equipment which is necessary to cope with, as well as to recover from, an SBO event. The licensee identified the SBO equipment that do not have an appropriate quality assurance program and will be covered under the quality-related program for NMP1. The licensee needs to verify that this quality-related program conforms to the guidance provided in RG 1.155, Appendix A.

Technical Specifications

The licensee did not provide any information on how the plant complies with the requirements of RG 1.155, Appendix B.

4.0 CONCLUSIONS

Based on our review of the licensee's submittals and the information available in the UFSAR for Nine Mile Point Unit 1, we find that the submittal conforms with the requirements of the SBO rule and the guidance of RG 1.155 with the following exceptions:

1. Independence of Offsite Power Source

   In its submittals, the licensee stated that NMP1 is in offsite power grouping "I1/2." Following the telephone conversation, the licensee agreed that the plant is in the "I3" grouping due to the fact that it is not possible for all of the essential buses to be powered from either offsite power source. This change in offsite power grouping does not affect the plant's required coping duration.

2. Condensate Inventory for Decay-Heat Removal

   NMP1 has sufficient condensate to cope with a 4-hour SBO event provided that the operators manually control the emergency condenser make-up flow control valves within 30 minutes and if the final reactor pressure is 260 psia. If a lower pressure should be needed to allow the diesel-driven fire pump to supplement the reactor vessel water inventory, the licensee needs to provide procedures for additional depressurization using the ADS valves, and to provide additional make-up water to the shell side of the emergency condensers or perform an analysis showing that an adequate condensate inventory exists.

3. Class-1E Battery Capacity

   Upon review of the information provided by the licensee, we conclude that, with 30-minute load shedding, the station batteries appear to have sufficient capacity to cope with a 4-hour SBO

event. However, we have three concerns that require a response from the licensee:

a. Time-load assignment

The licensee has divided the loads that usually occur in the first minute into two one-minute segments. By this it has lowered the total current drawn within the first minute.

b. Last-minute loads

The last-minute load should include the load needed to close the required circuit breakers to power the emergency buses from the offsite power source. It is expected that offsite power will be restored before the EDGs will be available and the safety loads will be connected to the first available offsite power source after an SBO event. The licensee assumed that an EDG will be started after an SBO. The licensee needs to verify that the estimated random load (i.e., EDG field flashing) is bounding when compared with the loads required to close the needed circuit breakers.

c. Turbine emergency bearing oil pump

The licensee assigned the load for the turbine emergency bearing oil pump to the 2 to 3 minute load segment. The licensee's load profile shows that this load will initiate at one minute into the event. The licensee needs to determine when this pump will start, and, if it is within the first minute, this load should be added to the 0 to 1 minute segment.

4. Compressed Air

The licensee is planning to cool down and depressurize the reactor using the emergency condensers. However, if it is determined that the reactor will have to be depressurized more quickly than is possible by using the emergency condensers (i.e., in order to inject water into the vessel using the fire pump), it may be necessary to use the ADS valves. However, we were unable to confirm that the ADS valves have a sufficient back-up supply of air to cope with a 4-hour SBO event. The licensee needs to verify that the ADS valves have an adequate reserve supply of air to perform any necessary depressurization.

5. Effects of Loss of Ventilation

In the drywell analysis, the licensee performed a comparison between NMP1 and BFN. The licensee assumed a leak rate of 25 gpm, which is considerably less than the 115-gpm (18 gpm per recirculation pump and 25 gpm maximum allowable technical specifications leakage) leak rate recommended by NUMARC. Using the 25-gpm leak rate, the licensee concluded that the drywell temperature would not exceed the design temperature. The licensee needs to evaluate the drywell heat up using a higher leak rate consistent with that recommended by NUMARC.

Since there is no air conditioning in the control room, the licensee needs to open the control room cabinet doors within 30 minutes of the onset of an SBO event.

6. Containment Isolation

The licensee needs to list in an appropriate procedure the CIVs which are either normally closed or open and fail as-is upon loss of AC power and cannot be excluded by the criteria given in RG 1.155, and identify the actions necessary to ensure that these

valves are fully closed, if needed. Valve closure needs to be confirmed by position indication (local, mechanical, remote, process information, etc.).

7. **Reactor Coolant Inventory**

For NMP1, which has five recirculation pumps, the total assumed leak rate is 115 gpm, and we calculated that the core will become uncovered in 1.25 hours. In order to be able to keep the core covered, the licensee needs to revise its station blackout procedure to instruct the operators to depressurize the reactor vessel to a level where the diesel-driven fire pump can be used to inject water into the vessel, should core uncovery become imminent during an SBO event.

8. **Quality Assurance and Technical Specifications**

Quality Assurance

The licensee needs to verify that its quality-related program conforms to the guidance provided in RG 1.155, Appendix A.

Technical Specifications

The licensee did not provide any information on how the plant complies with the requirements of RG 1.155, Appendix B.

5.0 REFERENCES

1. The Office of Federal Register, "Code of Federal Regulations Title 10 Part 50.63," 10 CFR 50.63, January 1, 1989.

2. U.S. Nuclear Regulatory Commission, "Evaluation of Station Blackout Accidents at Nuclear Power Plants - Technical Findings Related to Unresolved Safety Issue A-44," NUREG-1032, Baranowsky, P. W., June 1988.

3. U.S. Nuclear Regulatory Commission, "Collection and Evaluation of Complete and Partial Losses of Offsite Power at Nuclear Power Plants," NUREG/CR-3992, February 1985.

4. U.S. Nuclear Regulatory Commission, "Reliability of Emergency AC Power System at Nuclear Power Plants," NUREG/CR-2989, July 1983.

5. U.S. Nuclear Regulatory Commission, "Emergency Diesel Generator Operating Experience, 1981-1983," NUREG/CR-4347, December 1985.

6. U.S. Nuclear Regulatory Commission, "Station Blackout Accident Analyses (Part of NRC Task Action Plan A-44)," NUREG/CR-3226, May 1983.

7. U.S. Nuclear Regulatory Commission Office of Nuclear Regulatory Research, "Regulatory Guide 1.155 Station Blackout," August 1988.

8. Nuclear Management and Resources Council, Inc., "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," NUMARC 87-00, November 1987.

9. Nuclear Safety Analysis Center, "The Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants," NSAC-108, Wyckoff, H., September 1986.

10. Terry, C. D., letter to U. S. Nuclear Regulatory Commission, "Response to Station Blackout Rule," Docket No. 50-220, dated April 13, 1989.

11. Nine Mile Point Nuclear Station Unit 1 Updated Final Safety Analysis Report.

12. Terry, C. D., letter to U. S. Nuclear Regulatory Commission, "Supplemental Response to Station Blackout Rule," Docket No. 50-220, dated April 3, 1990.

13. Thadani, A. C., Letter to W. H. Rasin of NUMARC, "Approval of NUMARC Documents on Station Blackout (TAC-40577)," dated October 7, 1988.

14. Thadani, A. C., letter to A. Marion of NUMARC, "Publicly-Noticed Meeting December 27, 1989," dated January 3, 1990 (confirming "NUMARC 87-00 Supplemental Questions/Answers," December 27, 1989).

15. Terry, C. D., letter to U. S. Nuclear Regulatory Commission, notification of the installation of two new batteries, NMP1L 0491, April 16, 1990.

16. Terry, C. D., letter to U. S. Nuclear Regulatory Commission, response to question raised during the telephone conversation on October 9, 1990, NMP1L 0564, January 24, 1991.

17. Supplemental information package supplied in response to questions asked during the telephone conversation on October 9, 1990.

All analyses, confirmations, and other documentation supporting your SBO submittals should be maintained and available for further NRC staff inspection and assessment. The NRC staff is currently considering Technical Specifications (TS) for SBO equipment in context of the TS Improvement Program. In the interim, plant procedures to reflect the appropriate testing and surveillance requirements should be in place to ensure the operability of the necessary SBO equipment. You will be notified if a determination is made that TS are required for SBO equipment.

This requirement for confirmation and information affects one respondent; therefore, is not subject to Office of Management and Budget review under P.L. 96-511.

Sincerely,

ORIGINAL SIGNED BY:

Donald S. Brinkman, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

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