INDIANA MICHIGAN POWER
A unit of American Electric Power

Indiana Michigan Power
Cook Nuclear Plant
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March 18, 2005

AEP:NRC:5811
10 CFR 50.90

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

SUBJECT: Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
Partial Response to Request For Additional Information Regarding License Amendment Request to Extend the Allowed Outage Times for Emergency Diesel Generators, 69 kV Offsite Power Circuit, Component Cooling Water, and Essential Service Water (TAC Nos. MC4525 and MC4526)

REFERENCES:

1) Letter from J. N. Jensen, Indiana Michigan Power Company (I&M), to U. S. Nuclear Regulatory Commission (NRC) Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2 - Docket Nos. 50-315 and 50-316 - Extension of Allowed Outage Times for Emergency Diesel Generators, 69 kV Offsite Power Circuit, Component Cooling Water, and Essential Service Water," AEP:NRC:4811, dated September 21, 2004 (ML042780478).

2) Letter from C. F. Lyon, NRC, to M. K. Nazar, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Request for Additional Information Regarding License Amendment Request to Extend Allowed Outage Times (TAC Nos. MC4525 and MC4526)," dated January 18, 2005 (ML043650279).

3) Letter from C. F. Lyon, NRC, to M. K. Nazar, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Request for Additional Information Regarding License Amendment Request to Extend Allowed Outage Times (TAC Nos. MC4525 and MC4526)," dated February 25, 2005 (ML050490440).

Dear Sir or Madam:

By Reference 1, Indiana Michigan Power Company (I&M) proposed to amend Facility Operating Licenses DPR-58 and DPR-74 for Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2. I&M proposed changes to the CNP Unit 1 and Unit 2 Technical Specifications (TS) to permit extending allowed outage times (AOTs) from 72 hours to 14 days for an inoperable emergency diesel generator

A001

(EDG), an inoperable component cooling water (CCW) system loop, an inoperable essential service water (ESW) system loop, or an inoperable alternate offsite power circuit (69 kilovolt circuit).

As described in Reference 1, I&M has initiated a plant modification to install two permanent non-safety-related diesel generators in support of the proposed amendment. These supplemental diesel generators (SDGs) will be designed to provide a backup alternating current power source to either emergency bus in either Unit 1 or 2. The SDGs will have adequate capacity to power required safe shutdown loads in the event of a loss of offsite power and failure of the operable EDG. The SDGs will also be capable of supplying back-up power to the distributed ignition system (DIS) containment hydrogen igniters. Providing back-up power to the DIS may be required to resolve Nuclear Regulatory Commission (NRC) Generic Safety Issue 189, "Susceptibility of Ice Condenser and Mark III Containments to Failure from Hydrogen Combustion During a Severe Accident."

By References 2 and 3, the NRC transmitted requests for additional information regarding the amendment proposed by Reference 1. This letter provides I&M's response to questions 1, 7, 9, 10, 11, 12, 13, and 14 transmitted by Reference 2. I&M intends to provide responses to the remaining questions transmitted by Reference 2 and responses to Reference 3 in subsequent letters.

The proposed AOT extensions submitted by Reference 1 were supported, in part, by a risk evaluation. Subsequent to submittal of Reference 1, I&M identified a potential for alternative operational modeling of the CCW and ESW systems in that risk evaluation. Since use of alternative modeling would affect the results of the risk evaluation, I&M has elected to withdraw the requested changes to the CCW and ESW TS. I&M has also elected to reduce the scope of the proposed 69 kilovolt circuit AOT extension such that it will be a one-time allowance rather than a permanent TS change. New EDG and 69 kilovolt circuit TS pages will be provided in the separate letter responding to Reference 3.

Following identification of the potential alternative CCW and ESW modeling, I&M retained a contractor to enhance the Probabilistic Risk Assessment model to reflect the alternative modeling and to modify existing event trees to explicitly include the SDGs. I&M is recalculating the risk changes associated with the EDG AOT extension and the one-time 69 kilovolt circuit AOT extension. The recalculated values will be provided to the NRC in the response to the remaining questions transmitted by Reference 2.

Enclosure 1 to this letter provides an affirmation pertaining to the statements made in this correspondence. Enclosure 2 provides responses to the NRC questions listed above. The attachment to this letter contains a list of regulatory commitments made in this correspondence.

Enclosure 2 to the original amendment request transmitted by Reference 1 included an evaluation of significant hazards consideration performed in accordance with 10 CFR 50.92 and an environmental assessment performed in accordance with 10 CFR 51.22. The information provided in this letter, the withdrawal of the request for extended CCW and ESW AOTs, and the reduction in scope of the

69 kilovolt circuit extended AOT do not alter the validity of the original evaluation of significant hazards consideration for the remaining proposed changes. The environmental assessment provided in Enclosure 2 to Reference 1 also remains valid.

Should you have any questions, please contact Mr. John A. Zwolinski, Safety Assurance Director, at (269) 466-2428.

Sincerely,

J. N. Jensen
Site Vice President

Enclosures:

1. Affirmation
2. Partial Response to Nuclear Regulatory Commission Request for Additional Information

Attachment:

Regulatory Commitments

c: J. L. Caldwell, NRC Region III
K. D. Curry, Ft. Wayne AEP, w/o enclosures/attachment
J. T. King, MPSC
C. F. Lyon, NRC Washington, DC
MDEQ – WHMD/HWRPS
NRC Resident Inspector

**Enclosure 1 to AEP:NRC:5811**

**AFFIRMATION**

I, Joseph N. Jensen, being duly sworn, state that I am Site Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this request with the Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

Indiana Michigan Power Company

Joseph N. Jensen
Site Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 18th DAY OF March, 2005

Notary Public

My Commission Expires 6/10/2007

**Enclosure 2 to AEP:NRC:5811**

**Partial Response to Nuclear Regulatory Commission Request for Additional Information**

Documents referenced in this attachment are identified on Pages 18.

By Reference 1, Indiana Michigan Power Company (I&M) proposed to amend Facility Operating Licenses DPR-58 and DPR-74 for Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2. I&M proposed changes to the CNP Unit 1 and Unit 2 Technical Specifications (TS) to permit extending allowed outage times (AOTs) from 72 hours to 14 days for an inoperable emergency diesel generator (EDG), an inoperable component cooling water (CCW) system loop, an inoperable essential service water (ESW) system loop, or an inoperable alternate offsite power circuit (69 kilovolt circuit). References 2 and 3 transmitted Nuclear Regulatory Commission (NRC) requests for additional information regarding the proposed amendment. This enclosure provides I&M's response to questions 1, 7, 9, 10, 11, 12, 13, and 14 transmitted by Reference 2.

**NRC Question 1**

*The qualitative assessment of fire risk provided in Section 4.2.5 of the license amendment request dated September 21, 2004, does not provide an acceptable basis for concluding the risk of the proposed essential service water (ESW) and component cooling water (CCW) allowed outage time (AOT) extensions is "small" as discussed in Regulatory Guide (RG) 1.174. Provide a quantitative fire risk assessment for the proposed ESW and CCW AOT extensions, including delta core damage frequency (CDF), large early release frequency (LERF), incremental conditional core damage probability (ICCDP) and incremental conditional large early release probability (ICLERP). (RG 1.174, section 2.2.4; RG 1.177, section 2.3)*

*For example, a simplified confirmatory calculation performed by the staff using information available in the Donald C. Cook (CNP) individual plant examination (IPE) for severe accident vulnerabilities and individual plant examination of external events (IPEEE) for severe accident vulnerabilities submittals indicates an ICCDP of 7.6E-6 from fire scenarios when East ESW is out of service for 14 days. A similar calculation shows an ICCDP from fires of about 2.5E-6 when East CCW is out of service for 14 days. The staff's simplified confirmatory estimate of the increase in CDF from fires is on the order of 1.3E-5, which is in Region I of RG 1.174.*

*A quantitative estimate must be provided in this area. Please note that the staff's example is meant to illustrate that fires are potentially important when evaluating the risk from the proposed license amendment; it is not meant to be a comprehensive study nor to specify or suggest the methodology or approach to be used in I&M's risk assessment.*

*See the table on the following page for staff's simplified confirmatory example calculation of ICCDP for the East ESW out of service.*

*[Table not included in this letter]*

**I&M Response to NRC Question 1**

This question pertains to the proposed changes to the CCW system and ESW system AOTs. As described in the transmittal letter for this enclosure, I&M is withdrawing the proposed changes to the CCW and ESW AOTs. Therefore, no further response to NRC Question 1 is provided.

**NRC Question 7**

*Describe the process for maintaining the D. C. Cook PRA models current. What processes or controls were used to ensure the quality of the risk assessment provided in the submittal? Address measures used to ensure that the SDGs [supplemental diesel generators] were appropriately modeled in the PRA for this analysis. (RG 1.174, Section 2.2.3; RG 1.177, Section 2.3)*

**I&M Response to NRC Question 7**

Probabilistic Risk Assessment (PRA) model updates have been performed regularly since the initial submittal of the individual plant examination (IPE) in 1992. The following table shows the updates that have been performed.

| Date of Revision | Reason for Revision |
|---|---|
| May 1992 | Submittal of initial IPE. |
| June 1994 | Updated data analysis. |
| October 1995 | Revised human reliability analysis methodology. |
| May 1996 | Updated data analysis. |
| August 1997 | Converted to Top Logic model. |
| June 2001 | Major revision.* |
| October 2003 | Resolution of WOG Certification A & B F&Os. |

* The 2001 PRA model update scope included new plant-specific data, procedure and/or design changes, revision of the treatment of common cause failures to comply with the latest methodology, and removal of conservative assumptions and simplifications.

All PRA system notebooks and other supporting documentation are controlled in accordance with site procedures, utilizing the CNP document control system. Full revisions of PRA system notebooks are prepared, reviewed, and approved by different individuals. When potential model issues are identified, they are entered into the CNP corrective action program (CAP) to assure they are tracked to resolution. If a CAP item results in one or more minor revisions to any notebook, it is effected using a change sheet that requires preparation, review, and approval by different individuals. Model quantification is documented as a calculation in accordance with the CNP calculation procedure. This approach assures that a controlled copy of the PRA model files can be retrieved from the CNP document control system, since the model files are copied to a compact disk that is included in the base PRA model calculation.

A similar approach was taken to assure the quality of the risk evaluation supporting the proposed amendment. Initial PRA calculations with an independent preparer and reviewer were performed and reviewed by a contracted company. These calculations were accepted by I&M in accordance with the CNP owner acceptance procedure. Final PRA calculations to create the PRA information included in the submittal were performed by I&M personnel. The evaluation by I&M personnel was documented in accordance with the CNP calculation procedure. Also, controlled copies of the PRA model files supporting this calculation were copied to a compact disk and sent with the calculation to the CNP Nuclear Document Management department for long-term retention.

To assure that the SDGs were appropriately included in the PRA model used for the risk evaluation supporting the proposed amendment, meetings were held in which PRA modeling assumptions were discussed with representatives of the engineering design team, project management, Operations, and Licensing. These meetings were supplemented by electronic correspondence that described PRA modeling issues regarding the design and operation of the SDGs.

**NRC Question 9**

*Does the D. C. Cook PRA model credit repair or recovery of EDGs, the ESW system, or the CCW system? If "yes": (RG 1.177, Section 2.3.4.2)*

a. *Calculate the change in Unit 1 and Unit 2 CDF and LERF using repair/recovery curves updated to reflect the anticipated mean-time-to-repair for EDGs, ESW and CCW assuming approval of the extended AOTs and justify the appropriateness of these repair time estimates, given that the intent, at least partly, of the extended AOTs is to allow extensive maintenance activities (e.g., complete tear down of an EDG). Alternately, a bounding sensitivity may be performed assuming no recovery or repair is credited for the portion of the EDG, ESW, and CCW unavailability attributable to the extended AOT.*

b. *Calculate the Unit 1 and Unit 2 ICCDP and ICLERP assuming no recovery or repair is credited for the out-of-service EDG, ESW system, or CCW system.*

c. *Describe how EDG, ESW, or CCW recovery or repair is credited in the 10 CFR 50.65 (a)(4) risk assessment when the plant configuration includes an out-of-service EDG, ESW train, or CCW train, respectively?*

**I&M Response to NRC Question 9**

The CNP PRA model does not allow any credit for repair or recovery of any component within an EDG component boundary. Recoverable failures in support systems for the EDGs are not allowed during the EDG mission time. No response has been provided with respect to ESW and CCW systems because the proposed ESW and CCW AOT extensions have been withdrawn. No

response has been provided to subparts a, b, and c of NRC Question 9 because the response to the primary question was not "yes."

**NRC Question 10**

*Discuss and provide information on the reliability and availability of offsite power sources relating to the proposed change. Provide the basis for the loss of offsite power (LOOP) frequencies and non-recovery probabilities used in the PRA models. Were they adjusted to reflect the Northeast blackout of August 2003? If not, why not? How is the potential for loss of offsite power given a non-LOOP initiating event (e.g., "consequential LOOP") modeled in the D. C. Cook PRA models? (RG 1.174, section 2.2.2; RG 1.177 Section 2.3)*

**I&M Response to NRC Question 10**

Each portion of NRC Question 10 has been addressed individually below.

*Discuss and provide information on the reliability and availability of offsite power sources relating to the proposed change.*

The CNP switchyard and transmission and distribution system have historically exhibited high reliability and availability since the units were placed in service. CNP has not experienced a single-unit or dual-unit total LOOP event since the units began commercial operation (Unit 1-August 1975, Unit 2-July 1978). Partial LOOPs during the period from 1997 through 2004 were identified on Page 5 of Enclosure 2 to the original amendment request (Reference 1). Partial LOOPs prior to 1997 occurred on February 4, 1978 (due to snow and ice), February 1, 1986 (due to a fault in the unit auxiliary transformer), and May 12, 1991 (due to a main generator voltage regulator failure). Since the CNP normal operating configuration is to power the safety busses from the main generator, the May 12, 1991, event resulted in the safety busses being transferred to the EDGs. However, offsite power remained available throughout the event and powered reactor coolant pumps and balance of plant equipment. Operators transferred the safety busses to the offsite power supply once the cause of the event was determined. This event was not identified as a LOOP in Reference 4 and has not been considered to be a LOOP from a PRA perspective.

There are several measures established to assure the continued reliability and availability of offsite power supplies. Regulation 10 CFR 50.65 requires licensees to assess and manage the increase in risk that may result from proposed maintenance activities before performing the activities. As part of normal risk evaluations performed pursuant to 10 CFR 50.65, I&M has imposed limitations and restrictions concerning all maintenance activities associated with the switchyard and offsite power systems. Regulation 10 CFR 50.65 also requires licensees to monitor the performance or condition of structures, systems, or components against established goals. The 10 CFR 50.65 goals and availability data for the preferred and alternate offsite power supplies is provided on Page 4 of Enclosure 2 to Reference 1.

Maintenance activities associated with the CNP switchyard and related offsite power systems are also governed by a proceduralized inter-organizational agreement with the transmission and distribution organization. This agreement establishes responsibilities and lines of communication for the various organizations responsible for the operation, maintenance, and engineering of the switchyard, transmission, and distribution facilities associated with CNP. This agreement also provides the guidance to ensure that organizations responsible for operation, maintenance, and engineering of these facilities consider the impact of their activities on CNP and on the transmission system.

During an extended EDG AOT, specific compensatory measures will be established to enhance the reliability of the offsite power supply. Compensatory measures, such as those pertaining to weather conditions and elective switchyard maintenance, were identified on Page 16 of Enclosure 2 to Reference 1.

*Provide the basis for the loss of offsite power (LOOP) frequencies and non-recovery probabilities used in the PRA models.*

LOOP Frequencies

The LOOP initiating event at CNP (referred to internally as a Loss of Offsite Power (LOSP) event) is categorized in the PRA as a complete loss of offsite power accompanied by a turbine trip. Following the initial loss of power, at least one EDG would, by definition, come on line to supply electrical power. Events in which both EDGs fail are included under the station blackout event. Because of the possibility of offsite power unit crossties, the LOOP initiator is divided into a single unit LOOP and a dual unit LOOP. The LOOP frequency used in the PRA model was determined in accordance with the applicable section from the CNP Internal Initiating Events Analysis Notebook. This section is restated below.

4.10 Calculation Of Loss Of Offsite Power (LOSP) Frequency

Reference U4 ["Losses of Off-site Power at U.S. Nuclear Power Plants - Through 1997," EPRI TR-110398, April 1998.] provides data and frequencies of loss of offsite power events at U.S. nuclear power plants for the time period 1984 through 1997. For the Cook Station, with its ability to crosstie systems between units it is necessary to consider separately initiators which affect only a single unit and those that affect both units. The data in Reference U4 was reviewed and the single unit and multiple unit events were identified for the historical data for all multiple unit sites. Since hurricanes and salt spray were contributors to several losses of offsite power and they do not occur at the Cook plant, losses of off-site power caused by these events were removed from consideration. The tabulation of these events is provided in Appendix D. This information was used to develop a generic prior distribution for each initiator using a noninformative prior distribution for constant failure rates (Ref. U13 [PRA Procedures Guide, "NUREG/CR-2300, American Nuclear Society and the Institute of Electrical and Electronics Engineers", January 1983]). The error

factor was taken to be the square root of the ratio of the 95 percentile to 5 percentile values. Cook data was then used to update this prior to obtaining the values used in the analysis. The inputs and results of this analysis are given below. Note that the number of events for a dual unit LOSP is the total number of units involved since the frequency is per unit year.

| | Single Unit LOSP | Dual Unit LOSP |
|---|---|---|
| Number of events | 27 | 8 |
| Number of unit years | 1002.3 | 1002.3 |
| Prior mean frequency | 2.69E-02 per calendar year | 7.98E-03 per calendar year |
| Prior Error Factor | 1.37 | 1.78 |
| Cook Events | 0 | 0 |
| Cook Calendar years | 9.36 | 9.36 |
| Updated Frequency | 2.67E-02 per calendar year | 7.91 E-03 per calendar year |
| Error Factor | 1.37* (3.5) | 1.78* (5) |

* The calculated error factors do not account for uncertainty associated with plant to plant and site to site variations. These factors would increase the uncertainty significantly. Because of this, the error factors for single and dual unit LOSPs were judgmentally increased to 3.5 and 5, respectively. These are in line with those given in NUREG/CR-5750 (Ref. U1).

Non-Recovery Probabilities

The non-recovery probabilities (probabilities of the failure to recover offsite power) are described in the CNP Miscellaneous Systems Notebook. The applicable section and figure are restated below.

2.9 XHR – Failure To Recover Offsite Power

Application

Station Blackout (SBO)

Description

After a loss of offsite power and subsequent failure of emergency onsite power (the diesel generators) a station blackout occurs and the timing of the recovery of offsite power plays an important roll in the probability of core damage. The Internal Initiating Events Notebook (Reference U7 [PRA-NB-INIT, "Internal Initiating Events Analysis Notebook," Revision 3, Donald C. Cook Nuclear Plant, American Electric Power Nuclear Generating Group, October 2003]) developed the frequency of the loss of offsite power for two situations; loss to a single unit and loss to both units. These frequencies were based on a review of LOSP data for two unit sites with severe weather occurrences of LOSP not applicable to the Cook site

(e.g. hurricanes) excluded. The same data is used here to determine the probability of not recovering offsite power at the times modeled in the SBO event trees.

Analysis

Tabulated below are the single and dual unit loss of offsite power data from Appendix D of Reference U1 sorted in order of decreasing time of offsite power recovery.

| **Plant** | **Duration** (Hours) |
|---|---|
| Single Unit LOSP | |
| Palo Verde 2 | 18.97 |
| Byron | 12 |
| Nine Mile Point 1 | 5.92 |
| Zion | 4 |
| Vogtle | 2.33 |
| Catawba | 2 |
| Brunswick 2 | 1.5 |
| Oconee | 0.95 |
| Indian Point 3 | 0.7 |
| McGuire 1 | 0.66 |
| Diablo Canyon 2 | 0.63 |
| Nine Mile Point 2 | 0.6 |
| Quad Cities | 0.58 |
| Diablo Canyon 1 | 0.5 |
| Indian Point 3 | 0.5 |
| Indian Point 3 | 0.5 |
| McGuire 2 | 0.5 |
| Palo Verde | 0.4 |
| McGuire 1 | 0.33 |
| LaSalle | 0.25 |
| Turkey Point 3 | 0.25 |
| Turkey Point 3 | 0.25 |
| Palo Verde 1 | 0.2 |
| Susquehanna | 0.18 |
| Nine Mile Point 2 | 0.15 |
| Dresden 2 | 0.08 |
| San Onofre | 0.07 |
| | |
| Dual Unit LOSP | |
| Prairie Island | 5 |
| Turkey Point 3&4 | 2.08 |
| Calvert Cliffs | 1.97 |
| Beaver Valley | 0.25 |

This information is plotted in Figure 1 along with a lognormal fit to the data. The lognormal was chosen based on the analysis of Reference U10 [PRA-NB-ESW, "Essential Service Water System Notebook," Revision 2, Donald C. Cook Nuclear Plant, American Electric Power Nuclear Generating Group, October 2003]. This was done by operating on Ln [lognormal] (recovery time) using MS Excel. (See Reference U11 [PRA-NB-CCW, "Component Cooling Water System Notebook," Revision 2, Donald C. Cook Nuclear Plant, American Electric Power Nuclear Generating Group, October 2003]). First, the mean and standard deviation were determined and then the complementary cumulative probability (the probability of nonrecovery) was found. The parameters of the distributions are:

| | Mean of Ln of recovery time | Mean (hours) | Standard Deviation of Ln of recovery time |
|---|---|---|---|
| Single Unit LOSP | -0.414 | 0.661 | 1.388 |
| Dual Unit LOSP | 0.408 | 1.504 | 1.270 |

The resulting values for the nonrecovery probabilities are:

| XHR* | Time Hours | Single Unit LOSP | | Dual Unit LOSP | |
|---|---|---|---|---|---|
| | | Nonrecovery Probability | Error Factor | Nonrecovery Probability | Error Factor |
| XH1/XH6 | 8 | 0.0362 | 3.3 | 0.0942 | 5 |
| XH2/XH7 | 7 | 0.0445 | 3.3 | 0.113 | 5 |
| XH3/XH8 | 6 | 0.0560 | 3.3 | 0.138 | 5 |
| XH4/XH9 | 5 | 0.0725 | 3.3 | 0.172 | 5 |
| XH5/XH10 | 1 | 0.383 | 1.6 | 0.626 | 1.5 |

* Single unit LOSP/Dual Unit LOSP

While there is very little data for a dual unit LOSP, the results are consistent with what would be expected, longer recovery times and higher nonrecovery probabilities than the single unit LOSP values.

As can be seen from the data above and a review of Figure 1, there is very little data on recovery times for two unit stations, however the lognormal fit to the data tends to be conservative. Review of the above information and the information in Reference U10 indicates that a 50% increase in the mean single unit LOSP recovery time and a factor of 3 increase in the dual unit LOSP produces nonrecovery probabilities that could be considered as conservative estimates of the 95 percentile values. This information was then used to estimate the lognormal error factors in the table above.

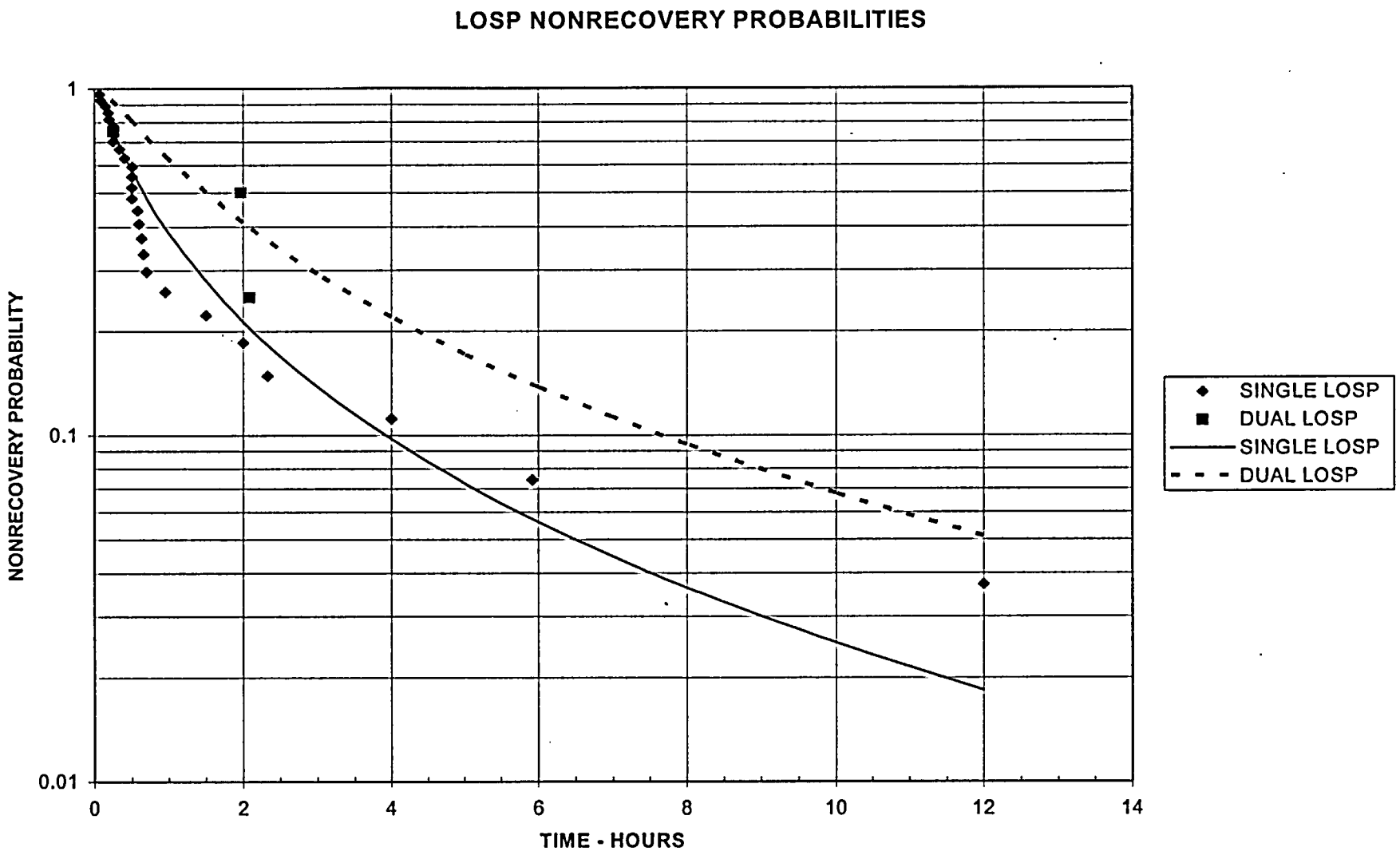
LOSP NONRECOVERY PROBABILITIES
NONRECOVERY PROBABILITY
1
0.1
0.01
0
2
4
6
8
10
12
14
TIME - HOURS
SINGLE LOSP
DUAL LOSP
SINGLE LOSP
DUAL LOSP

Figure 1

*Were they adjusted to reflect the Northeast blackout of August 2003? If not, why not?*

The LOOP frequencies and non-recovery probabilities used in the PRA models to support the proposed amendment have not been adjusted to reflect the Northeast blackout of August 2003. A basis for not adjusting the LOOP frequencies and non-recovery probabilities is provided below.

The CNP PRA LOOP initiating event frequencies provided above are based on data through 1997. The following revised point estimates for LOOP frequencies are based on the latest Electric Power Research Institute (EPRI) technical report (Reference 5), which includes EPRI data from 1994 through 2003.

**Revised LOOP Initiating Event Point Estimates Based on 1994-2003 EPRI Data**

| | Single Unit LOSP | Dual Unit LOSP |
|---|---|---|
| Number of events | 32 | 4 |
| Number of unit years | 1456.7 | 1456.7 |
| Prior mean frequency | 2.20E-02 per calendar year | 2.75E-03 per calendar year |

Compared to the previous point estimates provided in the section titled "LOOP Frequencies" above, there is a slight decrease in the initiating event frequencies if the later data are used. However, the revised estimates based on the EPRI report do not account for the August 2003 blackout. The addition of a single event to account for the August 2003 blackout yields the following results:

**Revised LOOP Initiating Event Frequency Point Estimates Based on 1994-2003 EPRI Data Including an Event to Account for the August 2003 Blackout**

| | Single Unit LOSP | Dual Unit LOSP |
|---|---|---|
| Number of events | 33 | 5 |
| Number of unit years | 1456.7 | 1456.7 |
| Prior mean frequency | 2.27E-02 per calendar year | 3.43E-03 per calendar year |

Although the revised point estimates with an additional event to account for the August 2003 blackout exhibit a slight increase in the initiating event frequency, the results are still less than the results provided in the CNP Internal Initiating Events Analysis Notebook.

In addition, the LOOP initiating frequency estimates used in support of the license amendment request compare favorably to the results of NUREG/CR-INEEL/EXT-04-02326 (Reference 6), which also includes the August 2003 blackout event. Table D-1 of Reference 6 shows the plant specific LOOP frequencies for critical operation for each CNP unit as:

CNP Unit 1: 3.10E-02/reactor critical year

CNP Unit 2: 3.07E-02/reactor critical year

Considering the uncertainties in the above statistics, the difference between an estimation of 2.7 LOOP events in 100 years (current LOOP initiating event frequency) and an estimation of 3.1 LOOP events in 100 years is considered to be insignificant.

*How is the potential for loss of offsite power given a non-LOOP initiating event (e.g., "consequential LOOP") modeled in the D. C. Cook PRA models?*

The potential for a LOOP given a non-LOOP initiating event (e.g., "consequential LOOP") is modeled in the CNP 4160 volt and 600 volt PRA notebook. The applicable item is restated below.

Section 4.0, Item number 22

The probability that offsite power will fail in the 24 hours subsequent to a reactor trip is modeled with basic events LOSP-24 (Unit 1), LOSP2-24 (Unit 2), and DLOSP-24 (Dual Unit Loss). The value of these events is calculated by dividing the initiating event frequency from Reference U7 [PRA-NB-INIT, "Internal Initiating Events Analysis Notebook," Revision 3, Donald C. Cook Nuclear Plant, American Electric Power Nuclear Generating Group, October 2003] by 8760 hours per year and multiplying the result by 24 hours. The resulting values are:

LOSP-24 = [(2.7E-02/yr) / (8760 hours/year)] * 24 hours

LOSP-24 = 7.4E-05.

LOSP2-24 = [(278E-02/yr) [correct value = 2.7E-02/yr] / (8760 hours/year)] * 24 hours

LOSP2-24 = 7.4E-05.

DLOSP-24 = [(7.9E-03/yr) / (8760 hours/year)] * 24 hours

DLOSP-24 = 2.2E-05.

**NRC Question 11**

*Section 4.2.1 of the submittal states: "Structural modifications were made to the CNP PRA model to support the addition of the SDGs. These modifications ... provide the foundation for adding the SDGs to the on-line risk-monitoring program using Safety Monitor ™." (RG 1.174, section 2.3; RG 1.177, section 2.3)*

a. *Will the Safety Monitor ™ be updated to include SDG credit prior to implementing the extended AOT for the EDG, ESW, or CCW systems?*

b. *Will 10 CFR 50.65 (a)(4) risk assessments take into account the availability of the SDGs?*

c. *Will the SDGs be credited as "available" for more than one unit at a time? If "yes," how will the credit be partitioned between units during periods when an extended AOT is employed for the EDG, ESW, or CCW system?*

**I&M Response to NRC Question 11**

a. The Safety Monitor ™ model will be updated to include the SDGs prior to use of the extended AOT for the EDGs.

b. The Safety Monitor ™ model is used to perform 10 CFR 50.65(a)(4) risk assessments. This will assure that the 10 CFR 50.65 (a)(4) risk assessments take into account the availability of the SDGs.

c. The SDGs will not be credited as "available" for extending an EDG AOT in more than one unit at a time. This restriction will be included in the Bases changes associated with the proposed TS changes.

**NRC Question 12**

*Section 4.1 of the submittal states: "Also, I&M intends to restrict elective maintenance activities on the SDGs during the time they are used to support an extended AOT." In Section 4.2.2 of the submittal, it states that the risk calculations credit availability of the SDGs for extended AOTs of the EDG, CCW or ESW systems. Please clarify whether this calculation input is an "intention" or a commitment. (RG 1.174, section 2.3; RG 1.177, section 2.3)*

**I&M Response to NRC Question 12**

I&M commits to designate the SDGs as guarded equipment when they are credited as available for extending an EDG AOT. The CNP on-line risk procedure requires that any work activity in a guarded equipment area be reviewed to determine if the activity may cause an adverse impact on the guarded equipment. If the activity is determined to result in an adverse impact, the work may not proceed unless two individuals qualified to perform risk assessments using the Safety

Monitor ™ configuration risk management software determine the risk to be acceptable. This process would preclude performance of elective maintenance on the SDGs when they are credited as available for extending an EDG AOT.

**NRC Question 13**

*Will the SDGs be in the D. C. Cook Maintenance Rule Program? How will the "... one and one third days of unavailability per SDG ..." assumed in the analysis be tracked? How will the availability of the SDGs be determined prior to entering an extended AOT for the EDG, CCW, or ESW system? (RG 1.174, section 2.3; RG 1.177, section 2.3)*

**I&M Response to NRC Question 13**

The SDGs will be included in the CNP Maintenance Rule Program prior to crediting them as available for extending an EDG AOT. The CNP Maintenance Rule Program is based on NUMARC 93-01 (Reference 7), as approved by Regulatory Guide 1.160 (Reference 8). The program establishes performance criteria, including unavailability criteria, for component functions included in the program. The performance criteria are based on expected maintenance activities, generic industry and vendor inputs, engineering analysis, and PRA inputs. The maintenance rule procedure for establishing performance criteria states that criteria should be established consistent with the modeling in the PRA, if the function is modeled in the assessment. The procedure also states that, if the performance criteria values established exceed the PRA modeled values, analysis must be performed to determine the effects of the criterion on the plant baseline PRA values. These provisions will assure consistency between the established unavailability criteria and the PRA modeled values.

Continued SDG availability will be verified quarterly by the performance of load testing. Automatic separation of the bus powered by the SDGs (4 kilovolt Bus 1) from the 69 kilovolt alternate offsite circuit will be tested once per 18 months. The verifications to be performed prior to entering an extended AOT are stated in the Bases changes transmitted by Reference 1. These Bases changes require 1) verifying the SDG equipment is mechanically and electrically ready for automatic operation; 2) verifying 24-hour on-site fuel supply is available for each SDG, and 3) ensuring the SDGs are aligned to automatically supply power to 69 kilovolt substation 4.16-kV Bus 1.

**NRC Question 14**

*As discussed with Mr. Waters, et al., of your staff in a telephone conversation on November 23, 2004, please address the traditional engineering criteria and defense-in-depth factors included in Section 2 of RG 1.174.*

**I&M Response to NRC Question 14**

The proposed amendment is consistent with the defense-in-depth philosophy as described in Regulatory Guide 1.174 (Reference 9). As stated in Regulatory Guide 1.174, Section 2.2.1.1, "Defense in Depth:"

*The engineering evaluation should evaluate whether the impact of the proposed LB [licensing basis] change (individually and cumulatively) is consistent with the defense-in-depth philosophy. In this regard, the intent of the principle is to ensure that the philosophy of defense in depth is maintained, not to prevent changes in the way defense in depth is achieved. The defense-in-depth philosophy has traditionally been applied in reactor design and operation to provide multiple means to accomplish safety functions and prevent the release of radioactive material.*

As described below, the proposed amendment maintains the defense in depth philosophy by continuing to ensure that, during an extended EDG AOT, multiple sources of electrical power (SDG, preferred offsite power, alternate offsite power, and opposite train EDG) are available to support components needed to accomplish safety functions and prevent the release of radioactive material.

SDGs

The SDGs will provide additional defense-in-depth by providing another source of emergency power. The combined capacity of both SDGs will exceed that of an EDG. The SDGs will be periodically load tested. The proposed TS change requires that the SDGs be verified available prior to entering an extended EDG AOT. The TS Bases change requires that the availability of the SDGs be re-verified periodically during the extended EDG AOT. The proposed TS change also requires that the AOT revert to 72 hours if either of the SDGs were to become unavailable during an extended EDG AOT.

The SDGs' design also provides a high degree of independence and diversity. The SDGs will be provided by a different vendor than the EDGs. The SDG units will be self-contained, requiring no external support systems except for fuel replenishment. Power to SDG controllers in the control rooms will be provided by the Technical Support Center uninterruptible power supply. The Bases change associated with the proposed amendment requires verification that the SDGs have a 24-hour fuel supply. This duration is consistent with other plants that credit similar non-safety related supplemental power supplies to support extended EDG AOTs. The SDGs will be protected against the effects of likely weather related events that could challenge the offsite power supply.

Preferred and Alternate Offsite Power Circuits

The reliability of the preferred (345 kilovolt and 765 kilovolt) and alternate (69 kilovolt) offsite circuits is unaffected by the proposed EDG AOT extension allowance. These circuits will remain as the primary and backup sources of offsite power to safety and non-safety

related components during an extended EDG AOT. The compensatory measures identified on Page 16 of Enclosure 2 to Reference 1 will provide added assurance that the preferred and alternate offsite circuits remain operable during an extended EDG AOT. The existing TS requirements for inoperable preferred and/or alternate offsite circuits are unaffected by the proposed EDG AOT extension allowance. These TS requirements would preclude continued unit operation if the preferred or alternate offsite circuit were to become inoperable during the extended EDG AOT.

Opposite Train EDG

The reliability of the opposite train EDG is unaffected by the proposed amendment. The opposite train EDG will remain as a source of emergency onsite power to a redundant train of safety and non-safety related components during an extended EDG AOT. The compensatory measures identified on Page 16 of Enclosure 2 to Reference 1 will provide added assurance that support systems for the opposite train EDG remain operable prior to an extended EDG AOT. The existing TS requirements for simultaneous inoperable EDGs are unaffected by the proposed amendment. These TS requirements would preclude continued unit operation if the opposite train EDG were to become inoperable during the extended EDG AOT.

Section 2.2.1.1 of Regulatory Guide 1.174 also states that defense-in-depth consists of a number of elements. These elements are restated below, followed by a description of how they are maintained by the proposed amendment.

*Consistency with the defense-in-depth philosophy is maintained if:*

*A reasonable balance among prevention of core damage, prevention of containment failure, and consequence mitigation is preserved.*

The proposed amendment will not change the balance among these protection attributes. There will be no change to the allocation of power from the preferred offsite circuit, the alternate offsite circuit, and the EDGs, among the components needed to prevent core damage, prevent containment failure, and mitigate the consequences of accidents. The SDGs will have adequate capacity to power required safe shutdown loads in the event of a LOOP and failure of the operable EDG.

*An over-reliance on programmatic activities to compensate for weaknesses in plant design is avoided.*

The new programmatic activities involved with the proposed amendment will be the compensatory measures that will be implemented during an extended EDG AOT, and the measures taken to maintain and verify the availability of the SDGs. These activities are not being implemented to compensate for weakness in plant design. The use of compensatory measures in conjunction with a risk-informed TS change is recognized in both Regulatory

Guide 1.174 and Regulatory Guide 1.177 (References 9 and 10). The measures that will be taken to maintain and verify the availability of the SDGs will be consistent with the manufacturer's recommendations, and consistent with measures implemented by other licensees for similar non-safety related supplemental power supplies used to support EDG AOT extensions. These measures will provide assurance that the SDGs will be available if needed and are not being implemented to compensate for any weakness in SDG design.

*System redundancy, independence, and diversity are maintained commensurate with the expected frequency and consequences of challenges to the system.*

The reduction in redundancy of the on-site electrical power system during the extended EDG AOT is no more than the reduction in redundancy that would occur during the currently authorized 72-hour AOT. The principal change resulting from the proposed amendment will be the duration of the AOT. There will be no impact on the safety function of the power supplies. The longer period of reduced EDG redundancy that will occur during the extended AOT is significantly offset by additional redundancy, independence, and diversity provided by the SDGs. The SDGs will be provided by a different vendor than the EDGs. The SDG units will be self-contained, requiring no external support system and will be required to have a 24-hour fuel supply on site prior to entering the EDG AOT. Power to SDG controllers in the control rooms will be provided by the Technical Support Center uninterruptible power supply. The SDGs will be protected against the effects of likely weather related events that could challenge the offsite power supply.

The compensatory actions and the configuration risk management program described in Reference 1 will provide additional assurance that redundant, independent, and diverse equipment remains available during an extended EDG AOT. The compensatory actions described in Reference 1 also assure that no adverse weather conditions that could challenge power supplies are expected when entering the extended EDG AOT for pre-planned maintenance.

*Defenses against potential common cause failures are maintained and the potential for introduction of new common cause failure mechanisms is assessed.*

The proposed EDG AOT extension does not change the design, operation, or potential failure modes of the EDGs or the preferred offsite power supply. The design of the alternate offsite power supply circuit will only be changed as needed to connect the output of the SDGs to the existing Class 1E electrical system. There will be no direct interface between the SDGs and the EDGs, or between the SDGs and the preferred offsite power supply. Protection from common cause failures between the EDGs and SDGs is provided by physical separation, difference in manufacturers, difference in design, use of separate fuel oil tanks, difference in operating and maintenance procedures, and protection against adverse weather.

*The independence of physical barriers is not degraded.*

Physical barriers associated with the EDGs and the preferred offsite power supply are not affected by the proposed amendment. The SDGs will be located in the alternate offsite power switchyard, which is physically separate from the EDGs. Electrical separation has also been considered. Each SDG will be separated from the Class 1E power system by two circuit breakers in series, one of which will be a Class 1E circuit breaker located at the Class 1E bus. Since the means of supplying power from the SDGs to the engineered safety features (ESF) busses will be a "dead bus" transfer, operation of the SDGs will not cause a transient in the power distribution system that could trip an operating unit.

*Defenses against human errors are preserved.*

In the event of an accident, the unit would continue to respond as designed and as assumed in the accident analyses. Therefore, no new operator actions will be created in the design basis accident analyses. The availability of the SDGs will provide defense-in-depth. Both SDGs will start automatically upon a sustained loss of power on 4.16-kV Bus 1. Upon attaining rated speed and voltage, the SDGs will automatically synchronize with each other. The power-operated disconnect switch on Bus 1 will automatically open to isolate the bus from the 69 kilovolt/4 kilovolt transformer, and the output breakers for both SDGs will automatically close onto Bus 1. The SDGs will be equipped with automatic voltage regulators and speed governors to maintain the steady state voltage and frequency output within prescribed limits.

Subsequent to the above automatic actions, operators can manually apply unit loads to the appropriate 4.16 kV ESF bus from the affected unit's control room. Operators will also have the capability to manually start and stop the SDGs locally and from either control room. I&M has committed (Reference 1) to provide procedures to support use of the SDGs, and actions have been initiated to provide operator training. This combination of automatic actions and manual actions performed in accordance with procedures and training will provide adequate protection against human error, while maintaining the appropriate level of operational flexibility.

*The intent of the General Design Criteria in Appendix A to 10 CFR Part 50 is maintained.*

As described in Section 1.4 of the Updated Final Safety Analysis Report (UFSAR), CNP was designed and licensed to plant specific design criteria (PSDC) rather than the General Design Criteria (GDC) in Appendix A to 10 CFR 50. The GDC in 10 CFR 50 Appendix A differ both in numbering and content from the PSDC adopted for CNP. There is no concise PSDC statement corresponding to GDC 17, "Electric Power Systems," which would be the GDC most relevant to the proposed amendment. The design basis for the CNP electric power systems is defined by the descriptions provided in Chapter 8 of the CNP UFSAR. These

descriptions, including those for the EDGs, preferred offsite power supply, and alternate offsite power supply, will not be affected by the proposed amendment except to recognize the addition of the SDGs connecting to an existing bus in the alternate offsite power supply system. The intent of the criteria underlying these descriptions will be maintained.

**References**


1. Letter from J. N. Jensen, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2 - Docket Nos. 50-315 and 50-316 - Extension of Allowed Outage Times for Emergency Diesel Generators, 69 kV Offsite Power Circuit, Component Cooling Water, and Essential Service Water," AEP:NRC:4811, dated September 21, 2004 (ML043650279).

2. Letter from C. F. Lyon, NRC, to M. K. Nazar, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Request for Additional Information Regarding License Amendment Request to Extend Allowed Outage Times (TAC NOS. MC4525 and MC4526)," dated January 18, 2005 (ML043650279).

3. Letter from C. F. Lyon, NRC, to M. K. Nazar, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Request for Additional Information Regarding License Amendment Request to Extend Allowed Outage Times (TAC NOS. MC4525 and MC4526)," dated February 25, 2005 (ML050490440).

4. EPRI Report TR 1000158, "Losses of Off-Site Power at U.S. Nuclear Power Plants – through 1999," dated July 2000.

5. EPRI Report TR 1009889, "Losses of Off-Site Power at U.S. Nuclear Power Plants – through 2003," dated April 2004.

6. NUREG/CR-INEEL/EXT-04-02326, "Evaluation of Loss of Offsite Power Events at Nuclear Power Plants: 1986 – 2003 (Draft)," dated October 2004 (ML0433803220).

7. NUMARC 93-01, "Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, dated April 1996.

8. Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, dated March 1, 1997.

9. Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," dated July 1998.

10. Regulatory Guide 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," dated August 1998.

ATTACHMENT TO AEP:NRC:5811

REGULATORY COMMITMENTS

The following table identifies those actions committed to by Indiana Michigan Power Company (I&M) in this document. Any other actions discussed in this submittal represent intended or planned actions by I&M. They are described to the Nuclear Regulatory Commission (NRC) for the NRC's information and are not regulatory commitments.

| Commitment | Date |
|---|---|
| New emergency diesel generator and 69 kilovolt circuit TS pages will be provided in the separate letter responding to the NRC request for additional information dated February 25, 2005 (ML050490440). | April 11, 2005 |
| I&M is recalculating the risk changes associated with the emergency diesel generator allowed outage time (AOT) extension and the one-time 69 kilovolt circuit AOT extension. The recalculated values will be provided to the NRC in the response to the remaining questions transmitted by the (NRC) request for additional information dated January 18, 2005 (ML043650279). | April 29, 2005 |
| The Safety Monitor ™ model will be updated to include the SDGs. | Prior to use of the extended AOT for the EDGs. |
| The SDGs will not be credited as "available" in more than one unit at a time. This restriction will be included in the Bases changes associated with the proposed TS changes. | Prior to crediting the SDGs as available for extending an EDG AOT. |
| The SDGs will be designated as guarded equipment. | When the SDGs are credited as available for extending an EDG AOT. |
| The SDGs will be included in the CNP Maintenance Rule Program. | Prior to crediting the SDGs as available for extending an EDG AOT. |