Consumers Energy

A CMS Energy Company

Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

June 27, 2000

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT
TECHNICAL SPECIFICATION CHANGE REQUEST REGARDING ALLOWABLE OUTAGE TIMES FOR SAFETY INJECTION TANKS AND LOW PRESSURE SAFETY INJECTION

Requests for changes to the Palisades Technical Specifications (TS) regarding allowed outage times (AOT) for safety injection tanks (LCO 3.5.1) and for a low-pressure safety injection train (LCO 3.5.2) are enclosed. The changes implement improvements to NUREG-1432 Standard TS covered by Technical Specification Task Force (TSTF) changes 59, Revision 1, and 58, Revision 1, respectively. The proposed AOT extensions will enhance overall plant safety by avoiding potential unscheduled plant shutdowns, and by providing increased flexibility for scheduling and performing maintenance activities. All discussion is in reference only to the Palisades Plant Improved Technical Specifications. The proposed changes:

1. Extend the AOTs for safety injection tanks (SIT). These changes (TSTF 59) are based on analyses in Combustion Engineering Owner's Group report, CE NPSD-994, "Joint Applications Report for Safety Injection Tank AOT/STI Extension," April 1995, and the recommendations of NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements," and Generic Letter 93-05 "Line Item Improvements to Reduce Surveillance Requirements for Testing During power Operation." CE NPSD-994 justified the AOT extensions using a series of deterministic and probabilistic analyses to conclude there would be negligible change in overall risk when compared to the shorter AOTs. Enclosure 1 covers this change.

2. Add an ACTION with an AOT of seven days when one train of low-pressure safety injection (LPSI) is inoperable. This change (TSTF 58) is based on analysis in Combustion Engineering Owner's Group report, CE NPSD-995, "Joint Applications Report for Low Pressure Safety Injection System AOT Extension," April 1995. CE NPSD-995 justified a seven day Completion Time for one train of

A001

LPSI out of service based on a series of deterministic and probabilistic analyses. Enclosure 2 covers this change.

The proposed changes affect only the Improved Technical Specifications (ITS), because the proposed changes are not needed until after implementation of ITS, currently scheduled for September 2000. Consumers Energy requests approval of these Technical Specification Changes no later than October 31, 2000 to support planned maintenance on low pressure safety injection pumps. It is requested that 60 days be allowed for implementation following license amendment approval.

A copy of this letter has been sent to the appropriate official of the State of Michigan.

SUMMARY OF COMMITMENTS

This letter contains no new commitments and no revisions to existing commitments.

Stephen T. Wawro,
Director of Staff

CC Administrator, Region III, USNRC
Project Manager, NRR, USNRC
NRC Resident Inspector - Palisades

Enclosure

CONSUMERS ENERGY COMPANY

To the best of my knowledge, the content of this License Amendment Request, which proposes changes to the Palisades Technical Specifications regarding allowed outage times for safety injection tanks and low pressure safety injection, is truthful and complete.

By ______________________
Stephen T. Wawro,
Director of Staff

Sworn and subscribed to before me this 27th day of June 2000.

Janice M. Milan, Notary Public
Allegan County, Michigan
(Acting in Van Buren County, Michigan)
My commission expires September 6, 2003

ENCLOSURE 1

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

June 27, 2000

TECHNICAL SPECIFICATION CHANGE REQUEST - LICENSE DPR-20
ALLOWABLE OUTAGE TIMES FOR SAFETY INJECTION TANKS

34 Pages

CONSUMERS ENERGY COMPANY
Docket 50-255
Technical Specifications Change Request
License DPR-20

1.0 INTRODUCTION

It is requested that the Technical Specifications (TS) contained in the Facility Operating License DPR-20, Docket 50-255, for the Palisades Plant be changed as described below. The changes implement improvements to NUREG-1432 Standard TS covered by Technical Specification Task Force (TSTF) change 59, Revision 1. The AOT extension will enhance overall plant safety by avoiding potential unscheduled plant shutdowns, and by providing increased flexibility for scheduling and performing maintenance activities. The proposed AOT is based on the results of a cooperative study performed by participating members of the Combustion Engineering Owners Group (CEOG) in conjunction with information provided herein. The study included an integrated review and assessment of plant operations, deterministic design basis factors, and overall plant risk using probabilistic safety assessment (PSA) techniques. All discussion is in reference only to the Palisades Plant Improved Technical Specifications, scheduled for implementation on or before October 31, 2000.

Attachment 1 to Enclosure 1 contains the proposed TS and Bases pages. Complete sections are included to maintain consistent format and pagination. The changed areas are marked with a vertical line in the margin. Attachment 2 to Enclosure 1 contains the current TS and Bases pages marked to show the proposed changes. These pages show shading for proposed additions and a line drawn through deleted text.

2.0 BACKGROUND

The NRC has been reviewing and granting improvements to technical specifications (TS) that are based, at least in part, on probabilistic risk assessment insights since the mid-1980's. In concert with this initiative, the CEOG submitted several joint application reports that provide justifications for TS AOT extensions to the NRC staff for generic review (CEOG Letter 95-344, D.F. Pilmer to NRC Document Control Desk, C-E Owners Group Submittal of Joint Application Reports, July 10, 1995). The justifications for these extensions are based on a balance of probabilistic and traditional engineering considerations. Risk assessments for the participating Combustion Engineering (CE) plants are contained in the reports. Palisades was a participating plant in that owner's group task, and the report pertinent to this submittal is CE NPSD-994, "Joint Applications Report for Safety Injection Tank AOT/STI Extension," ABB-Combustion Engineering Inc., May 1995.

2.1 Safety Injection Tank Changes

The proposed change will provide a 72 hour AOT for a SIT whose level or pressure, or both, cannot be verified due to malfunctioning instrumentation (LCO 3.5.1, Condition A). This is the same as the existing AOT for restoring SIT boron concentration to within limits. The change will also increase the allowed outage time (AOT) for a safety injection tank (SIT) determined to be inoperable due to conditions other than allowed by Condition A (such as tank level or pressure or both outside prescribed limits or the SIT's isolation motor operated valve (MOV) in other than the full open position) from one hour to 24 hours (LCO 3.5.1, Condition B).

2.2 Safety Injection Tanks (SIT)

The four 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 large break loss of coolant accident (LOCA). 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 emergency core cooling system (ECCS) line also utilized by high pressure safety injection and low pressure safety injection systems (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. The SIT gas pressure and volume, water volume, and outlet pipe size are designed to allow three of the four SITs to inject the necessary volume to ensure compliance with 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Plants." The design assumes the loss of inventory from one of the four SITs via the LOCA break.

The Safety Injection Tanks are described in the Palisades Technical Specifications Bases for LCO 3.5.1, as well as in the Updated Final Safety Analysis Report, Chapter 6

2.2 Palisades Plant Technical Specifications (TS)

The Palisades Plant Technical Specifications (TS) address the SITs as a portion of the ECCS. LCO 3.5.1 presently requires four SITs be operable in Modes 1 and 2. With one SIT inoperable due to boron concentration not within limits, the plant has 72 hours to restore boron concentration or must be in Mode 3 within the next 6 hours. With one SIT inoperable due to reasons other than boron concentration, the plant has one hour to restore the affected SIT to operable status or must be in Mode 3 within the next 6 hours.

With two or more SITs inoperable for any reason, the plant enters LCO 3.0.3. LCO 3.5.1 requires the operability of four SITs to ensure that sufficient borated water inventory is available to reflood the core following a large break loss of coolant accident (LOCA), assuming the inventory of one tank is lost out the break and does not reach the core.

The proposed changes will provide a 72 hour AOT for a SIT whose level or pressure, or both, cannot be verified due to malfunctioning instrumentation (LCO 3.5.1, Condition A). This is the same as the existing AOT for restoring SIT boron concentration to within limits. The changes will also increase the allowed outage time (AOT) for a safety injection tank (SIT) determined to be inoperable due to conditions other than allowed by Condition A (such as tank level or pressure or both outside prescribed limits or the SIT's isolation motor operated valve (MOV) in other than the full open position) from one hour to 24 hours (LCO 3.5.1, Condition B). The Combustion Engineering Owners Group Report CE NPSD-994, "Joint Applications Report for Safety Injection Tank AOT/STI Extension," ABB-Combustion Engineering Inc., May 1995, and the recommendations of NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements" and Generic Letter 93-05 "Line Item Improvements to Reduce Surveillance Requirements for Testing During power Operation" support the proposed changes.

3.0 PROPOSED TS CHANGES - DESCRIPTION AND BASIS

3.1 Description of TS Changes

The following changes are proposed:

> For TS 3.5.1, Safety Injection Tanks, LCO 3.5.1, Condition A., which currently reads "One SIT inoperable due to boron concentration not within limits," add "OR One SIT inoperable due to the inability to verify level or pressure."
>
> For LCO 3.5.1, Required Action A.1, which currently reads "Restore boron concentration to within limits," change this to read "Restore SIT to OPERABLE status."
>
> For LCO 3.5.1, Condition B., Completion Time, which currently reads "1 hour," change this to read "24 hours."

The TS Bases changes included in Attachments 1 and 2 provide the bases for the above changes, which is derived from the following discussion.

3.2 Basis for Proposed Changes

The Palisades Plant Technical Specifications (TS) address the SITs as a portion of the ECCS. LCO 3.5.1 presently requires four SITs be operable in Modes 1 and 2. With one SIT inoperable due to boron concentration not within limits, the plant has 72 hours to restore boron level or must be in Mode 3 within the next 6 hours. With one SIT inoperable due to reasons other than boron concentration not within limits, the plant has one hour to restore the affected SIT to operable status or must be in Mode 3 within the next 6 hours. With two or more SITs inoperable for any reason, the plant enters LCO 3.0.3. LCO 3.5.1 requires the operability of four SITs to ensure that sufficient borated water inventory is available to reflood the core following a large break loss of coolant accident (LOCA), assuming the inventory of one tank is lost out the break and does not reach the core. The proposed changes apply (1) to the case where an SIT must be considered inoperable due to actual level or pressure, or other condition, rendering the tank inoperable (extends AOT from one hour to 24 hours), and (2) to the case where an SIT must be considered inoperable due only to level or pressure instrumentation problems (establishes an AOT of 72 hours, the same as the existing AOT for boron concentration).

<u>Basis for Case (1) - 24 hour AOT</u>

Industry operating experience has demonstrated that many of the causes of SIT inoperability have been diagnosed and corrected within a relatively short period of time, but often longer than the existing one hour AOT. In several cases, the diagnosis of an inoperable SIT has resulted in plant shutdowns. A review of this operating experience, as well as a general review of current probabilistic safety analysis (PSA) studies, led to questioning whether transitioning to a lower Mode, as required by the existing TS Action, provides greater reactor safety than remaining at power and repairing the inoperable SIT.

If a single SIT were to be diagnosed as inoperable due to tank level or pressure, or both, being outside the limits established in Palisades Plant Technical Specifications, or due to the associated isolation valve in other than the fully open position, the current action statement would allow one hour to restore the tank to within limits or fully open the valve or, failing such actions, to transition the plant to Mode 3 within the following six hours. The proposed change to TS would allow 24 hours to restore operability prior to requiring a plant shutdown. The extension of the existing SIT AOT to 24 hours would provide sufficient time in which to diagnose and possibly repair minor SIT system malfunctions at power, thereby averting an unplanned shutdown. Since risk analyses demonstrate that the increased risk of operating with a single SIT out of service is negligible, increasing the AOT 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.

Basis for Case (2) - 72 hour AOT

The NRC issued Generic Letter (GL) 93-05 on September 27, 1993, and 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 AOT 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 Technical Specifications (STS) recognized that SIT instrumentation operability was not directly related to the capability of the SITs to perform their safety function. At the time of the development of the STS, the staff did not include a separate condition in the SIT TS for a SIT inoperable due to the inability to verify level or pressure, as was recommended in GL 93-05. However, the staff has stated its belief that this is appropriate based on 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.

The present Palisades Plant TS make no differentiation between a SIT that is inoperable due to actual inventory or gas pressure discrepancies and a SIT whose inventory or gas pressure cannot be verified due to instrumentation malfunction. The proposed change will allow continued operation for up to 72 hours for a single SIT that is deemed inoperable due solely to malfunctioning level or pressure instrumentation. Because this instrumentation provides no safety actuation, it is reasonable to extend the allowable outage time since the SIT is available to perform its safety function during this time even though technically inoperable. This proposed change is in accordance with the provisions of NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements" and Generic Letter 93-05 "Line Item Improvements to Reduce Surveillance Requirements for Testing During power Operation."

3.3 Deterministic Assessment of SIT AOT Extension

LCO 3.5.1 requires that all SITs be operable whenever the plant is in Modes 1 and 2. The LCO is based on the assumption that when the plant is in these Modes, the SITs must have the functionality that would be required for a LOCA at full rated thermal power. When the plant is in the applicable Modes, a 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, the perceived severity of the consequences of not having all SITs available to provide passive injection during a design basis LOCA appeared to warrant the restrictiveness of the requirement to return the SIT to operable status within 1 hour or shut down the plant. However, the present SIT AOT was based solely on engineering judgement and did not take into consideration a quantitative assessment of risk.

The SIT operational parameters are set by the design basis large break LOCA analysis. Since the SIT is a passive device and provides a limited function, operability has been assumed to mean that the equipment's initial conditions are within a band supported by 10 CFR 50, Appendix K design basis analysis. Analytical models of Appendix K 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, SIT inventory requirements are conservatively set at a high level. Extending the existing AOT from one hour to 24 hours for one SIT that is inoperable for reasons other than boron concentration being outside limits or the inability to verify level or pressure, will allow time 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 large break LOCA during this short time frame, and the potential risk associated with plant shutdowns, extending the SIT AOT will allow defense in depth to be maintained while not significantly affecting overall safety margins assumed in the design basis analysis.

The methodology, assumptions, and results of calculations performed to conservatively assess the radiological consequences of design basis accidents are described in the Palisades Updated Final Safety Analysis Report (UFSAR), and equipment AOTs are not considered in the analyzed accident scenarios. It is generally considered that the potential for accident initiation within the brief time intervals conditionally allowed by the TS for return of inoperable safety-related equipment to operable status is sufficiently small to justify continued power operations during those intervals. However, the impact of an AOT interval on the probability and estimated frequency of large radiological releases can be quantified by using PSA techniques to evaluate the risk associated with continued plant operations during periods of equipment inoperability. Part 6.2.2 of the joint applications report, CE NPSD-994, provides a discussion of the radiological release considerations included in the CEOG study. The report concludes that potential releases would remain within 10 CFR 100 limits in the unlikely event that a design basis accident occurred in the presence of a compromised ECCS, i.e., one of four SITs unavailable.

3.4 Probabilistic Safety Assessment of SIT AOT Extension

In addition to evaluating the impact of the AOT extension on deterministic factors associated with the plant design bases, a probabilistic safety assessment of risks involved with applicable plant operations was also performed. The assessment generally conforms to the three-tiered approach to an evaluation of the risk impact from an AOT extension that is identified in Regulatory Position C.2.3 of USNRC Regulatory Guide 1.177, An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications, August 1998, i.e., Tier 1: PRA Capability and Insights, Tier 2: Avoidance of Risk-Significant Plant Configurations, and Tier 3: Risk-Informed Configuration Risk Management. A summary of the results of this approach is provided in Part 3.5 of this enclosure.

The considerations, assumptions, methodologies, and detailed results of the risk assessment are reported in CE NPSD-994, "Joint Applications Report for Safety Injection Tank AOT/STI Extension," Final Report CEOG Task 836, prepared for the CE Owners Group, April 1995. CE NPSD-994 also contains other generic information relevant to the proposed AOT extension that is applicable to Palisades. The joint applications report, as supplemented, forms the risk-informed justification/basis for the proposed license amendments.

The Palisades contribution to the 1995 preparation of CE NPSD-994 was generated using the IPE models developed in response to Generic Letter (GL) 88-20, Individual Plant Examination for Severe Accident Vulnerabilities, and associated supplements. Subsequently in 1996, the NRC completed its review of the GL 88-20 submittals and in a letter to Consumers Energy dated February 7, 1996, Subject: Staff Evaluation Report of Palisades Plant - Individual Plant Examination (IPE) Submittal - Internal Events (TAC No. M74444), the NRC staff concluded "that the licensee's IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities, and therefore, that the Palisades IPE has met the intent of GL 88-20."

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, including:

- 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 Combustion Engineering Owners Group (CEOG) "Joint Applications Report for Safety Injection Tank AOT/STI Extension," CE NPSD-994, provides risk calculations associated with an AOT extension from one hour to 24 hours. The results of the analyses indicate that the average single and yearly AOT risk contributions are very small (8.77E-09 and 3.07E-09 for Palisades, respectively), and the average core damage frequency (CDF) is virtually unchanged (less than a 0.1% increase). The data and risk results in CE NPSD-994 pertaining to Palisades were supplied and endorsed by Consumers Energy.

A similar risk assessment was performed to evaluate "transition risk." Transition risk represents the risk associated with reducing power and going to hot or cold shutdown (Modes 4 or 5) following equipment failure. The results of this analysis indicate that the average core damage probability (CDP) attributable to transition risk is larger than the average CDP associated with continued operation of the plant at power with one SIT inoperable for the proposed AOT.

As part of the CEOG study an assessment was performed on the impact of the proposed AOT extension on large early release scenarios. The three classes of events considered for these release scenarios include: Class 1 event category (containment bypass); Class 2 event category (severe accidents accompanied by loss of containment isolation); and Class 3 event category (containment failure associated with energetic events in the containment). The assessment concluded that the unavailability of one SIT would not impact or alter the progression of Class 1 events since these events are characterized by an irrevocable loss of reactor inventory along with any makeup outside of containment. A small increase in Class 2 events could occur when an unmitigated large break LOCA occurs in conjunction with an initially unisolated containment. There will be no significant fission product releases unless the containment is unscrubbed (containment sprays are inoperable). This later combination of Class 2 events is considered of very low probability. Class 3 events are dominated by PCS transients that occur at high pressure. These events exclude those where SIT performance would be called for, and, therefore, SIT status is not a contributor to this event category. The assessment concluded that the unavailability of one SIT will result in a negligible impact on the large early release probability for Palisades.

The CEOG report concluded that the overall plant risk with the proposed AOT is either risk beneficial or, at the very least, risk neutral.

3.5 Summary of Results for Tier 1, 2 and 3 Evaluations

Tier 1 is an evaluation of the impact on plant risk of the proposed TS change as expressed by the change in core damage frequency, the incremental conditional change in core damage probability, and when appropriate, the change in large early release frequency and the incremental conditional large early release probability. A series of sensitivity studies were performed to estimate the risk impact of the proposed AOT extension on the core damage and large early release frequencies. The types of sensitivity studies were developed as part of the CEOG task with input from the NRC staff.

It can be seen from the data in Table 6.3.2-2 of CE NPSD-994 that there is minimal (1.0E-07/yr) increase in the calculated CDF for Palisades. The report concluded that increased unavailability of one SIT will result in negligible impact on the large early release frequency (LERF) (section 6.2.2 of the report). Thus, the RG 1.174 acceptance guideline of "very small" increases in these parameters is satisfied. In addition, the calculated ICCDP (Table 6.3.2-1) is less than 5E-07 and the expected ICLERP is less than 5E-08, and satisfy the acceptance guideline that the proposed AOT change has only a "small" quantitative impact on plant risk as defined in RG 1.177.

The PSA model used to calculate the estimated risk impact of the proposed AOT extension does not include an assessment of the potential risk due to internal fires and external events. The Palisades response to GL 88-20, Supplement 4, Individual Plant Examination of External Events for Severe Accident Vulnerabilities, (IPEEE) was submitted for NRC review in 1995. The NRC completed its review of the Palisades IPEEE in November 1999 (TAC No. M83653) and the staff stated "the licensee's IPEEE is capable of identifying the most likely severe accidents and severe accident vulnerabilities for Palisades. Therefore, it has met the intent of Supplement 4 to GL 88-20." The IPEEE concluded that there are no severe accident vulnerabilities to internal fire and external events. The SITs are only used to mitigate the consequences of a large break LOCA (LBLOCA). The only LBLOCA scenarios evaluated in the IPEEE were seismically induced LBLOCA. These scenarios had no impact on the seismic CDF calculations. Therefore, an inoperable SIT will have negligible impact on the fire or external event CDF or LERF.

Tier 2 is the avoidance of risk-significant plant configurations by identification of potentially high risk configurations that could exist if equipment in addition to that associated with the TS change is concurrently taken out of service or other risk significant operational factors such as concurrent system or equipment testing are involved. The objective of Tier 2 is to ensure that appropriate restrictions are placed on dominant risk significant configurations that would be relevant to the proposed TS change. No additional constraints or compensatory actions were identified that would avoid or reduce the probability of a risk significant configuration.

Tier 3 is the development of a proceduralized program, which ensures the risk impact of out-of-service equipment is appropriately evaluated prior to performing a maintenance activity. Because the SIT sequence modeling is relatively independent of that for other systems, it is appropriate to conclude that application of Tier 3 to the proposed SIT AOT is not necessary. However, at Palisades, planned and emergent work activities are evaluated for their impact on nuclear safety. A Palisades configuration risk management program is already in place to manage the risk associated with the planed removal of equipment from service for maintenance. The program will be adjusted to provide compliance with the revised Maintenance Rule, 10 CFR 50.65(a)(4), by November 28, 2000. Thus, work activities occurring at the same time that a SIT is unavailable will be evaluated to minimize impact on nuclear safety.

3.6 Implementation and Monitoring

As implied by its commitment to and endorsement of CE NPSD-994, Palisades will follow the Maintenance Rule (10 CFR 50.65) for controlling the actual equipment maintenance cycle by defining performance criteria for the SITs. The AOT extensions will allow efficient scheduling of maintenance within the boundaries established by the Maintenance Rule. The effect of the AOT extensions will be considered if any adverse trends in meeting established performance criteria are identified for the SITs. The Plant's implementation of the Maintenance Rule is thus the vehicle that monitors the effectiveness of the AOT extensions. Application of these implementation and monitoring strategies will help ensure that extension of the TS AOTs for SITs does not degrade operational safety over time, and that the risk incurred due to a SIT being out of service is minimized.

3.7 Other Considerations

The proposed changes to LCO 3.5.1 are similar to TS approved for licensees for whom the risk-informed SIT AOT has been granted, and differences are primarily those of structure in order to ensure the proposed action statements remain consistent with the Palisades TS format.

4.0 DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

An evaluation of the proposed change has been performed in accordance with 10CFR50.91(a)(1) regarding no significant hazards considerations using the standards in 10CFR50.92(c). A discussion of these standards as they relate to this amendment request follows:

10CFR50.92(c)(1) - Does Not Involve a Significant Increase in the Probability or Consequences of an Accident Previously Evaluated.

The Safety Injection Tanks (SITs) are passive components in the Emergency Core Cooling System. The SITs are not an accident initiator in any accident previously evaluated. Therefore, this change does not involve an increase in the probability of an accident previously evaluated.

SITs were designed to mitigate the consequences of Loss of Coolant Accidents (LOCA). These proposed changes do not affect any of the assumptions used in deterministic LOCA analysis. Hence the consequences of accidents previously evaluated do not change. In addition, in order to fully evaluate the effect of the SIT Allowable Outage Time (AOT) extension, probabilistic safety analysis (PSA) methods were utilized. The results of these analyses show no significant increase in the core damage frequency or large early release frequency. As a result, from a PSA standpoint, there would be no significant increase in the consequences of an accident previously evaluated. These analyses are detailed in CE NPSD-994, Combustion Engineering Owners Group "Joint Applications Report for Safety Injection Tank AOT/STI Extension."

The changes pertaining to SIT inoperability based solely on instrumentation malfunction do not involve a significant increase in the consequences of an accident as evaluated and endorsed by the Nuclear Regulatory Commission (NRC) in NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements." This evaluation is applicable to the Palisades Plant.

Therefore, these changes do not involve an increase in the probability or consequences of any accident previously evaluated.

10CFR50.92(c)(2) - Does Not Create the Possibility of a New or Different Kind of Accident from any Previously Evaluated.

This proposed change does not change the design, configuration, or method of operation of the plant. The proposed configuration (one SIT out of service) is already allowed. Therefore, this change does not create the possibility of a new or different kind of accident from any previously evaluated.

10CFR50.92(c)(3) - Does Not Involve a Significant Reduction in the Margin of Safety.

The proposed changes do not affect the limiting conditions for operation or their bases that are used in the deterministic analyses to establish the margin of safety. The proposed configuration (one SIT out of service) is already allowed. PSA evaluations were used to evaluate these changes. The results of these analyses show no significant increase in the core damage frequency or large early release frequency. These evaluations are detailed in CE NPSD-994. Therefore, this change does not involve a significant reduction in the margin of safety.

Therefore, based upon the reasoning presented above and the previous discussion of the amendment request, Consumers Energy has determined that the requested changes do not involve a significant hazards consideration.

5.0 ENVIRONMENTAL CONSIDERATION

The proposed license amendment changes requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The proposed amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite, and no significant increase in individual or cumulative occupational radiation exposure. Consumers Energy has concluded that the proposed amendment involves no significant hazards consideration and meets the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and that, pursuant to 10 CFR 51.22(b), an environmental impact statement or environmental assessment need not be prepared in connection with issuance of the amendment.

6.0 CONCLUSION

The risk contributions associated with extending the AOT for a single inoperable SIT from one to 24 hours (LCO 3.5.1, Condition B), and for adding the 72 hour AOT for SIT level or pressure indication (LCO 3.5.1, Condition A), have been quantitatively evaluated using the IPE for Palisades. The analyses, in conjunction with CE NPSD-994, show that the very small increase in the calculated "at power risk" can be offset by averting the risk associated with an unnecessary plant transition to a shutdown mode.

The integrated assessment reported in CE NPSD-994, as supplemented by this submittal, generally conforms to guidance provided in NUREG/CR-6141, *Handbook of Methods for Risk Based Analyses of Technical Specifications*, December 1994, and, except for the location of the CRMP description, USNRC Regulatory Guide 1.177, *An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications*, August 1998. Relative to the average Core Damage Frequency calculated for the appropriate severe accidents, NUREG/CR-6141 states, "A risk-based AOT assures that the single event and yearly AOT risk contributions are acceptable." Consumers Energy believes the proposed 24 hour AOT, and other AOT changes, qualify as a beneficial risk-based AOT, and that the proposed amendment is acceptable.

The Palisades Plant Review Committee has reviewed this TS Change Request and has determined that proposing these changes does not involve a significant hazards consideration. This change has been reviewed by the Nuclear Performance Assessment Department.

ATTACHMENT 1 TO ENCLOSURE 1

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

June 27, 2000

TECHNICAL SPECIFICATION CHANGE REQUEST - LICENSE DPR-20
ALLOWABLE OUTAGE TIMES FOR SAFETY INJECTION TANKS

REVISED TECHNICAL SPECIFICATIONS
AND
TECHNICAL SPECIFICATIONS BASES
PAGES

10 Pages

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Safety Injection Tanks (SITs)

LCO 3.5.1 Four SITs shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One SIT inoperable due to boron concentration not within limits. OR One SIT inoperable due to the inability to verify level or pressure.	A.1	Restore SIT to OPERABLE status.	72 hours
B. One SIT inoperable for reasons other than Condition A.	B.1	Restore SIT to OPERABLE status.	24 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1	Be in MODE 3.	6 hours
D. Two or more SITs inoperable.	D.1	Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.1.1	Verify each SIT isolation valve is fully open.	12 hours
SR 3.5.1.2	Verify borated water volume in each SIT is $\geq$ 1040 ft^3 and $\leq$ 1176 ft^3.	12 hours
SR 3.5.1.3	Verify nitrogen cover pressure in each SIT is $\geq$ 200 psig.	12 hours
SR 3.5.1.4	Verify boron concentration in each SIT is $\geq$ 1720 ppm and $\leq$ 2500 ppm.	31 days
SR 3.5.1.5	Verify power is removed from each SIT isolation valve operator.	31 days

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.1 Safety Injection Tanks (SITs)

BASES

BACKGROUND

The functions of the four SITs are to supply water to the reactor vessel during the blowdown phase of a Loss of Coolant Accident (LOCA), to provide inventory to help accomplish the refill phase that follows thereafter, and to provide Primary Coolant System (PCS) makeup for a small break LOCA.

The blowdown phase of a LOCA is the initial period of the transient during which the PCS departs from equilibrium conditions, and heat from fission product decay, hot internals, and the vessel continues to be transferred to the primary coolant. The blowdown phase of the transient ends when the PCS pressure falls to a value approaching that of the containment atmosphere.

The refill phase of a LOCA follows immediately after the primary coolant inventory has vacated the core through steam flashing and ejection out through the break. The core is essentially in adiabatic heatup. The balance of the SITs' inventory is then available to help fill voids in the lower plenum and reactor vessel downcomer to establish a recovery level at the bottom of the core and ongoing reflood of the core with the addition of Safety Injection (SI) water.

The SITs are pressure vessels partially filled with borated water and pressurized with nitrogen gas (Ref. 2). The SITs are passive components, since no operator or control action is required for them to perform their function. Internal tank pressure and elevation head are sufficient to discharge the contents to the PCS, if PCS pressure decreases below the SIT pressure.

Each SIT is piped into one PCS cold leg via the injection lines utilized by the High Pressure Safety Injection and Low Pressure Safety Injection (HPSI and LPSI) systems. Each SIT is isolated from the PCS by a motor operated isolation valve and two check valves in series. The motor operated isolation valves are normally open, with power removed from the valve motor to prevent inadvertent closure prior to or during an accident.

BASES

BACKGROUND (continued)	The SIT gas and water volumes, gas pressure, tank elevation, and outlet pipe size are selected to allow three of the four SITs to partially recover the core before significant clad melting or zirconium water reaction can occur following a LOCA. The need to ensure that three SITs are adequate for this function is consistent with the LOCA assumption that the entire contents of one SIT will be lost via the break during the blowdown phase of a LOCA.

APPLICABLE SAFETY ANALYSES

The SITs are credited in both the large and small break LOCA analyses at full power (Ref. 1). These are the Design Basis Accidents (DBAs) that establish the acceptance limits for the SITs. Reference to the analyses for these DBAs is used to assess changes to the SITs as they relate to the acceptance limits.

In performing the LOCA calculations, conservative assumptions are made concerning the availability of SI flow. These assumptions include signal generation time, equipment starting times, and delivery time due to system piping. In the early stages of a LOCA with a loss of offsite power, the SITs provide the sole source of makeup water to the PCS. (The assumption of a loss of offsite power is required by regulations.) This is because the LPSI pumps and HPSI pumps cannot deliver flow until the Diesel Generators (DGs) start, come to rated speed, and go through their timed loading sequence. In cold leg breaks, the entire contents of one SIT are assumed to be lost through the break during the blowdown and reflood phases.

The limiting large break LOCA is a double ended guillotine cold leg break at the discharge of the primary coolant pump. During this event, the SITs discharge to the PCS as soon as PCS pressure decreases to below SIT pressure. No operator action is assumed during the blowdown stage of a large break LOCA.

The worst case small break LOCA assumes a time delay before pumped flow reaches the core. For the larger range of small breaks, the rate of blowdown is such that the increase in fuel clad temperature is terminated initially by the SITs, with pumped flow then providing continued cooling.

As break size decreases, the SITs and HPSI pumps both play a part in terminating the rise in clad temperature. As break size continues to decrease, the role of the SITs continues to decrease until they are not required, and the HPSI pumps become solely responsible for terminating the temperature increase.

BASES

APPLICABLE SAFETY ANALYSES (continued)

This LCO helps to ensure that the following acceptance criteria, established by 10 CFR 50.46 for the ECCS, will be met following a LOCA:

a. Maximum fuel element cladding temperature is ≤ 2200°F;

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount that would be generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react; and

d. The core is maintained in a coolable geometry.

Since the SITs discharge during the blowdown phase of a LOCA, they do not contribute to the long term cooling requirements of 10 CFR 50.46.

Since the SITs are passive components, single active failures are not applicable to their operation. The SIT isolation valves, however, are not single failure proof; therefore, whenever the valves are open, power is removed from their operators and the switch is key locked open.

These precautions ensure that the SITs are available during an accident. With power supplied to the valves, a single active failure could result in a valve closure, which would render one SIT unavailable for injection. If the contents of a second SIT is lost through the break, only the contents of two SITs would reach the core. Since the only active failure that could affect the SITs would be the closure of a motor operated outlet valve, the requirement to remove power from these eliminates this failure mode.

The minimum volume requirement for the SITs ensures that three SITs can provide adequate inventory to reflood the core and downcomer following a LOCA. The downcomer then remains flooded until the HPSI and LPSI systems start to deliver flow.

The maximum volume limit is based on maintaining an adequate gas volume to ensure proper injection and the ability of the SITs to fully discharge, as well as limiting the maximum boron inventory in the SITs.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The minimum SIT volume of 1040 ft^3 and the maximum SIT volume of 1176 ft^3 correspond to a level of 174 inches and 200 inches, respectively. Each SIT is equipped with two float type level switches which activate control room alarms on high and low level. To allow for instrument inaccuracy, the low SIT level switch alarm is set at 176 inches and the high SIT alarm is set at 198 inches. As a backup to the SIT level switches and to facilitate operator use, level indication is also provided by a differential pressure transmitter which displays in percent tank level. The narrow indicating range of the differential pressure transmitter contains high and low alarms. The high level alarm trips at a slightly lower level than the high level switch and the low level alarm trips at a slightly higher level than the low level switch to alert the operator they are approaching the technical specification values.

The minimum nitrogen cover pressure requirement ensures that the contained gas volume will generate discharge flow rates during injection that are consistent with those assumed in the safety analyses.

A minimum pressure of 200 psig is used in the analyses. Each of the four SITs is equipped with two pressure switches and one pressure transmitter. The pressure switches activate separate control room alarms. One pressure switch provides a high pressure alarm and the other provides a low pressure alarm. The pressure transmitter provides a display of tank pressure and a common high/low pressure alarm. The low pressure alarms from the pressure switch and pressure transmitter are set sufficiently above the 200 psig value used in the safety analysis to provide margin for instrument inaccuracies. The high pressure alarms from the pressure switch and pressure transmitter are set well below the 250 psig tank design pressure and sufficiently above the normal operating pressure to avoid nuisance alarms.

The 1720 ppm limit for minimum boron concentration was established to ensure that, following a LOCA with a minimum level in the SITs, the reactor will remain subcritical in the cold condition following mixing of the SITs, Safety Injection Refueling Water Tank and PCS water volumes. Small break LOCAs assume that all full-length control rods are inserted, except for the control rod of highest worth, which is withdrawn from the core. Large break LOCA analyses assume that all full-length control rods remain withdrawn until the blowdown phase is over. For large break LOCAs, the initial reactor shutdown is accomplished by void formation. The most limiting case occurs at beginning of core life.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The maximum boron limit of 2500 ppm in the SITs is based on boron precipitation in the core following a LOCA. With the reactor vessel at saturated conditions, the core dissipates heat by boiling. Because of this boiling phenomenon in the core, the boric acid concentration will increase in this region. If allowed to proceed in this manner, a point will be reached where boron precipitation will occur in the core. Post LOCA emergency procedures direct the operator to establish simultaneous hot and cold leg injection to prevent this condition by establishing a forced flow path through the core regardless of break location. These procedures are based on the minimum time in which precipitation could occur, assuming that maximum boron concentrations exist in the borated water sources used for injection following a LOCA. Boron concentrations in the SITs in excess of the limit could result in precipitation earlier than assumed in the analysis.

The SITs satisfy Criterion 3 of 10 CFR 50.36(c)(2).

LCO

The LCO establishes the minimum conditions required to ensure that the SITs are available to accomplish their core cooling safety function following a LOCA. Four SITs are required to be OPERABLE to ensure that 100% of the contents of three of the SITs will reach the core during a LOCA.

This is consistent with the assumption that the contents of one tank spill through the break. If the contents of fewer than three tanks are injected during the blowdown phase of a LOCA, the ECCS acceptance criteria of 10 CFR 50.46 could be violated.

For an SIT to be considered OPERABLE, the isolation valve must be fully open, with power to the valve operator removed, and the limits established in the SR for contained volume, boron concentration, and nitrogen cover pressure must be met.

APPLICABILITY

In MODES 1 and 2 the SIT OPERABILITY requirements are based on an assumption of full power operation. Although cooling requirements decrease as power decreases, the SITs are required to be OPERABLE during the MODES when the reactor is critical.

In MODE 3 and below, the rate of PCS blowdown is such that the ECCS pumps can provide adequate injection to ensure that peak clad temperature remains below the 10 CFR 50.46 limit of 2200°F.

BASES

APPLICABILITY (continued)

In MODES 3, 4, 5, and 6, the SIT motor operated isolation valves may be closed to isolate the SITs from the PCS. This allows PCS cooldown and depressurization without discharging the SITs into the PCS or requiring depressurization of the SITs.

ACTIONS

A.1

If the boron concentration of one SIT is not within limits, it must be returned to within the limits within 72 hours. In this condition, the ability to maintain subcriticality or minimum boron precipitation time may be reduced, but the reduced concentration effects on core subcriticality during reflood are minor. Boiling of the ECCS water in the core during reflood concentrates the boron in the saturated liquid that remains in the core. In addition, the volume of the SIT is still available for injection.

Since the boron requirements are based on the average boron concentration of the total volume of three SITs, the consequences are less severe than they would be if an SIT were not available for injection.

Thus, 72 hours is allowed to return the boron concentration to within limits.

The combination of redundant level and pressure instrumentation for any single SIT provides sufficient information so that it is not worthwhile to always attempt to correct drift associated with one instrument, with the resulting radiation exposures during entry into containment, as there is sufficient time to repair one in the event that a second one became inoperable. Because these instruments do not initiate a safety action, it is reasonable to extend the allowable outage time for them. While technically inoperable, the SIT will be available to fulfill its safety function during this time, and, thus, this Completion Time results in a negligible increase in risk.

B.1

If one SIT is inoperable, for reasons other than boron concentration or the inability to verify level or pressure, the SIT must be returned to OPERABLE status within 24 hours. In this Condition, the required contents of three SITs cannot be assumed to reach the core during a LOCA as is assumed in the safety analysis.

CE-NPSD-994 (Ref. 3) provides a series of deterministic and probabilistic findings that support the 24 hour Completion Time as having no affect on risk as compared to shorter periods for restoring the SIT to OPERABLE status.

BASES

ACTIONS (continued)

C.1

If the SIT cannot be restored to OPERABLE status within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The allowed Completion Time is reasonable, based on operating experience, to reach the required plant conditions from full power condition in an orderly manner and without challenging plant systems.

D.1

If more than one SIT is inoperable, the plant is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 3.5.1.1

Verification every 12 hours that each SIT isolation valve is fully open, as indicated in the control room, ensures that SITs are available for injection and ensures timely discovery if a valve should be partially closed. If an isolation valve is not fully open, the rate of injection to the PCS would be reduced. Although a motor operated valve should not change position with power removed, a closed valve could result in not meeting accident analysis assumptions. A 12 hour Frequency is considered reasonable in view of other administrative controls that ensure the unlikelihood of a mispositioned isolation valve.

SR 3.5.1.2 and SR 3.5.1.3

SIT borated water volume and nitrogen cover pressure should be verified to be within specified limits every 12 hours in order to ensure adequate injection during a LOCA. Due to the static design of the SITs, a 12 hour Frequency usually allows the operator sufficient time to identify changes before the limits are reached. Operating experience has shown this Frequency to be appropriate for early detection and correction of off normal trends.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.4

Thirty-one days is reasonable for verification to determine that each SIT's boron concentration is within the required limits, because the static design of the SITs limits the ways in which the concentration can be changed. The 31 day Frequency is adequate to identify changes that could occur from mechanisms such as stratification or inleakage.

SR 3.5.1.5

Verification every 31 days that power is removed from each SIT isolation valve operator ensures that an active failure could not result in the undetected closure of an SIT motor operated isolation valve. If this were to occur, only two SITs would be available for injection, given a single failure coincident with a LOCA. Since installation and removal of power to the SIT isolation valve operators is conducted under administrative control, the 31 day Frequency was chosen to provide additional assurance that power is removed.

REFERENCES

1. FSAR, Section 14.17
2. FSAR, Chapter 6.1
3. CE-NPSD-994, "CEOG Joint Applications Report for Safety Injection Tank AOT/STI Extension," May 1995

ATTACHMENT 2 TO ENCLOSURE 1

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

June 27, 2000

TECHNICAL SPECIFICATION CHANGE REQUEST - LICENSE DPR-20
ALLOWABLE OUTAGE TIMES FOR SAFETY INJECTION TANKS

MARK-UP PAGES FOR
REVISED TECHNICAL SPECIFICATIONS
AND
TECHNICAL SPECIFICATIONS BASES

10 Pages

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Safety Injection Tanks (SITs)

LCO 3.5.1 Four SITs shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One SIT inoperable due to boron concentration not within limits. OR One SIT inoperable due to the inability to verify level or pressure.	A.1	Restore ~~boron concentration to within limits~~ SIT to OPERABLE status.	72 hours
B. One SIT inoperable for reasons other than Condition A.	B.1	Restore SIT to OPERABLE status.	~~1 hour~~ 24 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1	Be in MODE 3.	6 hours
D. Two or more SITs inoperable.	D.1	Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.1.1	Verify each SIT isolation valve is fully open.	12 hours
SR 3.5.1.2	Verify borated water volume in each SIT is $\geq$ 1040 ft^3 and $\leq$ 1176 ft^3.	12 hours
SR 3.5.1.3	Verify nitrogen cover pressure in each SIT is $\geq$ 200 psig.	12 hours
SR 3.5.1.4	Verify boron concentration in each SIT is $\geq$ 1720 ppm and $\leq$ 2500 ppm.	31 days
SR 3.5.1.5	Verify power is removed from each SIT isolation valve operator.	31 days

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.1 Safety Injection Tanks (SITs)

BASES

BACKGROUND

The functions of the four SITs are to supply water to the reactor vessel during the blowdown phase of a Loss of Coolant Accident (LOCA), to provide inventory to help accomplish the refill phase that follows thereafter, and to provide Primary Coolant System (PCS) makeup for a small break LOCA.

The blowdown phase of a LOCA is the initial period of the transient during which the PCS departs from equilibrium conditions, and heat from fission product decay, hot internals, and the vessel continues to be transferred to the primary coolant. The blowdown phase of the transient ends when the PCS pressure falls to a value approaching that of the containment atmosphere.

The refill phase of a LOCA follows immediately after the primary coolant inventory has vacated the core through steam flashing and ejection out through the break. The core is essentially in adiabatic heatup. The balance of the SITs' inventory is then available to help fill voids in the lower plenum and reactor vessel downcomer to establish a recovery level at the bottom of the core and ongoing reflood of the core with the addition of Safety Injection (SI) water.

The SITs are pressure vessels partially filled with borated water and pressurized with nitrogen gas (Ref. 2). The SITs are passive components, since no operator or control action is required for them to perform their function. Internal tank pressure and elevation head are sufficient to discharge the contents to the PCS, if PCS pressure decreases below the SIT pressure.

Each SIT is piped into one PCS cold leg via the injection lines utilized by the High Pressure Safety Injection and Low Pressure Safety Injection (HPSI and LPSI) systems. Each SIT is isolated from the PCS by a motor operated isolation valve and two check valves in series. The motor operated isolation valves are normally open, with power removed from the valve motor to prevent inadvertent closure prior to or during an accident.

BASES

BACKGROUND (continued)

The SIT gas and water volumes, gas pressure, tank elevation, and outlet pipe size are selected to allow three of the four SITs to partially recover the core before significant clad melting or zirconium water reaction can occur following a LOCA. The need to ensure that three SITs are adequate for this function is consistent with the LOCA assumption that the entire contents of one SIT will be lost via the break during the blowdown phase of a LOCA.

APPLICABLE SAFETY ANALYSES

The SITs are credited in both the large and small break LOCA analyses at full power (Ref. 1). These are the Design Basis Accidents (DBAs) that establish the acceptance limits for the SITs. Reference to the analyses for these DBAs is used to assess changes to the SITs as they relate to the acceptance limits.

In performing the LOCA calculations, conservative assumptions are made concerning the availability of SI flow. These assumptions include signal generation time, equipment starting times, and delivery time due to system piping. In the early stages of a LOCA with a loss of offsite power, the SITs provide the sole source of makeup water to the PCS. (The assumption of a loss of offsite power is required by regulations.) This is because the LPSI pumps and HPSI pumps cannot deliver flow until the Diesel Generators (DGs) start, come to rated speed, and go through their timed loading sequence. In cold leg breaks, the entire contents of one SIT are assumed to be lost through the break during the blowdown and reflood phases.

The limiting large break LOCA is a double ended guillotine cold leg break at the discharge of the primary coolant pump. During this event, the SITs discharge to the PCS as soon as PCS pressure decreases to below SIT pressure. No operator action is assumed during the blowdown stage of a large break LOCA.

The worst case small break LOCA assumes a time delay before pumped flow reaches the core. For the larger range of small breaks, the rate of blowdown is such that the increase in fuel clad temperature is terminated initially by the SITs, with pumped flow then providing continued cooling.

As break size decreases, the SITs and HPSI pumps both play a part in terminating the rise in clad temperature. As break size continues to decrease, the role of the SITs continues to decrease until they are not required, and the HPSI pumps become solely responsible for terminating the temperature increase.

BASES

APPLICABLE SAFETY ANALYSES (continued)

This LCO helps to ensure that the following acceptance criteria, established by 10 CFR 50.46 for the ECCS, will be met following a LOCA:

a. Maximum fuel element cladding temperature is ≤ 2200°F;

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount that would be generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react; and

d. The core is maintained in a coolable geometry.

Since the SITs discharge during the blowdown phase of a LOCA, they do not contribute to the long term cooling requirements of 10 CFR 50.46.

Since the SITs are passive components, single active failures are not applicable to their operation. The SIT isolation valves, however, are not single failure proof; therefore, whenever the valves are open, power is removed from their operators and the switch is key locked open.

These precautions ensure that the SITs are available during an accident. With power supplied to the valves, a single active failure could result in a valve closure, which would render one SIT unavailable for injection. If the contents of a second SIT is lost through the break, only the contents of two SITs would reach the core. Since the only active failure that could affect the SITs would be the closure of a motor operated outlet valve, the requirement to remove power from these eliminates this failure mode.

The minimum volume requirement for the SITs ensures that three SITs can provide adequate inventory to reflood the core and downcomer following a LOCA. The downcomer then remains flooded until the HPSI and LPSI systems start to deliver flow.

The maximum volume limit is based on maintaining an adequate gas volume to ensure proper injection and the ability of the SITs to fully discharge, as well as limiting the maximum boron inventory in the SITs.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The minimum SIT volume of 1040 ft^3 and the maximum SIT volume of 1176 ft^3 correspond to a level of 174 inches and 200 inches, respectively. Each SIT is equipped with two float type level switches which activate control room alarms on high and low level. To allow for instrument inaccuracy, the low SIT level switch alarm is set at 176 inches and the high SIT alarm is set at 198 inches. As a backup to the SIT level switches and to facilitate operator use, level indication is also provided by a differential pressure transmitter which displays in percent tank level. The narrow indicating range of the differential pressure transmitter contains high and low alarms. The high level alarm trips at a slightly lower level than the high level switch and the low level alarm trips at a slightly higher level than the low level switch to alert the operator they are approaching the technical specification values.

The minimum nitrogen cover pressure requirement ensures that the contained gas volume will generate discharge flow rates during injection that are consistent with those assumed in the safety analyses.

A minimum pressure of 200 psig is used in the analyses. Each of the four SITs is equipped with two pressure switches and one pressure transmitter. The pressure switches activate separate control room alarms. One pressure switch provides a high pressure alarm and the other provides a low pressure alarm. The pressure transmitter provides a display of tank pressure and a common high/low pressure alarm. The low pressure alarms from the pressure switch and pressure transmitter are set sufficiently above the 200 psig value used in the safety analysis to provide margin for instrument inaccuracies. The high pressure alarms from the pressure switch and pressure transmitter are set well below the 250 psig tank design pressure and sufficiently above the normal operating pressure to avoid nuisance alarms.

The 1720 ppm limit for minimum boron concentration was established to ensure that, following a LOCA with a minimum level in the SITs, the reactor will remain subcritical in the cold condition following mixing of the SITs, Safety Injection Refueling Water Tank and PCS water volumes. Small break LOCAs assume that all full-length control rods are inserted, except for the control rod of highest worth, which is withdrawn from the core. Large break LOCA analyses assume that all full-length control rods remain withdrawn until the blowdown phase is over. For large break LOCAs, the initial reactor shutdown is accomplished by void formation. The most limiting case occurs at beginning of core life.

BASES

APPLICABLE SAFETY ANALYSES (continued)	The maximum boron limit of 2500 ppm in the SITs is based on boron precipitation in the core following a LOCA. With the reactor vessel at saturated conditions, the core dissipates heat by boiling. Because of this boiling phenomenon in the core, the boric acid concentration will increase in this region. If allowed to proceed in this manner, a point will be reached where boron precipitation will occur in the core. Post LOCA emergency procedures direct the operator to establish simultaneous hot and cold leg injection to prevent this condition by establishing a forced flow path through the core regardless of break location. These procedures are based on the minimum time in which precipitation could occur, assuming that maximum boron concentrations exist in the borated water sources used for injection following a LOCA. Boron concentrations in the SITs in excess of the limit could result in precipitation earlier than assumed in the analysis. The SITs satisfy Criterion 3 of 10 CFR 50.36(c)(2).
LCO	The LCO establishes the minimum conditions required to ensure that the SITs are available to accomplish their core cooling safety function following a LOCA. Four SITs are required to be OPERABLE to ensure that 100% of the contents of three of the SITs will reach the core during a LOCA. This is consistent with the assumption that the contents of one tank spill through the break. If the contents of fewer than three tanks are injected during the blowdown phase of a LOCA, the ECCS acceptance criteria of 10 CFR 50.46 could be violated. For an SIT to be considered OPERABLE, the isolation valve must be fully open, with power to the valve operator removed, and the limits established in the SR for contained volume, boron concentration, and nitrogen cover pressure must be met.
APPLICABILITY	In MODES 1 and 2 the SIT OPERABILITY requirements are based on an assumption of full power operation. Although cooling requirements decrease as power decreases, the SITs are required to be OPERABLE during the MODES when the reactor is critical. In MODE 3 and below, the rate of PCS blowdown is such that the ECCS pumps can provide adequate injection to ensure that peak clad temperature remains below the 10 CFR 50.46 limit of 2200°F.

BASES

APPLICABILITY (continued)

In MODES 3, 4, 5, and 6, the SIT motor operated isolation valves may be closed to isolate the SITs from the PCS. This allows PCS cooldown and depressurization without discharging the SITs into the PCS or requiring depressurization of the SITs.

ACTIONS

A.1

If the boron concentration of one SIT is not within limits, it must be returned to within the limits within 72 hours. In this condition, the ability to maintain subcriticality or minimum boron precipitation time may be reduced, but the reduced concentration effects on core subcriticality during reflood are minor. Boiling of the ECCS water in the core during reflood concentrates the boron in the saturated liquid that remains in the core. In addition, the volume of the SIT is still available for injection.

Since the boron requirements are based on the average boron concentration of the total volume of three SITs, the consequences are less severe than they would be if an SIT were not available for injection.

Thus, 72 hours is allowed to return the boron concentration to within limits.

The combination of redundant level and pressure instrumentation for any single SIT provides sufficient information so that it is not worthwhile to always attempt to correct drift associated with one instrument, with the resulting radiation exposures during entry into containment, as there is sufficient time to repair one in the event that a second one became inoperable. Because these instruments do not initiate a safety action, it is reasonable to extend the allowable outage time for them. While technically inoperable, the SIT will be available to fulfill its safety function during this time, and, thus, this Completion Time results in a negligible increase in risk.

B.1

~~If one SIT is inoperable, for a reason other than boron concentration or the inability to verify level or pressure, the SIT must be returned to OPERABLE status within 1 hour. In this Condition, the required contents of three SITs cannot be assumed to reach the core during a LOCA. Due to the severity of the consequences should a LOCA occur in these conditions, the 1 hour Completion Time to open the valve, remove power to the valve, or restore the proper water volume or nitrogen cover pressure ensures that prompt action will be taken to return the inoperable SIT to OPERABLE status. The Completion Time minimizes the exposure of the plant to a LOCA in these conditions.~~

BASES

If one SIT is inoperable, for reasons other than boron concentration or the inability to verify level or pressure, the SIT must be returned to OPERABLE status within 24 hours. In this Condition, the required contents of three SITs cannot be assumed to reach the core during a LOCA as is assumed in the safety analysis.

CE-NPSD-994 (Ref. 3) provides a series of deterministic and probabilistic findings that support the 24 hour Completion Time as having no affect on risk as compared to shorter periods for restoring the SIT to OPERABLE status.

ACTIONS (continued)

C.1

If the SIT cannot be restored to OPERABLE status within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The allowed Completion Time is reasonable, based on operating experience, to reach the required plant conditions from full power condition in an orderly manner and without challenging plant systems.

D.1

If more than one SIT is inoperable, the plant is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 3.5.1.1

Verification every 12 hours that each SIT isolation valve is fully open, as indicated in the control room, ensures that SITs are available for injection and ensures timely discovery if a valve should be partially closed. If an isolation valve is not fully open, the rate of injection to the PCS would be reduced. Although a motor operated valve should not change position with power removed, a closed valve could result in not meeting accident analysis assumptions. A 12 hour Frequency is considered reasonable in view of other administrative controls that ensure the unlikelihood of a mispositioned isolation valve.

SR 3.5.1.2 and SR 3.5.1.3

SIT borated water volume and nitrogen cover pressure should be verified to be within specified limits every 12 hours in order to ensure adequate injection during a LOCA. Due to the static design of the SITs,

BASES

a 12 hour Frequency usually allows the operator sufficient time to identify changes before the limits are reached. Operating experience has shown this Frequency to be appropriate for early detection and correction of off normal trends.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.4

Thirty-one days is reasonable for verification to determine that each SIT's boron concentration is within the required limits, because the static design of the SITs limits the ways in which the concentration can be changed. The 31 day Frequency is adequate to identify changes that could occur from mechanisms such as stratification or inleakage.

SR 3.5.1.5

Verification every 31 days that power is removed from each SIT isolation valve operator ensures that an active failure could not result in the undetected closure of an SIT motor operated isolation valve. If this were to occur, only two SITs would be available for injection, given a single failure coincident with a LOCA. Since installation and removal of power to the SIT isolation valve operators is conducted under administrative control, the 31 day Frequency was chosen to provide additional assurance that power is removed.

REFERENCES

1. FSAR, Section 14.17
2. FSAR, Chapter 6.1
3. CE-NPSD-994, "CEOG Joint Applications Report for Safety Injection Tank AOT/STI Extension," May 1995

ENCLOSURE 2

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

June 27, 2000

TECHNICAL SPECIFICATION CHANGE REQUEST - LICENSE DPR-20
ALLOWABLE OUTAGE TIMES FOR LOW PRESSURE SAFETY INJECTION

46 Pages

CONSUMERS ENERGY COMPANY
Docket 50-255
Technical Specifications Change Request
License DPR-20

1.0 INTRODUCTION

It is requested that the Technical Specifications (TS) contained in the Facility Operating License DPR-20, Docket 50-255, for the Palisades Plant be changed as described below. The changes implement improvements to NUREG-1432 Standard TS covered by Technical Specification Task Force (TSTF) change 58, Revision 1. The AOT extension will enhance overall plant safety by avoiding potential unscheduled plant shutdowns, and by providing increased flexibility for scheduling and performing maintenance activities. The proposed AOT is based on the results of a cooperative study performed by participating members of the Combustion Engineering Owners Group (CEOG) in conjunction with information provided herein. The study included an integrated review and assessment of plant operations, deterministic design basis factors, and overall plant risk using probabilistic safety assessment (PSA) techniques. All discussion is in reference only to the Palisades Plant Improved Technical Specifications.

Attachment 1 to Enclosure 2 contains the proposed TS and Bases pages. Complete sections are included to maintain consistent format and pagination. The changed areas are marked with a vertical line in the margin. Attachment 2 to Enclosure 2 contains the current TS and Bases pages marked to show the proposed changes. These pages show shading for proposed additions and a line drawn through deleted text.

2.0 BACKGROUND

The NRC has been reviewing and granting improvements to technical specifications (TS) that are based, at least in part, on probabilistic risk assessment insights since the mid-1980's. In concert with this initiative, the CEOG submitted several joint application reports that provide justifications for TS AOT extensions to the NRC staff for generic review (CEOG Letter 95-344, D.F. Pilmer to NRC Document Control Desk, C-E Owners Group Submittal of Joint Application Reports, July 10, 1995). The justifications for these extensions are based on a balance of probabilistic and traditional engineering considerations, and risk assessments for the participating Combustion Engineering (CE) plants are contained in the reports. Palisades was a participating plant in that owner's group task, and the report pertinent to this submittal is CE NPSD-995, "Joint Applications Report for Low Pressure Safety Injection System AOT Extension;" ABB-Combustion Engineering Inc., May 1995. A license amendment request based on CE NPSD-995, as supplemented by the CEOG and the licensee, was approved for the designated pilot plant in 1998.

2.1 Low Pressure Safety Injection (Emergency Core Cooling System) Changes

The proposed change will extend the allowed outage time (AOT) for a single low pressure safety injection (LPSI) subsystem from 72 hours to seven days (168 hours). This AOT will apply in operating Modes 1, 2, and 3 with the primary coolant system (PCS) temperature at or above 325 degrees F.

2.2 Low Pressure Safety Injection System (LPSI)

The Emergency Core Cooling System (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 loss of coolant accident (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 Safety Injection Tanks (SIT) 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, 5, and 6, and at least one LPSI pump and subtrain are required for PCS heat removal in all of these modes.

A LPSI subsystem consists of one LPSI pump and two injection flowpaths, including motor operated valves. The LPSI subsystems, in combination with the two High Pressure Safety Injection (HPSI) subsystems, form the two redundant Emergency Core Cooling System (ECCS) trains. 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 Safety Injection Tank (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 (SIS). 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 Recirculation Actuation Signal (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 (SDHX), and discharge cooler water into PCS cold legs.

The ECCS is described in the Palisades Technical Specifications Bases for LCOs 3.5.1 and 3.5.2, as well as in the Updated Final Safety Analysis Report, Chapter 6, with the system description and operation set forth in section 6.1.2.

2.3 Palisades Plant Technical Specifications (TS)

The Palisades Plant Technical Specifications (TS) address the LPSI system as a portion of the ECCS. LCO 3.5.2 presently requires two ECCS trains be operable in Modes 1, 2 and 3 with the PCS temperature above 325 degrees F. With one or more ECCS trains inoperable, based upon any component inoperability, but with 100% of required ECCS flow available, the inoperable train(s) must be returned to operable status within 72 hours or transition to Mode 3 within 6 hours and reduce PCS temperature to less than 325 degrees F within 24 hours. LCO 3.5.2 requires the operability of two ECCS trains to ensure that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one train through any single active failure. Either train operating in conjunction with the safety injection tanks is capable of supplying sufficient core cooling to limit the peak cladding temperatures within the acceptance criteria for all postulated break sizes ranging from the double-ended break of the largest PCS hot leg pipe downward. In addition, each ECCS train provides long-term core cooling capability in the recirculation mode during the accident recovery period. In Mode 3 with PCS temperature less than 325 degrees F, and in Mode 4, LCO 3.5.3 requires one operable LPSI train, which is acceptable without single failure consideration based on the stable reactivity condition of the reactor and the limited core cooling requirements.

The proposed change will allow up to seven (7) days to restore operability to a LPSI subsystem, should that be the cause of ECCS train inoperability. The Combustion Engineering Owners Group (CEOG) report CE NPSD-995, "Joint Applications Report for Low Pressure Safety Injection System AOT Extension," supports the proposed change utilizing both deterministic and probabilistic safety analysis (PSA) methodologies to address the changes in risk when compared with present TS time limitations.

3.0 PROPOSED TS CHANGES - DESCRIPTION AND BASIS

3.1 Description of TS Changes

For LCO 3.5.2, ECCS - Operating, add a new Condition A and associated Required Action A.1 and Completion Time as follows:

Condition A.	One LPSI subsystem inoperable.
Required Action A.1	Restore subsystem to OPERABLE status.
Completion Time	7 days

For LCO 3.5.2, ECCS - Operating, Condition A., which currently reads "One or more ECCS trains inoperable," renumber this as Condition B and change it to read "One or more ECCS trains inoperable for reasons other than Condition A." (The AND condition regarding availability of 100% of required ECCS flow is retained.) Renumber the remaining Required Actions and Conditions.

The TS Bases changes included in Attachments 1 and 2 provide the basis for the above changes, which is derived from the following discussion.

3.2 Basis for Proposed Changes

The present Palisades Plant Technical Specifications address the LPSI system as a portion of the ECCS, and LCO 3.5.2 requires two ECCS trains to be operable in Modes 1, 2, and 3 when PCS temperature is equal to or greater than 325 degrees F. With one ECCS train inoperable, but with 100% of required ECCS flow still available, that train must be returned to operable status within 72 hours or a plant shutdown to Mode 3 is required. If both ECCS trains become inoperable, then the LCO is not met, and action must be taken to comply with LCO 3.0.3. The proposed change applies to the case where one LPSI subsystem becomes inoperable, and will allow up to 7 days to restore that subsystem to operable status.

In the specified operating modes, LPSI must be available in the event that LOCA mitigation becomes necessary. The estimated frequency of a LOCA where LPSI may be used is on the order of 7.6E-05 per year. The shutdown cooling function (SDC) of the LPSI system may also be used for PCS heat removal in the event of a SGTR or other non-LOCA design basis events. In contrast, at least one LPSI train is required by LCO 3.5.3 to be operable for PCS heat removal during normal shutdown operations in Mode 3 below a PCS temperature of 325 degrees F, and in Mode 4. In addition, at least one LPSI train is almost always in operation during Mode 5 and 6 for refueling. Therefore, in the broad view, performing preventive and corrective maintenance on LPSI trains when at power can enhance overall plant safety by increasing the availability and reliability of the LPSI system for normal shutdown-cooling operations, i.e., when it is most often needed.

In some cases, corrective maintenance and subsequent testing of a LPSI pump and/or associated valves may require a LPSI subsystem to be out of service for more than several days. In such cases, repair within the existing AOT could not be assured and may result in an unscheduled plant shutdown or a request for temporary relief to allow continued plant operation. Based on a review of the maintenance requirements of LPSI systems for CE pressurized water reactors, the CEOG study described in CE NPSD-995 concluded that a 7-day AOT would provide sufficient margin to effect most anticipated preventive and corrective maintenance activities and LPSI system surveillance tests at power.

3.3 Deterministic Assessment of LPSI AOT Extension

10 CFR 50.46 defines deterministic acceptance criteria that are used to judge the acceptability of a given ECCS design relative to reactor core cooling performance during postulated LOCAs. The ECCS cooling performance for Palisades is calculated using acceptable evaluation models that are designed pursuant to 10 CFR 50, Appendix K, and satisfies all of the 10 CFR 50.46 acceptance criteria. The required and acceptable features of Appendix K evaluation models ensure that thermohydraulic and hydrodynamic phenomena are conservatively represented in the calculations of peak cladding temperature (PCT), and the methodology provides assurance that the minimum equipment requirements for adequate response to design basis LOCAs are conservative. The Palisades safety analyses demonstrate that a single train of ECCS equipment operating in conjunction with safety injection tanks provides an adequate and conservative response to such events initiated from full power operation.

For Palisades, major ECCS components include four passively actuated SITs, two HPSI pumps, and two LPSI pumps. The proposed AOT extension from 72 hours to 7 days will be permitted in a condition where only one LPSI train is inoperable. If an ECCS train becomes inoperable for any other reason, the existing 72 hour AOT must be applied. If both ECCS trains are inoperable, power operation is not permitted and the plant must ultimately transition to a Mode where the LCO no longer applies.

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, the defense-in-depth principle ensures that 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 Mode 3 or 4.

Table 6.2.1-1 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 TS 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.

The methodology, assumptions, and results of calculations performed to conservatively assess the radiological consequences of design basis accidents are described in the Palisades Updated Final Safety Analysis Report (UFSAR), and equipment AOTs are not considered in the analyzed accident scenarios. It is generally considered that the potential for accident initiation within the brief time intervals conditionally allowed by the TS for return of inoperable safety-related equipment to operable status is sufficiently small to justify continued power operations during those intervals. However, the impact of an AOT interval on the probability and estimated frequency of large radiological releases can be quantified in a probabilistic framework by using PSA techniques to evaluate the risk associated with continued plant operations during periods of equipment inoperability. Part 6.2.2 of the joint applications report, CE NPSD-995, provides a discussion of the radiological release considerations included in the CEOG study. The report concludes that potential releases would remain within 10 CFR 100 limits in the unlikely event that a design basis accident occurred in the presence of a compromised ECCS, i.e., no LPSI.

<u>Summary:</u> 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. Therefore, extending the AOT 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 analyses for the Palisades ECCS.

3.4 Probabilistic Safety Assessment of LPSI AOT Extension

In addition to evaluating the impact of the AOT extension on deterministic factors associated with the plant design bases, a probabilistic safety assessment of risks involved with applicable plant operations was also performed. The assessment generally conforms to the three-tiered approach to an evaluation of the risk impact from an AOT extension that is identified in Regulatory Position C.2.3 of USNRC Regulatory Guide 1.177, An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications, August 1998, i.e., Tier 1: PRA Capability and Insights, Tier 2: Avoidance of Risk-Significant Plant Configurations, and Tier 3: Risk-Informed Configuration Risk Management. A summary of the results of this approach is provided in Part 3.5 of this enclosure.

The considerations, assumptions, methodologies, and detailed results of the risk assessment are reported in CE NPSD-995, "Joint Applications Report for Low Pressure Safety Injection System AOT Extension," Final Report CEOG Task 836, prepared for the CE Owners Group, May 1995, as supplemented by the associated RAI response dated May 31, 1996 (CEOG Letter 96-254, D.F. Pilmer to C.I. Grimes, Chief, Technical Specifications Branch, NRR, Project No. 692; June 14, 1996). CE NPSD-995 also contains other generic information relevant to the proposed AOT extension that is applicable to Palisades. The joint applications report, as supplemented, forms the risk-informed justification/basis for the proposed license amendments.

The Palisades contribution to the 1995 preparation of CE NPSD-995 was generated using the IPE models developed in response to Generic Letter (GL) 88-20, Individual Plant Examination for Severe Accident Vulnerabilities, and associated supplements. Subsequently in 1996, the NRC completed its review of the GL 88-20 submittals and in a letter to Consumers Energy dated February 7, 1996, Subject: Staff Evaluation Report of Palisades Plant - Individual Plant Examination (IPE) Submittal - Internal Events (TAC

No. M74444), the NRC staff concluded "that the licensee's IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities, and therefore, that the Palisades IPE has met the intent of GL 88-20."

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, including:

- 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 CEOG study considered and categorized the change in risk into "at power risk," "transition risk," and "shutdown risk." Consideration of the risk factors impacted by the extension in AOT from 72 hours to 7 days demonstrated no increase in average "at power" core damage frequency (CDF) for Palisades (Table 6.3.2-3), and a negligible increase in risk (less than a 3% increase in average "at power" CDF) for any Combustion Engineering plant. In order to perform a more complete assessment of the overall change in risk, an accounting for avoided risks associated with reducing power and going to hot or cold shutdown was also considered. This "transition risk" is important in understanding the trade-off between shutting down the plant to effect repairs, compared with restoring the LPSI subsystem to operability while at power. Also of interest in assessing overall plant risk is the risk avoided based on LPSI system maintenance while in cold shutdown. Every time the plant is placed below Mode 3, the LPSI system is required for decay heat removal when in the shutdown cooling mode of operation. Any maintenance performed on the LPSI system during shutdown cooling operations adds to the risk of a loss of shutdown cooling event. Therefore, performing LPSI system maintenance with the unit on-line, when the LPSI system is not normally in demand, represents a decrease in shutdown risk.

The results of the CEOG integrated assessment of the overall risk associated with adopting the proposed extended LPSI AOT concluded that the change in CDF due to the extension is insignificant (no increase in average CDF for Palisades, and less than a 3% increase in average CDF for any Combustion Engineering plant). Additionally, there is a reduction in overall plant risk when this risk is offset by the reduction in transition and shutdown risks. The CEOG study concluded that the overall plant impact of the LPSI AOT extension will either be risk beneficial, or at least risk neutral.

As part of the CEOG study, an assessment was performed on the impact of the proposed LPSI AOT extension on large early release scenarios. The assessments of the three classes of events (containment bypass, severe accidents accompanied by loss of containment isolation, and containment failure associated with energetic events in containment) considered for these scenarios concluded that the increased unavailability of one LPSI subsystem will result in a negligible impact on the large early release probability for Palisades.

The CEOG report concluded that the overall plant risk with the proposed AOT is either risk beneficial or, at the very least, risk neutral.

3.5 Summary of Results for Tier 1, 2 and 3 Evaluations

<u>Tier 1</u> is an evaluation of the impact on plant risk of the proposed TS change as expressed by the change in core damage frequency, the incremental conditional change in core damage probability, and when appropriate, the change in large early release frequency

and the incremental conditional large early release probability. A series of sensitivity studies were performed to estimate the risk impact of the proposed AOT extension on the core damage and large early release frequencies. The types of sensitivity studies were developed as part of the CEOG task with input from the NRC staff.

It can be seen from the data in Table 6.3.2-3 of CE NPSD-995 that there is no change in the calculated CDF for Palisades. The report concluded that increased unavailability of the LPSI system will result in negligible impact on the large early release frequency (LERF). Thus, the RG 1.174 acceptance guideline of "very small" increases in these parameters is satisfied. In addition, the calculated ICCDP (Table 6.3.2-2) is negligible (less than 5E-07) and the expected ICLERP is less than 5E-08, and satisfy the acceptance guideline that the proposed AOT change has only a "small" quantitative impact on plant risk as defined in RG 1.177.

The PSA model used to calculate the estimated risk impact of the proposed AOT extension does not include an assessment of the potential risk due to internal fires and external events. The Palisades response to GL 88-20, Supplement 4, Individual Plant Examination of External Events for Severe Accident Vulnerabilities, (IPEEE) was submitted for NRC review in 1995. The NRC completed its review of the Palisades IPEEE in November 1999 (TAC No. M83653) and the staff stated "the licensee's IPEEE is capable of identifying the most likely severe accidents and severe accident vulnerabilities for Palisades. Therefore, it has met the intent of Supplement 4 to GL 88-20." The IPEEE concluded that there are no severe accident vulnerabilities to internal fire and external events. The main safety function of LPSI is to mitigate the consequences of a large break LOCA (LBLOCA). The only LBLOCA scenarios evaluated in the IPEEE were seismically induced LBLOCA. These scenarios had no impact on the seismic CDF calculations. Therefore, an inoperable LPSI train will have negligible impact on the fire or external event CDF or LERF.

Tier 2 is the avoidance of risk-significant plant configurations by identification of potentially high risk configurations that could exist if equipment in addition to that associated with the TS change is concurrently taken out of service or other risk significant operational factors such as concurrent system or equipment testing are involved. The objective of Tier 2 is to ensure that appropriate restrictions are placed on dominant risk significant configurations that would be relevant to the proposed TS change. Palisades has not identified any additional constraints or compensatory actions that should be included with the proposed AOT extension in order to avoid planned high risk configurations. Assessments performed in accordance with provisions of the Palisades configuration risk management program (CRMP) will ensure that potentially risk significant configurations are identified prior to removing a LPSI train from service for corrective maintenance. Similarly, implementation of the CRMP will ensure that the risk significance of unexpected configurations resulting from unplanned maintenance or conditions while in the risk-informed AOT is properly evaluated.

Tier 3 is the development of a proceduralized program, which ensures the risk impact of out-of-service equipment is appropriately evaluated prior to performing a maintenance activity. The program applies to technical specification structures, systems or components for which a risk-informed AOT has been granted. A viable program would be one that is able to uncover risk-significant plant equipment outage configurations in a timely manner during normal plant operation and is described in RG 1.177 as the CRMP. The need for this third tier stems from the difficulty of identifying all possible risk-significant configurations under Tier 2 that will be encountered over extended periods of plant operation.

The Palisades Technical Specifications do not presently contain any AOTs that require implementation of a CRMP. However, a Risk-Informed Engineering Group (RIEG) and use of a proceduralized risk management process is in place. 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 on the Maintenance Rule revision (10CFR50.65(a)(4)), and which is consistent with the program described in RG 1.177, will be implemented at Palisades when the revised Maintenance Rule is implemented (by November 28, 2000). The primary tool for performing CRMP risk assessments for Palisades is the PSA On-Line Risk Monitor (OLRM) which uses the "Equipment Out Of Service" (EOOS) program, backed up by a matrix of Structures, Systems and Components (SSCs) and their safety impact.

3.6 Configuration Risk Management Program (CRMP)

Regulatory Position C.2.3.7.1 of RG 1.177 states, "Licensees should describe their capability to perform a contemporaneous assessment of the overall impact on safety of proposed plant configurations prior to performing and during performance of maintenance activities that remove equipment from service. Licensees should explain how these tools or other processes will be used to ensure that risk-significant plant configurations will not be entered and that appropriate actions will be taken when unforeseen events put the plant in a risk-significant configuration. The TS Administrative Controls should describe the licensee's program for performing a real-time risk assessment. The bases for TS for which an extended AOT is granted should reference this program description. The following program should be incorporated and should be described in the TS Administrative Controls section." Regulatory Position C.2.3.7.2 states in part, "The intent of the CRMP is to implement Section a(3) of the Maintenance Rule (10 CFR 50.65) with respect to on-line maintenance for risk-informed TS, ..."

In February 1999, the first public meeting of the NRC staff's Risk-Informed Licensing Panel was held in Washington DC. In view of the proposed revision to the Maintenance Rule (10 CFR 50.65(a)(4)) which will incorporate requirements for a CRMP, considerable debate ensued concerning the staff's position that the program description should be incorporated and described in the TS Administrative Controls section, and that licensee requests for risk-informed AOT extensions should include a proposed TS for this purpose. As a result of the meeting, the staff elected to provide interim guidance for the CRMP issue, which was developed and issued on July 1, 1999. The interim guidance notes that placing the CRMP description into a licensee-controlled document would be considered as a potential alternative to the RG 1.177 staff position of placing the CRMP into the TS Administrative Controls section. Therefore, Palisades is not proposing to include CRMP requirements in its TS.

Consumers Energy 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, <u>Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants</u>, May 2000, including those elements related to validation, control and update of the plant PSA, which will ensure compliance with 10 CFR 50.65(a)(4).

3.7 Implementation and Monitoring

As implied by its commitment to and endorsement of CE NPSD-995, Palisades will follow the Maintenance Rule (10 CFR 50.65) for controlling the actual equipment maintenance cycle by defining unavailability performance criteria for ECCS systems. The AOT extension will allow efficient scheduling of maintenance within the boundaries established by implementing the Maintenance Rule. The effect of the AOT extension will be considered if any adverse trends in meeting established performance criteria are identified for the ECCS. The Plant's implementation of the Maintenance Rule is thus the vehicle that monitors the effectiveness of the AOT extension. Application of these implementation and monitoring strategies will help ensure that extension of the TS AOT for LPSI does not degrade operational safety over time, and that the risk incurred when a LPSI subsystem is taken out of service is minimized.

3.8 Other Considerations

The proposed changes to LCO 3.5.2 are similar to TS approved for licensees for whom the risk-informed LPSI AOT has been granted, and differences are primarily those of structure in order to ensure the proposed action statements remain consistent with the Palisades TS format.

4.0 DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

An evaluation of the proposed change has been performed in accordance with 10CFR50.91(a)(1) regarding no significant hazards considerations using the standards in 10CFR50.92(c). A discussion of these standards as they relate to this amendment request follows:

10CFR50.92(c)(1) - Does Not Involve a Significant Increase in the Probability or Consequences of an Accident Previously Evaluated.

The Low Pressure Safety Injection system (LPSI) is part of the Emergency Core Cooling System. LPSI components are not accident initiators in any accident previously evaluated. Therefore, this change does not involve an increase in the probability of an accident previously evaluated.

The LPSI system is primarily designed to mitigate the consequences of a large Loss of Coolant Accident (LOCA). These proposed changes do not affect any of the assumptions used in the deterministic LOCA analysis. Hence the consequences of accidents previously evaluated do not change. In addition, in order to fully evaluate the LPSI AOT extension, probabilistic safety analysis (PSA) methods were utilized. The results of these analyses show no significant increase in the core damage frequency. As a result, from a PSA standpoint, there would be no significant increase in the consequences of an accident previously evaluated. These analyses are detailed in CE NPSD-995, Combustion Engineering Owners Group "Joint Applications Report for Low Pressure Safety Injection System AOT Extension."

Therefore, these changes do <u>not</u> involve a significant increase in the probability or consequences of any accident previously evaluated.

10CFR50.92(c)(2) - Does Not Create the Possibility of a New or Different Kind of Accident from any Previously Evaluated.

The proposed changes do not change the design, configuration, or method of operation of the plant. No new equipment is being introduced, and installed equipment is not being operated in a new or different manner. There is no change being made to the parameters within which the plant is operated, and the setpoints at which protective or mitigative actions are initiated are unaffected by this change. No alteration in the procedures which ensure the plant remains within analyzed limits is being proposed, and no change is being made to the procedures relied upon to respond to an off-normal event. As such, no new failure modes are being introduced. The proposed changes do not alter assumptions made in the safety analysis and licensing basis. Therefore, these changes do not create the possibility of a new or different kind of accident from any previously evaluated.

10CFR50.92(c)(3) - Does Not Involve a Significant Reduction in the Margin of Safety.

The proposed changes do not affect the limiting conditions for operation or their bases used in the deterministic analyses to establish the margin of safety. PSA evaluations were used to evaluate these changes. These evaluations demonstrate that the changes are either risk neutral or risk beneficial. These evaluations are detailed in CE NPSD-995. The margin of safety is established through equipment design, operating parameters, and the setpoints at which automatic actions are initiated. None of these are adversely impacted by the proposed changes. Therefore, this change does not involve a significant reduction in the margin of safety.

Therefore, based upon the reasoning presented above and the previous discussion of the amendment request, Consumers Energy has determined that the requested changes do not involve a significant hazards consideration.

5.0 ENVIRONMENTAL CONSIDERATION

The proposed license amendment changes requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The proposed amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite, and no significant increase in individual or cumulative occupational radiation exposure. Consumers Energy has concluded that the proposed amendment involves no significant hazards consideration and meets the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and that, pursuant to 10 CFR 51.22(b), an environmental impact statement or environmental assessment need not be prepared in connection with issuance of the amendment.

6.0 CONCLUSION

The risk contributions associated with extending the AOT for a single LPSI subsystem from 72 hours to 7 days have been quantitatively evaluated using the IPE for Palisades. The analyses, in conjunction with CE NPSD-995, show that the very small increase in the calculated "at power risk" can be offset by averting the risk associated with an unnecessary plant transition to a shutdown mode, and/or reduced risk during shutdown operations that can result from improved flexibility in scheduling and performing surveillance and maintenance activities.

The integrated assessment reported in CE NPSD-995, as supplemented by this submittal, generally conforms to guidance provided in NUREG/CR-6141, *Handbook of Methods for Risk Based Analyses of Technical Specifications*, December 1994, and, except for the location of the CRMP description, USNRC Regulatory Guide 1.177, *An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications*, August 1998. Relative to the average Core Damage Frequency calculated for the appropriate severe accidents, NUREG/CR-6141 states, "A risk-based AOT assures that the single event and yearly AOT risk contributions are acceptable." Consumers Energy believes the proposed 7-day AOT qualifies as a beneficial risk-based AOT, and that the proposed amendment is acceptable.

The Palisades Plant Review Committee has reviewed this TS Change Request and has determined that proposing these changes does not involve a significant hazards consideration. This change has been reviewed by the Nuclear Performance Assessment Department.

ATTACHMENT 1 TO ENCLOSURE 2

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

June 27, 2000

TECHNICAL SPECIFICATION CHANGE REQUEST - LICENSE DPR-20
ALLOWABLE OUTAGE TIMES FOR LOW PRESSURE SAFETY INJECTION

REVISED TECHNICAL SPECIFICATIONS
AND
TECHNICAL SPECIFICATIONS BASES
PAGES

15 Pages

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.2 ECCS - Operating

LCO 3.5.2 Two ECCS trains shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODE 3 with Primary Coolant System (PCS) temperature $\geq 325°F$.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One LPSI subsystem inoperable.	A.1 Restore LPSI subsystem to OPERABLE status.	7 days
B. One or more ECCS trains inoperable for reasons other than Condition A. AND At least 100% of the required ECCS flow available.	B.1 Restore train(s) to OPERABLE status.	72 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3. AND C.2 Reduce PCS temperature to $< 325°F$.	6 hours 24 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.2.1	Verify the following valves and hand switches are in the open position. Valve/Hand Switch Number — Function CV-3027 — SIRWT Recirc Valve HS-3027A — Hand Switch For CV-3027 HS-3027B — Hand Switch For CV-3027 CV-3056 — SIRWT Recirc Valve HS-3056A — Hand Switch For CV-3056 HS-3056B — Hand Switch For CV-3056	12 hours
SR 3.5.2.2	Verify each ECCS manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.5.2.3	Verify CV-3006, "SDC Flow Control Valve," is open and its air supply is isolated.	31 days
SR 3.5.2.4	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.5.2.5	Verify each ECCS automatic valve that is not locked, sealed, or otherwise secured in position, in the flow path actuates to the correct position on an actual or simulated actuation signal.	18 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.6	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.5.2.7	Verify each LPSI pump stops on an actual or simulated actuation signal.	18 months
SR 3.5.2.8	Verify, for each ECCS throttle valve listed below, each position stop is in the correct position. Valve Number — Function MO-3008 — LPSI to Cold leg 1A MO-3010 — LPSI to Cold leg 1B MO-3012 — LPSI to Cold leg 2A MO-3014 — LPSI to Cold leg 2B MO-3082 — HPSI to Hot leg 1 MO-3083 — HPSI to Hot leg 1	18 months
SR 3.5.2.9	Verify, by visual inspection, each ECCS train containment sump suction inlet is not restricted by debris and the suction inlet screens show no evidence of structural distress or abnormal corrosion.	18 months

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.2 ECCS - Operating

BASES

BACKGROUND

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

a. Loss of Coolant Accident (LOCA);

b. Control Rod Ejection accident;

c. Loss of secondary coolant accident, including a Main Steam Line Break (MSLB) or Loss of Normal Feedwater; and

d. Steam Generator Tube Rupture (SGTR).

The addition of negative reactivity is designed primarily for the loss of secondary coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power.

There are two phases of ECCS operation: injection and recirculation. In the injection phase, all injection is initially added to the Primary Coolant System (PCS) via the cold legs. After the Safety Injection Refueling Water Tank (SIRWT) has been depleted, the recirculation phase is entered as the ECCS suction is automatically transferred to the containment sump.

Two suitably redundant, 100% capacity trains are provided. Each train consists of a High Pressure Safety Injection (HPSI) and Low Pressure Safety Injection (LPSI) subsystem. In MODES 1 and 2, and in MODE 3 with PCS temperature ≥ 325°F, both trains must be OPERABLE. This ensures that 100% of the core cooling requirements can be provided in the event of a single active failure.

BASES

BACKGROUND (continued)

Each train of a Safety Injection Signal (SIS) actuates LPSI flow by starting one LPSI pump and opening two LPSI loop injection valves. Each train of an SIS actuates HPSI flow by starting one HPSI pump, opening the four associated HPSI loop injection valves, and closing the pressure control valves associated with each Safety Injection Tank. In addition, each train of a SIS will provide a confirmatory open signal to the normally open Component Cooling Water valves which supply seal and bearing cooling to the LPSI, HPSI, and Containment Spray pumps.

The safety analyses assume that one only train of safety injection is available to mitigate an accident. While operating under the provisions of an ACTION, an additional single failure need not be assumed in assuring that a loss of function has not occurred. Therefore, the LPSI flow assumed in the safety analyses can be met if there is an OPERABLE LPSI flow path from the SIRWT to any two PCS loops. The HPSI flow assumed in the safety analyses can be met if there is an OPERABLE HPSI flow path from the SIRWT to each cold leg. In each case, an OPERABLE flow path must include an OPERABLE pump and an OPERABLE injection valve.

A suction header supplies water from the SIRWT or the containment sump to the ECCS pumps. Separate piping supplies each train. The discharge headers from each HPSI pump divide into four supply lines after entering the containment, one feeding each PCS cold leg. The discharge headers from each LPSI pump combine to supply a common header which divides into four supply lines after entering containment, one feeding each PCS cold leg.

Motor operated valves are set to maximize the LPSI flow to the PCS. This flow balance directs sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the PCS cold legs.

For LOCAs coincident with a loss of off-site power that are too small to initially depressurize the PCS below the shutoff head of the HPSI pumps, the core cooling function is provided by the Steam Generators (SGs) until the PCS pressure decreases below the HPSI pump shutoff head.

During low temperature conditions in the PCS, limitations are placed on the maximum number of HPSI pumps that may be OPERABLE. Refer to the Bases for LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for the basis of these requirements.

BASES

BACKGROUND (continued)

During a large break LOCA, PCS pressure could decrease to < 200 psia in < 20 seconds. The ECCS systems are actuated upon receipt of an SIS. If offsite power is available, the safeguard loads start immediately. If offsite power is not available, all loads will be shed at the time the diesel generators receive an automatic start signal. With load shedding completed, the diesel generator breakers will close automatically when generator voltage approaches a normal operating value. Closing of the breakers will reset the load shedding signals and start the sequencer. The sequencers will initiate operation of the engineered safeguard equipment required for the accident. The time delay associated with diesel starting, sequenced loading, and pump starting determines the time before pumped flow is available to the core following a LOCA.

The active ECCS components, along with the passive Safety Injection Tanks (SITs) and the Safety Injection Refueling Water Tank (SIRWT), covered in LCO 3.5.1, "Safety Injection Tanks (SITs)," and LCO 3.5.4, "Safety Injection Refueling Water Tank (SIRWT)," provide the cooling water necessary to meet the Palisades Nuclear Plant design criteria (Ref. 1).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria, established by 10 CFR 50.46 for ECCSs, will be met following a LOCA:

a. Maximum fuel element cladding temperature is ≤ 2200°F;

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react;

d. Core is maintained in a coolable geometry; and

e. Adequate long term core cooling capability is maintained.

The LCO also limits the potential for a post trip return to power following an MSLB event.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Both a HPSI and a LPSI subsystem are assumed to be OPERABLE in the large break LOCA analysis at full power (Ref. 2). This analysis establishes a minimum required runout flow for the HPSI and LPSI pumps, as well as the maximum required response time for their actuation. The HPSI pump is also credited in the small break LOCA analysis. This analysis establishes the flow and discharge head requirements at the design point for the HPSI pump. The SGTR and MSLB accident analyses also credit the HPSI pumps, but are not limiting in their design.

The large break LOCA event with a loss of offsite power and a single failure (disabling one ECCS train) establishes the OPERABILITY requirements for the ECCS. During the blowdown stage of a LOCA, the PCS depressurizes as primary coolant is ejected through the break into the containment. The nuclear reaction is terminated either by moderator voiding (during large breaks) or control rod insertion (during small breaks).

Following depressurization, emergency cooling water is injected into the cold legs, flows into the downcomer, fills the lower plenum, and refloods the core.

On smaller breaks, PCS pressure will stabilize at a value dependent upon break size, heat load, and injection flow. The smaller the break, the higher this equilibrium pressure. In all LOCA analyses, injection flow is not credited until PCS pressure drops below the shutoff head of the HPSI pumps.

The LCO ensures that an ECCS train will deliver sufficient water to match decay heat boiloff rates soon enough to minimize core damage for a large LOCA. It also ensures that the HPSI pump will deliver sufficient water during a small break LOCA and provide sufficient boron to limit the return to power following an MSLB event. For smaller LOCAs, PCS inventory decreases until the PCS can be depressurized below the HPSI pumps' shutoff head. During this period of a small break LOCA, the SGs continue to serve as the heat sink providing core cooling.

ECCS - Operating satisfies Criterion 3 of 10 CFR 50.36(c)(2).

BASES

LCO

In MODES 1 and 2, and in MODE 3 with PCS temperature ≥ 325°F, two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming there is a single failure affecting either train. Additionally, individual components within the ECCS trains may be called upon to mitigate the consequences of other transients and accidents.

An ECCS train consists of an HPSI subsystem and a LPSI subsystem. In addition, each train includes the piping, instruments, and controls to ensure the availability of an OPERABLE flow path capable of taking suction from the SIRWT on an SIS and automatically transferring suction to the containment sump upon a Recirculation Actuation Signal (RAS).

During an event requiring ECCS actuation, a flow path is provided to ensure an abundant supply of water from the SIRWT to the PCS, via the HPSI and LPSI pumps and their respective supply headers, to each of the four cold leg injection nozzles is available. During the recirculation phase, a flow path is provided from the containment sump to the PCS via the HPSI pumps. For worst case conditions, the containment building water level alone is not sufficient to assure adequate Net Positive Suction Head (NPSH) for the HPSI pumps. Therefore, to obtain adequate NPSH, a portion of the Containment Spray (CS) pump discharge flow is diverted from downstream of the shutdown cooling heat exchangers to the suction of the HPSI pumps following recirculation during a large break LOCA. In this configuration, the CS pumps and shutdown cooling heat exchangers provide a support function for HPSI flow path OPERABILITY. The OPERABILITY requirements for the CS pumps and shutdown cooling heat exchangers are addressed in LCO 3.6.6, "Containment Cooling Systems." Support system OPERABILITY is addressed by LCO 3.0.6.

The flow path for each train must maintain its designed independence to ensure that no single active failure can disable both ECCS trains.

BASES

APPLICABILITY

In MODES 1 and 2, and in MODE 3 with PCS temperature ≥ 325°F, the ECCS OPERABILITY requirements for the limiting Design Basis Accident (DBA) large break LOCA are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. The HPSI pump performance is based on the small break LOCA, which establishes the pump performance curve and has less dependence on power. The requirements of MODE 2 and MODE 3 with PCS temperature ≥ 325°F, are bounded by the MODE 1 analysis.

The ECCS functional requirements of MODE 3, with PCS temperature < 325°F, and MODE 4 are described in LCO 3.5.3, "ECCS - Shutdown."

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "PCS Loops - MODE 5, Loops Filled," and LCO 3.4.8, "PCS Loops - MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation - High Water Level," and LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level."

ACTIONS

A.1

With one LPSI subsystem inoperable, action must be taken to restore OPERABLE status within 7 days. In this condition, the remaining OPERABLE ECCS train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure to the remaining LPSI subsystem could result in loss of ECCS function. The 7 day Completion Time is reasonable to perform corrective maintenance on the inoperable LPSI subsystem. The 7 day Completion Time is based on the findings of the deterministic and probabilistic analysis in Reference 5. Reference 5 concluded that extending the Completion Time to 7 days for an inoperable LPSI subsystem provides plant operational flexibility while simultaneously reducing overall plant risk. This is because the risks incurred by having the LPSI subsystem unavailable for a longer time at power will be substantially offset by the benefits associated with avoiding unnecessary plant transitions and by reducing risk during plant shutdown operations.

BASES

ACTIONS (continued)

B.1

With one or more ECCS trains inoperable for reasons other than Condition A, but at least 100% of the required ECCS flow available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on an NRC study (Ref. 3) using a reliability evaluation and is a reasonable amount of time to effect many repairs.

An ECCS train is inoperable if it is not capable of delivering the assumed flow to the PCS. The individual components are inoperable if they are not capable of performing their required function, or if supporting systems are not available.

The safety analyses assume that only one train of safety injection is available to mitigate an accident. While operating under the provisions of an ACTION, an additional single failure need not be assumed in assuring that a loss of function has not occurred. Therefore, the required LPSI flow (that assumed in the safety analyses) is available if there is an OPERABLE LPSI flow path from the SIRWT to any two PCS loops. The required HPSI flow (that assumed in the safety analyses) is available if there is an OPERABLE HPSI flow path from the SIRWT to each PCS loop. In each case, an OPERABLE flow path must include an OPERABLE pump and an OPERABLE loop injection valve.

The LCO requires the OPERABILITY of two independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not necessarily render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. The intent of this Condition is to maintain a combination of OPERABLE equipment such that 100% of the ECCS flow assumed to be delivered by a single OPERABLE train remains available. This allows increased flexibility in plant operations when components in opposite trains are inoperable.

An event accompanied by a loss of offsite power and the failure of an emergency DG can disable one ECCS train until power is restored. A reliability analysis (Ref. 4) has shown that the impact with one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.

Reference 4 describes situations in which one component, such as the shutdown cooling flow control valve, CV-3006, can disable both ECCS trains. With one or more components inoperable, such that 100% of the required ECCS flow (that assumed in the safety analyses) is not available, the facility is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be immediately entered.

BASES

ACTIONS (continued)

C.1 and C.2

If the inoperable trains cannot be restored to OPERABLE status within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and PCS temperature reduce to < 325°F within 24 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.2.1

Verification of proper valve position ensures that the flow path from the ECCS pumps to the PCS is maintained. CV-3027 and CV-3056 are stop valves in the minimum recirculation flow path for the ECCS pumps. If either of these valves were closed when the PCS pressure was above the shutoff head of the ECCS pumps, the pumps could be damaged by running with insufficient flow and thus render both ECCS trains inoperable.

Placing HS-3027A and HS-3027B for CV-3027, and HS-3056A and HS-3056B for CV-3056, in the open position ensures that the valves cannot be inadvertently misaligned or change position as the result of an active failure. These valves are of the type described in Reference 4, which can disable the function of both ECCS trains and invalidate the accident analysis. CV-3027 and CV-3056 are capable of being closed from the control room since the SIRWT must be isolated from the containment during the recirculation phase of a LOCA. A 12 hour Frequency is considered reasonable in view of other administrative controls ensuring that a mispositioned valve is an unlikely possibility.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.2

Verifying the correct alignment for manual, power operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a nonaccident position provided the valve automatically repositions within the proper stroke time. This Surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being mispositioned are in the correct position.

The 31 day Frequency is appropriate because the valves are operated under procedural control and an improper valve position would only affect a single train. This Frequency has been shown to be acceptable through operating experience.

SR 3.5.2.3

SR 3.5.2.3 verifies CV-3006 is in the open position and that its air supply is isolated. CV-3006 is the shutdown cooling flow control valve located in the common LPSI flow path. The valve must be verified in the full open position to support the low pressure injection flow assumptions used in the accident analyses. The inadvertent misposition of this valve could result in a loss of low pressure injection flow and thus invalidate these flow assumptions. CV-3006 is designed to be held open by spring force and closed by air pressure. To ensure the valve cannot be inadvertently misaligned or change position as the result of a hot short in the control circuit, the air supply to CV-3006 is isolated. Isolation of the air supply to CV-3006 is acceptable since the valve does not require repositioning during an accident.

The 31 day Frequency has been shown to be acceptable through operating practice and the unlikely occurrence of the air supply to CV-3006 being unisolated coincident with a inadvertent valve misalignment event or a hot short in the control circuit.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.4

Periodic surveillance testing of ECCS pumps to detect gross degradation caused by impeller damage or other hydraulic component problems is required by Section XI of the ASME Code. This type of testing may be accomplished by measuring the pump developed head at only one point of the pump characteristic curve. This verifies both that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code. Section XI of the ASME Code provides the activities and Frequencies necessary to satisfy the requirements.

SR 3.5.2.5, SR 3.5.2.6, and SR 3.5.2.7

These SRs demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated actuation signal, i.e., on an SIS or RAS, that each ECCS pump starts on receipt of an actual or simulated actuation signal, i.e., on an SIS, and that the LPSI pumps stop on receipt of an actual or simulated actuation signal, i.e., on an RAS. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 18 month Frequency is based on the need to perform these Surveillances under the conditions that apply during a plant outage and the potential for unplanned transients if the Surveillances were performed with the reactor at power. The 18 month Frequency is also acceptable based on consideration of the design reliability of the equipment and operating experience. The actuation logic is tested as part of the Engineered Safety Feature (ESF) testing, and equipment performance is monitored as part of the Inservice Testing Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.8

The HPSI Hot Leg Injection motor operated valves and the LPSI loop injection valves have position switches which are set at other than the full open position. This surveillance verifies that these position switches are set properly.

The HPSI Hot leg injection valves are manually opened during the post-LOCA long term cooling phase to admit HPSI injection flow to the PCS hot leg. The open position limit switch on each HPSI hot leg isolation valves is set to establish a predetermined flow split between the HPSI injection entering the PCS hot leg and cold legs.

The LPSI loop injection MOVs open automatically on a SIS signal. The open position limit switch on each LPSI loop injection valve is set to establish the maximum possible flow through that valve. The design of these valves is such that excessive turbulence is developed in the valve body when the valve disk is at the full open position. Stopping the valve travel at slightly less than full open reduces the turbulence and results in increased flow. Verifying that the position stops are properly set ensures that a single low pressure safety injection subsystem is capable of delivering the flow rate required in the safety analysis.

The 18 month Frequency is based on the same factors as those stated above for SR 3.5.2.5, SR 3.5.2.6, and SR 3.5.2.7.

SR 3.5.2.9

Periodic inspection of the containment sump ensures that it is unrestricted and stays in proper operating condition. The 18 month Frequency is based on the need to perform this Surveillance under outage conditions. This Frequency is sufficient to detect abnormal degradation and is confirmed by operating experience.

BASES

REFERENCES

1. FSAR, Section 5.1
2. FSAR, Section 14.17
3. NRC Memorandum to V. Stello, Jr., from R. L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975
4. IE Information Notice No. 87-01, January 6, 1987
5. CE-NPSD-995, "CEOG Joint Applications Report for Low Pressure Safety Injection System AOT Extension," May 1995

ATTACHMENT 2 TO ENCLOSURE 2

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

June 27, 2000

TECHNICAL SPECIFICATION CHANGE REQUEST - LICENSE DPR-20
ALLOWABLE OUTAGE TIMES FOR LOW PRESSURE SAFETY INJECTION

MARKED-UP PAGES FOR
REVISED TECHNICAL SPECIFICATIONS
AND
TECHNICAL SPECIFICATIONS BASES
PAGES

16 Pages

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.2 ECCS - Operating

LCO 3.5.2 Two ECCS trains shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODE 3 with Primary Coolant System (PCS) temperature ≥ 325°F.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One LPSI subsystem inoperable.	A.1 Restore LPSI subsystem to OPERABLE status.	7 days
~~A~~B. One or more ECCS trains inoperable for reasons other that Condition A. <u>AND</u> At least 100% of the required ECCS flow available.	~~A~~B.1 Restore train(s) to OPERABLE status.	72 hours
~~B~~C. Required Action and associated Completion Time not met.	~~B~~C.1 Be in MODE 3. <u>AND</u> ~~B~~C.2 Reduce PCS temperature to < 325°F.	6 hours 24 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.2.1	Verify the following valves and hand switches are in the open position. Valve/Hand Switch Number — Function CV-3027 — SIRWT Recirc Valve HS-3027A — Hand Switch For CV-3027 HS-3027B — Hand Switch For CV-3027 CV-3056 — SIRWT Recirc Valve HS-3056A — Hand Switch For CV-3056 HS-3056B — Hand Switch For CV-3056	12 hours
SR 3.5.2.2	Verify each ECCS manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.5.2.3	Verify CV-3006, "SDC Flow Control Valve," is open and its air supply is isolated.	31 days
SR 3.5.2.4	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.5.2.5	Verify each ECCS automatic valve that is not locked, sealed, or otherwise secured in position, in the flow path actuates to the correct position on an actual or simulated actuation signal.	18 months

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.2.6	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.5.2.7	Verify each LPSI pump stops on an actual or simulated actuation signal.	18 months
SR 3.5.2.8	Verify, for each ECCS throttle valve listed below, each position stop is in the correct position. Valve Number — Function MO-3008 — LPSI to Cold leg 1A MO-3010 — LPSI to Cold leg 1B MO-3012 — LPSI to Cold leg 2A MO-3014 — LPSI to Cold leg 2B MO-3082 — HPSI to Hot leg 1 MO-3083 — HPSI to Hot leg 1	18 months
SR 3.5.2.9	Verify, by visual inspection, each ECCS train containment sump suction inlet is not restricted by debris and the suction inlet screens show no evidence of structural distress or abnormal corrosion.	18 months

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.2 ECCS - Operating

BASES

BACKGROUND

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

a. Loss of Coolant Accident (LOCA);

b. Control Rod Ejection accident;

c. Loss of secondary coolant accident, including a Main Steam Line Break (MSLB) or Loss of Normal Feedwater; and

d. Steam Generator Tube Rupture (SGTR).

The addition of negative reactivity is designed primarily for the loss of secondary coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power.

There are two phases of ECCS operation: injection and recirculation. In the injection phase, all injection is initially added to the Primary Coolant System (PCS) via the cold legs. After the Safety Injection Refueling Water Tank (SIRWT) has been depleted, the recirculation phase is entered as the ECCS suction is automatically transferred to the containment sump.

Two suitably redundant, 100% capacity trains are provided. Each train consists of a High Pressure Safety Injection (HPSI) and Low Pressure Safety Injection (LPSI) subsystem. In MODES 1 and 2, and in MODE 3 with PCS temperature ≥ 325°F, both trains must be OPERABLE. This ensures that 100% of the core cooling requirements can be provided in the event of a single active failure.

BASES

BACKGROUND (continued)

Each train of a Safety Injection Signal (SIS) actuates LPSI flow by starting one LPSI pump and opening two LPSI loop injection valves. Each train of an SIS actuates HPSI flow by starting one HPSI pump, opening the four associated HPSI loop injection valves, and closing the pressure control valves associated with each Safety Injection Tank. In addition, each train of a SIS will provide a confirmatory open signal to the normally open Component Cooling Water valves which supply seal and bearing cooling to the LPSI, HPSI, and Containment Spray pumps.

The safety analyses assume that one only train of safety injection is available to mitigate an accident. While operating under the provisions of an ACTION, an additional single failure need not be assumed in assuring that a loss of function has not occurred. Therefore, the LPSI flow assumed in the safety analyses can be met if there is an OPERABLE LPSI flow path from the SIRWT to any two PCS loops. The HPSI flow assumed in the safety analyses can be met if there is an OPERABLE HPSI flow path from the SIRWT to each cold leg. In each case, an OPERABLE flow path must include an OPERABLE pump and an OPERABLE injection valve.

A suction header supplies water from the SIRWT or the containment sump to the ECCS pumps. Separate piping supplies each train. The discharge headers from each HPSI pump divide into four supply lines after entering the containment, one feeding each PCS cold leg. The discharge headers from each LPSI pump combine to supply a common header which divides into four supply lines after entering containment, one feeding each PCS cold leg.

Motor operated valves are set to maximize the LPSI flow to the PCS. This flow balance directs sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the PCS cold legs.

For LOCAs coincident with a loss of off-site power that are too small to initially depressurize the PCS below the shutoff head of the HPSI pumps, the core cooling function is provided by the Steam Generators (SGs) until the PCS pressure decreases below the HPSI pump shutoff head.

During low temperature conditions in the PCS, limitations are placed on the maximum number of HPSI pumps that may be OPERABLE. Refer to the Bases for LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for the basis of these requirements.

BASES

BACKGROUND (continued)

During a large break LOCA, PCS pressure could decrease to < 200 psia in < 20 seconds. The ECCS systems are actuated upon receipt of an SIS. If offsite power is available, the safeguard loads start immediately. If offsite power is not available, all loads will be shed at the time the diesel generators receive an automatic start signal. With load shedding completed, the diesel generator breakers will close automatically when generator voltage approaches a normal operating value. Closing of the breakers will reset the load shedding signals and start the sequencer. The sequencers will initiate operation of the engineered safeguard equipment required for the accident. The time delay associated with diesel starting, sequenced loading, and pump starting determines the time before pumped flow is available to the core following a LOCA.

The active ECCS components, along with the passive Safety Injection Tanks (SITs) and the Safety Injection Refueling Water Tank (SIRWT), covered in LCO 3.5.1, "Safety Injection Tanks (SITs)," and LCO 3.5.4, "Safety Injection Refueling Water Tank (SIRWT)," provide the cooling water necessary to meet the Palisades Nuclear Plant design criteria (Ref. 1).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria, established by 10 CFR 50.46 for ECCSs, will be met following a LOCA:

a. Maximum fuel element cladding temperature is $\leq$ 2200°F;

b. Maximum cladding oxidation is $\leq$ 0.17 times the total cladding thickness before oxidation;

c. Maximum hydrogen generation from a zirconium water reaction is $\leq$ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react;

d. Core is maintained in a coolable geometry; and

e. Adequate long term core cooling capability is maintained.

The LCO also limits the potential for a post trip return to power following an MSLB event.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Both a HPSI and a LPSI subsystem are assumed to be OPERABLE in the large break LOCA analysis at full power (Ref. 2). This analysis establishes a minimum required runout flow for the HPSI and LPSI pumps, as well as the maximum required response time for their actuation. The HPSI pump is also credited in the small break LOCA analysis. This analysis establishes the flow and discharge head requirements at the design point for the HPSI pump. The SGTR and MSLB accident analyses also credit the HPSI pumps, but are not limiting in their design.

The large break LOCA event with a loss of offsite power and a single failure (disabling one ECCS train) establishes the OPERABILITY requirements for the ECCS. During the blowdown stage of a LOCA, the PCS depressurizes as primary coolant is ejected through the break into the containment. The nuclear reaction is terminated either by moderator voiding (during large breaks) or control rod insertion (during small breaks).

Following depressurization, emergency cooling water is injected into the cold legs, flows into the downcomer, fills the lower plenum, and refloods the core.

On smaller breaks, PCS pressure will stabilize at a value dependent upon break size, heat load, and injection flow. The smaller the break, the higher this equilibrium pressure. In all LOCA analyses, injection flow is not credited until PCS pressure drops below the shutoff head of the HPSI pumps.

The LCO ensures that an ECCS train will deliver sufficient water to match decay heat boiloff rates soon enough to minimize core damage for a large LOCA. It also ensures that the HPSI pump will deliver sufficient water during a small break LOCA and provide sufficient boron to limit the return to power following an MSLB event. For smaller LOCAs, PCS inventory decreases until the PCS can be depressurized below the HPSI pumps' shutoff head. During this period of a small break LOCA, the SGs continue to serve as the heat sink providing core cooling.

ECCS - Operating satisfies Criterion 3 of 10 CFR 50.36(c)(2).

BASES

LCO

In MODES 1 and 2, and in MODE 3 with PCS temperature ≥ 325°F, two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming there is a single failure affecting either train. Additionally, individual components within the ECCS trains may be called upon to mitigate the consequences of other transients and accidents.

An ECCS train consists of an HPSI subsystem and a LPSI subsystem. In addition, each train includes the piping, instruments, and controls to ensure the availability of an OPERABLE flow path capable of taking suction from the SIRWT on an SIS and automatically transferring suction to the containment sump upon a Recirculation Actuation Signal (RAS).

During an event requiring ECCS actuation, a flow path is provided to ensure an abundant supply of water from the SIRWT to the PCS, via the HPSI and LPSI pumps and their respective supply headers, to each of the four cold leg injection nozzles is available. During the recirculation phase, a flow path is provided from the containment sump to the PCS via the HPSI pumps. For worst case conditions, the containment building water level alone is not sufficient to assure adequate Net Positive Suction Head (NPSH) for the HPSI pumps. Therefore, to obtain adequate NPSH, a portion of the Containment Spray (CS) pump discharge flow is diverted from downstream of the shutdown cooling heat exchangers to the suction of the HPSI pumps following recirculation during a large break LOCA. In this configuration, the CS pumps and shutdown cooling heat exchangers provide a support function for HPSI flow path OPERABILITY. The OPERABILITY requirements for the CS pumps and shutdown cooling heat exchangers are addressed in LCO 3.6.6, "Containment Cooling Systems." Support system OPERABILITY is addressed by LCO 3.0.6.

The flow path for each train must maintain its designed independence to ensure that no single active failure can disable both ECCS trains.

BASES

APPLICABILITY

In MODES 1 and 2, and in MODE 3 with PCS temperature ≥ 325°F, the ECCS OPERABILITY requirements for the limiting Design Basis Accident (DBA) large break LOCA are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. The HPSI pump performance is based on the small break LOCA, which establishes the pump performance curve and has less dependence on power. The requirements of MODE 2 and MODE 3 with PCS temperature ≥ 325°F, are bounded by the MODE 1 analysis.

The ECCS functional requirements of MODE 3, with PCS temperature < 325°F, and MODE 4 are described in LCO 3.5.3, "ECCS - Shutdown."

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "PCS Loops - MODE 5, Loops Filled," and LCO 3.4.8, "PCS Loops - MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation - High Water Level," and LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level."

ACTIONS

A.1

~~With one or more trains inoperable, but at least 100% of the required ECCS flow available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on an NRC study (Ref. 3) using a reliability evaluation and is a reasonable amount of time to effect many repairs.~~

~~An ECCS train is inoperable if it is not capable of delivering the assumed flow to the PCS. The individual components are inoperable if they are not capable of performing their required function, or if supporting systems are not available.~~

~~ACTIONS~~

~~A.1 (continued)~~

~~The safety analyses assume that only one train of safety injection is available to mitigate an accident. While operating under the provisions of an ACTION, an additional single failure need not be assumed in assuring that a loss of function has not occurred. Therefore, the required LPSI flow (that assumed in the safety analyses) is available if there is an OPERABLE LPSI flow path from the SIRWT to any two PCS loops. The required HPSI flow (that assumed in the safety analyses) is available if there is an OPERABLE HPSI flow path from the SIRWT to~~

BASES

~~each PCS loop. In each case, an OPERABLE flow path must include an OPERABLE pump and an OPERABLE loop injection valve.~~

~~The LCO requires the OPERABILITY of two independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not necessarily render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. The intent of this Condition is to maintain a combination of OPERABLE equipment such that 100% of the ECCS flow assumed to be delivered by a single OPERABLE train remains available. This allows increased flexibility in plant operations when components in opposite trains are inoperable.~~

~~An event accompanied by a loss of offsite power and the failure of an emergency DG can disable one ECCS train until power is restored. A reliability analysis (Ref. 4) has shown that the impact with one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.~~

~~Reference 4 describes situations in which one component, such as the shutdown cooling flow control valve, CV-3006, can disable both ECCS trains. With one or more components inoperable, such that 100% of the required ECCS flow (that assumed in the safety analyses) is not available, the facility is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be immediately entered.~~

With one LPSI subsystem inoperable, action must be taken to restore OPERABLE status within 7 days. In this condition, the remaining OPERABLE ECCS train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure to the remaining LPSI subsystem could result in loss of ECCS function. The 7 day Completion Time is reasonable to perform corrective maintenance on the inoperable LPSI subsystem. The 7 day Completion Time is based on the findings of the deterministic and probabilistic analysis in Reference 5. Reference 5 concluded that extending the Completion Time to 7 days for an inoperable LPSI subsystem provides plant operational flexibility while simultaneously reducing overall plant risk. This is because the risks incurred by having the LPSI subsystem unavailable for a longer time at power will be substantially offset by the benefits associated with avoiding unnecessary plant transitions and by reducing risk during plant shutdown operations.

B.1

With one or more ECCS trains inoperable for reasons other than Condition A, but at least 100% of the required ECCS flow available, the

BASES

inoperable components must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on an NRC study (Ref. 3) using a reliability evaluation and is a reasonable amount of time to effect many repairs.

An ECCS train is inoperable if it is not capable of delivering the assumed flow to the PCS. The individual components are inoperable if they are not capable of performing their required function, or if supporting systems are not available.

The safety analyses assume that only one train of safety injection is available to mitigate an accident. While operating under the provisions of an ACTION, an additional single failure need not be assumed in assuring that a loss of function has not occurred. Therefore, the required LPSI flow (that assumed in the safety analyses) is available if there is an OPERABLE LPSI flow path from the SIRWT to any two PCS loops. The required HPSI flow (that assumed in the safety analyses) is available if there is an OPERABLE HPSI flow path from the SIRWT to each PCS loop. In each case, an OPERABLE flow path must include an OPERABLE pump and an OPERABLE loop injection valve.

The LCO requires the OPERABILITY of two independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not necessarily render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. The intent of this Condition is to maintain a combination of OPERABLE equipment such that 100% of the ECCS flow assumed to be delivered by a single OPERABLE train remains available. This allows increased flexibility in plant operations when components in opposite trains are inoperable.

An event accompanied by a loss of offsite power and the failure of an emergency DG can disable one ECCS train until power is restored. A reliability analysis (Ref. 4) has shown that the impact with one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.

Reference 4 describes situations in which one component, such as the shutdown cooling flow control valve, CV-3006, can disable both ECCS trains. With one or more components inoperable, such that 100% of the required ECCS flow (that assumed in the safety analyses) is not available, the facility is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be immediately entered.

BASES

ACTIONS (continued)

~~B.1 and B.2~~C.1 and C.2

If the inoperable trains cannot be restored to OPERABLE status within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and PCS temperature reduce to < 325°F within 24 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.2.1

Verification of proper valve position ensures that the flow path from the ECCS pumps to the PCS is maintained. CV-3027 and CV-3056 are stop valves in the minimum recirculation flow path for the ECCS pumps. If either of these valves were closed when the PCS pressure was above the shutoff head of the ECCS pumps, the pumps could be damaged by running with insufficient flow and thus render both ECCS trains inoperable.

Placing HS-3027A and HS-3027B for CV-3027, and HS-3056A and HS-3056B for CV-3056, in the open position ensures that the valves cannot be inadvertently misaligned or change position as the result of an active failure. These valves are of the type described in Reference 4, which can disable the function of both ECCS trains and invalidate the accident analysis. CV-3027 and CV-3056 are capable of being closed from the control room since the SIRWT must be isolated from the containment during the recirculation phase of a LOCA. A 12 hour Frequency is considered reasonable in view of other administrative controls ensuring that a mispositioned valve is an unlikely possibility.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.2

Verifying the correct alignment for manual, power operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a nonaccident position provided the valve automatically repositions within the proper stroke time. This Surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being mispositioned are in the correct position.

The 31 day Frequency is appropriate because the valves are operated under procedural control and an improper valve position would only affect a single train. This Frequency has been shown to be acceptable through operating experience.

SR 3.5.2.3

SR 3.5.2.3 verifies CV-3006 is in the open position and that its air supply is isolated. CV-3006 is the shutdown cooling flow control valve located in the common LPSI flow path. The valve must be verified in the full open position to support the low pressure injection flow assumptions used in the accident analyses. The inadvertent misposition of this valve could result in a loss of low pressure injection flow and thus invalidate these flow assumptions. CV-3006 is designed to be held open by spring force and closed by air pressure. To ensure the valve cannot be inadvertently misaligned or change position as the result of a hot short in the control circuit, the air supply to CV-3006 is isolated. Isolation of the air supply to CV-3006 is acceptable since the valve does not require repositioning during an accident.

The 31 day Frequency has been shown to be acceptable through operating practice and the unlikely occurrence of the air supply to CV-3006 being unisolated coincident with a inadvertent valve misalignment event or a hot short in the control circuit.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.4

Periodic surveillance testing of ECCS pumps to detect gross degradation caused by impeller damage or other hydraulic component problems is required by Section XI of the ASME Code. This type of testing may be accomplished by measuring the pump developed head at only one point of the pump characteristic curve. This verifies both that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code. Section XI of the ASME Code provides the activities and Frequencies necessary to satisfy the requirements.

SR 3.5.2.5, SR 3.5.2.6, and SR 3.5.2.7

These SRs demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated actuation signal, i.e., on an SIS or RAS, that each ECCS pump starts on receipt of an actual or simulated actuation signal, i.e., on an SIS, and that the LPSI pumps stop on receipt of an actual or simulated actuation signal, i.e., on an RAS. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 18 month Frequency is based on the need to perform these Surveillances under the conditions that apply during a plant outage and the potential for unplanned transients if the Surveillances were performed with the reactor at power. The 18 month Frequency is also acceptable based on consideration of the design reliability of the equipment and operating experience. The actuation logic is tested as part of the Engineered Safety Feature (ESF) testing, and equipment performance is monitored as part of the Inservice Testing Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.8

The HPSI Hot Leg Injection motor operated valves and the LPSI loop injection valves have position switches which are set at other than the full open position. This surveillance verifies that these position switches are set properly.

The HPSI Hot leg injection valves are manually opened during the post-LOCA long term cooling phase to admit HPSI injection flow to the PCS hot leg. The open position limit switch on each HPSI hot leg isolation valves is set to establish a predetermined flow split between the HPSI injection entering the PCS hot leg and cold legs.

The LPSI loop injection MOVs open automatically on a SIS signal. The open position limit switch on each LPSI loop injection valve is set to establish the maximum possible flow through that valve. The design of these valves is such that excessive turbulence is developed in the valve body when the valve disk is at the full open position. Stopping the valve travel at slightly less than full open reduces the turbulence and results in increased flow. Verifying that the position stops are properly set ensures that a single low pressure safety injection subsystem is capable of delivering the flow rate required in the safety analysis.

The 18 month Frequency is based on the same factors as those stated above for SR 3.5.2.5, SR 3.5.2.6, and SR 3.5.2.7.

SR 3.5.2.9

Periodic inspection of the containment sump ensures that it is unrestricted and stays in proper operating condition. The 18 month Frequency is based on the need to perform this Surveillance under outage conditions. This Frequency is sufficient to detect abnormal degradation and is confirmed by operating experience.

BASES

REFERENCES

1. FSAR, Section 5.1

2. FSAR, Section 14.17

3. NRC Memorandum to V. Stello, Jr., from R. L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975

4. IE Information Notice No. 87-01, January 6, 1987

5. CE-NPSD-994, "CEOG Joint Applications Report for Safety Injection Tank AOT/STI Extension," May 1995