October 2, 2000

Mr. Nathan L. Haskell
Director, Licensing and Performance Assessment
Palisades Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

SUBJECT: PALISADES PLANT - ISSUANCE OF AMENDMENT RE: COMPLETION TIMES FOR SAFETY INJECTION TANKS AND LOW PRESSURE SAFETY INJECTION (TAC NOS. MA9332 AND MA9333)

Dear Mr. Haskell:

The Commission has issued the enclosed Amendment No. 191 to Facility Operating License No. DPR-20 for the Palisades Plant. The amendment consists of changes to the Improved Technical Specifications (ITS) in response to your application transmitted by letter dated June 27, 2000, as supplemented August 18 and 30, 2000.

The amendment changes ITS Sections 3.5.1, “Safety Injection Tanks (SITs),” and 3.5.2, “ECCS [Emergency Core Cooling System] - Operating,” regarding completion times for restoring an inoperable SIT or a low-pressure safety injection train.

A copy of our related safety evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

***/RA/***

Darl S. Hood, Senior Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-255

Enclosures: 1. Amendment No. 191 to DPR-20
2. Safety Evaluation

cc w/encls: See next page

October 2, 2000

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Palisades Plant
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Palisades Plant

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CONSUMERS ENERGY COMPANY

DOCKET NO. 50-255

PALISADES PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 191
License No. DPR-20

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Consumers Energy Company (the licensee) dated June 27, 2000, as supplemented August 18 and 30, 2000, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public; and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public;

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to the license amendment and Paragraph 2.C.(2) of Facility Operating License No. DPR-20 is hereby amended to read as follows:

> The Technical Specifications contained in Appendix A, as revised through Amendment No. 191, and the Environmental Protection Plan contained in Appendix B are hereby incorporated in the license. Consumers Energy Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of issuance and shall be implemented on or before December 31, 2000.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

Claudia M. Craig, Chief, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: October 2, 2000

ATTACHMENT TO LICENSE AMENDMENT NO. 191

FACILITY OPERATING LICENSE NO. DPR-20

DOCKET NO. 50-255

Revise Appendix A of the Improved Technical Specifications (ITS), which have been issued but not yet implemented, by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

| REMOVE | INSERT |
|---|---|
| ITS 3.5.1-1 | ITS 3.5.1-1 |
| ITS B 3.5.1-6 | ITS B 3.5.1-6 |
| ITS B 3.5.1-8 | ITS B 3.5.1-8 |
| ITS 3.5.2-1 | ITS 3.5.2.1 |
| ITS B 3.5.2-6 | ITS B 3.5.2-6 |
| ITS B 3.5.2-7 | ITS B 3.5.2-7 |
| ITS B 3.5.2-8 | ITS B 3.5.2-8 |
| ITS B 3.5.2-12 | ITS B 3.5.2-12 |

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 191 TO FACILITY OPERATING LICENSE NO. DPR-20

CONSUMERS ENERGY COMPANY

PALISADES PLANT

DOCKET NO. 50-255

## 1.0 INTRODUCTION

By application dated June 27, 2000, as supplemented August 18 and 30, 2000, the Consumers Energy Company (the licensee) requested changes to the Improved Technical Specifications (ITSs) for the Palisades Plant. The proposed amendment would change ITS Sections 3.5.1, "Safety Injection Tanks (SITs)," and 3.5.2, "ECCS [Emergency Core Cooling System] - Operating," regarding completion times for restoring an inoperable SIT or a low-pressure safety injection train. Specifically, the proposed amendment would change, from 1 hour to 24 hours, the ITS to extend the Completion Times (a.k.a. allowed outage time (AOT)) for a single inoperable SIT. The proposed amendment would also change, from 1 hour to 72 hours, the Completion Time for a single SIT if it is inoperable because its water level or nitrogen cover pressure cannot be verified. In addition, the amendment would extend, from 72 hours to 7 days, the Completion Time for restoring a single low-pressure safety injection (LPSI) train.

On November 30, 1999, the NRC staff issued Amendment No. 189 to the Operating License for the Palisades Plant to reflect the full conversion of the current Technical Specifications (TSs) to a set of ITS based on NUREG-1432, "Standard Technical Specifications, Combustion Engineering Plants," and certain subsequently approved changes. Amendment No. 189 is to be implemented by the licensee on or before October 31, 2000. The proposed amendment would only change the Palisades ITS as issued by Amendment No. 189. The proposed amendment would not change the current TSs for Palisades, which remain in effect until the licensee implements the ITS.

The August 18 and 30, 2000, supplemental letters provided additional clarifying information, reformatted ITS replacement pages, and revised ITS Bases pages in support of the original application. The supplemental letters were within the scope of the original application and did not change the staff's initial proposed no significant hazards consideration determination.

## 2.0 BACKGROUND

Since the mid-1980s, the NRC has been reviewing and granting improvements to TSs that are based, at least in part, upon probabilistic risk assessment (PRA) insights. In its final policy statement on TS improvements of July 22, 1993, the NRC stated that it:

> ". . . expects that licensees, in preparing their Technical Specification related submittals, will utilize any plant-specific PSA [probabilistic safety assessment][1] or risk survey and any available literature on risk insights and PSAs. . . . Similarly, the NRC staff will also employ risk insights and PSAs in evaluating Technical Specifications related submittals. Further, as a part of the Commission's ongoing program of improving Technical Specifications, it will continue to consider methods to make better use of risk and reliability information for defining future generic Technical Specification requirements."

The NRC reiterated this point when it issued the revision to 10 CFR 50.36, "Technical Specifications," in July 1995 (60 FR 36953). In August 1995, the NRC adopted a final policy statement on the use of PRA methods in nuclear regulatory activities that encouraged greater use of PRA to improve safety decision making and regulatory efficiency (60 FR 42622). The PRA policy statement included the following points:

1. The use of PRA technology should be increased in all regulatory matters to the extent supported by the state of the art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy.

2. PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical, within the bounds of the state of the art, to reduce unnecessary conservatism associated with current regulatory requirements.

3. PRA evaluations in support of regulatory decisions should be as realistic as practicable and appropriate supporting data should be publicly available for review.

In August 1995, the Combustion Engineering Owners Group (CEOG) submitted several Joint Application Reports for the NRC staff's review. Two of the CEOG Joint Application Reports[2] provided justifications for extensions of the TS Completion Times for SITs and for the LPSI system. The justifications for these extensions are based upon a balance of probabilistic considerations, traditional engineering considerations, including defense-in-depth, and operating experience. Risk assessments for all of the Combustion Engineering (CE, a.k.a. ABBCE) plants are contained in the reports. The NRC staff first reviewed the Joint Application Reports and then reviewed the licensee's plant-specific amendment request, which incorporated the Joint Application Reports by reference.

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[1] PSA and PRA are used interchangeably herein.

[2] CE NPSD-994, "Joint Application Report for Safety Injection Tank AOT/STI Extension," May 1995, and CE NPSD-995, "Joint Application Report for Low Pressure Safety Injection System AOT Extension," May 1995.

Arkansas Nuclear One, Unit 2 (ANO-2), had been the lead CE plant for the SIT and LPSI system TS changes. The NRC staff performed an in-depth review of the ANO-2 PRA methodology relating to these changes, as the lead plant for all of the CEOG. Therefore, a portion of the review of the Palisades amendment request was based upon a comparison of the Palisades PRA results with those from ANO-2.

In addition, one of the proposed changes would revise ITS 3.5.1, "Safety Injection Tanks (SITs)," to incorporate recommendations and suggestions from Generic Letter (GL) 93-05, "Line-Item Technical Specifications Improvements to Reduce Surveillance Requirements for Testing During Power Operations," dated September 27, 1993.

## 3.0 PROPOSED CHANGES

### 3.1 ITS 3.5.1 - Safety Injection Tanks

The licensee proposes to extend, from 1 to 72 hours, the ITS Completion Time for restoring one SIT that is inoperable due to the inability to verify level or pressure. The licensee also proposes to extend, from 1 to 24 hours, the ITS Completion Time for restoring one SIT that is inoperable for reasons other than boron concentration being outside of limits or the inability to verify level or pressure. These changes are implemented by making appropriate substitutions and additions to ITS 3.5.1 Action statements A and B.

### 3.2 ITS 3.5.2 - ECCS - Operating

The licensee proposes to extend, from 72 hours to 7 days, the ITS Completion Time for restoring one inoperable LPSI train. This change is implemented by revising ITS 3.5.2 Action Condition A so as to only address "One LPSI subsystem inoperable." The changes also include editorial changes (i.e., existing Action statement A is revised to exclude the new Action Condition A and is relocated to Action statement B; existing Action statement B is renumbered as Action statement C).

## 4.0 EVALUATION

The NRC staff evaluated the licensee's proposed amendment to the ITS using insights derived from traditional engineering considerations, the use of PRA methods, and operating experience to determine the safety impact of extending the Completion Times for restoring an inoperable SIT and for restoring an inoperable LPSI train.

### 4.1 Justification for Proposed Changes

#### 4.1.1 Justification for Proposed Change to SIT Completion Time from 1 to 72 Hours when SIT is Inoperable Due to Inability to Verify Level or Pressure

In GL 93-05, the NRC recommended that licensees add a condition to the SIT TS for the case where one SIT is inoperable due to the inoperability of water level and pressure channels in which the Completion Time to restore the SIT to operable status would be 72 hours. GL 93-05 stated that the NRC staff and industry efforts to develop new standard TSs (STS) recognized that SIT instrumentation operability was not directly related to the capability of the SITs to perform their safety function. Therefore, surveillance requirements for SIT pressure and level

instrumentation were relocated from the new STS. The only surveillance that was retained was the surveillance to confirm that the parameters defining SIT operability are within their specified limits. At the time of the development of the STS, the NRC staff did not include a separate condition in the SIT TS for an SIT inoperable due to the inability to verify water level or pressure, as was recommended in GL 93-05. However, the NRC staff believes that this is appropriate based upon the analysis done during the development of NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements," which formed the basis for the issuance of GL 93-05.

4.1.2 Justification for Proposed Change to SIT Completion Time from 1 to 24 Hours when SIT is Inoperable for Other Reasons

Industry operating experience has demonstrated that many of the causes of SIT inoperability have been diagnosed and corrected within a relatively short period, but one that is often longer than the existing 1-hour Completion Time. In several cases, the diagnosis of an inoperable SIT has resulted in plant shutdowns.

If a single SIT were to be diagnosed as inoperable for reasons other than boron concentration being outside of limits (which is already addressed under a separate action with a 72-hour Completion Time), ITS 3.5.1, Action B, would presently allow 1 hour for operators to restore the SIT to operability. If the action were not completed within 1 hour, the plant would have to be placed in Mode 3 (hot standby) within the next 6 hours, in accordance with Action C. The extension of the existing SIT Completion Time from 1 to 24 hours should provide the licensee with sufficient time in which to diagnose and possibly repair minor SIT system malfunctions at power, thereby averting an unplanned plant shutdown. Since risk analyses demonstrate that the increased risk of operating with a single SIT out of service is negligible, increasing the Completion Time can be beneficial by possibly avoiding unplanned shutdowns associated with an inoperable SIT. Unnecessary plant shutdowns associated with the outage of non-risk-significant equipment are undesirable because mode changes have the potential to increase the risk above that of steady-state operation.

4.1.3 Justification for Proposed Change to LPSI Train Completion Time from 72 Hours to 7 Days

The Palisades ITS presently address the LPSI system as a portion of the ECCS. ITS 3.5.2 requires two ECCS trains to be operable for operating Modes 1 (power operation), 2 (startup), or 3 (hot standby) when the primary coolant system (PCS) temperature is at or above 325 °F. With one ECCS train inoperable on the basis of any component inoperability but at least 100 percent of the required ECCS flow available, the train must be returned to operable status within 72 hours or a plant shutdown is required. The proposed change would allow up to 7 days for the licensee to restore operability to an inoperable LPSI train that is the cause of ECCS train inoperability.

The primary role of LPSI trains during power operation is to contribute to the mitigation of a large-break loss-of-coolant accident (LBLOCA). The postulated frequency of a LBLOCA event is on the order of 7.6E-05 per year. In contrast, during Modes 5 (cold shutdown) and 6

(refueling), the operability of at least one LPSI train operating in the shutdown cooling (SDC) mode is required at all times for PCS heat removal. Thus, in the broad view, performing preventive and corrective maintenance at power on LPSI trains can contribute to an overall enhancement of plant safety by increasing the availability of the LPSI train for SDC during Modes 5 and 6, when it is most needed.

In some instances, corrective maintenance of the LPSI pumps and valves and testing of valves may require taking one train of LPSI out of service for more than several days. Thus, repair within the existing Completion Time cannot be ensured and may result in an unscheduled shutdown or a request for temporary relief to allow continued plant operation while repairs are completed. To avoid these situations, the licensee is requesting a longer Completion Time. On the basis of the review of maintenance requirements of the LPSI train for CE pressurized-water reactors, the licensee determined that a 7-day Completion Time would provide sufficient margin to effect most anticipated preventive and corrective maintenance activities and LPSI train valve surveillance tests at power.

4.2 Traditional Engineering Evaluation

The performance of all of the ECCS, including SITs and the LPSI system, is calculated in accordance with 10 CFR Part 50, Appendix K, such that the ECCS ensures that the acceptance criteria of 10 CFR 50.46 are satisfied. These criteria were established in order to define deterministic acceptance criteria that could be used to judge the acceptability of a given ECCS design. The methodology defined in Appendix K conservatively represents LOCA thermohydraulic and hydrodynamic phenomenology to calculate the peak fuel cladding temperature. As a result, the methodology may well overstate the minimum equipment requirements for adequate response to an event.

4.2.1 SIT Evaluation

The SITs are passive pressure vessels partially filled with borated water and pressurized with a cover gas (nitrogen) to facilitate injection into the reactor vessel during the blowdown phase of a LBLOCA. This action provides inventory to assist in accomplishing the refill stage following blowdown.

Each SIT is piped into an associated PCS cold leg via an ECCS line also utilized by HPSI and LPSI. Each SIT discharge is isolated from the PCS during full pressure operations by two check valves in series. Each SIT also has a normally deenergized open motor-operated isolation valve utilized to isolate the SIT from the PCS during normal cooldown and depressurization evolutions. Each of these valves receive a safety injection actuation signal to open. The SIT gas pressure and volume, water volume, and outlet pipe size are designed to allow three of the four SITs to inject the inventory necessary to ensure compliance with 10 CFR 50.46, “Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Plants,” following a design-basis LOCA. The design assumes the loss of inventory from one SIT through the LOCA break.

Limiting Condition for Operation (LCO) 3.5.1 requires that all four SITs be operable whenever the plant is in Modes 1 or 2. The LCO is based upon the assumption that when the plant is in any of these modes of operation, the SITs must have the same functionality that would be required for a LOCA at full rated thermal power. When the plant is in any of the applicable modes, an SIT is considered operable when the following conditions exist:

- The associated isolation valve is fully open.
- Electric power has been interrupted to the motor for the associated isolation valve.
- Water inventory in the tank is within the assumed band.
- The boric acid concentration of the water inventory of the tank is within the assumed band.
- The nitrogen cover pressure within the tank is within the assumed band.

In the past, a justification for the short Completion Time for one inoperable SIT has been that the perceived severity of the consequences of not having all SITs available to provide passive injection during a design-basis LOCA warranted the severity of the requirement to return the SIT to operable status within 1 hour or shut down the unit. However, the current SIT Completion Time was based solely upon engineering judgment and did not take into consideration a quantitative assessment of risk.

The SIT operational parameters are set by the design-basis licensing LBLOCA analysis. Since the SIT is a passive device and provides a limited function, operability has been restricted to mean that the equipment's initial conditions are within a band supported by 10 CFR Part 50, Appendix K, design-basis analysis. Analytical models of Appendix K to 10 CFR Part 50 are devised so as to overestimate the amount of liquid lost from the break and to underestimate the residual inventory in the reactor vessel lower plenum. Consequently, inventory discharge requirements are conservatively set at a high level. Extending the Completion Time from 1 to 24 hours for one SIT that is inoperable for reasons other than boron concentration being outside of limits or the inability to verify water level or pressure will allow time for the licensee to correct minor problems with a SIT. Considering the short time frame that a SIT is allowed to be out of service, the low likelihood of a LBLOCA during this short time frame, and the potential risk associated with plant shutdowns, extending the SIT Completion Time should continue to ensure defense-in-depth is maintained and sufficient safety margin exists to meet the design-basis analysis for the Palisades ECCS.

The current Palisades ITS (as issued by Amendment No. 189) do not differentiate between a SIT that is inoperable due to tank inventory or nitrogen gas pressure discrepancies and a SIT whose inventory or gas pressure cannot be verified due solely to malfunctioning water level instrumentation or pressure instrumentation. Because these instruments provide no safety actuation, it is reasonable to extend the Completion Time to 72 hours under these conditions since the SIT is available to perform its safety function during this time. This change is consistent with the NRC staff's recommendations in GL 93-05.

4.2.2 LPSI System Evaluation

The ECCS includes two trains, and each train includes a LPSI subsystem in combination with a high pressure safety injection (HPSI) subsystem. The primary role of LPSI during power operation is to be available for use upon demand for LOCA mitigation. The LPSI system also defines the end-state for a design-basis steam generator tube rupture (SGTR) and other non-LOCA design-basis events (i.e., the LPSI system would be used for PCS heat removal as part of the shutdown cooling (SDC) system after the initial transient and radioactive releases have been controlled). The plant-specific safety analyses for Palisades demonstrates that either one of the ECCS trains operating in conjunction with the SITs satisfy the requisite 10 CFR 50.46 ECCS performance acceptance criteria. In addition to being available for accident mitigation, the most common use of the LPSI system is for decay heat removal during normal shutdown cooling operations in Modes 4 (hot shutdown), 5, and 6.

A LPSI subsystem consists of one LPSI pump and two injection flowpaths, including motor-operated valves. The two LPSI pumps are high volume, low head centrifugal pumps designed to inject large quantities of borated water into the PCS to flood and cool the core during the early stages of a LOCA. During the injection phase of a LOCA, the LPSI pumps take suction from the safety injection refueling water tank (SIRWT), which contains borated water. The borated water is pumped to a common LPSI discharge header entering containment. Once inside containment, the discharge header divides into four LPSI injection lines, which combine with the HPSI and SIT injection lines. In this way, flow is directed independently through each of the four PCS cold legs into the reactor vessel. The LPSI pumps automatically start and the valves open upon receipt of a safety injection signal. When SIRWT inventory is depleted during the injection phase, a low SIRWT level signal produces a recirculation actuation signal (RAS). The RAS stops the LPSI pumps, opens the containment sump isolation valves, closes the SIRWT outlet valves, and shifts the suction of the HPSI and containment spray pumps to the containment sump.

During the recirculation phase of the LOCA scenario, the LPSI pumps are stopped by an automatic or manually initiated RAS and long-term core cooling is supplied by the HPSI pumps taking suction from the containment sump. During normal shutdown operation (Modes 4, 5, and 6), the LPSI pumps also provide shutdown cooling flow to the reactor core. In this configuration, the LPSI pumps take suction from one PCS hot leg, send the water through the shutdown cooling heat exchangers, and discharge cooler water into PCS cold legs.

For the design-basis SGTR and other non-LOCA events where safety injection may be required for PCS inventory control, the HPSI system functions to keep the reactor core covered. The LPSI system may be used (as part of the SDC system) for PCS and core heat removal after the initial transient and radioactive releases have been controlled. Loss of both LPSI trains is beyond design-basis accident assumptions and the proposed AOT extension does not change the design basis for these events. However, in the unlikely event that one LPSI train is out of service and the second LPSI train fails, operators can continue to control and satisfy the PCS and core heat removal safety function by steaming one or both steam generators, as applicable to the specific event, in Modes 3 or 4.

Table 6.2.1-I of CE NPSD-995 provides a comparison of secondary side heat removal capabilities for CEOG plants, and includes the approximate condensate storage depletion time (without refill). The minimum contained volume of condensate and primary make-up water

storage tanks required by the Palisades ITS is 100,000 gallons. However, the steam generator heat sink can be maintained indefinitely, provided a source of make-up water remains available. Plant procedures provide instructions for replenishing condensate inventory storage, or using service water or fire water as a backup source. Extending the LPSI AOT would not impact this defense-in-depth capability.

In summary, the LPSI system may be used for a non-LOCA event after the event has been brought under control and the plant is at the low temperature and pressure conditions where SDC operations can be initiated. Moreover, having one LPSI system out of service at the time of event initiation (LOCA) would not impact defense-in-depth capabilities for the PCS and core heat removal safety function at Palisades. In addition to the accident considerations, the fact that the LPSI system is required for decay heat removal every time the plant is placed in cold shutdown indicates that it would be prudent to perform maintenance on the LPSI system during power operations rather than during shutdown when the demand for the system is at its highest. Based on the above, the NRC staff concludes that extending the Completion Time for one inoperable LPSI train from 72 hours to 7 days should continue to ensure defense-in-depth is maintained and sufficient safety margin exists to meet the design-basis analysis for the Palisades ECCS.

4.3 Evaluation of the PRA Used to Support the Proposed TS Changes

The NRC staff used a three-tiered approach to evaluate the risk associated with the proposed TS changes. The first tier evaluated the PRA model and the impact of the Completion Time extensions for the LPSI system and SITs on plant operational risk. The second tier addressed the need to preclude potentially high risk configurations by identifying the need for any additional constraints or compensatory actions that, if implemented, would avoid or reduce the probability of a risk-significant configuration during the time when one SIT or one LPSI train is out of service. The third tier evaluated the licensee's configuration risk management program to ensure that the applicable plant configuration will be appropriately assessed from a risk perspective before entering into or during the proposed Completion Times. Each tier and the associated findings are discussed below.

4.3.1 Cross Comparison Approach

After completing a detailed evaluation for the tentative approval of SIT and LPSI TS Completion Time extensions for ANO-2, the original CEOG lead plant for the risk-informed TS pilot project, the NRC staff used a cross comparison approach to consider the viability of similar Completion Time relaxations for other participating CEOG plants, including Palisades. The pilot technical evaluation report[3] used in support of the NRC staff's draft safety evaluation for ANO-2[4] focused upon:

[3]SCIE-NRC-318-97, “Technical Evaluation of Combustion Engineering Owners Group (CEOG) Joint Application for Safety Injection Tanks and Low Pressure Safety Injection System Allowed Outage Time (AOT) Extension,” July 21, 1997.

[4]SECY-97-095, “Probabilistic Risk Assessment Implementation Plan Pilot Application for Risk-Informed Technical Specifications,” April 30, 1997.

- the process adopted by the CEOG to assess single Completion Time risk,
- the identification of ANO-2 accident sequences in which credit was taken for SITs and LPSI,
- independent verification of the single Completion Time risk [essentially equivalent to incremental conditional core damage probability (ICCDP)[5]], and
- determination of the significance of single Completion Time risk relative to an acceptance guideline value.

The objective of this cross comparison evaluation is to use insights derived from the ANO-2 technical evaluation to examine the validity of the conclusions drawn in the joint submittals. Because a common methodology was employed by the CEOG to quantify Completion Time risk and because CE plants generally have similar design characteristics, the NRC staff believes that the findings of the lead pilot plant evaluation will be generally applicable to other CE plants. The NRC staff confirmed that differences in the underlying PRA models are chiefly attributed to:

- minor design differences,
- operational differences,
- success criteria assumptions, and
- common cause failure β-factor assumptions.

The cross comparison draws on information contained in the CEOG Joint Application Reports, the licensees' responses to the NRC staff's requests for additional information, the licensees' individual plant examinations (IPEs) performed in response to Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities," and the corresponding IPE evaluations performed by the NRC staff.

4.3.2 Impact of SITs upon Tier 1, 2, and 3 Requirements (Risk Measures)

The following factors are chiefly responsible for the differences in SIT Completion Time risks among the CE plants:

- modeling for success criteria for SITs,
- initiating event (IE) frequency assumed for the initiators challenging the SITs, and
- credit for SITs in mitigating medium LOCAs.

The licensee's SIT single Completion Time risk (or essentially equivalently, ICCDP) for Palisades is 8.77E-09 and is well within the acceptance guideline value of 5.0E-07 published in Regulatory Guide 1.177, "An Approach for Plant-Specific Risk-Informed Decision making: Technical Specifications." In addition, the change in the Palisades updated baseline core damage frequency (CDF) (as reported in the CEOG Joint Application Report) due to the SIT Completion Time change is about 0.19 percent (i.e., from 5.15E-05 per year to 5.16E-05 per year). The change in CDF of 1.0E-07 per year is within the very small change acceptance guideline published in Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis."

[5]ICCDP = [(conditional CDF with the subject equipment out of service) - (baseline CDF with nominal expected equipment unavailabilities)] X (duration of single Completion Time under consideration).

The Tier 2 evaluation did not identify the need for any additional constraints or compensatory actions that, if implemented, would avoid or reduce the probability of a risk-significant configuration. Because the SIT sequence modeling is relatively independent of that for other systems, the NRC staff concludes that application of Tier 3 to the proposed SIT Completion Time is not necessary.

4.3.3 Impact of LPSI upon Tier 1, 2, and 3 Requirements

The following factors are chiefly responsible for the differences in LPSI Completion Time risks among the CE plants:

- use of LPSI to mitigate multiple initiating events,
- HPSI redundancies, and
- LPSI common cause β-factor assumptions.

The LPSI ICCDP for Palisades is 6.14E-09, which is less than the acceptance guideline value of 5.0E-07 from Regulatory Guide 1.177, and is essentially null. In addition, the change in the Palisades updated baseline CDF (as reported in the licensee's submittal of August 18, 2000), is essentially null due to the LPSI Completion Time change is 3.20E-07 per year. The change in CDF is within the very small acceptance guideline published in Regulatory Guide 1.174.

The Tier 2 evaluation did not identify the need for any additional constraints or compensatory actions that, if implemented, would avoid or reduce the probability of a risk-significant configuration.

The Tier 3 requirements for configuration risk management are considered to be adequately satisfied since the licensee has an on-line PRA-based monitor, called the On-Line Risk Monitor (OLRM), which uses the "Equipment Out Of Service" program, backed up by a matrix of structures, systems, and components and their safety impact. In addition, the licensee has a risk-informed engineering group and uses a proceduralized risk management process. This process is used for evaluating planned on-line corrective or preventive maintenance and is also used to support compliance with the Maintenance Rule. A CRMP based upon the Maintenance Rule revision [10 CFR 50.65(a)(4)], and which is consistent with the program described in Regulatory Guide 1.177, will be implemented at Palisades when the revised Maintenance Rule is implemented (by November 28, 2000). The licensee will include the description of a CRMP and its key elements in appropriate Palisades Plant Administrative Procedures (PAP), (one of these is PAP 4.02, "Control of Equipment"). In addition, the CRMP will be maintained and used as described in Regulatory Guide 1.182, "Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants," dated May 2000, including those elements related to validation, control, and update of the plant PRA, which will ensure compliance with 10 CFR 50.65(a)(4).

4.3.4 PRA Quality

The Palisades IPE was prepared mainly by utility personnel with consulting services provided by Tenera, LP, and ABB Impell on the front-end analysis, and Tenera, LP, and Gabor, Kenton and Associates on the back-end analysis. The Palisades PRA group provided the plant knowledge for preparation of the IPE modeling while the consultants provided general direction

and methodology guidance. The front-end portion of the IPE is a Level 1 PRA. The specific technique used for the Level 1 PRA was a small event tree/large fault tree technique with fault tree linking. Internal initiating events and internal flooding were considered in the analysis. Event trees were developed for all classes of initiating events. Intersystem dependencies were addressed and tables of system dependencies were provided. Data for quantification of the models was provided, including common cause events and human errors. A number of actions were taken to ensure that the IPE modeled the as-built, as-operated plant. Specifically,

- Walkdowns were used to obtain the latest and most accurate information with regard to the as-built configuration of the plant. During the walkdowns, particular attention was given to the development of the human reliability analysis.

- Wide use was made of plant-specific data to develop initiating event frequencies and component unavailabilities.

- Plant staff were heavily involved in the IPE analysis.

The independent review team for the IPE was led by the plant safety engineering group, which had (and continues to have) considerable experience and knowledge of plant operations and design, as well as expertise in the review and approval of 10 CFR 50.59 safety evaluations. The review included a detailed evaluation of the event trees and system success criteria for the front-end analysis, which assured that plant systems and responses were modeled realistically. For the back-end analysis, Tenera, LP, and Gabor, Kenton and Associates performed a detailed review of the containment event trees. All questions and comments from the reviews were resolved. The front- and back-end analyses were also reviewed in detail by the consultants to ensure that the PRA was consistent with readily accepted methodologies and techniques. No changes were required to the IPE/PRA for use to support this change request.

The NRC staff finds that the small ICCDPs and ICLERP estimated for the changes in Completion Times are consistent with the credit taken for the subject systems in the PRA modeling. The licensee's review of the PRA models, along with the NRC staff's cross comparison review approach, provide reasonable assurance that the models appropriately reflect the equipment and procedural characteristics at the plant.

4.3.5 Conclusions Regarding the Licensee's LPSI and SIT Design Similarities to ANO-2 and PRA Used to Support the Proposed Amendment

The Palisades Plant has strong LPSI and SIT design similarities to ANO-2, the original CEOG lead pilot plant for this project. Therefore, the NRC staff believes that on the basis of the three-tiered approach, cross comparative results provide sufficient validation for the following conclusions:

- The proposed TS Completion Time modifications have only a minimal quantitative impact upon plant risk. The calculated ICCDPs are small, primarily because of the association of SITs and LPSI with low probability initiating events and limited impact upon the success criteria of other mitigation systems (Tier 1).

- The review did not identify the need for any additional constraints or compensatory actions that, if implemented, would avoid or reduce the probability of a risk-significant configuration (Tier 2).

- The licensee has implemented a risk-informed Configuration Risk Management Program to assess the risk associated with the removal of equipment from service during the proposed LPSI Completion Time. The program provides the necessary assurances that appropriate assessments of plant risk configurations using the OLRM, augmented by additional analysis, when appropriate, are sufficient to support the present Completion Time extension requests for the LPSI system (Tier 3). Because the SIT sequence modeling is relatively independent of that for other systems, the NRC staff concludes that application of Tier 3 to the proposed SIT Completion Time is not necessary.

4.4 Implementation and Monitoring

The NRC staff expects the licensee to implement these TS changes in accordance with the three-tiered approach described above. In addition, the licensee has stated through endorsement of the CEOG Joint Application Reports that the maintenance rule (10 CFR 50.65) will be the vehicle that controls the actual equipment maintenance cycle by defining unavailability performance criteria for the SITs and the LPSI system. The Completion Time extensions will allow efficient scheduling of maintenance within the boundaries established by implementing the maintenance rule. The effect of the Completion Time extensions should be considered if any adverse trends in meeting established performance criteria are identified for the SITs and the LPSI system. The maintenance rule will thereby be the vehicle that monitors the effectiveness of the Completion Time extensions. Application of these implementation and monitoring strategies will help to ensure that extension of TS Completion Times for SITs and the LPSI system does not degrade operational safety over time and that the risk incurred when a SIT or a LPSI system is taken out of service is minimized.

5.0 SUMMARY

The NRC staff has evaluated the licensee's proposed changes to ITS 3.5.1 and ITS 3.5.2 for compliance with regulatory requirements as documented in this evaluation and has determined that they are acceptable. This determination is based upon the following:

1. The need to maintain reliable safety systems.

2. Consideration of the design-basis requirements for the SITs and the LPSI systems.

3. NRC staff recommendations contained in GL 93-05 regarding SIT TS requirements.

4. Insights gained from the quantitative evaluation of the risk associated with having one SIT or one LPSI train out of service.

5. A three-tiered implementation strategy that ensures that the risk incurred when a SIT or LPSI system is taken out of service is minimized.

6. Performance monitoring through the maintenance rule to ensure that extension of TS Completion Times for SITs and the LPSI system does not degrade operational safety over time.

On the basis of the traditional engineering analysis, the NRC staff finds that with the proposed extended Completion Times, the SIT and LPSI systems continue to ensure that defense-in-depth is maintained and that sufficient safety margin exists to meet the design-basis analysis for the Palisades ECCS. The changes are also consistent with the NRC staff's recommendations in GL 93-05.

On the basis of the PRA analysis, the NRC staff finds that the Completion Time for restoring one SIT that is inoperable for the inability to verify level or pressure may be extended to 72 hours with negligible impact upon risk. Similarly, the NRC staff finds that the Completion Time for restoring one SIT that is inoperable for reasons other than boron concentration not within limits, or due to the inability to verify water level or pressure, may be extended to 24 hours with negligible impact upon risk. The NRC staff also finds that the Completion Time for restoring one inoperable LPSI train may be extended to 7 days with a relatively negligible impact upon risk.

This amendment also includes changes to the ITS Bases to reflect the changes to ITS 3.5.1 and ITS 3.5.2.

## 6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Michigan State official was notified of the proposed issuance of the amendment. The State official had no comments.

## 7.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (65 FR 46007 (two notices at this cite dated July 26, 2000)). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

## 8.0 CONCLUSION

The Commission has concluded, based upon the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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