P.O. Box 63
Lycoming, New York 13093

Constellation Nuclear

Nine Mile Point Nuclear Station

A Member of the Constellation Energy Group

March 27, 2002
NMP1L 1656

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63
TAC No. MB4612

Subject: ***Application for Amendment to the Technical Specifications - Extension of Allowed Outage Time for an Inoperable Diesel Generator***

Gentlemen:

Nine Mile Point Nuclear Station, LLC, (NMPNS) hereby transmits an application for amendment to Nine Mile Point Unit 1 (NMP1) Technical Specifications (TSs) as set forth in Appendix A of Operating License DPR-63. Enclosed as Attachment A is the proposed change to the NMP1 TSs. The supporting information and analyses pursuant to 10 CFR 50.92 which demonstrate that the proposed changes do not involve a significant hazards consideration are included as Attachment B. Attachment C includes a hand mark-up copy of the affected TS page. Attachment D provides the basis for concluding that this application meets the criteria of 10 CFR 51.22 for categorical exclusion from performing an environmental assessment. Attachments E through I provide additional supplemental information.

This license amendment application proposes to revise Section 3.6.3, "Emergency Power Sources," of the NMP1 TSs. Specifically, the proposed change revises Specification 3.6.3.c to extend the allowed outage time (AOT) for an inoperable diesel generator (DG) from 7 days to 14 days. The purpose of this change is to accommodate additional online maintenance of the DGs and increase DG availability during scheduled refueling outages. It is expected that this change will also reduce the duration of the refueling outages, as well as reduce the complexity of the scheduling and performance of refueling outage activities. The extended AOT would typically be used for voluntary planned maintenance or inspections. NMPNS intends to limit use of the extended AOT for a required overhaul of a DG to once per DG per operating cycle. However, the extended AOT can be entered as necessary to support corrective maintenance.

A001

In addition, this license amendment application proposes necessary related changes to update TS Sections 3.4.4, "Emergency Ventilation System," and 3.4.5, "Control Room Air Treatment System," consistent with the power source provisions of TS Limiting Condition for Operation (LCO) 3.0.1, "Operability Requirements." Specifically, the proposed changes revise TS LCOs 3.4.4.a and 3.4.5.a by removing longstanding contradictory requirements regarding DG operability. These changes are consistent with currently approved NRC staff positions and are necessary to implement the proposed extended DG AOT.

With regard to the review and approval schedule for this application, it is anticipated that the proposed change will support a planned maintenance outage for each DG during the first quarter of 2003, which will precede the Spring 2003 refueling outage (RFO17). In order to assure completion of the maintenance outages for both DGs prior to RFO17, allowing for associated work control planning and scheduling activities, NMPNS requests approval of this application and issuance of the TS amendment by December 31, 2002.

Pursuant to 10 CFR 50.91(b)(1), NMPNS has provided a copy of this license amendment application and the associated analyses regarding no significant hazard considerations to the appropriate state representative.

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 27, 2002.

Very truly yours,

John T. Conway

John T. Conway
Site Vice President

JTC/CDM/jm
Attachments

cc: Mr. H. J. Miller, NRC Regional Administrator, Region I
Mr. G. K. Hunegs, NRC Senior Resident Inspector
Mr. P. S. Tam, Senior Project Manager, NRR (2 copies)
Mr. John P. Spath
NYSERDA
286 Washington Avenue Ext.
Albany, NY 12203-6399
Records Management

ATTACHMENT A

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

Proposed Change to the Current Technical Specifications (TSs)

Replace existing TS pages 173, 178, and 256 with the attached corresponding revised pages. The revised replacement pages have been retyped in their entirety, incorporating the changes, and include marginal markings (revision bars) to indicate the changes.

LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT

3.4.4 EMERGENCY VENTILATION SYSTEM

Applicability:

Applies to the operating status of the emergency ventilation system.

Objective:

To assure the capability of the emergency ventilation system to minimize the release of radioactivity to the environment in the event of an incident within the primary containment or reactor building.

Specification:

a. Except as specified in Specification 3.4.4e below, both circuits of the emergency ventilation system shall be operable at all times when secondary containment integrity is required.

b. The results of the in-place cold DOP and halogenated hydrocarbon tests at design flows on HEPA filters and charcoal adsorber banks shall show ≥ 99% DOP removal and ≥ 99% halogenated hydrocarbon removal when tested in accordance with ANSI N.510-1980.

4.4.4 EMERGENCY VENTILATION SYSTEM

Applicability:

Applies to the testing of the emergency ventilation system.

Objective:

To assure the operability of the emergency ventilation system.

Specification:

Emergency ventilation system surveillance shall be performed as indicated below:

a. At least once per operating cycle, not to exceed 24 months, the following conditions shall be demonstrated:

(1) Pressure drop across the combined HEPA filters and charcoal adsorber banks is less than 6 inches of water at the system rated flow rate (± 10%).

(2) Operability of inlet heater at rated power when tested in accordance with ANSI N.510-1980.

LIMITING CONDITION FOR OPERATION

3.4.5 CONTROL ROOM AIR TREATMENT SYSTEM

Applicability:

Applies to the operating status of the control room air treatment system.

Objective:

To assure the capability of the control room air treatment system to minimize the amount of radioactivity or other gases entering the control room in the event of an incident.

Specification:

a. Except as specified in Specification 3.4.5e below, the control room air treatment system shall be operable during refueling and power operating conditions and also whenever irradiated fuel or the irradiated fuel cask is being handled in the reactor building.

b. The results of the in-place cold DOP and halogenated hydrocarbon test design flows on HEPA filters and charcoal adsorber banks shall show ≥ 99% DOP removal and ≥ 99% halogenated hydrocarbon removal when tested in accordance with ANSI N.510-1980.

SURVEILLANCE REQUIREMENT

4.4.5 CONTROL ROOM AIR TREATMENT SYSTEM

Applicability:

Applies to the testing of the control room air treatment system.

Objective:

To assure the operability of the control room air treatment system.

Specification:

a. At least once per operating cycle, or once every 24 months, whichever occurs first, the pressure drop across the combined HEPA filters and charcoal adsorber banks shall be demonstrated to be less than 1.5 inches of water at system design flow rate (± 10%).

b. The tests and sample analysis of Specification 3.4.5b, c and d shall be performed at least once per operating cycle or once every 24 months, or after 720 hours of system operation, whichever occurs first or following significant painting, fire or chemical release in any ventilation zone communicating with the system.

LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT
c. One diesel-generator power system may be inoperable provided two 115 kv external lines are energized. If a diesel-generator power system becomes inoperable, it shall be returned to an operable condition within 14 days. In addition, if a diesel-generator power system becomes inoperable coincident with a 115 kv line de-energized, that diesel-generator power system shall be returned to an operable condition within 24 hours.	c. Weekly – determine the cell voltage and specific gravity of the pilot cells of each battery.
d. If a reserve power transformer becomes inoperable, it shall be returned to service within seven days.	d. Surveillance for startup with an inoperable diesel-generator – prior to startup the operable diesel-generator shall be tested for automatic startup and pickup of the load required for a loss-of-coolant accident.
e. For all reactor operating conditions except startup and cold shutdown, the following limiting conditions shall be in effect: (1) One operable diesel-generator power system and one energized 115 kv external line shall be available. If this condition is not met, normal orderly shutdown will be initiated within one hour and the reactor will be in the cold shutdown condition within ten hours.	e. Surveillance for operation with an inoperable diesel-generator – If a diesel-generator becomes inoperable from any cause other than an inoperable support system or preplanned maintenance or testing, within 8 hours, either determine that the cause of the diesel-generator being inoperable does not impact the operability of the operable diesel-generator or demonstrate operability by testing the operable diesel-generator. Operability by testing will be demonstrated by achieving steady state voltage and frequency.

ATTACHMENT B

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

Supporting Information and No Significant Hazards Consideration Analysis

1.0 INTRODUCTION

1.1 Description of Proposed Change

This license amendment application proposes to revise Section 3.6.3, "Emergency Power Sources," of the Nine Mile Point Unit 1 (NMP1) Technical Specifications (TSs). Specifically, the proposed change revises TS 3.6.3.c to extend the allowed outage time (AOT) for an inoperable diesel generator (DG) from 7 days to 14 days.

The proposed extension of the AOT for an inoperable DG is adequate to perform normal DG inspections and preventive maintenance, including the required periodic overhauls, and also to perform the post-maintenance and operability tests required to return the DG to an operable status. The extended AOT would typically be used for voluntary planned maintenance or inspections. A required overhaul of a DG will be performed at a frequency of no more than once per DG per operating cycle. However, the extended AOT can be entered as necessary to support corrective maintenance. Note that the post-maintenance test normally performed following an overhaul of an NMP1 DG is the monthly operability surveillance in accordance with TS 4.6.3.b.

In addition, this license amendment application proposes necessary related changes to update TS Sections 3.4.4, "Emergency Ventilation System," and 3.4.5, "Control Room Air Treatment System," consistent with the power source provisions of TS Limiting Condition for Operation (LCO) 3.0.1, "Operability Requirements." Specifically, the proposed changes revise TS LCOs 3.4.4.a and 3.4.5.a by removing longstanding contradictory requirements regarding DG operability. The proposed changes are consistent with currently approved NRC staff positions and are necessary to implement the proposed extended DG AOT.

1.2 Reason for Change

Implementation of the proposed AOT extension for an inoperable DG will provide the following benefits:

- Avert unnecessary unplanned plant shutdowns and minimize the potential need for requests for enforcement discretion. Risks incurred by unexpected plant shutdowns

can be comparable to and often exceed those associated with continued power operation.

- Improve DG availability during refueling outages. It is anticipated that there will be a reduction in the risk directly attributed to DG maintenance as well as a reduction in the risk associated with the synergistic effects of DG unavailability coincident with the numerous activities and equipment outages that occur during a refueling outage.

- Potentially reduce the number of individual entries into LCO action statements by providing sufficient time to perform related maintenance tasks with a single entry.

- Permit the required DG overhauls to be scheduled and performed online.

- Allow additional flexibility in the scheduling and performance of DG preventive maintenance.

- Allow better control and allocation of resources. Allowing online DG preventive maintenance (including overhauls) provides the flexibility to focus more quality resources on required or elected DG maintenance.

The proposed changes to TS Sections 3.4.4 and 3.4.5 for the emergency ventilation and control room air treatment systems remove the existing requirements for DG operability from LCOs 3.4.4.a and 3.4.5.a. Currently, whenever an emergency power source (DG) is declared inoperable, the affected emergency ventilation system circuit and the control room air treatment system are required to be declared inoperable. The AOT for an inoperable emergency ventilation system circuit or control room air treatment system is seven days. Failure to restore the emergency power source to operable status within the 7-day AOT would lead to a TS-required plant shutdown pursuant to Specifications 3.4.4.e and f and 3.4.5.e and f (plant shutdown would also be required pursuant to the existing DG requirements in TS Section 3.6.3). Thus, a plant shutdown would be required for an inoperable emergency ventilation system circuit and control room air treatment system due solely to the inoperability of an emergency power source (DG). This is contrary to the power source provisions of TS Section 3.0.1, which allow an inoperable system, subsystem, train, or device to be considered operable for satisfying the requirements of the applicable LCO when it is determined that the inoperability is solely because its emergency or normal power source is inoperable.

The changes to LCOs 3.4.4.a and 3.4.5.a are necessary to implement the proposed extension of the DG AOT from 7 days to 14 days. Otherwise, a plant shutdown would be required at seven days for an inoperable DG pursuant to the 7-day AOTs for the emergency ventilation and control room air treatment systems even though the extended DG AOT proposed for Specification 3.6.3.c would allow a DG to be inoperable for up to 14 days. This would obviously defeat the purpose for extending the DG AOT.

1.3 Background

TS Section 3.6.3 prescribes requirements for the NMP1 emergency power sources, which include the offsite 115 kV AC power sources and the onsite standby AC power sources (DGs). As required by 10 CFR 50, Appendix A, General Design Criterion (GDC) 17, "Electric Power Systems," the design of the offsite and onsite AC electrical power systems must provide independence and redundancy to assure an available source of power to permit functioning of structures, systems, and components important to safety. Accordingly, the NMP1 offsite and onsite AC electrical power systems, including the associated power sources, provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents. The offsite and onsite AC electrical power systems are further described below and are described in detail in Section IX of the NMP1 Updated Final Safety Analysis Report (UFSAR).

The current requirements for DG operability contained in TS LCOs 3.4.4.a and 3.4.5.a for the emergency ventilation and control room air treatment systems were added to the TSs in 1975 by Amendment No. 4. These changes were based on model TSs provided by the Atomic Energy Commission (AEC) in a letter to P. D. Raymond (Niagara Mohawk) from G. Lear (AEC), dated December 10, 1974. In 1984, Amendment No. 55 added the current operability requirements and power source provisions of TS LCO 3.0.1 in response to an NRC request contained in a letter to all power reactor licensees, dated April 10, 1980. The letter included a model TS definition for operability and the models for LCOs 3.0.3 and 3.0.5, which delineated additional operability conditions and actions. In particular, model LCO 3.0.5 included provisions for conditions where a system, subsystem, train, or device is declared inoperable solely because of an inoperable normal or emergency power source.

The power source provisions of model LCO 3.0.5 were incorporated into NMP1 TS LCO 3.0.1, which effectively superseded the requirements for DG operability included in LCOs 3.4.4.a and 3.4.5.a. As such, DG operability should no longer have been an explicit requirement for operability of the emergency ventilation system circuits and the control room air treatment system. Removal of the DG operability requirements should have been incorporated into Amendment No. 55 in order to maintain consistency between the DG operability requirements contained in TS LCOs 3.4.4.a and 3.4.5.a and the power source provisions contained in TS LCO 3.0.1.

The proposed changes do not affect the design, operational characteristics, function, or reliability of the offsite or onsite AC electrical power system, nor do the changes affect the emergency ventilation or control room air treatment system in such a manner.

1.3.1 Description of the Offsite AC Power System

The NMP1 115 kV reserve bus provides electrical power for plant startup, and also

serves as a reserve or normal power supply for plant auxiliaries. The 115 kV bus is energized from two offsite power sources via 115 kV transmission Line Nos. 1 and 4. Line No. 4 is fed from the Lighthouse Hill substation and is connected to the Niagara Mohawk transmission system at the J. A. FitzPatrick 115 kV switchyard. Line No. 1 is fed from the Oswego steam station via the South Oswego substation. The Line No. 4 power source (Lighthouse Hill substation) includes the Bennetts Bridge hydroelectric generators which have the capability of startup without power input from outside sources (Black Start). Each of these transmission lines has sufficient capacity and capability to supply the electrical loads required to safely shutdown the plant and mitigate the effects of a design basis accident (DBA).

The two 115 kV transmission lines connect to the common 115 kV reserve bus within the 115 kV switchyard. The 115 kV reserve bus is equipped with a normally closed motor-operated bus sectionalizing disconnect switch which will automatically open on an unisolated line, bus, or transformer fault to establish physical independence between the two 115 kV offsite circuits. It was recognized that this design does not strictly conform to GDC 17 for physical independence of the offsite circuits. However, as described in a letter from C. V. Mangan (Niagara Mohawk) to D. B. Vassallo (NRC), dated December 22, 1983, an evaluation of the design of the NMP1 115 kV switchyard concluded that the present design meets the intent of GDC 17.

The 115 kV reserve bus feeds reserve station service transformers 101N and 101S via remote-operated normally closed disconnect switches. The reserve transformers are sized to permit plant startup, shutdown, or operation at reduced load with only one reserve transformer available and the normal station service transformer out of service. The 115 kV/4160 V stepdown reserve transformers are the normal power supplies for power boards 102 and 103, with power board 102 fed from transformer 101N and power board 103 fed from transformer 101S. Power boards 102 and 103 supply the 4160 V emergency core cooling system (ECCS) loads, as well as other engineered safeguards and safety-related loads. DGs 102 and 103 are the alternate power supplies for power boards 102 and 103, respectively. Either of the two reserve station service transformers can supply power board 101; however, it is normally supplied from transformer 101S to help balance the loads between the two transformers. Power board 101 supplies certain selected plant auxiliary loads, with the balance of the auxiliary loads being divided approximately equally between power boards 11 and 12, which are normally powered from the 24 kV main generator via the 24 kV/4160 V stepdown normal station service transformer (T10).

1.3.2 Description of the Onsite AC Power System

The onsite AC power system is divided into two distinct categories: emergency (safety-related) and normal (nonsafety-related). The onsite emergency AC power system includes the safety-related equipment, systems, and loads required to safely shutdown the plant and mitigate the effects of a DBA. The onsite normal AC power system includes the nonsafety-related equipment, systems, and loads, including the plant auxiliaries.

The onsite emergency AC power system includes redundant and independent DGs 102 and 103, which provide onsite emergency electrical power to power boards 102 and 103, respectively. The safety function of the DG system is to provide sufficient electrical power to operate the loads needed for accident mitigation and safe shutdown following a loss of offsite power (LOSP) or degraded voltage event. The emergency loads supplied from each power board comprise an independent divisional load group, with the equipment of each load group capable of satisfying the accident mitigation and safe shutdown requirements of the plant. Each DG is designed to independently start and carry the maximum anticipated emergency load supplied from its power board. As such, a single DG can satisfy the safety function of the DG system. For the DBA loss of coolant accident (LOCA) concurrent with a LOSP, the DGs will automatically start and load onto their power boards, followed by the automatic sequential loading of the ECCS loads. Additional loads required for accident mitigation are manually loaded.

Each DG is rated for continuous operation at 2586 kW and 10% overload operation at 2845 kW for 2-hours in a 24-hour period. In addition, each DG has a 2000 hr/yr rating of 2838 kW and a 7 day/yr emergency rating of 2945 kW. These ratings are limited by engine output capability, hence kW ratings are specified. The 2000 hr/yr rating is used as the design basis load limit in the DG loading analysis. The results of the analysis are presented in Figure IX-6 of the NMP1 UFSAR. Use of the 2000 hr/yr rating as the design load limit is slightly conservative with respect to the guidance provided in Revision 2 of Regulatory Guide 1.9, "Selection, Design, and Qualification of Diesel-Generator Units Used As Standby (Onsite) Electric Power Systems At Nuclear Power Plants," which was in effect at the time the DG loading analysis was originally issued. Revision 2 of Regulatory Guide 1.9 (as defined in Section 3.7.2 of IEEE Std 387-1977) allows the short-time rating (2-hours in a 24-hour period) of 2845 kW to be used as the design load limit.

2.0 EVALUATION

2.1 General Design Criteria and Regulatory Guide Compliance

The onsite AC power system complies with the applicable NRC General Design Criteria and AEC/NRC Safety and Regulatory Guides as described in the "Technical Supplement to Petition for Conversion from Provisional Operating License to Full-Term Operating License," dated July 1972, and Amendment No. 1 to the Technical Supplement, dated November 23, 1973. The proposed extension of the DG AOT does not add or delete any safety-related systems, equipment, or DG loads, or alter the design or function of the onsite AC power system. Therefore, compliance with the applicable GDCs, Safety Guides, and Regulatory Guides as previously described in the above docketed correspondence is not affected by this change.

Regulatory Guide 1.93, "Availability of Electric Power Sources," prescribes a maximum AOT of 72 hours for an inoperable AC power source and serves as the basis for the applicable required actions specified in the Standard Technical Specifications for BWR/4 and BWR/6 plants (NUREG-1433 and NUREG-1434). The current 7-day AOT specified

in TS 3.6.3.c does not conform to Regulatory Guide 1.93. NMP1 was licensed with custom TSs, and the requirements contained in Specification 3.6.3.c were originally developed and approved by the NRC well before the existence of Regulatory Guide 1.93. The proposed change to extend the AOT for an inoperable DG from 7 days to 14 days is justified based on the evaluations provided in Sections 2.2 and 2.3 below. The NRC has approved 14-day AOTs for several other plants, including Clinton Power Station (TAC No. MB0861) and Perry Nuclear Power Plant (TAC No. MA3537), which are BWR/6 plants.

The proposed changes to TS LCOs 3.4.4.a and 3.4.5.a for the emergency ventilation and control room air treatment systems are consistent with the power source provisions of TS LCO 3.0.1. Moreover, these changes are consistent with the intent of the equivalent specifications (3.6.4.3 and 3.7.4) for the standby gas treatment and main control room environmental systems of the Standard Technical Specifications for BWR/4 plants (NUREG-1433). As such, the changes are consistent with currently approved NRC staff positions for compliance with the applicable GDCs and Regulatory Guides.

2.2 Deterministic Evaluation

2.2.1 Defense-In-Depth Evaluation

The impact of the proposed extension of the DG AOT was evaluated and determined to be consistent with the defense-in-depth philosophy. The limited unavailability of a single power source caused by entry into a TS action does not significantly change the balance among the defense-in-depth principles of prevention of core damage, prevention of containment failure, and consequence mitigation.

The defense-in-depth philosophy requires multiple means or barriers to be in place to accomplish safety functions and prevent the release of radioactive material. NMP1 is designed and operated consistent with the defense-in-depth philosophy. The safety-related equipment required to mitigate the consequences of postulated accidents consists of two independent divisional load groups. Each of these load groups can be powered from three independent sources (either of the two offsite sources or the associated DG). Furthermore, the loss of an entire load group will not prevent the safe shutdown of the plant in the event of a DBA. Accordingly, the unavailability of a single DG by voluntary entry into a TS action statement for DG maintenance does not reduce the amount of available equipment to a level below that necessary to mitigate a DBA. The remaining power sources and safety-related equipment are designed with adequate independence, capacity, and capability to provide power to the necessary equipment during postulated accidents. Specifically, with one DG out of service, two offsite power sources on the affected load group and the entire unaffected load group will remain available. Therefore, consistent with the defense-in-depth philosophy, the proposed change will continue to provide for multiple means to accomplish safety functions and prevent the release of radioactive material in the event of an accident. In addition, since the proposed extension of the DG AOT will allow additional DG maintenance to be performed online,

there should be an increase in DG availability during refueling outages, thus providing increased defense-in-depth during outages.

The proposed extension of the DG AOT does not introduce any new common cause failure modes and protection against common cause failure modes previously considered is not compromised. Defenses against human errors are maintained, in that the proposed change does not require any new operator response or introduce any new opportunities for human errors not previously considered. Qualified personnel will continue to perform DG maintenance whether such maintenance is performed online or during plant shutdowns.

Appropriate restrictions and compensatory measures will be established to assure that system redundancy, independence, and diversity are maintained commensurate with the risk associated with the extended AOT. These include TS and Maintenance Rule (10 CFR 50.65) programmatic requirements as well as administrative controls in accordance with the configuration risk management program (CRMP). To allow continued plant operation with an inoperable DG, TS 3.6.3.g currently requires all emergency equipment aligned to an operable DG to have no inoperable components. This requirement is intended to provide assurance that a LOSP occurring concurrent with an inoperable DG does not result in a complete loss of safety function of critical systems. In addition, appropriate plant procedures will include provisions for implementing the following compensating measures and configuration risk management controls when a DG is removed from service for any extended AOT duration (greater than 7 days and up to 14 days):

- The redundant DG will be verified operable and no elective testing or maintenance activities will be scheduled on the redundant (operable) DG.

- No elective testing or maintenance activities will be scheduled in the 115 kV switchyard or on the 115 kV power supply lines and transformers which could cause a line outage or challenge offsite power availability.

- The NMP1 diesel driven firewater pump (DFP) will be verified operable as a feedwater makeup source to the NMP1 reactor pressure vessel (RPV).

- The Nine Mile Point Unit 2 (NMP2) DFP and cross-tie to NMP1 will be verified operable as a feedwater makeup source to the NMP1 RPV.

While in the proposed extended DG AOT, additional elective equipment maintenance or testing that requires the equipment to be removed from service will be evaluated and activities that yield unacceptable results will be avoided.

Therefore, consistent with the defense-in-depth philosophy, multiple barriers currently exist and additional barriers will be provided to minimize the risk associated with entering the extended DG AOT so that protection of the public health and safety is assured.

The proposed changes to TS LCOs 3.4.4.a and 3.4.5.a for the emergency ventilation and control room air treatment systems remove the requirements for DG operability. The previous incorporation of TS Amendment No. 55 has effectively superseded the requirements for DG operability in these LCOs by adding the power source provisions of LCO 3.0.1. As such, DG operability should no longer have been an explicit requirement for operability of the emergency ventilation system circuits and the control room air treatment system. Removal of the DG operability requirements from LCO 3.4.4.a and 3.4.5.a should increase defense-in-depth by appropriately allowing credit for available accident mitigating systems. Therefore, the proposed changes to TS LCOs 3.4.4.a and 3.4.5.a will not adversely affect the defense-in-depth attributes that assure protection of public health and safety.

2.2.2 Safety Margin Evaluation

The proposed extension of the DG AOT remains consistent with the codes and standards applicable to the onsite AC sources, except Regulatory Guide 1.93 as discussed previously. The DG reliability and availability are monitored and evaluated with respect to Maintenance Rule (10 CFR 50.65) performance criteria to assure DG out of service times do not degrade operational safety over time. It should be noted that the DG unavailability hours incurred as a result of planned overhaul maintenance performed online during the proposed extended AOT are exempt from reporting under the Regulatory Assessment Planned Unavailable Hours performance indicator (NEI 99-02, Revision 2). In addition, as further discussed below, the proposed extension of the DG AOT will not erode the reduction in severe accident risk that was achieved with implementation of the Station Blackout (SBO) Rule (10 CFR 50.63) or affect any of the safety analyses assumptions or inputs as described in the NMP1 UFSAR.

The proposed changes to TS LCOs 3.4.4.a and 3.4.5.a for the emergency ventilation and control room air treatment systems are consistent with the power source provisions of TS LCO 3.0.1 and do not affect the existing 7-day AOTs for these systems. The changes remove the DG operability requirements from LCO 3.4.4.a and 3.4.5.a, which should increase the applicable safety margins by appropriately allowing credit for available accident mitigating systems. Moreover, the proposed changes are consistent with the intent of the equivalent specifications for the standby gas treatment and main control room environmental systems of the Standard Technical Specifications for BWR/4 plants (NUREG-1433). Therefore, the proposed changes to TS LCOs 3.4.4.a and 3.4.5.a will have no adverse effect on the availability of the emergency ventilation and control room air treatment systems or their capability to perform their intended safety functions as required for compliance with the radiological guidelines of 10 CFR 100 and GDC 19.

SBO Capability Assessment

An SBO is defined as the complete loss of AC electric power to the essential and nonessential switchgear buses in a nuclear power plant. An SBO would result from a

LOSP concurrent with a turbine trip and failure of the onsite emergency AC power system. To address the potentially significant risk of core damage associated with an SBO event, the NRC issued the SBO Rule, promulgated as 10 CFR 50.63, "Loss of All Alternating Current Power," and Regulatory Guide 1.155. The SBO Rule requires that a licensed nuclear power plant be able to withstand an SBO for a specified time and recover. The ability to cope with an SBO for a certain time period provides additional defense-in-depth should both offsite and onsite emergency AC power systems fail concurrently. Methodologies for coping with an SBO acceptable to the NRC for compliance with the SBO Rule are provided in NUMARC 87-00 (and supplements), "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," and Regulatory Guide 1.155, "Station Blackout." NMP1 is classified as a 4-hour duration coping plant with a 0.975 target DG reliability (see UFSAR Section IX.B.6). The proposed extension of the DG AOT will not impact the SBO coping analysis since the DGs are not assumed to be available during the coping period. The SBO coping analysis credits operator actions to actuate the automatic depressurization system and initiate the DFP after the reactor vessel is depressurized to assure that sufficient water inventory is maintained in the vessel for core cooling. The assumptions used in the SBO coping analysis regarding DG reliability are unaffected by the proposed change since preventive maintenance and testing will continue to be performed to maintain the reliability assumptions.

The proposed changes to TS LCOs 3.4.4.a and 3.4.5.a are consistent with currently approved NRC staff positions regarding power source operability and will have no adverse effect on the availability of the emergency ventilation and control room air treatment systems or their capability to perform their intended safety functions. Accordingly, the proposed changes will have no adverse impact on the assumptions or conclusions of the SBO coping analysis or erode the reduction in severe accident risk that was achieved with implementation of the SBO Rule (10 CFR 50.63).

<u>Design Basis Requirements and Safety Analyses Impact</u>

The proposed extension of the DG AOT will not affect any safety analyses inputs or assumptions as described in the NMP 1 UFSAR. The unavailability of a single DG due to maintenance does not reduce the number of DGs below the minimum required by the safety analyses. Furthermore, the proposed AOT extension will have no impact on the availability of the two offsite power sources. Thus, the remaining power sources and safety-related equipment will remain capable of providing power to the equipment required to safely shutdown the plant and mitigate the effects of a DBA. Therefore, the proposed extended DG AOT provides continued assurance that the intended safety functions of the offsite and onsite AC electrical power systems will be met.

The proposed changes to TS LCOs 3.4.4.a and 3.4.5.a for the emergency ventilation and control room air treatment systems are consistent with the power source provisions of TS LCO 3.0.1 and do not affect the existing 7-day AOTs for these systems. With an inoperable normal or emergency power source, the affected emergency ventilation system circuit and the control room ventilation system would remain operable. This is

consistent with the intent of the equivalent specifications for the standby gas treatment and main control room environmental systems of the Standard Technical Specifications for BWR/4 plants (NUREG-1433). Therefore, the proposed changes will have no adverse impact on the associated safety analyses inputs or assumptions as described in the NMP1 UFSAR. Accordingly, the proposed changes will not adversely affect the availability of the emergency ventilation and control room air treatment systems or their capability to perform their intended safety functions.

2.3 Probabilistic Risk Assessment (PRA)

To further assess the overall impact on plant safety of the proposed extended DG AOT, a PRA was performed consistent with the guidance pertaining to risk-informed criteria specified in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific Risk-Informed Decisionmaking: Technical Specifications." The PRA provides a quantitative evaluation of the risk associated with the change in terms of average Core Damage Frequency (CDF) and average Large Early Release Frequency (LERF) produced by the extension of the AOT for an inoperable DG. This evaluation included consideration of the Maintenance Rule program established pursuant to 10 CFR 50.65(a)(4) to control the performance of other potentially high risk tasks during a DG outage, as well as consideration of specific compensatory measures to minimize risk. All of these elements were included in a risk evaluation using the three-tiered approach suggested in RG 1.177, as follows:

Tier 1 - PRA Capability and Insights
Tier 2 - Avoidance of Risk-Significant Plant Configurations
Tier 3 - Risk-Informed CRMP

Evaluations addressing each of these tiers are provided below. The PRA model serves as the primary tool for these evaluations. Therefore, in order to establish the qualification of the PRA model, supplemental background information related to the development, certification, application, and quality of the PRA model in place at NMP1 is presented first.

Note that the following risk evaluation and supplemental background information presented in Sections 2.3 and 2.4 do not address the proposed changes to TS LCOs 3.4.4.a and 3.4.5.a for the emergency ventilation and control room air treatment systems. These changes are consistent with the power source provisions of TS LCO 3.0.1 and do not affect the existing 7-day AOTs for these systems. Moreover, the changes are consistent with the intent of the equivalent specifications for the standby gas treatment and main control room environmental systems of the Standard Technical Specifications for BWR/4 plants (NUREG-1433). As such, the proposed changes are consistent with currently approved NRC positions. Therefore, Nine Mile Point Nuclear Station (NMPNS) believes that the proposed changes to TS LCOs 3.4.4.a and 3.4.5.a are adequately justified based on the foregoing deterministic evaluation alone.

2.3.1 PRA Model Development

The NMP1 PRA is based on a detailed model of the plant that was developed from the NMP1 Individual Plant Examination (IPE) and NMP1 Individual Plant Examination for External Events (IPEEE) projects. The PRA model has undergone NRC review and Boiling Water Reactor Owner's Group (BWROG) certification. The model was recently updated to incorporate review comments, current plant design, current procedures, recent plant operating data, current PRA techniques, and general improvements identified by the Nine Mile Point PRA team.

Key milestones for the development of the NMP1 PRA model are as follows:

- IPE submitted to the NRC in July 1993
- IPE Safety Evaluation Report (SER) received from the NRC in April 1996
- IPEEE submitted to the NRC in July 1996
- BWROG certification issued in June 1998
- IPEEE SER received from the NRC in July 2000
- NMP1 PRA model update completed in June 2001 - Model U1PRA01A
- NMP1 PRA model update for proposed DG AOT extension completed in January 2002 - Model U1PRA01B

The PRA model update to support the proposed extension of the DG AOT was a partial update that only addressed the inclusion of additional initiating events, DG test data, and DFP test data through 2001. This updated PRA model incorporates the following:

- Plant-specific unreliability and unavailability data (failure data was evaluated through 12/31/00, with a small gap in the 1991 - 1993 time frame between the IPE and the start of the Institute of Nuclear Power Operations Equipment Performance and Information Exchange System (EPIX). Unavailability is based on data between 08/01/98 and 07/31/99, which is assumed representative). DG and DFP unavailability data have been updated through December 31, 2001.
- Plant-specific initiating event data has been developed through December 31, 2001.
- Plant-specific configuration (design and operation) as of December 31, 2000. (systems analysis document references and latest EOPs used).
- Insights from several years of plant-specific applications utilizing the original IPE and IPEEE.
- Insights from the NRC review comments.
- Review comments from the BWROG certification effort.

Key goals of the PRA model development process were to:

- Understand the underlying plant risks and key sources of uncertainty.
- Identify areas where cost-effective risk improvement opportunities exist.
- Develop a tool to quantify nuclear safety and support a comprehensive risk management program.

- Establish an in-house risk analysis capability to support plant decisionmaking.

An independent assessment of the NMP1 PRA, using the self-assessment process developed as part of the BWROG peer review certification program, was completed to assure that the NMP1 PRA was comparable to other PRA programs in use throughout the industry. The NMP1 PRA was certified by the BWROG in June 1998 following an inspection and review by a PRA peer review certification team. The certification review results were documented and evaluated for inclusion in the last PRA model update. The findings from the review primarily related to improvements in the areas of guidance, documentation, models, and the capturing of plant changes. Overall, the certification review provided high technical marks on the PRA, and there were no findings that significantly impacted the PRA results. The certification team assigned a Grade 3 to the NMP1 PRA, which is deemed suitable for applications such as single TS actions if supported by deterministic evaluations. Attachment E provides the key findings from the PRA certification inspection and review and includes a summary of the qualifications and experience of the certification team members.

2.3.2 PRA Model Maintenance

The PRA model is applied and controlled as defined in administrative procedure NIP-REL-02, “Probabilistic Risk Assessment Program,” and engineering department procedure NEP-REL-01, “Evaluations, Analysis, and Update of the Probabilistic Risk Assessment (PRA) Program.” Ongoing assessments of the PRA model and reports are part of the normal duties of the PRA engineers. When a change to plant procedures, plant design, or operational data is identified that impacts the PRA model, the PRA engineer uses the guidance in the following table to prioritize the change and assist in the development of an implementation schedule.

Grade	Definition	Action
1	Extremely important and necessary to address to assure the technical adequacy of the PRA, the quality of the PRA, or the quality of the PRA update process.	Immediate update considered.
2	Important and necessary to address, but may be deferred to the next planned PRA update.	Consider in next planned update.
3	Considered desirable to maintain maximum flexibility in PRA applications and consistency with the industry, but is not likely to significantly affect results or conclusions.	Consider in next 2-3 planned updates.
4	Editorial or minor technical item, low priority.	Consider as update opportunity exists.

Planned updates to the PRA model are scheduled on a regular basis by the PRA team. Planned updates include an information gathering phase that is intended to capture plant changes that had not been previously identified by the PRA team. The normal scheduled (planned) update considers all aspects of the PRA.

An unplanned update is undertaken when a Grade 1 item is identified for immediate update. An unplanned update may also be undertaken to address a need for a specific application of the PRA. An unplanned update is considered a limited scope update and does not necessarily include a detailed plant information review or consideration of all aspects of the PRA. This type of update is intended to augment the PRA between normal planned updates as needed. The update of the initiating event frequency, DG reliability data, and DFP reliability data for the proposed extension of the DG AOT represents an unplanned update which was limited in scope to these changes. A summary of the updated PRA model is provided in Attachment G.

2.3.3 PRA Model Application

The NMP1 Level 2 PRA model was used to determine the risk associated with removing a DG from service for planned maintenance in accordance with the proposed 14-day AOT. The risk measures used are CDF and LERF. The base CDF is 2.6E-05/yr and the base LERF is 2.2E-06/yr. The PRA model is a consolidation of the NMP1 IPE and NMP1 IPEEE, which explicitly includes fires and seismic events. A description of the CRMP is provided in Section 2.3.6 of this submittal.

The PRA model is used by NMP1 work control and operations personnel throughout the online work planning and implementing processes. The PRA model is implemented through the use of a Safety Monitor and color codes as described in administrative procedure GAP-PSH-03, "Control of On-Line Work Activities." The results obtained from the PRA model are used along with other inputs, such as TS requirements and operator system knowledge, in a blended approach to determine the final work schedule. The PRA model is currently not applicable to shutdown conditions; thus, the risk assessments for work activities during plant outages are performed consistent with the defense-in-depth philosophy as described in administrative procedure NIP-OUT-01, "Shutdown Safety."

The guidance contained in Regulatory Guides 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and 1.177 was utilized to assure that the results of the PRA model are acceptable to support the proposed extension of the DG AOT. With regard to the risk evaluations performed to support the change, NMPNS is confident that the results of the evaluations (described more fully in Section 2.3.4 and Attachment H) are technically sound and consistent with the expectations for quality set forth in Regulatory Guide 1.177. The scope, level of detail, and quality of the PRA are sufficient to support a technically defensible and realistic evaluation of the risk involved with the proposed change.

2.3.4 Tier 1: PRA Capability and Insights

As noted previously, risk-informed support for the proposed extension of the AOT for an inoperable DG is based on PRA calculations performed to quantify the change in average

CDF and average LERF. To determine the effect of the proposed change with respect to plant risk, the guidance provided in Regulatory Guides 1.174 and 1.177 was used.

PRA Results

An evaluation was performed based on the assumption that the full extended AOT (i.e., 14 days) would be applied once per DG per refueling cycle. The total fuel cycle time was calculated to be operating days based on the current 24-month fuel cycle (allowing for planned and unplanned plant outages). The incremental conditional core damage probability (ICCDP) and incremental conditional large early release probability (ICLERP) were calculated as recommended in Regulatory Guide 1.177. The results of the risk evaluation are presented in Attachment H. The results of the risk evaluation were compared against the risk significance criteria in Regulatory Guide 1.174 for changes in the annual average CDF and LERF and Regulatory Guide 1.177 for ICCDP and ICLERP. The ICCDP and ICLERP were calculated for both DG 102 and DG 103, which indicates that an outage of DG 103 is more limiting. Based on the limiting calculated values for the ICCDP and ICLERP, the proposed extended DG AOT has only a small quantitative impact on plant risk. The following table summarizes the results of the risk evaluation:

Risk Metric	Acceptance Criterion	Evaluation Results
ΔCDF_{Avg}	< 1.0E-06/yr	2.2E-07/yr
$\Delta LERF_{Avg}$	< 1.0E-07/yr	7.7E-09/yr
$ICCDP_{102}$	< 5.0E-07	1.1E-07
$ICCDP_{103}$	< 5.0E-07	3.2E-07
$ICLERP_{102}$	< 5.0E-08	5.3E-09
$ICLERP_{103}$	< 5.0E-08	9.6E-09

These results consider the information recently included in the PRA model update for the case where the plant is operating with a DG out of service. This model update was completed in January 2002 as part of the evaluation for the proposed extension of the DG AOT and includes select data and plant changes through 2001. The previous PRA update was completed in June 2001 and plant data was current to the end of 2000.

Uncertainty Analysis

While no formal uncertainty quantification was performed, the PRA model inputs generally have a range factor (the range factor is defined as the ratio of the 95^{th} to 5^{th} confidence levels) of approximately 10 or less. Thus, propagation of this uncertainty through the dominant sequences would lead to results with a range factor of 10 or less. Moreover, since the proposed extension of the DG AOT involves a change in the risk calculation, the uncertainty distribution is less of an issue because the uncertain parameters will act on the baseline model and the DG out of service model uniformly. In addition, model uncertainty and completeness uncertainty have been minimized through the certification and update processes discussed above.

Transition and Shutdown Risk

The proposed change to extend the DG AOT will reduce the probability of an unplanned manual shutdown initiated by online DG unavailability. The risk associated with an unplanned manual shutdown has been included in the NMP1 PRA update and can be considered here. Unplanned manual shutdowns are included in the scram initiators (i.e., SCRAM and BSCRAM). These initiators have a frequency of 4.8/yr in the PRA and account for a total CDF of 4.28E-07/yr. As a result, one manual shutdown would contribute approximately 8.23E-08/yr (4.28E-07/4.8 = 8.23E-08/yr) to overall plant core damage risk.

While a shutdown risk model has not been developed for NMP1, DG unavailability does contribute to shutdown risk. Thus, any incremental risk associated with the extending the online AOT would be at least partially offset by a reduction in overall shutdown risk.

2.3.5 Tier 2: Avoidance of Risk-Significant Plant Configurations

As previously discussed, a CRMP is in place at NMP1 for compliance with the Maintenance Rule (10 CFR 50.65), and in particular, for compliance with paragraph (a)(4) of the Rule. The CRMP provides assurance that risk-significant plant equipment configurations are precluded or minimized when plant equipment is removed from service. Accordingly, any increase in risk posed by the removal of a DG from service and the potential combinations of other equipment out of service will be managed in accordance with the CRMP. Additional compensating measures and configuration risk management controls that will apply when entering the proposed extended DG AOT (greater than 7 days and up to 14 days) include:

- The redundant DG is operable and elective testing and maintenance activities on the redundant (operable) DG are precluded.

- Elective testing and maintenance activities are precluded in the 115 kV switchyard or on the 115 kV power supply lines and transformers which could cause a line outage or challenge offsite power availability.

- The NMP1 DFP is operable as a feedwater makeup source to the NMP1 RPV.

- The NMP2 DFP and cross-tie to NMP1 are operable as a feedwater makeup source to the NMP1 RPV.

While in the proposed extended DG AOT, additional elective equipment maintenance or testing that requires the equipment to be removed from service will be evaluated and activities that yield unacceptable results will be avoided.

The dominant sequences in the NMP1 PRA are evaluated to assure that important equipment are identified and evaluated when a DG is out of service. Attachment G provides the initiating event frequency distribution and top ten core damage sequences

for the baseline PRA model and also for the cases when DG 102 and DG 103 are out of service. Tables 1 through 4 of Attachment I provide the dominant CDF and LERF sequences for DGs 102 and 103. The last column in the tables identifies the important elements in the sequence to be considered in the PRA evaluations. Two types of evaluations are considered:

1. Important systems and equipment are assessed to determine whether their unreliability has increased since the last PRA update based on plant operational experience.

2. Important equipment and human actions are assessed to determine whether compensating measures can be credited to reduce risk while the DG is out of service.

Based on Tables 1 through 4 of Attachment I, the following are identified as contributors to risk when a DG is out of service:

- LOSP initiating event (BLOSP, LOSP)
- Scram initiating event (BSCRAM, OG)
- Seismic initiating event (SEIS1, SEIS2, SEIS3, SEIS4, SEIS5, SEIS6)
- Fire initiating event (FC12, FC21, FC22, FC23, FC24)
- Loss of DC (BD1X)
- Redundant DG (EDG102, EDG103)
- Diesel driven fire pump (DFP)
- DC battery on demand (BAT11)
- Electromatic relief valves (ERVs) sticking open (ERV)
- Reactor recirculation pump seals (RRSEAL)
- Emergency condensers (EC)
- Operator actions:
  - Shed DC loads (O15)
  - Align diesel firewater pump (OR1)
  - Control RPV level from East/West instrument room (HRA, SOP-14)
  - Control emergency condenser makeup (OMU) on loss of instrument air

Each of the above identified risk contributors is further discussed below:

<u>Loss of offsite power initiating event (BLOSP or LOSP)</u>

This event initiator is the most important and is known to be sensitive to human interaction (testing and maintenance activities). This initiator has been updated based on plant-specific experience through the end of 2001. There has never been a plant trip at NMP1 as a result of losing one or both 115 kV offsite power sources. Table 5 of Attachment I provides an evaluation of the LOSP precursor events at NMP1. The following table summarizes the LOSP initiating event frequencies used in the PRA model.

LOSP Causes[1]	EPRI TR[1]	Bayesian Update with NMP1 Data[2]	NMP1 PRA Baseline[3]	Compensatory Factor[4]	Compensatory Frequency[5]
Plant and Grid	0.023/yr	0.015	0.02/yr	0.5	0.01
Weather-Related	0.011/yr	0.0086	0.01/yr	1.0	0.01
Total	0.034/yr	0.024	0.03/yr	-	0.02

Notes:

1. EPRI TR 1000158, "Losses of Off-Site Power at U.S. Nuclear Power Plants – Through 1999," dated July 2000. The EPRI TR value was used as a mean value with a variance equal to the mean squared.

2. The EPRI TR distribution was used as a prior and was Bayesian updated with zero trip events in 32 years of experience at NMP1.

3. The NMP1 PRA Baseline initiating event frequency for LOSP is based on an assumed event (1/32 = 0.03) and partitioned according to the EPRI TR.

4. The Compensatory Factor is the reduction factor used when compensatory measures are applied and is based on plant and site-specific data. As shown in Table 5 of Attachment I, one of the two (0.5) Plant and Grid precursor events leading to a loss of both 115 kV lines (no plant trip) at NMP1 was due to testing and maintenance (human interaction). Compensating measures preclude this event (i.e., no testing and maintenance activities are allowed). NMP2 experience also indicates that LOSP precursor events caused by testing and maintenance interaction are about 50% (0.5).

5. The Compensatory Frequency is the value used when the compensating measures are required to be in effect due to one of the DGs being out of service.

The LOSP initiating event frequencies in the above table are judged to be slightly conservative based on Bayesian analyses. Assuming one event has occurred also allows an event to occur in the near future without potentially invalidating the PRA model. For a planned DG outage, the PRA credits the compensatory measure to preclude elective testing or maintenance activities in the 115 kV switchyard or on the 115 kV power lines and transformers which could cause a line outage or challenge offsite power availability. Also, DG outages are not likely to be planned if severe weather is anticipated; however, no reduction was taken for this contribution.

Scram initiating event (BSCRAM, OG)

Plant scram data was evaluated and the PRA model was updated based on the plant-specific data through 2001. In addition, other initiating events were updated which resulted in minor changes to the frequencies for the scram initiating event. No credit was taken for any reduction in the frequency of this event.

Seismic initiating event (SEIS1, SEIS2, SEIS3, SEIS4, SEIS5, SEIS6)

This initiating event frequency is unchanged.

Fire initiating event (FC12, FC21, FC22, FC23, FC24)

The fire initiating event is relatively important at NMP1 and compensating measures can influence their frequency (e.g., thermography in key high risk locations). There have been no recent fires or precursor events that would influence the initiating event frequency. No compensating measures have been credited in the PRA model.

Loss of DC (BD1X)

The loss of DC power board 11, and the subsequent loss of offsite power (OG) and the DFP (FP2), becomes an initiating event when DG 103 is out of service because DC power board 11 is required for recovery of offsite power or DG 102. There have been no recent reliability problems identified which relate to DC power, and thus the frequency for this initiating event remains unchanged.

The redundant DG (EDG102, EDG103)

For a planned DG outage, the PRA credits operability of the redundant DG as a compensating measure. DG unreliability was evaluated for NMP1, and recent plant-specific data was added to the PRA model for the evaluation. Specifically, the PRA database was updated to reflect that no failures occurred in 24 demands in 2001. Previously, the PRA database only included DG failure data through 2000. A sensitivity assessment was performed for a subsequent start failure of DG 102 which occurred in January 2002. The results of the study demonstrated that the additional DG start failure had no significant impact on the PRA conclusions.

Diesel driven firewater pump (DFP)

For a planned DG outage, the PRA credits operability of the DFP as a compensating measure. DFP unreliability was evaluated for NMP1, and recent plant-specific data was added to the PRA model for the evaluation. Specifically, the PRA database was updated to reflect that no failures occurred in 52 demands in 2001. Previously, the PRA database only included DFP failure data through 2000. In addition, the (NMP2) DFP and cross-tie to NMP1 were added to the PRA model and included as a compensatory measure. The crediting of the NMP2 DFP for NMP1 event response requires consideration of the risk impact to NMP2 since there is some probability that when NMP1 needs the NMP2 DFP, NMP2 would also need it. Based on a sensitivity assessment of the probability of such sequences occurring, it was concluded that there is no significant risk impact on the NMP2 SBO analysis or PRA due to crediting the NMP2 DFP for NMP1 SBO and fire event responses.

DC battery on demand (BAT11)

Failure of DC battery 11 on demand (given a LOSP) becomes an important initiating event when DG 103 is out of service because DC battery 11 is required for recovery of

offsite power or DG 102. There have been no recent reliability problems identified which relate to DC power, and thus the frequency for this initiating event remains unchanged.

ERVs sticking open (ERV)

A stuck open ERV results in a LOCA type scenario, which can reduce the time available for operator actions and recovery. There was one fairly recent occurrence (LER 00-04) on October 2, 2000 during a plant startup. The reactor was at 384 °F and about 38 psig when an ERV was discovered to be open. Since the major contribution to this failure was judged to have occurred during shutdown and revealed itself during startup, no changes to this failure probability for power operation were made. A recent plant trip (LER 01-01) challenged all six ERVs, and all of the valves reclosed successfully.

Reactor recirculation pump seals (RRSEAL)

A reactor recirculation pump seal LOCA can reduce the time available for operator actions and recovery. The NMP1 PRA models the likelihood of the occurrence of reactor recirculation pump seal leakage in excess of the limits for SBO and non-SBO conditions. This PRA model utilizes vendor information and testing performed on the seals. A number of recirculation pump seal failures have occurred over the past few years. The problems relate primarily to seal cooling, debris intrusion, and installation issues. In one case, seal cooling was interrupted to a seal for a period of 57 days. This event demonstrated the ruggedness of the seals with respect to cooling. The installation issue appears to have been corrected by more closely following vendor recommendations. However, debris intrusion continues to be an issue since RPV coolant contains various impurities. As a result, seal performance is closely monitored using indicators such as seal area pressure, seal temperature, and drywell leakage. By identifying the onset of seal failures early, the affected seals can be isolated, which significantly reduces plant impact. The primary issue in the PRA is SBO performance wherein any leaks cannot be isolated because AC power is unavailable to the isolation valves. Based on the trending by plant staff and the corrective actions in place, the PRA team has concluded that the seal performance is adequately modeled in the PRA (e.g., 0.05 probability of failure in SBO scenarios).

Emergency condensers (EC)

Emergency condensers provide a means of controlling reactor pressure, inventory, and heat removal so long as there is no LOCA condition. The emergency condensers are reliable, with no recent reliability problems related to system success as modeled by the PRA, and thus their failure probability remains unchanged.

Operator actions

Several operator actions have been identified as potentially important and total dependency is assumed in the PRA model for several key operator actions (e.g., if the

operators fail to shed DC loads early (O15), no credit can be taken for the operators maintaining level in the East/West instrument room via SOP-14, top event HRA).

- Shed DC loads (O15)
- Align the DFP (OR1)
- Control RPV level from the East/West instrument room (HRA, SOP-14)
- AC power recovery
- Control emergency condenser makeup (OMU) on loss of instrument air

No credit was taken for operator reliability compensating measures in the PRA model, except for the operator action to align the NMP2 DFP through the cross-tie. This action is currently proceduralized and it is assumed that the existing human error rate in the PRA applies without any compensating measure. However, this cross-tie capability had not been previously credited in the PRA and has been added as an important compensating measure.

2.3.6 Tier 3: Risk-Informed CRMP

Consistent with 10 CFR 50.65(a)(4), and as indicated above, NMPNS has developed a CRMP which provides assurance that the risk impact of out of service equipment is properly evaluated prior to performing a work activity. The procedures and instructions governing this process are GAP-PSH-03, NAI-PSH-02, "Use of the Safety Monitor," NIP-OUT-01 and GAI-OPS-11, "Shutdown Safety Review." The guidance provided in GAP-PSH-03 provides assurance that the risk associated with planned online work activities is evaluated and that the work activities are scheduled appropriately. The CRMP includes an integrated review (i.e., both probabilistic and deterministic) to identify risk-significant equipment outage configurations in a timely manner during the online work management process for both planned and emergent work. Appropriate consideration is given to equipment unavailability, operational activities (e.g., testing, load dispatching), and weather conditions. The CRMP includes provisions for performing a configuration-dependent assessment of the overall impact on risk of proposed plant configurations prior to, and during, the performance of online work activities that remove equipment from service. Risk is re-assessed if an equipment failure or malfunction, or other emergent condition, produces a plant configuration that had not been previously assessed.

For online work activities, a quantitative risk assessment is performed to assure that the activity does not pose an unacceptable risk. This evaluation is performed using the Safety Monitor. The results of the risk assessment are classified by color code in order of the increased risk of the activity. These color code classifications are described in the following table:

Color Code	Level Criteria	Action
GREEN	CDF $<$ 2 X PRA Baseline (maintenance included)	Risk level is acceptable, no further actions are necessary.
YELLOW	CDF $\geq$ 2 X PRA Baseline;	Risk level is high, requires

Color Code	Level Criteria	Action
	CDF < 10 X PRA Baseline (maintenance included)	supporting PRA analysis of acceptable duration.
RED	CDF ≥ 10 X PRA Baseline (maintenance included)	Significant risk level, work may require plant outage to perform. Online requires supporting PRA analysis, compensatory action recommendations, and plant management approval to perform.

Emergent work is reviewed by work management and operations to evaluate the impact on the risk assessment performed during the schedule development process. Prior to beginning any work, the work scope and schedule are reviewed to assure that nuclear safety and plant operations remain consistent with regulatory requirements, as well as management expectations.

2.4 Maintenance Rule Program Controls

To assure that the proposed extension of the DG AOT does not degrade operational safety over time, should equipment not meet its performance criteria, an evaluation is required as part of the Maintenance Rule (10 CFR 50.65).

The reliability and availability of the NMP1 DGs are monitored under the Maintenance Rule program as described in administrative procedures NIP-REL-01, "Maintenance Rule," S-MRM-REL-0101, "Maintenance Rule," and N1-MRM-REL-0105, "Maintenance Rule Performance Criteria." If the pre-established reliability and availability performance criteria are exceeded for the DGs, consideration must be given to 10 CFR 50.65(a)(1) actions, including increased management attention and goal setting in order to restore DG performance (i.e., reliability and availability) to an acceptable level. The performance criteria are risk informed, and therefore, are a means to manage the overall risk profile of the plant. An accumulation of large core damage probabilities over time is precluded by the performance criteria.

In practice, the actual out of service time for the DGs is minimized to assure that the Maintenance Rule reliability and unavailability performance criteria for the DGs are not exceeded. Overall DG unavailability will be minimized consistent with the Maintenance Rule performance criteria (currently 1.5%) such that the proposed AOT extension is expected to have a minimal impact on DG unavailability. Any change to the Maintenance Rule performance criteria will be evaluated using the PRA model, consistent with the Maintenance Rule programmatic requirements.

Both NMP1 DGs are currently in the 10 CFR 50.65(a)(2) Maintenance Rule category (i.e., the DGs are meeting established performance criteria). Performance of DG overhaul maintenance online is not expected to result in exceeding the current Maintenance Rule criteria for the DGs.

Pursuant to 10 CFR 50.65(a)(3), DG reliability and unavailability are monitored and periodically evaluated with respect to Maintenance Rule performance criteria. The Maintenance Rule unavailability performance criterion for the NMP1 DGs is currently 1.5%. For the rolling 24-month Maintenance Rule monitoring period ending January 31, 2002, DG 102 unavailability is at 0.59% (99.41% availability) and DG 103 unavailability is at 0.57% (99.43% availability). Since the Maintenance Rule program also includes monitoring for DG reliability, fault exposure is not included in the unavailability performance values. In the past ten years, DG 103 has not experienced any fault exposure unavailability, while DG 102 has incurred 356.81 hours of fault exposure unavailability due to a recent failure that occurred in January 2002. Prior to that event, the last time DG 102 experienced fault exposure unavailability was in December 1998. Although fault exposure is not included in the Maintenance Rule program, with the January 2002 fault exposure added to the 3-year performance indicator for safety system unavailability (NEI 99-02), overall DG unavailability is still acceptable at 1.3%. The NMP1 Maintenance Rule program establishes reliability criteria at the Functional Failure (FF) level rather than at the Maintenance Preventable Functional Failure (MPFF) level. This provides assurance that all DG FFs are assessed for possible 10 CFR 50.65(a)(1) goal setting and monitoring under the Maintenance Rule program, regardless of maintenance preventability. Maintenance Rule performance criteria for DG reliability is no more than 3 FFs in 20 demands, no more than 4 FFs in 50 demands, and no more than 5 FFs in 100 demands. DG 103 has had 104 consecutive satisfactory starts since its last FF, which occurred in March 1995. DG 102 has experienced 4 FFs in its last 100 starts, but only 1 in the last 50 and 20 starts. Prior to the failure in January 2002, DG 102 had 69 consecutive satisfactory starts. Only two of the previous three FFs were MPFFs, and all three FFs occurred more than four years ago (in 1997).

The Maintenance Rule program provides a process to identify and correct adverse trends to assure that the proposed extended DG AOT does not degrade operational safety over time. Compliance with the Maintenance Rule, not only optimizes the reliability and availability of important equipment, it also establishes controls for the management of the risk associated with removing equipment from service for testing or maintenance in accordance with 10 CFR 50.65(a)(4).

3.0 CONCLUSION

The proposed extension of the DG AOT is based upon both a deterministic evaluation and a risk-informed assessment. The deterministic evaluation concluded that the proposed change is consistent with the defense-in-depth philosophy, in that (1) there continues to be multiple means available to accomplish the required safety functions and prevent the release of radioactive material in the event of an accident and (2) multiple barriers currently exist and additional barriers will be provided to minimize the risk associated with entering the extended DG AOT, so that protection of the public health and safety is assured. The deterministic evaluation also concluded that the proposed change will not erode the reduction in severe accident risk that was achieved with implementation of the SBO Rule or affect any of the safety analyses assumptions or

inputs as described in the UFSAR. The risk-informed assessment concluded that the increase in plant risk is small and consistent with the NRC "Safety Goals for the Operations of Nuclear Power Plants; Policy Statement," Federal Register, Vol. 51, p. 30028 (51 FR 30028), August 4, 1986, as further described in Regulatory Guide 1.177. When taken together, the results of the deterministic evaluation and risk-informed assessment provide high assurance that the equipment required to safely shutdown the plant and mitigate the effects of a DBA will remain capable of performing their safety functions when a DG is out of service for maintenance or repairs in accordance with the proposed extended AOT.

The proposed extension of the DG AOT is consistent with NRC policy and will continue to provide protection of the public health and safety. The proposed change advances the objectives of the NRC's PRA Policy Statement, "Use of Probabilistic Risk Assessment Methods in Nuclear Activities: Final Policy Statement," Federal Register, Volume 60, p. 42622 (60 FR 42622), August 16, 1995, for enhanced decisionmaking and results in more efficient use of resources and reduction of unnecessary burden. The capability of performing planned overhaul maintenance on the DGs online should improve overall DG availability, which in turn, should result in a reduction in shutdown risk due to an increase in availability of the DGs during refueling outages.

A deterministic evaluation of the proposed changes to TS LCOs 3.4.4.a and 3.4.5.a for the emergency ventilation and control room air treatment systems was performed. The evaluation concluded that these changes are consistent with the power source provisions of TS LCO 3.0.1 and the intent of the equivalent specifications for the standby gas treatment and main control room environmental systems of the Standard Technical Specifications for BWR/4 plants (NUREG-1433). As such, the proposed changes are consistent with currently approved NRC staff positions and there will be no adverse effect on the associated safety analyses inputs or assumptions as described in the NMP1 UFSAR. Furthermore, removal of the DG operability requirements from LCO 3.4.4.a and 3.4.5.a should increase defense-in-depth and the applicable safety margins by appropriately allowing credit for available accident mitigating systems. Accordingly, the proposed changes will have no adverse impact on the defense-in-depth attributes or the availability of the emergency ventilation and control room air treatment systems or their capability to perform their intended safety functions.

Therefore, based on the above evaluations and conclusions, NMPNS believes that the proposed changes are acceptable and operation in the proposed manner will not present undue risk to public health and safety or be inimical to the common defense and security.

4.0 NO SIGNIFICANT HAZARDS CONSIDERATION ANALYSIS

According to 10 CFR 50.91, at the time a licensee requests an amendment to its operating license, the licensee must provide to the NRC its analysis, using the standards in 10 CFR 50.92, concerning the issue of no significant hazards consideration. According to 10 CFR 50.92(c), a proposed amendment to an operating license involves no significant

hazards considerations if operation of the facility in accordance with the proposed amendment would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated; or

2. Create the possibility of a new or different kind of accident from any accident previously evaluated; or

3. Involve a significant reduction in a margin of safety.

Nine Mile Point Nuclear Station (NMPNS) has evaluated this proposed amendment pursuant to 10 CFR 50.91 and has determined that it involves no significant hazards considerations.

The following analysis has been performed:

<u>The operation of Nine Mile Point Unit 1, in accordance with the proposed amendment, will not involve a significant increase in the probability or consequences of an accident previously evaluated.</u>

The proposed changes to the diesel generator (DG) allowed outage time (AOT) and Limiting Conditions for Operation (LCOs) for the emergency ventilation and control room air treatment systems do not affect the design, operational characteristics, function, or reliability of these systems. These systems are designed to mitigate the consequences of previously evaluated accidents and, as such, are not accident initiators.

The proposed extension of the AOT for an inoperable DG will not significantly affect the capability of the DGs to perform their accident mitigation safety functions or adversely affect DG or offsite power availability. A Probabilistic Risk Assessment (PRA) was performed which concluded that the increase in plant risk is small and consistent with the NRC "Safety Goals for the Operations of Nuclear Power Plants; Policy Statement," as further described in Regulatory Guide 1.177. A deterministic evaluation concluded that the plant defense-in-depth philosophy will be maintained with the proposed AOT. The current TS and Maintenance Rule programmatic requirements and the additional administrative controls provide assurance that a loss of offsite power occurring concurrent with an inoperable DG will not result in a complete loss of function of critical systems. Furthermore, the design basis for the onsite AC power system will continue to comply with the 10 CFR 50, Appendix A, General Design Criteria, as applicable, including the intent of Criterion (GDC) 17.

The proposed changes to the LCOs for the emergency ventilation and control room air treatment systems remove the requirements for DG operability. The changes are consistent with the power source provisions of LCO 3.0.1 and do not affect the existing 7-day AOTs for these systems. Removal of the DG operability requirements should increase defense-in-depth by appropriately allowing credit for available accident

mitigating systems. Moreover, the proposed changes are consistent with the intent of the equivalent specifications for the standby gas treatment and main control room environmental systems of the Standard Technical Specifications for BWR/4 plants (NUREG-1433). Accordingly, the proposed changes will have no adverse effect on the defense-in-depth attributes that assure protection of public health and safety or the associated safety analyses inputs or assumptions as described in the NMP1 Update Final Safety Analysis Report.

Therefore, operation in accordance with the proposed changes would not involve a significant increase in the probability or consequences of an accident previously evaluated.

<u>The operation of Nine Mile Point Unit 1, in accordance with the proposed amendment, will not create the possibility of a new or different kind of accident from any accident previously evaluated.</u>

The proposed changes do not alter the design, configuration, or method of operation of the plant, nor do the changes alter any safety analyses inputs or assumptions. The proposed extended DG AOT will not reduce the number of DGs below the minimum required for safe shutdown or accident mitigation. The proposed changes to the LCOs for the emergency ventilation and control room air treatment systems are consistent with currently approved NRC staff positions and there will be no adverse effect on system availability or the capability of these systems to perform their intended safety functions. Accordingly, no new component failure modes, system interactions, or accident responses will be created that could result in a new or different kind of accident. Therefore, operation in accordance with the proposed changes would not create the possibility of a new or different kind of accident from any accident previously evaluated.

<u>The operation of Nine Mile Point Unit 1, in accordance with the proposed amendment, will not involve a significant reduction in a margin of safety.</u>

The proposed extension of the DG AOT remains consistent with the codes and standards applicable to the onsite AC sources, except Regulatory Guide 1.93. The proposed 14-day AOT is justified based on the results of a deterministic evaluation and PRA, and has been approved for several other plants. The DG reliability and availability are monitored and evaluated with respect to Maintenance Rule (10 CFR 50.65) performance criteria to assure DG out of service times do not degrade operational safety over time. Furthermore, extension of the DG AOT will not erode the reduction in severe accident risk that was achieved with implementation of the Station Blackout (SBO) Rule (10 CFR 50.63) or affect any safety analyses assumptions or inputs. The SBO coping analysis is unaffected by the AOT extension since the DGs are not assumed to be available during the coping period. The assumptions used in the coping analysis regarding DG reliability are unaffected since preventive maintenance and testing will continue to be performed to maintain the reliability assumptions. In addition, there will be no significant risk impact on the Nine Mile Point Unit 2 (NMP2) SBO analysis or PRA due to crediting the NMP2 diesel driven fire pump for NMP1 SBO and fire event responses.

The proposed changes to the LCOs for the emergency ventilation and control room air treatment systems are consistent with the power source provisions of TS LCO 3.0.1 and do not affect the existing 7-day AOTs for these systems. The changes remove the DG operability requirements from the LCOs, which should increase the applicable safety margins by appropriately allowing credit for available accident mitigating systems. Moreover, the proposed changes are consistent with the intent of the equivalent specifications for the standby gas treatment and main control room environmental systems of the Standard Technical Specifications for BWR/4 plants (NUREG-1433). Accordingly, the proposed changes will have no adverse effect on the availability of the emergency ventilation and control room air treatment systems or their capability to perform their intended safety functions as required for compliance with the radiological dose guidelines of 10 CFR 100 and GDC 19.

Therefore, operation in accordance with the proposed changes would not involve a significant reduction in a margin of safety.

ATTACHMENT C

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

"Marked-Up" Copy of the Current Technical Specifications (TSs)

The current version of TS pages 173, 178, and 256 has been marked-up by hand to reflect the proposed changes.

LIMITING CONDITION FOR OPERATION

3.4.4 EMERGENCY VENTILATION SYSTEM

Applicability:

Applies to the operating status of the emergency ventilation system.

Objective:

To assure the capability of the emergency ventilation system to minimize the release of radioactivity to the environment in the event of an incident within the primary containment or reactor building.

Specification:

a. Except as specified in Specification 3.4.4e below, both circuits of the emergency ventilation system ~~and the diesel generators required for operation of such circuits~~ shall be operable at all times when secondary containment integrity is required.

b. The results of the in-place cold DOP and halogenated hydrocarbon tests at design flows on HEPA filters and charcoal adsorber banks shall show ≥99% DOP removal and ≥99% halogenated hydrocarbon removal when tested in accordance with ANSI N.510-1980.

SURVEILLANCE REQUIREMENT

4.4.4 EMERGENCY VENTILATION SYSTEM

Applicability:

Applies to the testing of the emergency ventilation system.

Objective:

To assure the operability of the emergency ventilation system.

Specification:

Emergency ventilation system surveillance shall be performed as indicated below:

a. At least once per operating cycle, not to exceed 24 months, the following conditions shall be demonstrated:

(1) Pressure drop across the combined HEPA filters and charcoal adsorber banks is less than 6 inches of water at the system rated flow rate (±10%).

(2) Operability of inlet heater at rated power when tested in accordance with ANSI N.510-1980.

LIMITING CONDITION FOR OPERATION

3.4.5 CONTROL ROOM AIR TREATMENT SYSTEM

Applicability:

Applies to the operating status of the control room air treatment system.

Objective:

To assure the capability of the control room air treatment system to minimize the amount of radio-activity or other gases entering the control room in the event of an incident.

Specification:

a. Except as specified in Specification 3.4.5e below, the control room air treatment system ~~and the diesel generators required for operation of this system~~ shall be operable during refueling and power operating conditions and also whenever irradiated fuel or the irradiated fuel cask is being handled in the reactor building.

b. The results of the in-place cold DOP and halo-genated hydrocarbon test design flows on HEPA filters and charcoal adsorber banks shall show ≥99% DOP removal and ≥99% halogenated hydrocarbon removal when tested in accordance with ANSI N.510-1980.

SURVEILLANCE REQUIREMENT

4.4.5 CONTROL ROOM AIR TREATMENT SYSTEM

Applicability:

Applies to the testing of the control room air treatment system.

Objective:

To assure the operability of the control room air treatment system.

Specification:

a. At least once per operating cycle, or once every 24 months, whichever occurs first, the pressure drop across the combined HEPA filters and charcoal adsorber banks shall be demonstrated to be less than 1.5 inches of water at system design flow rate (±10%).

b. The tests and sample analysis of Specification 3.4.5b, c and d shall be performed at least once per operating cycle or once every 24 months, or after 720 hours of system operation, whichever occurs first or following significant painting, fire or chemical release in any ventilation zone communicating with the system.

LIMITING CONDITION FOR OPERATION

c. One diesel-generator power system may be inoperable provided two 115 kv external lines are energized. If a diesel-generator power system becomes inoperable, it shall be returned to an (14) operable condition within seven days. In addition, if a diesel-generator power system becomes inoperable coincident with a 115 kv line de-energized, that diesel-generator power system shall be returned to an operable condition within 24 hours.

d. If a reserve power transformer becomes inoperable, it shall be returned to service within seven days.

e. For all reactor operating conditions except startup and cold shutdown, the following limiting conditions shall be in effect:

(1) One operable diesel-generator power system and one energized 115 kv external line shall be available. If this condition is not met, normal orderly shutdown will be initiated within one hour and the reactor will be in the cold shutdown condition within ten hours.

SURVEILLANCE REQUIREMENT

c. Weekly - determine the cell voltage and specific gravity of the pilot cells of each battery.

d. Surveillance for startup with an inoperable diesel-generator - prior to startup the operable diesel-generator shall be tested for automatic startup and pickup of the load required for a loss-of-coolant accident.

e. Surveillance for operation with an inoperable diesel-generator - If a diesel-generator becomes inoperable from any cause other than an inoperable support system or preplanned maintenance or testing, within 8 hours, either determine that the cause of the diesel-generator being inoperable does not impact the operability of the operable diesel-generator or demonstrate operability by testing the operable diesel-generator. Operability by testing will be demonstrated by achieving steady state voltage and frequency.

ATTACHMENT D

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

Eligibility for Categorical Exclusion from Performing an Environmental Assessment

The provisions of 10 CFR 51.22 provide criteria for, and identification of, licensing and regulatory actions eligible for exclusion from performing an environmental assessment. Nine Mile Point Nuclear Station, LLC, has reviewed the proposed amendment and determined that it does not involve significant hazard considerations, and there will be no significant change in the types or a significant increase in the amounts of any effluents that may be released offsite; nor will there be any significant increase in individual or cumulative occupational radiation exposure. Therefore, the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is required to be prepared in connection with the issuance of this license amendment.

ATTACHMENT E

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

Nine Mile Point Unit 1 Probabilistic Risk Assessment Peer Review Certification Information

The PRA peer review certification team identified two Facts and Observations (F&Os) with a significance level of "A" and 80 F&Os with a significance level of "B." The significance levels for the F&Os are defined as follows:

A - Extremely important and necessary to address for ensuring the technical adequacy of the PRA, the quality of the PRA, or the quality of the PRA update process.

B - Important and necessary to address, but may be deferred until the next PRA update.

Table 1 below provides a summary of the qualifications and experience of the PRA peer review certification team members. Table 2 provides a listing of the individual F&O review items, including the PRA team's response/resolution to each item, assigned a significance level of "A," as well as the significance level "B" items which could potentially have a risk impact on the proposed 14-Day DG AOT. In each case, the PRA was either updated to resolve the comment or, based on the response/resolution, the item would have little or no impact on the important event sequences and equipment relative to the proposed DG AOT.

TABLE 1: PRA PEER REVIEW CERTIFICATION TEAM EXPERIENCE

TEAM MEMBER	EXPERIENCE SUMMARY			
	Degree	Years Experience	Years of PRA/PSA Experience	Selected PRA/PSA Projects
John Favara	BS, Mechanical Engineering - Manhattan College MS, Mechanical Engineering - Manhattan College	15	15	• Developed FitzPatrick fault tree models • Developed Event Trees for FitzPatrick and IP3 • Responsible for Containment Performance Analysis on FitzPatrick and IP3 • Many PSA Applications
K. Canavan	BS, Chemical Engineering - Manhattan College	13	11	• Oyster Creek PSA team leader for Levels 1, 2, and IPEEE • Davis-Besse Nuclear Power Station PSA team • PSA Applications • BWROG IRBR Vice Chairman
E.T. Burns	BS, Engineering Science – RPI MS, Nuclear Engineering - RPI Ph.D., Nuclear Engineering - RPI	26	21	• Technical reviewer of Level 1 IPEs for fifteen BWR plants • Manager, technical advisor, or lead engineer on many IPEs/PRAs for BWR plants • Lead engineer on several containment safety studies
C.E. Buchholz	BS, Nuclear & Mechanical Engineering – UC Berkeley MS, Mechanical Engineering - UC Berkeley	13	7	• Level 1 for Alto Lazio, ABWR, SBWR, Lungmen • Level 2 for ABWR, SBWR, Lungmen
Gerry Kindred	BS, Technology/ Health Physics Specialty - Univ. of State of New York AS, Nuclear Engineering Technology - Chattanooga State	20	1	• On-line PRA Evaluations • Project Manager – Perry Safety Monitor

TABLE 1: PRA PEER REVIEW CERTIFICATION TEAM EXPERIENCE

TEAM MEMBER	EXPERIENCE SUMMARY			
	Degree	Years Experience	Years of PRA/PSA Experience	Selected PRA/PSA Projects
T.J. Mikschl	BS, Environmental Engineering - Humboldt State University	14	14	• Beznau Shutdown PSA Systems Analysis Task Leader • Quantification Task Lead on several IPE/PSA Projects (Diablo Canyon, South Texas Project) • Technical contributions to more than 12 PSA/IPE/IPEEE projects

TABLE 2: SIGNIFICANT PRA CERTIFICATION F&Os

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
IE-9	Inadvertent Actuation Normally, BWRs do not separate out inadvertant actuation as an Initiating Event. This is acceptable because most actuations result in increased RPV inventory, not reduced. However, for NMP-1 the Containment Spray system has an automatic actuation feature. An inadvertant actuation could result in equipment failures or sufficient concern regarding continued operability that an immediate shutdown would occur (i.e., scram).	B	No impact. Spurious operation of containment spray is definitely a plant shutdown or scram. It is considered as such and IPE Table 3.1.1-5 has been updated in PRA Table 3.1.2-1. Obviously the SCRAM initiating event frequency subsumes this contribution. No other impacts on equipment critical to plant response have been identified. If a spurious actuation occurred, operators would shut down the system (per N1-OP-14 Sect D6) provided there was no indications that required system operation. Most likely a manual shutdown would ensue for inspection for possible equipment damage. It is possible that the spray could cause recirculation pumps and/or drywell coolers to trip. Recirc pump trip is considered a success in ATWS scenarios and a minor contributor to others. Drywell coolers are not modeled in the PRA as their significance is low compared to DHR. MAAP run LI01C shows DW temp <300°F at 30 hours after a SCRAM with no drywell coolers available provided EC or torus cooling is operational.
IE-9	Overfill The overfill event can be a serious challenge at NMP-1 due to the high flow shaft driven feedwater pump. In addition, the potential to damage EC lines as well as the potential for carryover of reactor coolant into the main steam lines provide unique challenges to the operators and plant systems.	B	No Impact. The IPE states that main steam impact was not likely and important (page 3.1.2.1-3). EC impact was modeled for extreme events (top event FL). Actual event on 11/5/96 (LER-96-11) demonstrates failure mode of concern. Water entered EC (not in operation) and main steam lines. Plant modification N1-97-012 subsequently installed additional high level trip of motor driven feed pumps (pump 12 kept running with flow control valve indicating closed and

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
			leaking significantly, pump trip is not required if valve is closed). A subsequent overfill event led to another modification which installed a level-setdown circuit to limit post-SCRAM water level. The PRA update has included the modifications, principally in Top Event FL, and refined overfill modeling. This is described in Sections 4.2.11 and 3.2.1.2 of the updated PRA. Failure of setdown logic is included in a "super-component" in Top Event FL.
IE-9	<u>BOC</u> Special initiating events were discussed in the initiating event notebooks. However the following initiating events are believed to be incorrectly screened from the quantification process: Breaks outside containment (BOC): 1. Main steam line 2. Isolation condenser steam line or multiple tube ruptures 3. Feedwater lines 4. RWCU Because of the potential for Level 2 impacts (e.g., LERF), there is not a good reason presented to eliminate from quantification. These sequences emphasize the need for isolation and its consequential importance. The break outside containment (BOC) evaluation discusses that there are no breaks of high energy lines that may occur in the reactor building. The discussion for BOC appears to be in error because it neglects the possibilities of: 1) An EC line break in the reactor building 2) Massive EC tube sheet failure can also be a potential BOC contributor	B	No Impact. IPE Table 3.1.1-9 previously explained why these events are not risk significant. The BOC evaluation has been revised in PRA Section 5.3.3 to clarify previous inaccuracies and better explain why these events are low frequency. CDF and LERF contributions are judged to be <1E-8, which is < 1% contributor to CDF and LERF. EC isolation is modeled in Top Event EI and discussion in Section 5.3.3 has been enhanced. Future updates could consider explicit modeling of these but this is not viewed as a significant priority for the current update since the contribution is small. The addition of HELB/BOC initiators will not change results but rather provide a separate accounting of the individual contributions. Their exclusion does not impact day-to-day use of the PRA as long as the team is aware of the model's treatment.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	3) RWCU pipe, pressure regulator, or Hx failures could also lead to a BOC The BOC can influence the LERF determination.		
IE-11	Loss of Both RPS Buses The loss of both RPS buses appears to be a potentially severe event because: 1) Loss of all FW occurs (Footnote 37 on P. 3.2.3-16) 2) Auto open of CS injection valves at pressures greater than allowable (this is an ISLOCA potential contributor) 3) Both ECs go into operation These events would appear to warrant a separate event tree evaluation to ensure that the RPS buses are adequately treated in any application including the Maintenance Rule (Loss of single RPS bus is currently not encompassed in the model).	B	No Impact. Loss of a single RPS bus has been added to PRA as an initiator and the event trees handle failure of second RPS bus. Failure of both RPS buses would initiate SCRAM, ECs, containment isolation, core spray (including opening the injection valves). This is the fail-safe condition for the systems, which are designed as de-energize to actuate. Loss of a RPS bus does not directly cause a plant trip and SOP-14 provides direction for loss of RPS buses. Core Spray injection MOVs open on loss of both RPS, but a check valve must fail to overpressure system. ISLOCA contribution is <<1E-7 and is not modeled (PRA Section 5.3.3).
IE-11	Table 3.1.1-5 FMEA -- Grouping 1) Disposition of unpiped stuck open SV is referred to as covered by IORV. This is judged inappropriate because IORV is piped to the torus where as stuck open SV is piped to drywell and creates an immediate LOCA signal and high drywell temperature. The latter may lead to spray or emergency depressurization of the EL functionality. 2) The loss of drywell cooling should be addressed in terms of its impact on accident sequence. This includes events that can cause loss of drywell cooling (DWC) such as RWX (loss of RBCLC).	B	No impact. Stuck open SV is modeled as a SLOCA. It is explicitly included in transient/SLOCA event tree model. PRA (Section 3.2.1.2) has been revised to clarify our modeling. Loss of drywell cooling will lead to manual controlled shutdown or scram. The reason for not requiring treatment has been evaluated and added to the PRA (Section 5.3.2).

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	Loss of DWC can cause high drywell temperatures which may lead to direction for emergency depressurization and flashing of reference legs and loss of RPV level indication.		
IE-13	<u>AC Recovery</u> The AC recovery curve used in the IPE is well described and derived. The use of a weighted curve from NUREG-1032 is questioned because the dominant contributors at NMP-1 may be more heavily weighted to grid and severe weather related incidents than in the NUREG-1032 generic data.	B	No Impact. As part of the PRA update, LOSP and its recovery were reevaluated and checked to be consistent with the Unit 2 analysis. Our calculations are generally the same as recommended by the BWROG Certification Commenter. The major difference is that NMP uses plant specific initiating event frequency, which is lower than the NUREG and then applies the NMP IE frequency with the generic NUREG recovery factors. NMP believes that treating these as independent is reasonable. If every plant in the Northeast used 0.025/yr unrecoverable LOSP at 8 hours, every PRA would have a significantly high non-recovery curve. Obviously, this treatment is not correct. Industry data sources exclude this event but recognize it; it was before NMP1 operation, its likelihood has been significantly reduced, its frequency could be estimated as 1/100 years or less, etc. The NMP1 analysis is consistent with NUREG analyses, is reasonable, and its basis is well documented. The recommendations above would certainly be a conservative approach, but not considered realistic.
IE-13	<u>Reactor Building Closed Loop Cooling Water System Initiating Event</u> The loss of RBCLC initiating event (RWX) is calculated based on the system fault tree for Top Event RW using the RISKMAN system initiating event option. A review of this model showed that the common cause failure between the two normally running pumps was not included in the quantification of the initiating event frequency. During normal plant operation	B	No impact. RWX = 6.76E-3 and is based on operating equipment failures. Including common cause would add a 3E-5 value, which is not significant, but it has been included in PRA. S1X is failure one normally operating pump, thus there is no common cause. Only one pump is running at a time in

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	2 of the 3 RBCLC pumps are running with one in standby. Arguments can be made to exclude the run mode common cause failures between the running and standby pumps, but the common cause failure of the 2 normally running pumps should be included in the model. The report documentation should be improved by presenting and explaining the details of the system initiating event calculations. Assumptions regarding the exclusion of run mode common cause failures between normally running and standby pumps should be presented for Initiators S1X, TWX and RWX.		TBCLC, thus there is no common cause of running pumps. Documentation for support system initiating event frequency development using the systems fault trees has been enhanced using the newly created system modeling references for each system where fault trees are used for initiating event frequency development.
AS-4	Support system initiators based on loss of ac/dc power are not considered. This treatment does not address the system dependencies.	B	No Impact. Agree. Loss of emergency AC initiators A2X and A3X are included and have always been included. Loss of DC initiators (D1X and D2X), RPS bus initiators (R1X and R2X), and normal AC bus initiators (A1X, B1X, and B2X) have been added to the PRA; they do not significantly affect results, but improve completeness.
AS-6	The top event for short term recovery of offsite power (top event OGR) is questioned following all initiating events. The application of this top event to all initiating events result in the application of the short term recovery of offsite power to large LOCA and ATWS events. The ATWS and LOCA events most likely result in core damage before top event OGR could be successful.	A	No impact. The PRA has been modified to utilize OGRF for ATWS, LLOCA and MLOCA initiators. Sensitivity case was run with this change to confirm original judgment that this is insignificant. It was based on an intermediate update with external events. CDF changed from 2.738E-5 to 2.739E-5, a difference of about 1E-8.
AS-9	It is not clear that the credit taken for operators keeping MSIVs open in an ATWS is appropriate. This action may be required within a relatively short time and the directions in the EOPs do not accelerate the diagnosis and action while many actions are competing for the operators' attention, and time is critical.	B	No impact. A 0.5 probability of failure is used because it was judged uncertain whether operators would do it in time based on operator interviews, timing considerations, and simulator experience. Increasing this to 1.0 would be too

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
			conservative.
AS-11	OR Rules for SBO It appears that the rules for SBO may select an incorrect value for the HEP for OR1 (Operator Aligns Diesel FW pump). The specific cases are for (a) NSL = F and (b) NSL = F * RC = F. The rules appear to place this. (a) NSL = F in OR14 which is an HEP at > 2 hrs. (b) NSL = F * RC = F is OR13 which is an HEP at 1 hour Case (a) would appear to be incorrect in that 2 hours is generally not available and EC availability is not asked so it could be both ECs are also failed. Time with NSL at 300 gpm should lead to << 2 hours available (see TODD1 MAAP run). Case (b) with RC = F and NSL = F and not asking EC should be less than 1 hour. In conjunction with this observation is the observation that the HEPs for OR1 and SBO appear to be independent of time available. This local manual action would appear to be a strong function of time available.	B	No impact. There is no impact since OR13 and OR14 are essentially identical. Whether there is 1 or 2 hours, the HRA was assessed to be similar (this is conservative). If both ECs are unavailable, the OR13 rules ensure that the 1-hour time frame is used which is correct. If both RC=F*NSL=F, OR13 rules ensure that 1 hour is correctly used. If only NSL=F, the rules ensure that OR14 is correctly used. As described for top event NSL, leakage is time dependent (not 300 gpm at time 0) and 2 hours is correct. Also, with regard to comment on time dependence – 1 hour versus 2 hours would not lead to a significant difference in related HEP.
AS-11	In several event trees, (e.g., TRSL1), the top event RV, EMRV operation is questioned. Top event RV is not conditional on top event RO which questions EMRV operation on high pressure early in the event trees. If the EMRVs do not function for pressure relief, the potential that they will not function for depressurization is increased.	B	No impact. Agree. PRA now includes the conditional calculation of RV dependent on RO. A very conservative sensitivity case was run to confirm that this dependency was not significant in the IPE. CDF changed from 2.7394E-5 to 2.7532E-5 when RV is set to RVF whenever RO fails. This is very conservative and shows a value of 1.4E-7/yr.
AS-14	The elimination of reactor vessel rupture from the Level 1 analysis precludes its	B	No impact.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	treatment from Level 2 considerations. Reactor vessel rupture may be an important contributor to high early release (LERF).		Vessel rupture has been added to the PRA model as part of the update, but it is not significant.
AS-17	<u>SBO/LOSP</u> The response to an SBO in the model has the following characteristics: • NSL = F (excess seal leakage) or RC = F (SORV) the ECs are not asked. This would appear to mean that ECs are assumed failed. This seems very pessimistic in modeling. • RC = F and no ECs asked, no time for AC recovery is provided beyond 1 hour. • NSL = F and no ECs asked, 2 hours is provided for offsite AC recovery. These modeling assumptions do not appear to be explicitly discussed and there may be significant variations in the success for each depending on: • the EC operation or not • the size of the seal leak 25, 45, 115 or 300 gpm These are not accounted for in the modeling.	B	No impact. The ECs are not a success and provide only some time delay if NSL=F or RC=F. The timing treatment is conservative and additional modeling will not change results significantly because timing will still be in the 1-2 hour range (i.e., 1 hr 40 minutes does not lead to significantly different results than if 2 hours and 20 minutes is used for recovery of a particular scenario). Also, every permutation adds complexity to the model and increases run times – this must be balanced with the information provided. Success criteria and SBO model documentation explain this, but do not explicitly describe timing conservatism in detail. The expansion of the documentation is not considered a priority for the current update as the information can be determined currently, albeit with some effort.
TH-7	<u>SBO</u> The technical basis is to assure that the drywell temperature remains below 280°F. The drywell emergency depressurization limit in the EOPs is not provided in the MPR SBO Report. It is believed necessary to ensure that the drywell temperature will remain below this limit to avoid EOP directions to emergency depressurize (ED). ED is	B	No impact. MAAP analyses were reviewed. All MAAP runs were performed with EC depressurizing the RPV and are not useful for this issue. However, a separate run, LI01C, is useful for this discussion. In this run the RPV is kept at pressure, CRD is used for level control, drywell coolers are tripped, and torus cooling is in operation. Relative to drywell heat-up, this is similar to the

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	believed to reduce RPV water inventory and reduce the EC ability to remove decay heat.		case where the EC is removing decay heat but not providing significant depressurization (i.e., operators are cycling it). When EC is operational pressure will be maintained in the 700-900 psig range which offsets the cool CRD injection for this case and torus cooling provides relatively the same DHR benefit as ECs (i.e., roughly 4% power). MAAP run LI10C shows that drywell temperature does not reach 300°F (EOPs have been revised from the 280 °F value) before 24 hours as long as there is some DHR from primary containment. Section 3.3 has been updated to include this discussion.
TH-14	No independent review of MAAP runs was available.	B	No impact. Agree, Kenton-Gabor/ERIN/NMP personnel conducted several reviews, but it appears not to be well documented in one place (e.g. numerous memos back and forth between ERIN, K&G, NMP, plus review of success criteria, etc.). The PRA update includes sign-off reviews to resolve this. However, MAAP has not been a priority for the first PRA update and this will require effort for future updates.
SY-5	<u>CRD</u> Verify that 110 gpm assumption about CRD injection is consistent with the HRAs accounted for and the procedural direction. HRA only says turn on pump. No valves get manipulated. Most plants can't get 110 gpm if scram is reset.	B	No impact. NMP1 has a direct line to the RPV which provides a flowpath most plants do not have. This line is useful for the post-SCRAM-reset conditions mentioned above. Section 4.2.16 has been updated to better document the relevant information.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
SY-5	<u>EC</u> The isolation condenser (IC) is designed to be vented of non-condensibles from the primary side. Without this vent, the accumulation of non-condensibles can severely restrict the decay heat removal capability of the IC.	B	No impact. This was evaluated during the IPE development. Accumulation of non-condensables was found to be unlikely as the ECs are declared inoperable if the vent valves are closed for any reason. Therefore, EC impact would be limited to the non-combustibles generated over a short period of time. Also, the vent lines are designed to close on a containment isolation signal and are unavailable for many scenarios anyway.
SY-8	<u>SLC</u> The failure probability for SLC with all supports available is 1.4E-3. This appears lower than might be calculated if the CCF due to the following were included: • test and maintenance that defeats the entire system • explosive valves (see Monticello event) • SLC pumps (see INEEL CCF data base)	B	No impact. All of the above failure modes are included in the SLC model. The PRA update reconsiders all these.
SY-12	<u>AC Power/DC Power</u> Is there a basis to allow the charger to carry all required DC electrical loads with the battery failed or severely degraded? Specifically, will the DC loads following a LOCA <u>signal</u> be sufficiently high to overload the charger capacity if the battery is not available? Note that a LOCA signal may be generated by events that cause high drywell pressure and/or low RPV level. In other BWRs, it is found that the charger can be overloaded if the battery is unavailable to act as a "buffer" during load sequencing. The NMP1 design feature that addresses this should be referenced.	B	No impact. Section 4.2.1 documents that battery demand is modeled and required to start the diesel when normal 115 kV AC power is unavailable. For the case where normal AC power is available, the battery charger can successfully supply DC power board loads without the assistance of the battery. An extremely conservative battery load (e.g., several loads assumed to occur at the same instant in time) can be found in the calculations which is on the order of 700-800 Amps. However, these loads occur over time (e.g., LOCA signals sequenced) and the steady state battery load on the order of 300 Amps is more realistic. This is below the Charger

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	There are also unverified hand calculations that indicate the following: • charger capacity is 400-500 amp • DBA/LOCA REQUIRES 800 AMP - therefore need the battery in the circuit		capacity of 400-500 Amps. In the extremely unlikely case that the Charger trips, it is recoverable.
DA-7	<u>Unavailabilities for Updates</u> The system unavailabilities should use the Maintenance Rule data.	B	No impact. Agree. The PRA update includes this data.
DA-7	<u>SLC Maintenance Unavailability</u> The maintenance unavailability is reported as a single value on P. 3.3.2-11, but in the model it is applied to each pump. There is no discussion of how the reported value was derived or should be applied; however, the raw data does include a description of the individual tests. However, there appears to be confusion regarding whether the data search for SLC was to address unavailability of single or multiple trains of SLC. One example is that test N1-ST-M1 and N1-ST-QBT specify "liquid poison tank isolated." If the tank is isolated this would defeat the SLC system operation, not just 1 train. However, in the PRA model it is assumed that this "data" applies to individual SLC trains.	B	No impact. In the IPE and updated PRA, each pump is allowed to be out of service and the Maintenance Rule tracks each train. Multiple trains are not taken out at the same time and isolation of the tank only applies to one pump train at a time. Maintenance Rule data monitoring is now used as a basis and it is better documented.
DA-8	<u>Common Cause Data Sources</u> The NMP-1 IPE used the PLG database of generic MGL CCF factors. This database was recognized as a state of the art resource at the time the NMP-1 IPE was performed, and therefore a grade of 3 was assigned to this model element (i.e., DA-8). But in the past several years,	B	Minimal impact. The PRA update utilizes INEL/NUREG/CR-6268 data. A search for plant-specific events has yet to be performed.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	updated resources, such as the INEL 94/0064 database collected for the NRC, have become available. The update of the CCF analysis to incorporate the improvements represented by the INEL database would provide a significant enhancement to the NMP-1 IPE and is considered essential to maintaining a study capable of supporting Grade 3 and 4 applications. The update process should include a plant-specific screening of the events in the INEL generic database, and a review of NMP-1 data to identify plant-specific common cause events. One component failure mode missing from the current analysis is the failure of the explosive valves in the Liquid Poison System to open on demand.		
DA-8	Use INEL Data Base developed for the NRC for the assessment of common cause failure probabilities.	B	No impact. Latest industry data used for the update.
DA-8	<u>Explosive Valves</u> The reference for explosive valve data is considered not desirable. A search of NPRDS or an explicit LER search is judged more useful and appropriate for this important input parameter.	B	No impact. The comment did not have referenced attachment. Incorporating plant-specific events in a Bayesian update is considered much more important than trying to search NPRDS and LERs which are unreliable to say the least. Our present strategy is to use any good data sources developed outside and focus internal resources on improving development and use of plant-specific data identified, and is relatively well founded. Included in PRA update. INEL/NUREG/CR-6268 data, other credible sources, plant-specific data are used in update. However, factors for explosive valves are not readily available and judgment is necessary.
DA-8	<u>CCF of Batteries</u> The CCF of batteries is not incorporated in the assessed split fractions and rules. The data is generated in data analysis module of RISKMAN, but not included in	A	No impact. The present PRA model correctly includes common cause modeling of battery 11 and 12.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	the event tree model.		
DA-19	<u>Common Cause - Split Fraction Assignment Rules</u> The review of the common cause failure modeling included an inspection of some of the event tree split fraction assignment rules. Some errors in these assignments were identified and are noted here to be corrected as part of the next IPE update. <u>Containment Spray Top Event C4.</u> The split fraction rules for C44 and C4B are not mutually exclusive, and C44 is listed first. Split Fraction C44 (6.3E-1) is to be used given independent failure of C1, C2 and C3, and C4B (7.8E-2) applies to the condition where C1 and C2 are failed due to support failures, and C3 is failed independently. The current rules in event trees TRSL2, LOCA, and AT3 will assign Split Fraction C44 to both of these conditions. The rule for C4B should be placed ahead of the rule for C44. <u>Emergency Condenser Makeup: Top Events LC1 and LC2.</u> A split fraction should be defined and quantified in the system analysis for Top Event LC2 for the condition where LC1 is failed due support failures. Currently the event trees (i.e., SBO and TRSL1) assign Split Fraction LC26 (4.7E-2) to any condition where Top Event LC1 is failed. This is conservative for conditions where LC1 is failed due to support failures where the split fraction for LC2 should be approximately 2.7E-3. <u>Demand on Batteries 11 and 12: Top Events DA and DB.</u> The system analysis for Top Events DA and DB defined and quantified a split fraction for Top Event DB given the failure of Top Event DA that accounts for common cause failure on demand between the batteries. The split fraction that models this dependency is	B	No impact. The PRA has been updated to address the comments.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	not used in the event tree (i.e., SUP1) split fraction assignments. Instead, the split fractions are assigned as if there were no dependency between the top events.		
HR-12	<u>Operator Action to Depressurize</u> The Human Error Probabilities (HEP) for depressurization appear to be too high and show no time dependence as might be expected from models such as the EPRI ORE data model or the Time Reliability Correlation. ZOD05 (1 hr) = 3E-3 ZOD06 (2 hr) = 3E-3 Estimates from other PSAs reviewed by the BWROG Certification effort are in the range of 2 to 5E-4 at 1 hour.	B	No impact. The HRA evaluated this HEP and concluded that diagnosis dominated. Blowdown is not highly time dependent as blowdown is keyed to specific plant parameters. Operators may be assisted by trending parameter(s) over time in a case where they can anticipate blowdown over time. However, anticipatory blowdown is not allowed and, regardless of time, operators must wait until specific plant parameters meet pre-defined values. In this regard, diagnosis and attendant failure modes such as information overload and distraction play a role. At this time the HRA treatment is judged adequate and potentially conservative. This could be revisited with additional simulator valuation and/or review of other plant's analyses at some later date.
HR-15	<u>ADS Inhibit</u> The ADS inhibit HEP under ATWS conditions is given as a function of the accident sequence: 1. ZAI 01----2.3E-4 2. ZAI 02----2.3E-2 for TLOF This is considered a strength of the PSA. The basis for 2.3E-4 for all events but TLOF is questioned. The specific issue is related to the fact that FW trip on high level or manual trip by procedure ("Terminate") may occur for these non-TLOF events. This will make the response look more like a TLOF sequence and a more rapid operator demand response required. In addition, the confusion and stress associated with an ATWS event does not appear to be	B	No impact. ASX and RWX initiators were added to AI2 rules. The lower value for AI1 is because of the extra time and AI is almost all legs of EOPs. Operators do not trip FW pumps as part of ATWS "Terminate and Prevent."

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	addressed. In addition, the TLOF can be caused by other events such as LOSP and PLOF. These appear adequately included in the model rules although not included in the HRA discussion. There may, however, be other transients that also result in loss of FW that are not included in the rules. These may include: • ASX • LOSS OF TBCLC • LOSS OF RBCLC • LOSS OF A BUS		
HR-17	<u>SBO-DC LOAD SHED</u> N1-SOP-18 states that Station Battery load reduction occurs within 30 min. This is inconsistent with the HRA and use in the PRA model. The 15 minutes assumed in the PRA is a time when the action is assumed to occur in the PRA with a 99% reliability. No discussion of the procedural statement specifying the 30 min. is even provided in the HRA. (The procedure even specifies that some loads do not need to be dropped before 2 hours. This does not seem to be accounted for in the HRA.)	B	No impact. The Model is consistent with procedures. Based on interviews at the simulator and the fact that procedures require DC load shedding to be started **WITHIN** 30 minutes, we evaluated the likelihood that it would be started in 15 minutes. We judged from SBO analysis that early versus late DC load shedding could make the difference of a few hours of available battery life and wanted to model this realism. The 15 minutes is based on evaluating timing, resources, etc., and provides 8 hours of battery life. If they do not start load shedding within 15 minutes, we ask if load shedding is started within 30 minutes which would provide 4 hours of battery life. If load shedding is not started within 30 minutes, it results in an assumed battery life of 2 hours. This is not Level of Significance B and it is incorrect to say we are not consistent with procedures. Modeling more realism and time steps consistent with procedures (Within 30 minutes does not mean that they are precluded from quicker action and it does not mean we

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
			cannot model the probability of performing the action earlier). The model has not been changed. The write-up, however, has been clarified.
HR-17	<u>Z-A201 - SHED LOADS FROM POWER BOARD 16</u> The derivation of the HEP for this action does not appear to address the time available and time required to complete this action. It is judged that this action is dependent on the available cues and may be significantly dependent on the competing resources under certain sequences that would limit the success of the action.	B	No impact. This action was not determined to be time dependent and represents an error of commission during a recovery task. Time is not a factor with this particular action, although it is a factor for the action that could initiate this failure. The decision to cross-tie loads would be made based on available resources and priority. Time plays a role in the probability that the cross-tie action is started. However, this subject HEP represents the probability that the cross-tie is incorrectly performed and bus failure is induced. This represents a classic "skip a step" error that is relatively insensitive to time available and is modeled correctly.
HR-17	<u>Z-LS02 - Shed Electrical Loads to Protect EDG From Overload</u> This action is applicable when a LOCA signal occurs coincident with diesel demand (e.g., LOSP). The evaluation does not appear to address the following performance shaping factors: • Time available and time required to perform the actions necessary. • The degree of training received on this and whether it is a well known and anticipated action. • The effect of competing tasks that may conflict with the performance under the LOSP initiator.	B	No impact. This issue appears to result from some confusion regarding IPE terminology. Shed is incorrectly used and this action should be more aptly called Manage Electrical Loads to Protect EDG from Overload. This action involves checking EDG load prior to starting additional loads as the load sequencing process controls loads automatically initiated due to LOSP and SBO signals. There are no EDG based shedding actions specified in N1-SOP-5, just cautions regarding the establishment of additional loads. This wording has been fixed in the PRA update – See Sections 5.2 and 3.2.1.1.
HR-26	<u>Dependency</u>	B	No impact.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	One of the difficult areas of the dependency among operator actions is that in the response to a loss of offsite power. For NMP-1, two operator actions that are important as part of the model success states are that operators: • Shed AC loads from the diesel buses (LS) • Shed DC loads from the DC buses (O15) These actions appear to be required within relatively short times following the initiating event. It may be that there is a strong dependency between these operator actions. No discussion of this possibility, the timing of the 2 actions, or the training regarding these is included in the HRA.		These events are not highly dependent. As discussed above, AC action is not really a "shed" action, it is a manage AC loads action that has been clarified in the updated PRA. The manage load action occurs any time a load is added to the EDG. This insures operators do not overload the EDG. The DC action is a shed action and must be started within 30 minutes. These actions are carried out by different operators under different time pressures. The documentation has been clarified.
HR-19	<u>SBO Depressurize</u> The assignment of split fractions for depressurization in the SBO event tree uses the same probability of 3E-3 regardless of the timing conditions. This appears to relegate the time dependence of the action to a subsidiary role. This is judged an area that could use additional investigation: Shortest time could be a sequence of events with no EC, seal LOCA, SORV estimated time to core damage is 0.4 hrs (see TODD1 MAAP run). Longest time could be sequences that extend to 8 hrs. before AC recovery. It would appear inconsistent with many HRA models to find that the HEP does not vary over an 8 hr span.	B	No impact. Blowdown is an action that takes less than 1 minute to accomplish and, with a span of 25 minutes to 8 hours, the operators should feel little time pressure. It should be noted that the HEP is based on a 25-45 minute time window. There is ample opportunity for recovery in even the 25 minute case as numerous cues would exist (i.e., Lo-Lo, Lo-Lo-Lo, ADS timer). A bigger contribution would come from either distraction (i.e., DG recovery) or the wish to avoid downsides of blowdown (i.e., limits EC effectiveness should it be recoverable, PC challenge). There may be some additional recovery to be applied to the longer cases, such as TSC should be staffed, etc., but this is viewed as minor, conservative, and a low priority.
DE-9	<u>Dependencies Not Modeled</u>	B	No impact.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	The following dependencies that are believed to be very important to capture in the quantitative model are not currently included: D/G system fault tree does not have the following dependencies included explicitly: (1) D/G raw water; (2) ventilation; (3) inadvertent operation of sprinklers 3.2.1.23 of the IPE for Turbine Bldg. HVAC does not appear to address the issue of MSIV closure. This means that loss of TB HVAC, which causes MSIV closure, would receive recovery of the MSIV closure at OM in the model with the same conditional probability as a spurious MSIV closure event.		These dependencies are insignificant and accounted for. TB HVAC is in IPE Table 3.1.1-5, has been added to 3.2.1.23, and is addressed in Element IE observation. EDG unreliability and unavailability are based solely on plant-specific data per the maintenance rule. Failure of any EDG component, including the raw water pump, ventilation, spurious operation of fire suppression (note there are no water sprinklers in EDG room), or any other failure mode is included. Also, these failure modes would not affect any other PRA components (only EDG), thus this is not a dependency except on EDG and is accounted for in the data. EDG room ventilation, including CCF, has been added to the model.
QU-11	<u>OGR</u> This node addresses the restoration of offsite AC power within 1 hour. In general this appears to be an acceptable estimate. There may be low frequency sequences that could result in core damage in a substantially shorter time (~ 0.5 hr). • LOSP • EC fail • Seal Failure • SORV • LOCA • ATWS	B	No impact. OGR has been set to guaranteed failure for ATWS, MLOCA, LLOCA in the PRA update (very small impact on results). For other events there is time available. Seal LOCA does not likely occur at time zero. The others are transients and SLOCAs where there is over ½ hour or their frequency is extremely small.
QU-18	<u>Split Fraction</u> The selection of ADS inhibit split fraction for AASX (ATWS) initiators (loss of Air) should be characteristic of loss of FW. (Loss of Air will cause rods to drift in and	B	No impact. Agree. AI2 is used for AASX. Note, however, that this is not the same as loss of FW initiator and is conservative.

Element - Sub-Element	PRA Certification F&O	Level of Signif.	DG AOT Risk Impact
	FW will mismatch and trip on high level.)		
QU-18	REC Operator recoveries for heat removal (ZREC2) for most IE, for ASX (ZREC3), for S1X (ZREC4) are based on engineering judgment. It would be desirable to construct a basis for these quantitative estimates that can be used in estimating variations in the model for changes in applications.	B	No impact. Agree. Judgment is still used but the basis is expanded in PRA update Section 4.2.26.
L2-7	The binning of accidents into the level 2 analysis appears to have some weaknesses related to the usefulness of the groups in the level 2 analysis. For example: • All SBO sequences are binned into IB. A review of these sequences indicates that many of them have adequate core cooling, however, the containment heat removal fails which subsequently leads to core damage. • The success criteria for depressurization in the L1 trees include the use of 2 ECs (or ECs in combination with other systems). However, if the ECs become unavailable as the accident progresses, the vessel will re-pressurize before the vessel fails. Thus, the containment may be subjected to HPME/DCH. • Binning of the accident sequences does not address the addition of water from outside the containment. If a substantial amount of water is added, the containment performance will be very different than if no water was added from outside containment.	B	No impact. All SBO sequences go to ClassIB in the level 1. This is due to the fact that failure is dominated by cases that occur before 8 hours and involve combinations of EC failure, AC recovery failure, and operator actions. These scenarios have loss of injection type factors. However, the level 2 has macros (see CDEARLY) which bin the sequences appropriately independent of the Class1B assignment. In other words, the assignment of Class1B in L1 does not automatically direct the sequence to LERF. The success criteria only allow ECs to depressurize under LOCA conditions and the possibility of re-pressurization under LOCA conditions is less. Also, the system analysis for ECs requires 24 hours of operation which would represent re-pressurization. Water addition to the PC is controlled by EOPs which define torus water level. In the case of PC flooding, water level is raised beyond EOP control values and the level 2 handles the cases accordingly.

ATTACHMENT F

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

NRC Review Comments Summary

The NRC SERs for the NMP1 IPE and IPEEE were reviewed and specific comments were identified and assigned as individual items for the NMP1 PRA update. Provided in the table below is a listing of each comment, along with the NMPNS PRA team response/resolution:

NRC Comments on IPE & IPEEE		
Item[1, 2]	Comments	Response/Disposition
SE pp. 1-3	Summary of IPE paraphrased from Submittal.	CDF, LERF, importance from IPE is summarized. Due to the update, more recent values and dominant contributors have been developed.
TE-FE pp. 2-7 (and throughout)	Summary of IPE paraphrased from Submittal.	CDF, importance from IPE, number of initiators and number of event trees is summarized. Due to the update, more recent values, dominant contributors, initiators, and event trees have been developed.
TE-FE p. 7	"Possible shortcoming," core spray pumps can survive to 300F (rated for 140F) with 0.5 probability based on engineering judgment.	NMPNS PRA team stands by its judgment. Also, RAW for CI top event, where this issue is modeled, is 1.15 for CDF and 1.0 for LERF.
TE-FE pp. 9 & 23	No uncertainty analysis or sensitivity analysis are provided although the submittal implies these analyses may have been performed.	NMPNS has performed uncertainty and sensitivity analyses as part of model development but none have been formally documented to date.
TE-FE p. 10	The IPE did not specify a freeze date.	The PRA update was frozen as of 12/31/00 although documents slightly older than 12/31/00 are used as reference. Up-to-date drawings, calculations, and other documents were "pulled" as required during the update process. This is a necessary process, and controlled via tracking revision numbers or dates, since the update process is a time-intensive endeavor.

NRC Comments on IPE & IPEEE		
Item[1, 2]	Comments	Response/Disposition
TE-FE p. 10	The IPE was reviewed inhouse ... However, there is no indication that the independent reviews were performed by individuals with PRA expertise...	The BWROG certification review was subsequently performed by a team of PRA experts. This review augments those reviews performed by NMPNS staff.
TE-FE p. 13	Seal LOCA combined with small LOCA.	Seal LOCA may be higher frequency than other small LOCAs but since it is isolable, overall frequency is similar. Breaking out seal LOCA as a separate initiator may have merits in the future to provide more resolution regarding results.
TE-FE p. 13	IPE uses 2E-2/yr for spurious open relief valve. Other plants use higher values. Other plants have experienced problems with ERVs. PB uses 0.19/yr, GG uses 0.14/yr, BF uses 0.04/yr, QC uses 0.1/yr.	One failure in 20 years operation is 0.05/yr. Given NMP1's experience, 0.02/yr is judged appropriate.
TE-FE p. 22	Dependency table lists Nitrogen but system section indicates the system is not modeled.	Nitrogen is mentioned in the dependency matrix as a point of information only. It is not modeled and only represents a potential backup to instrument air for some components. This capability is not modeled.
TE-BE pp. v-vi (and throughout)	Summary of IPE paraphrased from Submittal.	LERF, importance from IPE, and dominant contributors are discussed. Due to the update, more recent values and dominant contributors have been developed.
TE-BE pp. v & 23	Definition of early is consistent with SECY-90-405 but dissimilar to NUREG-1150.	NMPNS definition is also consistent with the PRA Procedures guide.
TE-BE p. 24	The analyses of ex-vessel steam explosions, DCH, and reactivity insertion phenomena are less complete.	Treatment is adequate but improvements could be considered at some later date.
TE-BE p. 25	Two improvement initiatives noted: drywell head preload, containment venting pressure.	Section 10.0 of updated PRA tracks initiatives.
TE-BE p. 29	It is not easy to trace and review results produced by a very large integrated risk model...	CET split fraction rules, binning, and macros were not included in the IPE but have been placed in the PRA update. Still, every PRA model, including linked fault trees, is time-consuming to assess, as by their nature they are complicated and extensive.
TE-HRA p. 16 (and throughout)	Summary of IPE paraphrased from Submittal.	HRA values, importance from IPE, and dominant contributors are discussed. Due to the update, more recent values and dominant contributors have been developed.

NRC Comments on IPE & IPEEE		
Item[1, 2]	Comments	Response/Disposition
TE-HRA p. 28	Few pre-initiator actions were quantified.	NMPNS considers that dominant contributors have been included but additional actions could be considered at a later date.
SEI pp. 2-3 (and throughout)	Several improvement initiatives noted.	Section 10.0 of updated PRA tracks initiatives.
SEI pp. 2-3, TE-SEIS p. 3	Method for seismic PRA using SMA is rough… CDF will be greater than that obtained by convolving fragility…	Seismic event trees and fragilities have been explicitly included in the model. PLG method for failure probabilities is used.
SEI p. 11	Weak HRA regarding recovery of AC power after DC is depleted.	Screening values are used and are considered adequate. More detailed analysis could be considered at a later date.
SEI p. 2, TE-SEIS p. 3	The two success paths … consist of redundant trains of the same equipment… a departure from the EPRI methodology.	The NMPNS PRA team does not agree with the interpretation that this represents a departure from the EPRI methodology. If redundant <u>and diverse</u> trains are required, how are DC and DG functions to be satisfied at any plant? In any regard, NRC approved the approach for meeting IPEEE commitments and a more complete modeling approach has been subsequently included explicitly in the PRA model.
TE-SEIS p. 7	No discussion about external flooding…	This is not included with seismic but rather with other external hazards.
TE-SEIS p. 8	Crediting short term action in a seismic event (i.e., blowdown) is a weakness.	NRC notes that the analytical decision related to this issue is driven by plant design. However, NMPNS believes the operators will be reliable relative to blowdown even given an earthquake and aftershocks.
TE-Fire p. 4	Issue of collateral damage of equipment due to fire suppression actuation is not addressed.	The fire screening assumed equipment failed in an entire area, thus bounding many widespread water spray actuations. Also, the IPE internal flooding assessment addressed water spray noting that critical electrical cabinets have been designed with spray protection. A more detailed assessment of potential for spray damage could be considered in the future but is unlikely to lead to any significant additional insights or contributors to plant risk.
TE-Fire p. 6	Plant-specific fire initiator data was not used.	The fire risk assessment included a review of NMP1 fire events.
TE-Fire p. 6	Hot work ignition of cables and hydrogen sources are screened but generally higher than unqualified and junction box ignition frequencies.	This would not significantly change ignition frequency but a more complete accounting including more detailed plant-specific data analysis could be included at a future date.

NRC Comments on IPE & IPEEE		
Item[1, 2]	Comments	Response/Disposition
TE-Fire pp. 6 & 10	Control cables are screened.	NRC comments that control cable events are included in EPRI database but that NMPNS assumption should have minor impact on results. A more detailed assessment of control cables could be considered in the future but is unlikely to lead to any significant additional insights or contributors to plant risk.
TE-Fire pp. 12 & 15	IPEEE does not consider potential that fire fighting may lead to smoke propagation throughout the plant.	Fire fighters opening doors can lead to spreading smoke. This could cause additional actuation of suppression systems and/or impact accessibility. Additional actuation is discussed above. Also, smoke will generally rise to upper areas of buildings and local action credited generally involves actions in lower areas (i.e., east-west instrument rooms, fire protection spool pieces).
TE-Fire p. 13	NMP1 submittal is very brief regarding control equipment faults and potential for hot short related equipment damage.	Control equipment is considered in that control circuits are widely fused and hot shorts are considered low probability occurrences especially considering already low fire frequencies. More detailed analysis could be considered in the future but is unlikely to lead to any significant additional insights or contributors to plant risk.
TE-Fire p. 16	Submittal does not address non-safety related control system impact on safety systems.	As discussed above, control circuits are widely fused and design requirements specify electrical separation between safety-related and nonsafety-related systems. Potential for unrecognized dependencies could be reviewed at a later date but is unlikely to lead to any significant additional insights or contributors to plant risk.
TE-Fire p. 16	Flooding and moisture intrusion not considered.	This was evaluated in the IPE internal flooding assessment and is also included in the updated PRA.
TE-Fire p. 20	It is not clear how fire propagation was included.	Fire area boundaries were included as specified in the plant's Appendix R program. Subzone propagation was addressed in calculations related to equipment damage. Propagation in the control room was treated statistically. These issues could be discussed further but are unlikely to lead to any significant additional insights or contributors to plant risk.
TE-Other p. 1	High wind fragility is conservative.	More realistic analysis could be considered at a later date.
TE-Other p. 3	Rutch reference does not account for higher magnitude tornados having wider damage paths.	NRC recommends NUREG/CR-4461 method which could be evaluated at some later date but is unlikely to lead to any significant additional insights or contributors to plant risk.

NRC Comments on IPE & IPEEE		
Item[1, 2]	Comments	Response/Disposition
TE-Other pp. 4-5	PMP could lead to higher conditional probability of loss of offsite power since non-safety switchgear could be flooded in the event. (LOP estimate optimistic).	NRC appears to misunderstand the assessment. PMP has high conditional probability for damaging EDGs because they are in small rooms with potential for water intrusion. Lower conditional probability for offsite power is based on equipment being in general areas of the plant. Thus, water spreads over a wider area and, over the limited time-frame of a PMP event, does not reach critical heights for nonsafety-related switchgear damage. More detailed walkdowns and pictures to demonstrate the conclusion could be developed.

[1] SE = IPE Staff Evaluation (Letter and enclosure 1 to letter); TE = Technical Evaluation (enclosures 2, 3, and 4 to letter); TE-FE = Technical Evaluation, Front End (enclosure 2); TE-BE = Technical Evaluation, Back End (enclosure 3); TE-HRA = Technical Evaluation, Human Reliability Analysis (enclosure 4).

[2] SEI = IPEEE Staff Evaluation (Letter and enclosure 1 to letter); TE = Technical Evaluation (enclosures 2, 3, and 4 to letter); TE-SEIS = Technical Evaluation, Seismic (enclosure 2); TE-Fire = Technical Evaluation, Fire (enclosure 3); TE-Other = Technical Evaluation, Other External Events (enclosure 4).

ATTACHMENT G

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

Updated PRA Results Summary

Summary of Baseline Model U1 PRA01B	
Internal and External Events CDF	2.57E-05/yr
Internal and External Events LERF	2.18E-06/yr
Shutdown CDF	Not Evaluated
Configuration Risk Management Tool	Safety Monitor

Initiator Contribution to CDF

Initiator ID	Initiator Description	% CDF Contribution
FT3B1	Fire in Turbine Building 261' South (Trays 12TB, 12TD, 12CAU)	13.6%
FT3B3	Fire in Turbine Building 261' South (Trays 12TB, 12TD)	9.7%
BLOSP	Loss of Offsite Power – SBO	7.5%
FC11	Fire in Cable Spreading Room 250'	6.1%
FC31	Fire in Main Control Room	5.7%
BSCRAM	SCRAM Induced LOSP/SBO	5.0%
ASX	Loss of Instrument Air	4.7%
FT2B4	Fire in Turbine Building 250' South	3.0%
SEIS4	Earthquake (0.25g to 0.51g)	2.5%
FT2D1	Fire in Turbine Building 250' East	2.2%

Dominant Core Damage Sequences

Core Damage Sequence Description	Freq (/yr)
Fire in Turbine Building 261' (Trays 12TB, 12TD, 12CAU) and Operators fail to utilize East/West Instrument room for mitigation	2.1E-06
Fire in Turbine Building 261' (Trays 12TB, 12TD) and Operators fail to utilize East/West Instrument room for mitigation	1.5E-06
Cable spreading room fire causes SBO and DFP failure occurs	8.0E-07
Control room fire causes SBO and DFP failure occurs	6.6E-07
Instrument air fails, RPV overfill failure, failure of Feedwater, and failure to blowdown	6.0E-07
Earthquake (0.25g to 0.51g) and SMA success path failure	4.8E-07
Cable spreading room fire causes SBO and seal LOCA occurs	3.9E-07
Control room fire causes SBO and seal LOCA occurs	3.3E-07
Fire in Turbine Building 250' South causes SBO and DFP fails	2.7E-07
Fire in Turbine Building 250' East causes LOSP and PB-102 failure, PB-103 independently fails and DFP failure occurs	2.6E-07

Summary of Model U1 PRA01B with DG 102 failed and Compensating Measures In Place	
Internal and External Events CDF	2.9E-05/yr
Internal and External Events LERF	2.3E-06/yr
Shutdown CDF	Not Evaluated
Configuration Risk Management Tool	Safety Monitor

Initiator Contribution to CDF

Initiator ID	Initiator Description	% CDF Contribution
BLOSP	Loss of Offsite Power – SBO	22.4%
FT3B1	Fire in Turbine Building 261' South (Trays 12TB, 12TD, 12CAU)	11.7%
FT3B3	Fire in Turbine Building 261' South (Trays 12TB, 12TD)	8.4%
BSCRAM	SCRAM Induced LOSP/SBO	7.8%
ASX	Loss of Instrument Air	4.5%
SEIS4	Earthquake (0.25g to 0.51g)	3.2%
FC11	Fire in Cable Spreading Room 250'	2.3%
FC31	Fire in Main Control Room	2.3%
SEIS3	Earthquake (0.1g to 0.25g)	2.2%
BTT	Turbine Trip Induced LOSP/SBO	2.1%

Dominant Core Damage Sequences

Core Damage Sequence Description	Freq (/yr)
Fire in Turbine Building 261' (Trays 12TB, 12TD, 12CAU) and Operators fail to utilize East/West Instrument room for mitigation	2.3E-06
Fire in Turbine Building 261' (Trays 12TB, 12TD) and Operators fail to utilize East/West Instrument room for mitigation	1.7E-06
LOSP and operators fail to shed DC loads w/in 30 min, EDGs fail, EDG recovery fails, and offsite power recovery fails	1.2E-06
LOSP and EDGs fail, a seal LOCA occurs, EDG recovery fails, and offsite power recovery fails	7.8E-07
LOSP and EDGs fail, EDG recovery fails, offsite power recovery fails, and operators fail to utilize East/West Instrument room for mitigation	7.0E-07
LOSP and Div 1 DC fails, and a seal LOCA occurs	6.0E-07
Instrument air fails, RPV overfill failure, failure of Feedwater, and failure to blowdown	5.2E-07
LOSP and EDGs fail, operators fail to align DFP, EDG recovery fails, and offsite power recovery fails	4.8E-07
Earthquake (0.25g to 0.51g) and SMA success path failure	4.8E-07
Cable spreading room fire causes SBO and seal LOCA occurs	4.4E-07

Summary of Model U1 PRA01B with EDG-103 failed and Compensating Measures In-Place	
Internal and External Events CDF	3.4E-05/yr
Internal and External Events LERF	2.4E-06/yr
Shutdown CDF	Not Evaluated
Configuration Risk Management Tool	Safety Monitor

Initiator Contribution to CDF

Initiator ID	Initiator Description	% CDF Contribution
BLOSP	Loss of Offsite Power – SBO	27.1%
FT3B1	Fire in Turbine Building 261' South (Trays 12TB, 12TD, 12CAU)	9.7%
BSCRAM	SCRAM Induced LOSP/SBO	8.2%
FT3B3	Fire in Turbine Building 261' South (Trays 12TB, 12TD)	6.9%
BD1X	Loss of Div 1 DC Induced LOSP/SBO	3.8%
ASX	Loss of Instrument Air	3.7%
SEIS4	Earthquake (0.25g to 0.51g)	2.7%
FC23	Fire in Aux Control Room	2.5%
BTT	Turbine Trip Induced LOSP/SBO	2.2%
FC11	Fire in Cable Spreading Room 250'	1.9%

Dominant Core Damage Sequences

Core Damage Sequence Description	Freq (/yr)
Fire in Turbine Building 261' (Trays 12TB, 12TD, 12CAU) and Operators fail to utilize East/West Instrument room for mitigation	2.3E-06
Fire in Turbine Building 261' (Trays 12TB, 12TD) and Operators fail to utilize East/West Instrument room for mitigation	1.74E-06
LOSP and operators fail to shed DC loads w/in 30 min, EDGs fail, EDG recovery fails, and offsite power recovery fails	1.2E-06
LOSP and EDGs fail, a seal LOCA occurs, EDG recovery fails, and offsite power recovery fails	8.0E-07
LOSP and EDGs fail, EDG recovery fails, offsite power recovery fails, and operators fail to utilize East/West Instrument room for mitigation	7.1E-07
LOSP and Div 1 DC fails, and a seal LOCA occurs	6.5E-07
Instrument air fails, RPV overfill failure, failure of Feedwater, and failure to blowdown	6.0E-07
LOSP and Div 1 DC fails, and Operators fail to utilize East/West Instrument room for mitigation	5.81E-07
LOSP and EDGs fail, operators fail to align DFP, EDG recovery fails, and offsite power recovery fails	5.4E-07
LOSP and operators fail to shed DC loads w/in 15 min, EDG recovery fails, and offsite power recovery fails	5.0E-07

ATTACHMENT H

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

Tier 1: Probabilistic Risk Assessment (PRA) Study Results

Methodology and Acceptance Criteria

Regulatory Guides 1.174 and 1.177 describe the requirements for making risk-informed changes to the Technical Specifications (TSs). This evaluation provides the risk quantification inputs to these requirements. The following risk metrics were used to evaluate the risk impact of extending the diesel generator (DG) allowed outage time (AOT) for Nine Mile Point Unit 1 (NMP1) from 7 days to 14 days:

- ΔCDF_{Avg} = Change in the annual average Core Damage Frequency due to any increased online maintenance unavailability of a DG due to the TS change. This risk metric is used to compare against the criteria in Regulatory Guide 1.174.

- $\Delta LERF_{Avg}$ = Change in the annual average Large Early Release Frequency due to any increased online maintenance unavailability of a DG due to the TS change. This risk metric is used to compare against the criteria in Regulatory Guide 1.174.

- ICCDP = Incremental Conditional Core Damage Probability with a DG out of service for 14 days (the proposed DG AOT). This risk metric is used as recommended in Regulatory Guide 1.177 to determine whether the proposed TS change has an acceptable risk.

- ICLERP = Incremental Conditional Large Early Release Probability with a DG out of service for 14 days (the proposed DG AOT). This risk metric is used as recommended in Regulatory Guide 1.177 to determine whether the proposed TS change has an acceptable risk.

The ΔCDF_{Avg} due to the proposed change in DG AOT is estimated using the following equation:

(1) $$\Delta CDF_{Avg} = (T_{102}/T) * CDF_{102Out} + (T_{103}/T) * CDF_{103Out} + [1 - (T_{102} + T_{103})/T] * CDF_{Base} - CDF_{Base}$$

Where:

CDF_{102Out} = CDF estimated with the PRA model with DG 102 out of service (compensating measures and configuration risk management controls implemented).

CDF_{103Out} = CDF estimated with the PRA model with DG 103 out of service (compensating measures and configuration risk management controls implemented).

CDF_{Base} = Baseline annual average CDF with current (prior to proposed TS change) average unavailability of DGs.

T = Total fuel cycle time in operating days. The NMP1 fuel cycle is 24 months. In estimating a value for T, it was assumed the plant was in planned and unplanned outages for a total of 60 days during the 24 month fuel cycle. Thus, T = 670 days (2*365 – 60 = 670 days).

T_{102} = Total time per fuel cycle that DG 102 is out of service for the extended AOT. The 14-day TS value is conservatively used.

T_{103} = Total time per fuel cycle that DG 103 is out of service for the extended AOT. The 14-day TS value is conservatively used.

The $\Delta LERF_{Avg}$ due to the proposed change in DG AOT is estimated using the following equation:

(2) $$\Delta LERF_{Avg} = (T_{102}/T) * LERF_{102Out} + (T_{103}/T) * LERF_{103Out} + [1 - (T_{102} + T_{103})/T] * LERF_{Base} - LERF_{Base}$$

Where:

$LERF_{102Out}$ = LERF estimated with the PRA model with DG 102 out of service (compensating measures and configuration risk management controls implemented).

$LERF_{103Out}$ = LERF estimated with the PRA model with DG 103 out of service (compensating measures and configuration risk management controls implemented).

$LERF_{Base}$ = Baseline annual average LERF with current (prior to proposed TS change) average unavailability of DGs.

The acceptance criteria for change in CDF and LERF given in Regulatory Guide 1.174 are as follows:

< 1.0E-06 change in CDF is not risk-significant
< 1.0E-07 change in LERF is not risk-significant

ICCDP and ICLERP are calculated using the following equations, which are based on the definitions given in Regulatory Guide 1.177:

(3) $ICCDP_{102} = (CDF_{102Out} - CDF_{Base}) * (14\ days)$
(4) $ICCDP_{103} = (CDF_{103Out} - CDF_{Base}) * (14\ days)$
(5) $ICLERP_{102} = (LERF_{102Out} - LERF_{Base}) * (14\ days)$
(6) $ICLERP_{103} = (LERF_{103Out} - LERF_{Base}) * (14\ days)$

The acceptance criteria for ICCDP and ICLERP given in Regulatory Guide 1.177 are as follows:

$ICCDP < 5.0E\text{-}07$
$ICLERP < 5.0E\text{-}08$

Assumptions

The following are key assumptions in the PRA supporting the proposed extension of the DG AOT:

- The important compensating measures and configuration risk management controls assumed in the PRA evaluation are described in Section 2.3.5 of Attachment B.
- A 14-day outage of each DG is assumed to occur once per fuel cycle.
- A total of 60 days of planned and unplanned (forced) outage time per cycle is assumed.
- The NMP1-Nine Mile Point Unit 2 (NMP2) diesel driven firewater pumps (DFPs) and firewater cross-tie are assumed to be operable with either unit's DFP being capable of providing NMP1 reactor pressure vessel (RPV) feedwater injection.
- AC power recovery is credited as in the baseline PRA, except that the out of service DG is not allowed to be recovered.

Calculations

The following CDF and LERF values for an out of service DG were calculated with the NMP1 PRA (see Attachment G) and are required inputs to the risk metric calculations required by Regulatory Guides 1.174 and 1.177 using a 1E-12/yr truncation. Note that the calculations credit the compensating measures included in the PRA model as described in Sections 2.2.1 and 2.3.5 of Attachment B:

CDF_{102Out} = 2.9E-05/yr (DG 102 unavailable plus compensating measures)
CDF_{103Out} = 3.4E-05/yr (DG 103 unavailable plus compensating measures)
$LERF_{102Out}$ = 2.3E-06/yr (DG 102 unavailable plus compensating measures)

$LERF_{103Out}$ = 2.4E-06/yr (DG 103 unavailable plus compensating measures)

The following CDF and LERF baseline values (see Attachment G) and assumptions regarding DG unavailability are also required inputs to the risk metric calculations:

CDF_{Base} = 2.57E-05/yr (baseline average maintenance PRA model)
$LERF_{Base}$ = 2.18E-06/yr (baseline average maintenance PRA model)
T = 670 days (24 month fuel cycle minus 60 days of planned and unplanned outage time)
T_{102} = 14 days
T_{103} = 14 days

Substituting the above calculation inputs into Equations (1) through (6) results in the following risk metric values:

ΔCDF_{Avg} = 2.2E-07/yr (acceptance criteria is < 1.0E-06/yr)
$\Delta LERF_{Avg}$ = 7.7E-09/yr (acceptance criteria is < 1.0E-07/yr)
$ICCDP_{102}$ = 1.1E-07 (acceptance criteria is 5.0E-07)
$ICCDP_{103}$ = 3.2E-07 (acceptance criteria is 5.0E-07)
$ICLERP_{102}$ = 5.3E-09 (acceptance criteria is 5.0E-08)
$ICLERP_{103}$ = 9.6E-09 (acceptance criteria is 5.0E-08)

ATTACHMENT I

NINE MILE POINT NUCLEAR STATION, LLC

LICENSE NO. DPR-63

DOCKET NO. 50-220

Dominant Sequence and Loss of Offsite Power (LOSP) Events Tables

Table 1: DG 102 Core Damage Frequency (CDF) Sequences and Important Equipment and Human Actions

Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
1	BLOSP	2.1219E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG103, O15
2	BLOSP	2.1065E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OR1F*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG103, DFP
3	BLOSP	1.8503E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*OR1F*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG103, DFP, ERV
4	BLOSP	1.2077E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG103, DFP, RRSEAL
5	BLOSP	9.3723E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG103, RRSEAL
6	BLOSP	8.3993E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OSP8*EDG8*HRA4	CLASSIB	LOSP, EDG103, HRA
7	BLOSP	7.5732E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*OSP4*EDG4*HRAF	CLASSIB	LOSP, EDG103, O15
8	BLOSP	6.3042E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OR14*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG103, OR1
9	BLOSP	5.5377E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*OR13*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG103, OR1, ERV
10	SEIS3	3.7704E-008	COMP43*OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FPF*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	EDG103
11	BLOSP	3.6143E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG103, OR1, RRSEAL
12	FC12	3.3150E-008	KAF*KBF*A1F*B1F*B2F*A22*A3F*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC12, DFP
13	BLOSP	2.6614E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG103, DFP, O15

Table 1: DG 102 Core Damage Frequency (CDF) Sequences and Important Equipment and Human Actions					
Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
14	BSCRAM	2.5674E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*OSP2*EDG2*HRAF	CLASSIB	OG, EDG103, O15
15	BSCRAM	2.5488E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OR1F*OSP8*EDG8*HRAF	CLASSIB	OG, EDG103, DFP
16	BSCRAM	2.2389E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*OR1F*OSPF*EDG1*HRAF	CLASSIB	OG, EDG103, DFP, ERV
17	BLOSP	2.1068E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*O301*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG103, O15, ERV
18	BLOSP	2.1068E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG103, O15, ERV
19	SEIS4	1.6904E-008	COMP44*OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FPF*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	EDG103
20	FC12	1.5537E-008	KAF*KBF*A1F*B1F*B2F*A22*A3F*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*NSL1*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC12, RRSEAL
21	BSCRAM	1.4648E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF	CLASSIB	OG, EDG103, DFP, RRSEAL
22	FC24	1.4594E-008	NPRP1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC24, EDG103, DFP
23	BLOSP	1.3664E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OMU1*LTF*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG103, DFP, OMU
24	BLOSP	1.2286E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*NSL1*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG103, O15, RRSEAL
25	BSCRAM	1.1368E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OSP8*EDG8*HRAF	CLASSIB	OG, EDG103, RRSEAL
26	SEIS4	1.0939E-008	COMP34*COMP4F*OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FPF*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*ROF*SCF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	EDG103
27	BLOSP	1.0536E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OMU1*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG103, OMU
28	BLOSP	1.0326E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*NSL1*OR1F*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG103, DFP, ERV, RRSEAL
29	BSCRAM	1.0163E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OSP8*EDG8*HRA4	CLASSIB	OG, EDG103, HRA

Table 2: DG 103 CDF Sequences and Important Equipment and Human Actions					
Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
1	BLOSP	2.1219E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG102, O15
2	BLOSP	2.1065E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OR1F*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG102, DFP
3	BLOSP	1.8503E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*OR1F*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG102, DFP, ERV
4	BLOSP	1.2077E-007	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG102, DFP, RRSEAL
5	BLOSP	9.5966E-008	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*LC1F*OR1F*OSPF*EDGD*HRAF	CLASSIB	LOSP, BAT11, DFP
6	BLOSP	9.3723E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG102, RRSEAL
7	FC23	8.7237E-008	KAF*KBF*A1F*B1F*B2F*A2F*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC23, DFP
8	BLOSP	8.3993E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OSP8*EDG8*HRA4	CLASSIB	LOSP, EDG102, HRA
9	BLOSP	7.5732E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*OSP4*EDG4*HRAF	CLASSIB	LOSP, EDG102, O15
10	BLOSP	6.3042E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OR14*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG102, OR1
11	BLOSP	5.5377E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*OR13*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG102, ERV, OR1
12	BLOSP	4.2517E-008	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OSPF*EDGD*HRAF	CLASSIB	LOSP, BAT11, RRSEAL
13	FC23	4.0888E-008	KAF*KBF*A1F*B1F*B2F*A2F*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*NSL1*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC23, RRSEAL
14	BLOSP	3.8265E-008	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*LC1F*OSPF*EDGD*HRA4	CLASSIB	LOSP, BAT11, HRA
15	SEIS3	3.7704E-008	COMP43*OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FPF*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	EDG102
16	BLOSP	3.6143E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG102, RRSEAL
17	BLOSP	2.8721E-008	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*LC1F*OR14*OSPF*EDGD*HRAF	CLASSIB	LOSP, BAT11, OR1
18	BLOSP	2.6614E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG102, DFP
19	BSCRAM	2.5674E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*OSP2*EDG2*HRAF	CLASSIB	OG, EDG102, O15
20	BSCRAM	2.5488E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OR1F*OSP8*EDG8*HRAF	CLASSIB	OG, DFP
21	FC21	2.5444E-008	KAF*KBF*A1F*B1F*B2F*A2F*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC21, DFP

Table 2: DG 103 CDF Sequences and Important Equipment and Human Actions					
Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
22	BSCRAM	2.2389E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*OR1F*OSPF*EDG1*HRAF	CLASSIB	OG, EDG102, DFP, ERV
23	BLOSP	2.1068E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*O301*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG102, O15, ERV
24	BLOSP	2.1068E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG102, O15, ERV
25	BD1X	1.8313E-008	OG1*DAF*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*LC1F*OR1F*OSPF*EDGD*HRAF	CLASSIB	OG, DFP
26	SEIS4	1.6904E-008	COMP44*OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FPF*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	EDG102,
27	BLOSP	1.6797E-008	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*EC21*LC1F*OSPF*EDGD*HRAF	CLASSIB	LOSP, BAT11, EC
28	BLOSP	1.4679E-008	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*LC1F*OSPF*EDGB*HRAF	CLASSIB	LOSP, BAT11, O15
29	BSCRAM	1.4648E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF	CLASSIB	OG, EDG102, DFP, RRSEAL
30	FC24	1.4594E-008	NPRP1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC24, EDG102, DFP
31	BLOSP	1.3664E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OMU1*LTF*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG102, DFP, OMU
32	FC22	1.2381E-008	KAF*KBF*A1F*B1F*B2F*A2F*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*RVF*ODF*IAF*IBF	CLASSIA	FC22, DFP
33	BLOSP	1.2286E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*NSL1*OR1F*OSP2*EDG2*HRAF	CLASSIB	LOSP, EDG102, O15, RRSEAL
34	BLOSP	1.2044E-008	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*LC1F*OSPF*EDGC*HRAF	CLASSIB	LOSP, BAT11, O15
35	FC21	1.1926E-008	KAF*KBF*A1F*B1F*B2F*A2F*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*CNF*FWF*NSL1*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	FC21, RRSEAL
36	BSCRAM	1.1612E-008	OG1*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*LC1F*OR1F*OSPF*EDGD*HRAF	CLASSIB	OG, BAT11, DFP
37	BSCRAM	1.1368E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OSP8*EDG8*HRAF	CLASSIB	OG, EDG102, RRSEAL
38	SEIS4	1.0939E-008	COMP34*COMP4F*OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FPF*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*ROF*SCF*FWF*LTF*CR1F*CR2F*SUF*C1F*C2F*C3F*C4F*HIF*IAF*IBF*OR1F	CLASSID	EDG102
39	BLOSP	1.0536E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OMU1*OSP8*EDG8*HRAF	CLASSIB	LOSP, EDG102, OMU
40	BLOSP	1.0326E-008	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*NSL1*OR1F*OSPF*EDG1*HRAF	CLASSIB	LOSP, EDG102, DFP, ERV, RRSEAL
41	BSCRAM	1.0163E-008	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OSP8*EDG8*HRA4	CLASSIB	OG, EDG102, HRA

Table 3: DG 102 Large Early Release Frequency (LERF) Sequences and Important Equipment and Human Actions					
Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
1	CBLOSP	9.1224E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
2	CBLOSP	5.0120E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*O301*OSPF*EDG1*HRAF*OI1*IRF*GVF*SIC*TDC*RMF*ELF	EHGH	LOSP, EDG103, ERV, O15
3	CBLOSP	3.6722E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*NC3*RMF*ELF	EHGH	LOSP, EDG103, DFP, RRSEAL
4	CBLOSP	3.6722E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*RMF*ELF	EHGH	LOSP, EDG103, DFP, RRSEAL
5	CBLOSP	3.6697E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*O301*OSPF*EDG1*HRAF*OI1*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG103, ERV
6	CBLOSP	3.5620E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CX1*ELF	EHGH	LOSP, EDG103, DFP, RRSEAL
7	CBLOSP	3.1476E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*TD3*RMF*ELF	EHGH	LOSP, EDG103, DFP, RRSEAL
8	CBLOSP	2.8836E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*NSL1*OR1F*OSP2*EDG2*HRAF*OI1*IRF*GVF*SIC*TDC*RMF*ELF	EHGH	LOSP, EDG103, RRSEAL, O15
9	CBLOSP	2.7301E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG103, RRSEAL, OR1
10	CBLOSP	2.1113E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*NSL1*OR1F*OSP2*EDG2*HRAF*OI1*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG103, RRSEAL, O15
11	CBLOSP	1.6130E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*OSPF*EDG1*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG103, ERV, O15
12	CBLOSP	1.4223E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*IR6*GVF*SI6*RM4*ELF	EHGH	LOSP, EDG103, DFP, RRSEAL
13	CBLOSP	1.4223E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*IR6*GVF*SI6*NC3*RM4*ELF	EHGH	LOSP, EDG103, DFP, RRSEAL
14	CBLOSP	1.2987E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*OSPF*EDG1*HRAF*OI4*IRF*GVF*SI6*TD2*RMF*ELF	EHGH	LOSP, EDG103, ERV, O15
15	CBLOSP	1.2191E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*IR6*GVF*SI6*TD3*RM4*ELF	EHGH	LOSP, EDG103, DFP, RRSEAL
16	CALOSP	1.2139E-009	OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*QM1*SLF*SUF*NMF*SU2F*NM2F*C1F*C2F*C3F*C4F*ISF*NFF*RXF*SEF*TR8*RB6	EHGH	LOSP, EDG103
17	CBSCRA	1.1065E-009	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	OG, EDG103, DFP, RRSEAL
18	CBLOSP	1.0990E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*NC3*RMF*ELF	EHGH	LOSP, EDG103, RRSEAL, OR1
19	CBLOSP	1.0990E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*RMF*ELF	EHGH	LOSP, EDG103, RRSEAL, OR1
20	CBLOSP	1.0660E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*CX1*ELF	EHGH	LOSP, EDG103, RRSEAL, OR1

Table 3: DG 102 Large Early Release Frequency (LERF) Sequences and Important Equipment and Human Actions

Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
21	CBLOSP	1.0321E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*OMU1*LTF*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG103, DFP, OMU

Table 4: DG 103 LERF Sequences and Important Equipment and Human Actions					
Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
1	CBLOSP	9.1224E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
2	CBLOSP	5.0120E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*O301*OSPF*EDG1*HRAF*OI1*IRF*GVF*SIC*TDC*RMF*ELF	EHGH	LOSP, EDG102, ERV, O15
3	CBLOSP	3.7637E-009	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSPF*EDGB*HRAF*EIF*OI1*IRF*NFF*DCF*OPF*RXF*CEF	EHGH	LOSP, BAT11, DFP, RRSEAL
4	CBLOSP	3.6722E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*NC3*RMF*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
5	CBLOSP	3.6722E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*RMF*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
6	CBLOSP	3.6697E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*O301*OSPF*EDG1*HRAF*OI1*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG102, ERV, O15
7	CBLOSP	3.5620E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CX1*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
8	CBLOSP	3.1476E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*TD3*RMF*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
9	CBLOSP	2.8836E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*NSL1*OR1F*OSP2*EDG2*HRAF*OI1*IRF*GVF*SIC*TDC*RMF*ELF	EHGH	LOSP, EDG102, RRSEAL, O15
10	CBLOSP	2.7301E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG102, RRSEAL, OR1
11	CBLOSP	2.1113E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*O151*O301*NSL1*OR1F*OSP2*EDG2*HRAF*OI1*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG102, RRSEAL, O15
12	CBLOSP	1.6130E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*OSPF*EDG1*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG102, ERV, O15
13	CBLOSP	1.4869E-009	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*EC21*LC1F*OR1F*OSPF*EDGB*HRAF*EIF*OI1*IRF*NFF*DCF*OPF*RXF*CEF	EHGH	LOSP, BAT11, DFP, EC
14	CBLOSP	1.4223E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*IR6*GVF*SI6*RM4*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
15	CBLOSP	1.4223E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*IR6*GVF*SI6*NC3*RM4*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
16	CBLOSP	1.2987E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*RC1*O151*OSPF*EDG1*HRAF*OI4*IRF*GVF*SI6*TD2*RMF*ELF	EHGH	LOSP, EDG102, ERV, O15
17	CBLOSP	1.2191E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*IR6*GVF*SI6*TD3*RM4*ELF	EHGH	LOSP, EDG102, DFP, RRSEAL
18	CALOSP	1.2139E-009	OGF*OGRF*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*QM1*SLF*SUF*NMF*SU2F*NM2F*C1F*C2F*C3F*C4F*ISF*NFF*RXF*SEF*TR8*RB6	EHGH	LOSP, EDG102
19	CBLOSP	1.1264E-009	OGF*DA1*OGRF*KAF*KBF*A1F*B1F*B2F*A2F*D1F*A3B*A67F*A4F*A5F*R1F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSPF*EDGB*HRAF*EIF*OI1*IRF*NFF*DCF*OPF*RXF*CEF	EHGH	LOSP, BAT11, RRSEAL, OR1
20	CBSCRA	1.1065E-009	OG1*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F*W2F*W3F*W4F*WIAF*WIBF*NSL1*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	OG, EDG102, DFP, RRSEAL

Table 4: DG 103 LERF Sequences and Important Equipment and Human Actions					
Rank	Initiator	Frequency	Failed and Multi-State Split Fractions	Bin	Important Elements
21	CBLOSP	1.0990E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F *W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*NC3*RMF*ELF	EHGH	LOSP, EDG102, RRSEAL, OR1
22	CBLOSP	1.0990E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F *W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*SI6*RMF*ELF	EHGH	LOSP, EDG102, RRSEAL, OR1
23	CBLOSP	1.0660E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS*W1F *W2F*W3F*W4F*WIAF*WIBF*NSL1*OR14*OSP2*EDG2*HRAF*OI4*IRF*GVF*CX1*ELF	EHGH	LOSP, EDG102, RRSEAL, OR1
24	CBLOSP	1.0321E-009	OGF*OGR1*KAF*KBF*A1F*B1F*B2F*A22*A319*A67F*A4F*A5F*FP2*S1F*S2F*SAF*SBF*TWF*RWF*ASF*CWS* W1F*W2F*W3F*W4F*WIAF*WIBF*OMU1*LTF*OR1F*OSP2*EDG2*HRAF*OI4*IRF*GVF*CZ8*ELF	EHGH	LOSP, EDG102, DFP, OMU

Table 5: LOSP Related Events from Licensee Event Report (LER) Search				
LER	Summary	Mode	Impact	Cause
80-33	The loss of a 115 kV auxiliary power feed to an emergency power bus was experienced. The diesel generator (DG) automatically started.	Power Operation	Loss of one 115 Kv source to emergency bus No plant trip	Equipment
82-04	During 115 kV breaker exercising (South Oswego substation) a ground directional relay caused a breaker on the alternate 115 kV line (Lighthouse Hill substation) to open. The coincident opening of these breakers resulted in the LOSP and the start of both DGs.	Power Operation	Loss of both 115 kV sources No plant trip	Human (Plant)
82-05	The 115 kV line supplied from Lighthouse Hill was taken out of service for maintenance for approximately 5 hours on 2/8/82. The maintenance was to repair an open loop (see LER 82-04).	Power Operation	One 115 kV source unavailable No challenge	Maintenance
83-14	A 115 kV offsite power line was removed from service on 6/15, 6/16, 6/17, 6/20, and 6/21/83 for ten hours each day. The removal of the 115 kV line was to allow construction of a 115 kV line for Unit 2.	Power Operation	One 115 kV source unavailable No challenge	Maintenance
84-12	During a refuel outage, work was to be done on the breaker that supplies 4160 V power board 102. This required backfeeding powerboard 102 through 600 V powerboard 16. When the breaker for powerboard 102 was opened in preparation for the maintenance, the newly installed protective relays sensed the undervoltage on powerboard 102 and tripped the powerboard 16 tie breaker, resulting in a loss of power to powerboard 102 and a DG 102 start.	Refuel	Loss of one 115 kV source to emergency bus No plant trip	Maintenance
84-15	Calibration work was being performed on the powerboard 103 undervoltage relays. DG 103 and its output breaker were taken out of service for this work. Calibration work was then performed on the relays one at a time per procedure. Due to personnel error, the protective relaying was actuated, causing the 115 kV offsite source breaker to trip, de-energizing powerboards 103 and 17B, which caused approximately half of the plant's safety-related loads to become inoperable.	Power Operation	Loss of one 115 kV source to emergency buses No Plant Trip	Maintenance
87-18	A training department instructor noted that the 115 kV power failure special operating procedure was not included in the procedure index. A check by the operations department revealed that procedure had been removed from the control room master procedure file without proper review.	Startup	Non-event	NA
90-23	Experienced a LOSP, which resulted in the automatic start of DGs 102 and 103. The cause of the event was a phase imbalance detected on phases two and three of reserve transformer 101N.	Power Operation	Loss of both 115 kV sources No plant trip	Equipment (Plant)
93-07	Experienced a momentary LOSP that resulted in the automatic start of DGs 102 and 103. The cause of the event was two concurrent lightning strikes on both 115	Power Operation	Loss of both 115Kv sources	Weather

Table 5: LOSP Related Events from Licensee Event Report (LER) Search				
LER	Summary	Mode	Impact	Cause
	kV lines.		No plant trip	
01-01	Experienced a scram due to a main generator trip. The cause of the generator trip was a grid perturbation coupled with a malfunction of the negative phase sequence current relay due to a design flaw.	Power Operation	No loss of 115 kV source	NA
01-02	A 115 kV transmission line (Line 4) was declared inoperable due to a degraded voltage condition. It was determined that Line 4 could not provide the power required for a LOCA when Line 1 was out of service.	Power Operation	No loss of 115 kV source	NA