Consumers Energy

A CMS Energy Company

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

February 18, 2000

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

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT
TECHNICAL SPECIFICATIONS CHANGE REQUEST - Auxiliary Feedwater

A request for a change to the Palisades Technical Specifications, which proposes revisions for both the Current Technical Specifications (CTS) and the Improved Technical Specifications (ITS), is enclosed. The revisions to the CTS remove Surveillance Requirement 4.9a.2 associated with the backup steam supply to turbine driven Auxiliary Feedwater (AFW) Pump P-8B; the revisions to the ITS remove Condition A from LCO 3.7.5. The associated bases have been revised accordingly.

On February 5, 2000, a steam leak developed in the underground piping which provides a manual backup steam supply to Auxiliary Feedwater Pump P-8B. This manual backup steam supply line provides no required safety function, but it does provide an alternative steam supply to P-8B for operational flexibility. This line is routed underground beneath the floor of the Turbine Building. The area immediately surrounding the leak has been excavated and the pipe section containing the leak has been cut out and replaced. However, since the apparent cause of the leak is corrosion originating from the exterior of the pipe, the integrity of the remainder of the line, which has not been completely inspected, cannot be quantitatively proven. Due to the inability to easily demonstrate complete code compliance for the entire length of underground pipe, the decision was made on February 13, 2000, to consider this manual backup steam supply line inoperable.

Both complete replacement of the underground pipe, and rerouting the steam supply through the turbine building have been considered. Because such a replacement has been judged to have no significant safety benefit, the expense of repair cannot be justified on the basis of maintaining operational flexibility.

A001

On February 16, 2000 Consumers Energy Company requested, and the NRC granted, Enforcement Discretion to allow plant startup and subsequent operation without compliance with the surveillance requirement (and implied operability requirement) of Technical Specifications (TS) 4.9a.2. for the manual backup steam supply for steam turbine driven Auxiliary Feedwater Pump P-8B. That discretion was granted until a Technical Specifications change request could be submitted and reviewed. This letter submits that change request for NRC review.

The following enclosures are included with this letter:

Enclosure 1: Technical Specifications Change Request.

Enclosure 2: A Summary Of Significant Correspondence And Commitments Relevant To The Steam Driven Auxiliary Feedwater Pump (P-8B).

Enclosure 3: A Review of Probabilistic Safety Analyses And Failure Effects On The Auxiliary Feedwater System.

Enclosure 4: A Review Of The FSAR Chapter 14 Safety Analyses Reliance on The Auxiliary Feedwater System.

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

SUMMARY OF COMMITMENTS

1. This letter completes the commitment made in our February 16, 2000 request for Enforcement Discretion on this subject.

2. The connections to the former underground backup steam supply for Pump P-8B turbine will be isolated from the main steam piping using at least one manual isolation valve, and from the P-8B turbine driver with a pipe cap or flanged connection prior to leaving Cold Shutdown from the current outage.

Daniel G. Malone
Acting Director, Licensing

CC: Administrator, Region III, USNRC
Project Manager, NRR, USNRC
NRC Resident Inspector - Palisades
Lou Brandon, Michigan Department of Environmental Quality

Enclosures

ENCLOSURE 1

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

TECHNICAL SPECIFICATIONS CHANGE REQUEST
Auxiliary Feedwater

CONSUMERS ENERGY COMPANY
Docket 50-255
Technical Specifications Change Request
License DPR-20
Enclosure 1

It is requested that the Technical Specifications contained in the Facility Operating License DPR-20, Docket 50-255, for the Palisades Plant be changed as described below.

The following attachments have been included with this Technical Specifications Change Request :

1. The proposed CTS page. The changed area is marked with a vertical line in the margin.

2. The proposed ITS pages. The changed areas are marked with a vertical line in the margin.

3. The existing CTS page marked to show the proposed change. Deleted text is shown as strike-out; added text is shown in bold text enclosed in square brackets ([ ]).

4. The existing ITS pages marked to show the proposed changes. Deleted text is shown as strike-out; added text is shown in bold text enclosed in square brackets ([ ]).

I. The following CTS Changes are Proposed:

A. Current CTS 4.9a.2 is a monthly test which states:

a. At least once per 31 days:

2. The OPERABILITY of the steam-driven pump shall be verified by starting alternately from each control room switch and from the pump test-key switch in a three month period.

B. Proposed CTS 4.9a.2 states:

a. At least once per 31 days:

2. The OPERABILITY of the steam driven pump shall be verified by starting alternately from the control room switch for the steam supply (CV-0522B) and from the pump test-key switch.

II. Discussion of CTS Changes:

Auxiliary Feedwater Pump P-8B is required to be operable by LCO 3.5.1.a:

3.5.1 The primary coolant shall not be heated above 300 °F unless the following conditions are met:

a. Both electric driven Auxiliary Feedwater Pumps and one fire protection pump shall be operable. The steam driven pump shall be operable prior to making the reactor critical.

The Surveillance Requirement (SR), 4.9a.2 phrase "each control room switch" refers to the switches on the main control board that operate the steam supply valves, CV-0522B and CV-0522A, for the normal (automatically actuated) and backup (manually actuated) supplies to the P-8B turbine. There is no other reference to the manual backup steam supply for P-8B in the CTS.

The proposed change will eliminate the requirement to test the backup steam supply (CV-0522A) for pump P-8B, and will also eliminate the implied operability requirement for that steam supply. All other CTS testing requirements for P-8B, including the testing of the normal steam supply (CV-0522B) will remain unchanged. Eliminating the testing of CV-0522A will result in the two remaining 4.9a.2 tests being performed on alternate months.

The existing wording of SR 4.9a.2 was added to CTS by Amendment 162. The Pre-Amendment 162 SR 4.9a.2 wording was issued by Amendment 96; it stated:

> *The OPERABILITY of the steam-driven pump shall be confirmed as required by Specification 4.3.c and Table 4.1.3 Item 16a.*

Table 4.1.3 Item 16a had the following entries:

> *"Auxiliary Feedwater Pump Start" "Test" "M(3)(5)" [monthly] "Switch"*

Footnote (3) stated:

> *"Test method to be alternated to include starting auxiliary feedwater pump from the control room hand switch, from the breaker (or alternate steam supply) and from the pump test-key switch in a three month period."*

The change made by Amendment 162 was classified as an editorial change, moving a pump surveillance from the instrumentation section to the AFW system section.

The pre-Amendment 96 wording of SR 4.9a.2 was issued by Amendment 67:

> *The OPERABILITY of the steam-driven pump shall be confirmed as required by Specification 4.3.c and Table 4.1.3 Item 16a.*

Table 4.1.3 Item 16a had the following entries:

> *"Auxiliary Feedwater Pump "Test" "M(3)(5)" [monthly] "Internal Test Signal" Auto Initiation"*

Footnote (3) stated:

> *"Test method to be alternated to include starting auxiliary feedwater pump from the control room hand switch, from the breaker and from the automatic start in a three month period."*

Neither our Amendment request (October 28, 1985) nor the Safety Evaluation issued with Amendment 96 discuss the reasoning for the addition of the requirement to test the alternate (backup) steam supply for P-8B.

III. The following ITS Changes are Proposed:

A. LCO 3.7.5 Condition A has been deleted. The remaining conditions and their associated actions have been re-lettered.

B. LCO 3.7.5 Condition B has been revised to delete the second Completion Time which reads: "AND 10 days from discovery of failure to meet the LCO"

C. The existing wording of ITS SR 3.7.5.1 has been revised to only require verification of valve alignment in the remaining steam supply to P-8B. Current SR 3.7.5.1 is a monthly test which states:

Verify each required AFW manual, power operated, and automatic valve in each water flow path and in both steam supply flow paths to the steam turbine driven pump, that is not locked, sealed, or otherwise secured in position, is in the correct position.

Proposed ITS SR 3.7.5.1 states:

Verify each required AFW manual, power operated, and automatic valve in each water flow path and in the steam supply flow path to the steam turbine driven pump, that is not locked, sealed, or otherwise secured in position, is in the correct position.

D. The Bases for ITS LCO 3.7.5 have been revised accordingly.

IV. Discussion of ITS Changes:

A. Condition A for ITS LCO 3.7.5 currently provides a 7 day completion time for restoration if one of the two steam supplies for the turbine driven AFW pump becomes inoperable (provided that the other supply is operable). Condition B allows a 3 day completion time for restoration of an inoperable AFW pump (provided that at least 100% of required AFW flow and at least two operable AFW pumps are available).

Elimination of Condition A will shorten the allowed completion time from 7 days to 3 days for the normal steam supply to AFW pump P-8B; it will remove any ITS requirement for the backup supply to be operable.

B. Elimination of the second Completion Time for Condition B is appropriate since, as described in the LCO 3.7.5 Bases at the top of page B 3.7.5-6:

> *The 10 day Completion Time provides a limitation time allowed in the specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 72 hours and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.*

When LCO 3.7.5 Condition A is deleted, the additional limit of 10 days is not necessary. Any inoperable required AFW component would have to be restored to operable status within 3 days (72 hours).

C. The revision to SR 3.7.5.1 eliminates reference to the backup steam supply.

V. Justification for Proposed Changes:

A. Reason for the Desired Changes:

On February 5, 2000, while operating steam turbine driven Auxiliary Feedwater Pump P-8B, a steam leak was observed. Auxiliary Feedwater Pump P-8B was placed in service using the manual backup (underground) steam supply (CV-0522A) and was put into service per normal system operating procedures to support the flushing and sodium concentration reduction efforts in Steam Generator E-50B. Electric Motor Driven Auxiliary Feedwater Pump P-8C had been secured and P-8B was providing auxiliary feedwater flow to both steam generators. Auxiliary Feedwater Pump P-8B had been running a little over half an hour at the time of discovery. The steam leak was observed to be coming from the 590' elevation floor in the northwest corner of the turbine building adjacent to Drain Cooler E-7A. A portion of the steam piping downstream of CV-0522A, which was in service, is buried five feet beneath the floor in this area.

Both complete replacement of the underground pipe, and rerouting the steam supply through the turbine building have been considered. Because such a replacement has been judged to have no significant safety benefit, the expense of repair cannot be justified on the basis of maintaining operational flexibility.

This event did not occur during an emergency demand event on the Auxiliary Feedwater System, but rather during a planned evolution. Prior to this, the plant had been shutdown by taking the turbine generator off line for a planned weekend outage. The motivation for the shutdown was to reduce the quantity of sodium and other impurities in the steam generators. The plant was in Hot Shutdown. Prior to this event, Electric Motor Driven Auxiliary Feedwater Pump P-8C had been in service providing makeup to both steam generators. Following discovery, immediate action taken was to manually isolate steam flow to the P-8B turbine from both the manual backup (CV-0522A) and the normal (CV-0522B) steam supply paths, thus removing P-8B from service. The manual steam isolation valves for both of these paths were closed and caution tagged. Auxiliary Feedwater supply was promptly transferred to pump P-8C, when P-8B was shutdown. Electric Motor Driven Pump P-8A was also operable and available for use.

Since the occurrence of this event, the point of piping failure has been excavated allowing external inspection of the piping and soil conditions. Prior to excavation, the failure location was identified by viewing the piping internally with a boroscope. Pitting of the internal surfaces of the piping could be seen during the boroscope examination around the area where the failure occurred.

The piping was further inspected using the boroscope technique for about one hundred feet upstream of the point of failure after the failed segment was removed. This inspection covered the majority of the remaining portion of the buried piping, with no further pitting of the internal piping surface being observed, which provides some confidence that no other portions of the buried piping are close to the point of failure.

The Consumers Energy Metallurgy Laboratory has been involved in supporting the cause determination for the failed piping segment. The metallurgy exams have confirmed that the pipe base material is consistent with the original specification of carbon steel pipe. Thus, there is no indication that the leak was due to an original piping material defect, piping damaged during handling in the field, or an error made during installation welding in the field. There was also no evidence of failure due to mechanical forces. The metallurgical examination did find extensive wall thinning that originated from the outside diameter of the pipe. The wall thinning is more significant at the top of the pipe than at the bottom of the pipe. Analysis for both chemical and microbiological corrosion mechanisms are being completed. The most significant conclusion that can be drawn is that the failure occurred at this point in the pipe due to an externally driven corrosion mechanism that was not localized. This corrosion appears to exist, at least to some extent, over the entire range of piping made visible by the excavation. The metallurgists estimate that the corrosion rate has been relatively slow with estimates from 0.003" to 0.007" per year. Although it has not been fully confirmed, it appears that the original coating may have never been designed for the steam piping temperatures which this piping experiences in service. It has also been suggested that the organic based substance which was originally applied to the piping probably heated up and became fluid, which would have then allowed it to slump down the sides of the pipe under the wrapping due to gravity. This would have left the top of the piping with less protective coating than the bottom and made the top of the pipe more accessible for corrosion than the bottom of the pipe. This would be consistent with the metallurgical results of more thinning at the pipe top than at the bottom. Because there is no protective coating still intact on the removed piping sample, the above must remain a hypothesis, which will probably not be able to be confirmed. Therefore, the root cause appears to be degradation of the original piping protective cover leading to a slowly progressing corrosion of the exterior surface of the piping.

B. Relevant History of Auxiliary Feedwater Pumps

The original design of the Palisades plant Auxiliary Feedwater System consisted of a single train having one electric motor driven pump (P-8A) and one steam turbine driven pump (P-8B) with a single underground steam supply that supplied auxiliary feedwater through a common set of valves and piping. The electric motor driven pump was not originally configured for automatic sequencing onto an emergency diesel generator and the steam supply for the steam turbine driven pump was connected downstream of the main steam isolation valve from the steam generator. Both pumps were installed in the safety related Auxiliary Feedwater Pump Room in the Turbine building. Due to concerns in the event of a steam supply line break where the loss of the steam supply to the steam turbine driven pump could, given the single failure of the motor driven pump, result in loss of all auxiliary feedwater, a modification was completed in 1974 as part of the plant high energy line break modifications which moved the existing underground steam supply to upstream of the main steam isolation valve for Steam Generator E-50B and installed a second above ground steam supply upstream of the main steam isolation valve for Steam Generator E-50A to supply P-8B. At this point in time, both steam supplies to P-8B required manual initiation and the new above ground steam supply was established as the normal, or preferred full capacity steam supply, with the underground steam supply being a backup source. However, both steam supplies to P-8B were required at this time to alleviate single failure concerns during a steam supply line break event which could render both auxiliary feedwater pumps unavailable.

In response to NUREG-0578 in 1979, automatic initiation of the Auxiliary Feedwater System was established with a control circuit that started the electric motor driven pump (P-8A) followed by start of the steam turbine driven pump (P-8B) through CV-0522B, the normal above ground steam supply. Other modifications completed during this time period occurred due to fire concerns. These modifications included installation of nitrogen backup to instrument air for CV-0522B, the normal above ground steam supply to P-8B, and installation of a control switch for CV-0522B as well as flow control circuitry in the Auxiliary Hot Shutdown Panel (C-150). The backup underground steam supply, CV-0522A, was left as a manually actuated device with no backup to plant instrument air since it simply served as a redundant motive force at the time.

In the early 1980's as part of our NUREG-0737 action plan, a third auxiliary feedwater pump (P-8C) was installed by converting one of the three original high pressure safety injection pumps to provide an independent train of auxiliary feedwater supplied by an emergency diesel generator (on the opposite electrical train from that supplying P-8A). A key aspect of this modification was to eliminate single failure concerns since P-8A & P-8B were part of a single train residing in the same room (flooding concern) and providing flow through the same valves and piping. The new auxiliary feedwater pump, P-8C, and its associated flow control valves were located in the west engineering safeguards room of the auxiliary building to provide assurance of single failure protection (redundancy) from the P-8A/P-8B train, for which the pumps were located in the turbine building and the flow control valves in the component cooling water room of the auxiliary building.

An additional action taken in response to NUREG-0737 was to provide automatic sequencing of the two electric motor driven auxiliary feedwater pumps (P-8A & P-8C) onto the two separate emergency diesel generators. The automatic sequencing of auxiliary feedwater pumps, upon receipt of an actuation signal, was established as P-8A, followed by P-8C, followed by P-8B. Each subsequent pump will only start if flow is not established within a specified time of the previous pump start signal. As stated previously, only the normal above ground steam supply through CV-0522B was provided with automatic actuation controls for P-8B. With installation of the independent train provided by P-8C, the single failure concerns that had previously resulted in installation of the second steam line to P-8B were now superseded.

To meet the requirements of 10CFR50.62 (ATWS rule), the steam turbine control circuitry was modified to allow automatic start of the steam driven turbine and associated auxiliary feedwater pump upon loss of DC control power. This circuitry is associated with control of CV-0522B, which supplies steam through the normal above ground steam supply from Steam Generator E-50A.

C. AFW Design Requirements

Current FSAR Chapter 14 safety analyses do not include any consideration for Steam Driven Auxiliary Feedwater Pump P-8B. Furthermore, use of the backup underground steam supply through CV-0522A would require manual action in order to support accident mitigation and therefore, is not addressed as a valid option in any of the FSAR design basis events. Use of CV-0522A and the associated underground steam supply line is optional by current design and optional in off-normal or normal operating procedures. The underground steam supply line's importance changed with the installation of Auxiliary Feedwater Pump P-8C, which eliminated single failure concerns associated with the previous redundant pump but single train auxiliary feedwater system provided by P-8A & P-8B.

The P-8C train provides an independent train which is not susceptible to common mode failures that would affect the P-8A/P-8B train from steam line breaks, seismic events, floods, missiles or fires. Although both trains take suction from a common condensate storage tank, the suctions for each train are provided by separate suction piping, each with a separate emergency backup supply (firewater for P-8A/P-8B train and service water for P-8C train). Therefore, existence of the two independent trains of auxiliary feedwater (P-8A/P-8B train and P-8C train) provides independence as required by Branch Technical Position ASB 10-1 Items B.2 and B.4; existence of the two electrically powered and one steam turbine driven auxiliary feedwater pump provides the diversity required by Branch Technical Position ASB 10-1 Item B.2. Multiple active component failures would be required to jeopardize auxiliary feedwater availability without consideration for the backup underground steam supply to P-8B. (Even with two steam supplies, a single turbine driven pump would not, by itself, be single failure proof to provide independence and redundancy.) Therefore, the backup underground steam supply is not required for a safety function to meet NUREG-0737 design requirements.

D. Design Basis Event Considerations

FSAR accident descriptions for Palisades do not address the existence of the backup underground steam supply through CV-0522A and therefore do not rely on the underground line for any mitigation of accidents. Current design is based on the automatically sequenced start of P-8A, followed by P-8C and then by P-8B through CV-0522B on the normal above ground steam supply. The auto start of P-8B is the last pump available based on all analysis and its use is only required through CV-0522B for non-FSAR Chapter 14 safety analyses on the normal above ground steam supply. There is no single active component failure that combined with other required FSAR Chapter 14 analysis assumptions (including those that require the assumption of loss of offsite power) would require use of the backup underground steam supply for the auxiliary feedwater system to perform its required function.

Malfunctions evaluated in the FSAR and in related documents generally fit in the areas of line breaks, flooding and failures to start or properly operate. Failure of steam lines in the Auxiliary Feedwater Pump Room assumes a line break and failure of both P-8A and P-8B. Resolution of such failures occurred with the installation of P-8C, which is housed in a separate structure in the auxiliary building.

In addition to the FSAR Chapter 14 accidents requirement, there are also requirements for Station Blackout and Post-Fire Safe Shutdown. Reliance on auxiliary feedwater is credited for decay heat removal during the 4 hour assumed duration of the Station Blackout Event, which requires no other single failure assumptions. During the 4 hour period, the turbine driven pump is used to supply auxiliary feedwater to both steam generators for removal of decay heat. However, the implied assumption is that the normal above ground normal steam supply through CV-0522B would be used. CV-0522B is the preferred valve, with backup nitrogen supply provided since the analysis assumes the normal air supply is lost. No credit is taken in the analysis for use of the backup underground steam supply through CV-0522A in support of cooldown either as a source of steam for P-8B or as a steaming path from steam generator E-50B.

For the Post-Fire Safe Shutdown Analysis P-8C is the preferred source of feedwater for this event. Only one case exists where use of the underground steam supply through CV-0522A was considered as available to help the plant in achieving cold shutdown. This case is associated with a fire in the Southwest Cable Penetration Room, which will affect controls for P-8A, and CV-0522B. The analysis of record notes that either P-8C or CV-0522A would be available for supplying auxiliary feedwater to the steam generators but only requires one source of auxiliary feedwater. P-8C is the preferred source of feedwater for this event. In addition, the manual handwheel on CV-0522B is available for use in providing a steam supply to P-8B during this event.

In addition, 10 CFR 50 Appendix R requirements call for the plant to be able to achieve cold shutdown. Under certain assumed fires, the result is loss of both electrical driven auxiliary feedwater pumps. Being able to achieve cold shutdown requires the use of the steam from the steam generators at very low pressures. Post-modification testing demonstrated successful low flow performance of the turbine driven pump through CV-0522B down to steam generator pressures below 39 psia. Since the performance was based on use of CV-0522B only (No parallel operation of the two steam lines) the analytical assumptions have only been verified for use of the normal above ground steam supply. In all cases the backup underground steam supply through CV-0522A is not relied upon to mitigate the event and therefore, is not required to fulfill any safety function.

E. Probabilistic Safety Assessment

The PSA group evaluated permanently disabling (isolating CV-0522A) the backup underground steam supply line to AFW pump P-8B. Two different evaluations were performed: one using the risk monitoring software (EOOS) and one using the new revised PSAR1 model.

EOOS was used to determine the initial significance of failure of the backup underground steam supply line to P-8B. Backup underground steam supply valve CV-0522A was failed to obtain results. The result of the EOOS run was a risk achievement worth (RAW) = 1.00 and corresponding increase in core damage frequency (CDF) of 1.00E-7/yr. EOOS uses the Palisades IPE model and credits the use of the alternate shutdown panel for operation of P-8B.

Palisades updated the PSA model last year (1999) as PSAR1, but is not yet installed on EOOS. The updated PSAR1 (at-power, internal events) was re-quantified with the failure of CV-0522A set to true. The resultant evaluation from PSAR1 was a RAW = 1.11 and corresponding increase in CDF of 6.61E-6/yr. However, the alternate shutdown panel was not credited in the PSAR1 model. A screening value (probability of failure = .1) for the reliability of the alternate shutdown panel (only for those sequences affected by CV-0522A) was evaluated. This results in a RAW = 1.01 and corresponding increase in CDF of 7.28E-7/yr.

Based on the EOOS evaluation and the PSAR1 model, permanently disabling the backup underground steam supply line to AFW pump P-8B is below the Regulatory Guide 1.174 threshold of 1E-6/yr increase in CDF. Therefore, permanently disabling the backup underground steam supply line to P-8B is considered to be non-safety significant.

F. Isolation of the Abandoned Buried Piping

Because, a) the buried piping is unsuitable for further use, b) there is no safety reliance placed on that steam supply to P-8B, and c) repair or replacement would be more expensive than can be justified by the slight increase in operational flexibility provided by a second steam supply, the connections to the former underground backup steam supply for Pump P-8B turbine will be isolated from the main steam piping using at least one manual isolation valve, and from the P-8B turbine driver with a pipe cap or flanged connection prior to leaving Cold Shutdown from the current outage.

VI. Analysis of No Significant Hazards Consideration

A. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

The proposed Technical Specifications changes would allow plant operation without requiring the manual backup steam supply to the turbine driven auxiliary feedwater pump.

The connections to the former underground backup steam supply for Pump P-8B turbine will be isolated from the main steam piping using at least one manual isolation valve, and from the P-8B turbine driver with a pipe cap or flanged connection prior to leaving Cold Shutdown from the current outage. Since the backup underground steam supply is not credited in any plant safety analyses nor required for any design or license basis events, adequate redundancy in other required sources of supplying auxiliary feedwater exists such that no increase in consequences of an accident will result. Probabilistic Safety Analysis, comparing plant operation with and without the manual backup steam supply, has shown there to be no significant change in risk. Therefore, operation of the plant in accordance with the proposed Technical Specifications would not involve a significant increase in the probability or consequences of an accident previously evaluated.

B. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

Operation of the plant in accordance with the proposed Technical Specifications would not add any new equipment, settings, or alter any plant operating methodology. The only change is the elimination of a testing requirement for a removed plant component. Functioning of that plant component is not assumed in any safety analyses. Since there will be no change in operating plant equipment, settings, or normal operating methodology, operation in accordance with the proposed Technical Specifications would not create the possibility of a new or different kind of accident from any accident previously evaluated.

C. Does this change involve a significant reduction in a margin of safety?

The proposed Technical Specifications change would allow operation of the plant without the manual backup steam supply to the turbine driven auxiliary feedwater pump. There are no analyzed accidents which require the manual backup steam supply to mitigate the effects of the accident. A Probabilistic Safety Analysis, comparing plant operation with and without the manual backup steam supply, has shown there to be no significant change in risk.

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

VII. Conclusion

The Palisades Plant Review Committee has reviewed this Technical Specifications change request and has determined that operation of the plant in accordance with the proposed changes would not involve a significant hazards consideration. This change has been reviewed by the Nuclear Performance Assessment Department.

CONSUMERS ENERGY COMPANY

TECHNICAL SPECIFICATIONS CHANGE REQUEST

To the best of my knowledge, the content of this Technical Specifications change request, which revises the Auxiliary Feedwater System requirements related to the steam supplies for the turbine driven pump, is truthful and complete.

Daniel G. Malone
Acting Director, Licensing

Sworn and subscribed to before me this 18th day of February 2000

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

ENCLOSURE 1
ATTACHMENT 1

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

TECHNICAL SPECIFICATIONS CHANGE REQUEST
Auxiliary Feedwater

CURRENT TECHNICAL SPECIFICATIONS
PROPOSED PAGE

4.9 AUXILIARY FEEDWATER SYSTEM TESTS

Surveillance Requirements

Auxiliary Feedwater Pumps

a. At least once per 31 days:

1. The OPERABILITY of each motor-driven pump shall be verified by starting from the control room hand switch, from the breaker and from the pump test-key switch in a three month period.

2. The OPERABILITY of the steam driven pump shall be verified by starting alternately from the control room switch for the steam supply (CV-0522B) and from the pump test-key switch.

3. Verify that each non-automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

b. At least once per 18 months:

1. Verify that each Automatic Valve (CV-0736A, CV-0737A, CV-0727 and CV-0749) actuates to its correct position (or that specified flow is established) upon receipt of a simulated auxiliary feedwater pump start signal.

2. Verify that each pump starts automatically upon receipt of an auxiliary feedwater actuation test signal.

Basis

The periodic testing of Section 4.9.a will verify auxiliary feedwater pump control circuits.

The OPERABILITY testing of Section 4.9.b will verify auto initiation of the auxiliary feedwater system by simulating a low steam generator level and observation of pump start. To automatically start the "C" pump requires placing the "A" pump in manual. To automatically start the "B" pump requires placing the "A & C" pumps in manual. These tests may be performed during plant operations. OPERABILITY of the flow control valves (CV-0736A, CV-0737A, CV-0727 and CV-0749) will be verified through simulation of an auxiliary feedwater pump start signal and observing auxiliary feedwater system flow as monitored by installed instrumentation.

Reference

FSAR, Section 9.7

Amendment No. ~~53, 96~~, ~~162~~,

ENCLOSURE 1
ATTACHMENT 2

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

TECHNICAL SPECIFICATIONS CHANGE REQUEST
Auxiliary Feedwater

IMPROVED TECHNICAL SPECIFICATIONS
PROPOSED PAGES

3.7 PLANT SYSTEMS

3.7.5 Auxiliary Feedwater (AFW) System

LCO 3.7.5 Two AFW trains shall be OPERABLE.

---NOTES---

1. Only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4.
2. The steam driven pump is only required to be operable prior to making the reactor critical.
3. Two AFW pumps may be placed in manual for testing, for a period of up to 4 hours.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more AFW trains inoperable in MODE 1, 2, or 3. AND At least 100% of required AFW flow available to each steam generator. AND At least two AFW pumps OPERABLE.	A.1 Restore train(s) to OPERABLE status.	72 hours

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time of Condition A not met. OR One or more AFW trains inoperable for reasons other than Condition A with at least 100% of the required AFW flow available in MODE 1, 2, or 3.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 30 hours
C. Two AFW trains inoperable with less than 100% of the required AFW flow available, in MODE 1, 2, or 3. OR Required AFW train inoperable in MODE 4.	----------NOTE---------- LCO 3.0.3 and all other LCO Required Actions requiring MODE changes or power reductions are suspended until at least 100% of the required AFW flow is available. ---------- C.1 Initiate action to restore one AFW train to OPERABLE status.	 Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.5.1	Verify each required AFW manual, power operated, and automatic valve in each water flow path and in the steam supply flow path to the steam turbine driven pump, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.5.2	----------NOTE---------- Not required to be met for the turbine driven AFW pump in MODE 3 below 800 psig in the steam generators. ----------	
	Verify the developed head of each required AFW pump at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.7.5.3	----------NOTE---------- Only required to be met in MODES 1, 2 or 3 when AFW is not in operation. ----------	
	Verify each AFW automatic valve that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.7.5.4	----------NOTE---------- Only required to be met in MODES 1, 2, and 3. ----------	
	Verify each required AFW pump starts automatically on an actual or simulated actuation signal.	18 months

B 3.7 PLANT SYSTEMS

B 3.7.5 Auxiliary Feedwater (AFW) System

BASES

BACKGROUND

The AFW System automatically supplies feedwater to the steam generators to remove decay heat from the Primary Coolant System upon the loss of normal feedwater supply. The AFW pumps take suction through a common suction line from the Condensate Storage Tank (CST) (LCO 3.7.6, "Condensate Storage and Supply") and pump to the steam generator secondary side via two separate and independent flow paths to a common AFW supply header for each steam generator. The steam generators function as a heat sink for core decay heat. The heat load is dissipated by releasing steam to the atmosphere from the steam generators via the Main Steam Safety Valves (MSSVs) (LCO 3.7.1, "Main Steam Safety Valves (MSSVs)") or Atmospheric Dump Valves (ADVs) (LCO 3.7.4, "Atmospheric Dump Valves (ADVs)"). If the main condenser is available, steam may be released via the turbine bypass valve.

The AFW System consists of two motor driven AFW pumps and one steam turbine driven pump configured into two trains. One train (A/B) consists of a motor driven pump (P-8A) and the turbine driven pump (P-8B) in parallel, the discharges join together to form a common discharge. The A/B train common discharge separates to form two flow paths, which feed each steam generator via each steam generator's AFW penetration. The second motor driven pump (P-8C) feeds both steam generators through separate flow paths via each steam generator AFW penetration and forms the other train (C). The two trains join together at each AFW penetration to form a common supply to the steam generators. Each AFW pump is capable of providing 100% of the required capacity to the steam generators as assumed in the accident analysis. The pumps are equipped with independent recirculation lines to prevent pump operation against a closed system.

Each motor driven AFW pump is powered from an independent Class 1E power supply, and feeds both steam generators.

BASES

BACKGROUND (continued)

The steam turbine driven AFW pump receives steam from the steam generator E-50A main steam header upstream of the Main Steam Isolation Valve (MSIV). The steam supply valve receives an open signal from the Auxiliary Feedwater Actuation Signal (AFAS) instrumentation. The turbine driven AFW pump feeds both steam generators through the same flow paths as motor driven AFW pump P-8A.

One pump at full flow is sufficient to remove decay heat and cool the plant to Shutdown Cooling (SDC) System entry conditions.

The AFW System supplies feedwater to the steam generators during normal plant startup, shutdown, and hot standby conditions.

The AFW System is designed to supply sufficient water to the steam generators to remove decay heat with steam generator pressure at the setpoint of the MSSVs, with exception of AFW pump P-8C. If AFW pump P-8C is used, operator action may be required to either trip two of four Primary Coolant Pumps (PCPs), start an additional AFW pump, or reduce steam generator pressure. This will allow the required flowrates to the steam generators that are assumed in the safety analyses. Subsequently, the AFW System supplies sufficient water to cool the plant to SDC entry conditions, and steam is released through the ADVs, or the turbine bypass valve if the condenser is available.

The AFW System actuates automatically on low steam generator level by an AFAS as described in LCO 3.3.3, "Engineered Safety Feature (ESF) Instrumentation" and 3.3.4, "ESF Logic." The AFAS initiates signals for starting the AFW pumps and repositioning the valves to initiate AFW flow to the steam generators. The actual pump starts are on an "as required" basis. P-8A is started initially, if the pump fails to start, or if the required flow is not established in a specified period of time, P-8C is started. If P-8A and P-8C do not start, or if required flow is not established in a specified period of time, then P-8B is started.

The AFW System is discussed in the FSAR, Section 9.7 (Ref. 1).

BASES

APPLICABLE SAFETY ANALYSES

The AFW System mitigates the consequences of any event with a loss of normal feedwater.

The design basis of the AFW System is to supply water to the steam generator to remove decay heat and other residual heat, by delivering at least the minimum required flow rate to the steam generators at pressures corresponding to the lowest MSSV set pressure plus 3% with the exception of AFW pump P-8C. If AFW pump P-8C is used, operator action may be required to either trip two of the four PCPs, start an additional AFW pump or reduce steam generator pressure. This will allow the required flowrate to the steam generators that are assumed in the safety analyses.

The limiting Design Basis Accident for the AFW System is a loss of normal feedwater.

In addition, the minimum available AFW flow and system characteristics are serious considerations in the analysis of a small break loss of coolant accident.

The AFW System design is such that it can perform its function following loss of normal feedwater combined with a loss of offsite power with one AFW pump injecting AFW to one steam generator.

The AFW System satisfies Criterion 3 of 10 CFR 50.36(c)(2).

LCO

This LCO requires that two AFW trains be OPERABLE to ensure that the AFW System will perform the design safety function to mitigate the consequences of accidents that could result in overpressurization of the primary coolant pressure boundary. Three independent AFW pumps, in two diverse trains, ensure availability of residual heat removal capability for all events accompanied by a loss of offsite power and a single failure. This is accomplished by powering two pumps from independent emergency buses. The third AFW pump is powered by a diverse means, a steam driven turbine supplied with steam from a source not isolated by the closure of the MSIVs.

BASES

LCO (continued)

The AFW System is considered to be OPERABLE when the components and flow paths required to provide AFW flow to the steam generators are OPERABLE. This requires that the two motor driven AFW pumps be OPERABLE in two diverse paths, each supplying AFW to both steam generators. Prior to making the reactor critical during a plant startup, the turbine driven AFW pump shall be OPERABLE and capable of supplying AFW flow to both steam generators. When steam generator pressure is reduced, it is not required to have design inlet pressure available to the turbine driver in order to declare the turbine driven AFW pump OPERABLE. As steam generator pressure drops, the required AFW pump discharge head decreases accordingly. The reduced steam generator pressure available at lower temperatures in MODE 3 does not inhibit the turbine driven AFW pump's ability to feed the steam generator (Ref. 3). The piping, valves, instrumentation, and controls in the required flow paths shall also be OPERABLE.

The LCO is modified by three Notes. Note one indicates that only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4. This is because of reduced heat removal requirements, the short period of time in MODE 4 during which AFW is required, and the insufficient steam pressure available in MODE 4 to power the turbine driven AFW pump. Note two states that the turbine driven AFW pump is only required to be made OPERABLE prior to making the reactor critical. It is required to be OPERABLE during subsequent MODE 1, 2, and 3 operation. This allowance is needed to provide sufficient steam pressure to perform turbine and pump testing. Note three indicates that any two AFW pumps may be placed in manual mode for the purpose of testing, for not more than 4 hours. In this situation, the third AFW pump would still be available in the event of a plant transient. The two pumps that are in manual could be used at the discretion of the operator.

APPLICABILITY

In MODES 1, 2, and 3, the AFW System is required to be OPERABLE and to function in the event that the main feedwater is lost. In addition, the AFW System is required to supply enough makeup water to replace steam generator secondary inventory, lost as the plant cools to MODE 4 conditions.

During heatup, the turbine driven AFW pump is only required to be made OPERABLE prior to making the reactor critical. It is required to be OPERABLE during subsequent MODE 1, 2, and 3 operation. This allowance is needed to provide sufficient steam pressure to perform turbine and pump testing.

BASES

APPLICABILITY (continued)

In MODE 4, the AFW System may be used for heat removal via the steam generator.

In MODES 5 and 6, the steam generators are not normally used for decay heat removal, and the AFW System is not required.

ACTIONS

A.1

With one or more AFW trains (pump or flow paths) inoperable, in MODE 1, 2, or 3, and at least 100% of the required AFW flow available to each steam generator, and at least two AFW pumps OPERABLE, action must be taken to restore the components to OPERABLE status within 72 hours. The 72 hour Completion Time is reasonable, based on the redundant capabilities afforded by the AFW System, the time needed for repairs, and the low probability of a DBA event occurring during this period. Two AFW pumps and the associated flow paths remain to supply feedwater to both steam generators.

B.1 and B.2

When Required Action A.1 cannot be completed within the required Completion Time, or with one or more AFW trains (pump or flow paths) inoperable, for reasons other than Condition A with at least 100% of the required AFW flow available in MODES 1, 2, and 3, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be placed in at least MODE 3 within 6 hours, and in MODE 4 within 30 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

BASES

ACTIONS (continued)

C.1

Required Action C.1 is modified by a Note indicating that all required MODE changes or power reductions are suspended until at least 100% of the required AFW flow is available.

With two trains inoperable and less than 100% of the required AFW flow available in MODES 1, 2, and 3, or the required AFW train inoperable in MODE 4, the plant is in a seriously degraded Condition with no safety related means for conducting a cooldown, and only limited means for conducting a cooldown with nonsafety grade equipment. In such a condition, the plant should not be perturbed by any action, including a power change, that might result in a trip. The seriousness of this condition requires that action be started immediately to restore at least 100% of the required AFW flow available. LCO 3.0.3 is not applicable, as it could force the plant into a less safe condition.

SURVEILLANCE REQUIREMENTS

SR 3.7.5.1

Verifying the correct alignment for the required manual, power operated, and automatic valves in the AFW water and steam supply flow path provides assurance that the proper flow paths exist for AFW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves are verified to be in the correct position prior to locking, sealing, or securing. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This Surveillance does not require any testing or valve manipulations; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position.

This test need not be performed for the steam driven AFW pump for MODE 4 operation.

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.5.2

Verifying that each required AFW pump's developed head at the flow test point is greater than or equal to the required developed head ensures that AFW pump performance has not degraded during the cycle. Flow and differential head are normal tests of pump performance required by Section XI of the ASME Code (Ref. 2). This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice tests confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance.

This SR is modified by a Note indicating that this SR for the turbine driven AFW pump does not have to be met in MODE 3 when steam pressure is below 800 psig. This is because there is insufficient steam pressure and pump discharge pressure to allow the turbine driven pump to reach the normal test conditions.

Performance of inservice testing, discussed in the ASME Code, Section XI (Ref. 2), at 3 month intervals satisfies this requirement.

SR 3.7.5.3

This SR ensures that AFW can be delivered to the appropriate steam generator, in the event of any accident or transient that generates an AFAS, by demonstrating that each automatic valve in the flow path actuates to its correct position on an actual or simulated actuation signal. Specific signals (e.g., AFAS) are tested under Section 3.3, "Instrumentation." 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 acceptable, based on the design reliability and operating experience of the equipment.

This SR is modified by a Note which states the SR is only required to be met in MODES 1, 2, and 3 when AFW is not in operation. With AFW in operation, the required trains are already aligned with the flow control valves in manual control.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.5.4

This SR ensures that the AFW pumps will start in the event of any accident or transient that generates an AFAS by demonstrating that each AFW pump starts automatically on an actual or simulated actuation signal. Specific signals (e.g., AFAS, handswitch) are tested under Section 3.3, "Instrumentation."

This test need not be performed for the steam driven AFW pump for MODE 4 operation.

The 18 month Frequency is acceptable, based on the design reliability and operating experience of the equipment.

This SR is modified by a Note. The Note states that the SR is only required to be met in MODES 1, 2, and 3. In MODE 4, the required pump is already operating and the autostart function is not required.

REFERENCES

1. FSAR, Section 9.7

2. ASME, Boiler and Pressure Vessel Code, Section XI, Inservice Inspection, Article IWV-3400.

3. Palisades Design Basis Document 1.03, Auxiliary Feedwater System, Section 3.4.1.

ENCLOSURE 1
ATTACHMENT 3

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

TECHNICAL SPECIFICATIONS CHANGE REQUEST
Auxiliary Feedwater

CURRENT TECHNICAL SPECIFICATIONS
EXISTING PAGE MARKED TO SHOW PROPOSED CHANGES

4.9 AUXILIARY FEEDWATER SYSTEM TESTS

Surveillance Requirements

Auxiliary Feedwater Pumps

a. At least once per 31 days:

1. The OPERABILITY of each motor-driven pump shall be verified by starting from the control room hand switch, from the breaker and from the pump test-key switch in a three month period.

2. The OPERABILITY of the steam-driven pump shall be verified by starting alternately from ~~each~~ **[the]** control room switch **[for the steam supply (CV-0522B)]** and from the pump test-key switch in a three month period.

3. Verify that each non-automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

b. At least once per 18 months:

1. Verify that each Automatic Valve (CV-0736A, CV-0737A, CV-0727 and CV-0749) actuates to its correct position (or that specified flow is established) upon receipt of a simulated auxiliary feedwater pump start signal.

2. Verify that each pump starts automatically upon receipt of an auxiliary feedwater actuation test signal.

Basis

The periodic testing of Section 4.9.a will verify auxiliary feedwater pump control circuits.

The OPERABILITY testing of Section 4.9.b will verify auto initiation of the auxiliary feedwater system by simulating a low steam generator level and observation of pump start. To automatically start the "C" pump requires placing the "A" pump in manual. To automatically start the "B" pump requires placing the "A & C" pumps in manual. These tests may be performed during plant operations. OPERABILITY of the flow control valves (CV-0736A, CV-0737A, CV-0727 and CV-0749) will be verified through simulation of an auxiliary feedwater pump start signal and observing auxiliary feedwater system flow as monitored by installed instrumentation.

Reference

FSAR, Section 9.7

Amendment No. ~~53, 96~~, ~~162~~

ENCLOSURE 1
ATTACHMENT 4

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

TECHNICAL SPECIFICATIONS CHANGE REQUEST
Auxiliary Feedwater

IMPROVED TECHNICAL SPECIFICATIONS
EXISTING PAGES MARKED TO SHOW PROPOSED CHANGES

3.7 PLANT SYSTEMS

3.7.5 Auxiliary Feedwater (AFW) System

LCO 3.7.5 Two AFW trains shall be OPERABLE.

---NOTES---

1. Only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4.
2. The steam driven pump is only required to be operable prior to making the reactor critical.
3. Two AFW pumps may be placed in manual for testing, for a period of up to 4 hours.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A. One steam supply to turbine driven AFW pump inoperable.~~	~~A.1 Restore steam supply to OPERABLE status.~~	~~7 days~~ ~~AND~~ ~~10 days from discovery of failure to meet the LCO~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B~~**[A]**. One or more AFW trains inoperable ~~for reasons other than Condition A~~ in MODE 1, 2, or 3. AND At least 100% of required AFW flow available to each steam generator. AND At least two AFW pumps OPERABLE.	~~B~~**[A]**.1 Restore train(s) to OPERABLE status.	72 hours ~~AND~~ ~~10 days from discovery of failure to meet the LCO~~
~~C~~**[B]**. Required Action and associated Completion Time of Condition A ~~or B~~ not met. OR One or more AFW trains inoperable for reasons other than Condition A ~~or B~~ with at least 100% of the required AFW flow available in MODE 1, 2, or 3.	~~C~~**[B]**.1 Be in MODE 3. AND ~~C~~**[B]**.2 Be in MODE 4.	6 hours 30 hours

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~D~~**[C]**. Two AFW trains inoperable with less than 100% of the required AFW flow available, in MODE 1, 2, or 3. OR Required AFW train inoperable in MODE 4.	----------NOTE---------- LCO 3.0.3 and all other LCO Required Actions requiring MODE changes or power reductions are suspended until at least 100% of the required AFW flow is available. ---------- ~~D~~**[C]**.1 Initiate action to restore one AFW train to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.5.1	Verify each required AFW manual, power operated, and automatic valve in each water flow path and in ~~both~~**[the]** steam supply flow paths to the steam turbine driven pump, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.5.2	----------NOTE---------- Not required to be met for the turbine driven AFW pump in MODE 3 below 800 psig in the steam generators. ---------- Verify the developed head of each required AFW pump at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.7.5.3	----------NOTE---------- Only required to be met in MODES 1, 2 or 3 when AFW is not in operation. ---------- Verify each AFW automatic valve that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.7.5.4	----------NOTE---------- Only required to be met in MODES 1, 2, and 3. ---------- Verify each required AFW pump starts automatically on an actual or simulated actuation signal.	18 months

B 3.7 PLANT SYSTEMS

B 3.7.5 Auxiliary Feedwater (AFW) System

BASES

BACKGROUND

The AFW System automatically supplies feedwater to the steam generators to remove decay heat from the Primary Coolant System upon the loss of normal feedwater supply. The AFW pumps take suction through a common suction line from the Condensate Storage Tank (CST) (LCO 3.7.6, "Condensate Storage and Supply") and pump to the steam generator secondary side via two separate and independent flow paths to a common AFW supply header for each steam generator. The steam generators function as a heat sink for core decay heat. The heat load is dissipated by releasing steam to the atmosphere from the steam generators via the Main Steam Safety Valves (MSSVs) (LCO 3.7.1, "Main Steam Safety Valves (MSSVs)") or Atmospheric Dump Valves (ADVs) (LCO 3.7.4, "Atmospheric Dump Valves (ADVs)"). If the main condenser is available, steam may be released via the turbine bypass valve.

The AFW System consists of two motor driven AFW pumps and one steam turbine driven pump configured into two trains. One train (A/B) consists of a motor driven pump (P-8A) and the turbine driven pump (P-8B) in parallel, the discharges join together to form a common discharge. The A/B train common discharge separates to form two flow paths, which feed each steam generator via each steam generator's AFW penetration. The second motor driven pump (P-8C) feeds both steam generators through separate flow paths via each steam generator AFW penetration and forms the other train (C). The two trains join together at each AFW penetration to form a common supply to the steam generators. Each AFW pump is capable of providing 100% of the required capacity to the steam generators as assumed in the accident analysis. The pumps are equipped with independent recirculation lines to prevent pump operation against a closed system.

Each motor driven AFW pump is powered from an independent Class 1E power supply, and feeds both steam generators.

BASES

BACKGROUND (continued)

The steam turbine driven AFW pump receives steam from ~~either~~ **[the steam generator E-50A]** main steam header upstream of the Main Steam Isolation Valve (MSIV). ~~Each of the steam feed lines will supply 100% of the requirements of the turbine driven AFW pump.~~ The steam supply ~~from steam generator E-50A~~ **[valve]** receives an open signal from the Auxiliary Feedwater Actuation Signal (AFAS) instrumentation. ~~The steam supply from steam generator E-50B does not. This steam source is a manual backup.~~ The turbine driven AFW pump feeds both steam generators through the same flow paths as motor driven AFW pump P-8A.

One pump at full flow is sufficient to remove decay heat and cool the plant to Shutdown Cooling (SDC) System entry conditions.

The AFW System supplies feedwater to the steam generators during normal plant startup, shutdown, and hot standby conditions.

The AFW System is designed to supply sufficient water to the steam generators to remove decay heat with steam generator pressure at the setpoint of the MSSVs, with exception of AFW pump P-8C. If AFW pump P-8C is used, operator action may be required to either trip two of four Primary Coolant Pumps (PCPs), start an additional AFW pump, or reduce steam generator pressure. This will allow the required flowrates to the steam generators that are assumed in the safety analyses. Subsequently, the AFW System supplies sufficient water to cool the plant to SDC entry conditions, and steam is released through the ADVs, or the turbine bypass valve if the condenser is available.

The AFW System actuates automatically on low steam generator level by an AFAS as described in LCO 3.3.3, "Engineered Safety Feature (ESF) Instrumentation" and 3.3.4, "ESF Logic." The AFAS initiates signals for starting the AFW pumps and repositioning the valves to initiate AFW flow to the steam generators. The actual pump starts are on an "as required" basis. P-8A is started initially, if the pump fails to start, or if the required flow is not established in a specified period of time, P-8C is started. If P-8A and P-8C do not start, or if required flow is not established in a specified period of time, then P-8B is started.

The AFW System is discussed in the FSAR, Section 9.7 (Ref. 1).

BASES

APPLICABLE SAFETY ANALYSES

The AFW System mitigates the consequences of any event with a loss of normal feedwater.

The design basis of the AFW System is to supply water to the steam generator to remove decay heat and other residual heat, by delivering at least the minimum required flow rate to the steam generators at pressures corresponding to the lowest MSSV set pressure plus 3% with the exception of AFW pump P-8C. If AFW pump P-8C is used, operator action may be required to either trip two of the four PCPs, start an additional AFW pump or reduce steam generator pressure. This will allow the required flowrate to the steam generators that are assumed in the safety analyses.

The limiting Design Basis Accident for the AFW System is a loss of normal feedwater.

In addition, the minimum available AFW flow and system characteristics are serious considerations in the analysis of a small break loss of coolant accident.

The AFW System design is such that it can perform its function following loss of normal feedwater combined with a loss of offsite power with one AFW pump injecting AFW to one steam generator.

The AFW System satisfies Criterion 3 of 10 CFR 50.36(c)(2).

LCO

This LCO requires that two AFW trains be OPERABLE to ensure that the AFW System will perform the design safety function to mitigate the consequences of accidents that could result in overpressurization of the primary coolant pressure boundary. Three independent AFW pumps, in two diverse trains, ensure availability of residual heat removal capability for all events accompanied by a loss of offsite power and a single failure. This is accomplished by powering two pumps from independent emergency buses. The third AFW pump is powered by a diverse means, a steam driven turbine supplied with steam from a source not isolated by the closure of the MSIVs.

BASES

LCO (continued)

The AFW System is considered to be OPERABLE when the components and flow paths required to provide AFW flow to the steam generators are OPERABLE. This requires that the two motor driven AFW pumps be OPERABLE in two diverse paths, each supplying AFW to both steam generators. Prior to making the reactor critical during a plant startup, the turbine driven AFW pump shall be OPERABLE ~~with redundant steam supplies from each of the two main steam lines upstream of the MSIVs~~ and capable of supplying AFW flow to both steam generators. When steam generator pressure is reduced, it is not required to have design inlet pressure available to the turbine driver in order to declare the turbine driven AFW pump OPERABLE. As steam generator pressure drops, the required AFW pump discharge head decreases accordingly. The reduced steam generator pressure available at lower temperatures in MODE 3 does not inhibit the turbine driven AFW pump's ability to feed the steam generator (Ref. 3). The piping, valves, instrumentation, and controls in the required flow paths shall also be OPERABLE.

The LCO is modified by three Notes. Note one indicates that only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4. This is because of reduced heat removal requirements, the short period of time in MODE 4 during which AFW is required, and the insufficient steam pressure available in MODE 4 to power the turbine driven AFW pump. Note two states that the turbine driven AFW pump is only required to be made OPERABLE prior to making the reactor critical. It is required to be OPERABLE during subsequent MODE 1, 2, and 3 operation. This allowance is needed to provide sufficient steam pressure to perform turbine and pump testing. Note three indicates that any two AFW pumps may be placed in manual mode for the purpose of testing, for not more than 4 hours. In this situation, the third AFW pump would still be available in the event of a plant transient. The two pumps that are in manual could be used at the discretion of the operator.

APPLICABILITY

In MODES 1, 2, and 3, the AFW System is required to be OPERABLE and to function in the event that the main feedwater is lost. In addition, the AFW System is required to supply enough makeup water to replace steam generator secondary inventory, lost as the plant cools to MODE 4 conditions.

During heatup, the turbine driven AFW pump is only required to be made OPERABLE prior to making the reactor critical. It is required to be OPERABLE during subsequent MODE 1, 2, and 3 operation. This allowance is needed to provide sufficient steam pressure to perform turbine and pump testing.

BASES

APPLICABILITY (continued)

In MODE 4, the AFW System may be used for heat removal via the steam generator.

In MODES 5 and 6, the steam generators are not normally used for decay heat removal, and the AFW System is not required.

ACTIONS

A.1

~~If one of the two steam supplies to the turbine driven AFW pump is inoperable, action must be taken to restore OPERABLE status within 7 days. The 7 day Completion Time is reasonable based on the following reasons:~~

~~a. The redundant OPERABLE steam supply to the turbine driven AFW pump;~~

~~b. The availability of redundant OPERABLE motor driven AFW pumps; and~~

~~c. The low probability of an event requiring the inoperable steam supply to the turbine driven AFW pump.~~

~~The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any continuous failure to meet the LCO.~~

~~The 10 day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 7 days and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.~~

~~B.1~~

With one or more AFW trains (pump or flow paths) inoperable, ~~for reasons other than Condition A,~~ in MODE 1, 2, or 3, and at least 100% of the required AFW flow available to each steam generator, and at least two AFW pumps OPERABLE, action must be taken to restore the components to OPERABLE status within 72 hours. ~~This Condition includes the loss of two steam supply lines to the turbine driven AFW pump.~~ The 72 hour Completion Time is reasonable, based on the redundant capabilities afforded by the AFW System, the time needed for repairs, and the low probability of a DBA event occurring during this period. Two AFW pumps and the associated flow paths remain to supply feedwater to both steam generators.

BASES

ACTIONS

B.1 (continued)

~~The second Completion Time for Required Action B.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any continuous failure to meet this LCO.~~

~~The 10 day Completion Time provides a limitation time allowed in the specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 72 hours and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.~~

~~C.1 and C.2~~**[B.1 and B.2]**

When ~~either~~ Required Action A.1 ~~or B.1~~ cannot be completed within the required Completion Time, or with one or more AFW trains (pump or flow paths) inoperable, for reasons other than Condition A ~~or B~~ with at least 100% of the required AFW flow available in MODES 1, 2, and 3, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be placed in at least MODE 3 within 6 hours, and in MODE 4 within 30 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

~~D.1~~**[C.1]**

Required Action ~~D~~**[C]**.1 is modified by a Note indicating that all required MODE changes or power reductions are suspended until at least 100% of the required AFW flow is available.

With two trains inoperable and less than 100% of the required AFW flow available in MODES 1, 2, and 3, or the required AFW train inoperable in MODE 4, the plant is in a seriously degraded Condition with no safety related means for conducting a cooldown, and only limited means for conducting a cooldown with nonsafety grade equipment. In such a condition, the plant should not be perturbed by any action, including a power change, that might result in a trip. The seriousness of this condition requires that action be started immediately to restore at least 100% of the required AFW flow available. LCO 3.0.3 is not applicable, as it could force the plant into a less safe condition.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.5.1

Verifying the correct alignment for the required manual, power operated, and automatic valves in the AFW water and steam supply flow paths provides assurance that the proper flow paths exist for AFW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves are verified to be in the correct position prior to locking, sealing, or securing. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This Surveillance does not require any testing or valve manipulations; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position.

This test need not be performed for the steam driven AFW pump for MODE 4 operation.

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.5.2

Verifying that each required AFW pump's developed head at the flow test point is greater than or equal to the required developed head ensures that AFW pump performance has not degraded during the cycle. Flow and differential head are normal tests of pump performance required by Section XI of the ASME Code (Ref. 2). This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice tests confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance.

This SR is modified by a Note indicating that this SR for the turbine driven AFW pump does not have to be met in MODE 3 when steam pressure is below 800 psig. This is because there is insufficient steam pressure and pump discharge pressure to allow the turbine driven pump to reach the normal test conditions.

Performance of inservice testing, discussed in the ASME Code, Section XI (Ref. 2), at 3 month intervals satisfies this requirement.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.5.3

This SR ensures that AFW can be delivered to the appropriate steam generator, in the event of any accident or transient that generates an AFAS, by demonstrating that each automatic valve in the flow path actuates to its correct position on an actual or simulated actuation signal. Specific signals (e.g., AFAS) are tested under Section 3.3, "Instrumentation." 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 acceptable, based on the design reliability and operating experience of the equipment.

This SR is modified by a Note which states the SR is only required to be met in MODES 1, 2, and 3 when AFW is not in operation. With AFW in operation, the required trains are already aligned with the flow control valves in manual control.

SR 3.7.5.4

This SR ensures that the AFW pumps will start in the event of any accident or transient that generates an AFAS by demonstrating that each AFW pump starts automatically on an actual or simulated actuation signal. Specific signals (e.g., AFAS, handswitch) are tested under Section 3.3, "Instrumentation."

This test need not be performed for the steam driven AFW pump for MODE 4 operation.

The 18 month Frequency is acceptable, based on the design reliability and operating experience of the equipment.

This SR is modified by a Note. The Note states that the SR is only required to be met in MODES 1, 2, and 3. In MODE 4, the required pump is already operating and the autostart function is not required.

REFERENCES

1. FSAR, Section 9.7

2. ASME, Boiler and Pressure Vessel Code, Section XI, Inservice Inspection, Article IWV-3400.

3. Palisades Design Basis Document 1.03, Auxiliary Feedwater System, Section 3.4.1.

ENCLOSURE 2

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

A SUMMARY OF SIGNIFICANT CORRESPONDENCE AND COMMITMENTS RELEVANT TO THE STEAM DRIVEN AUXILIARY FEEDWATER PUMP (P-8B)

Significant Correspondence and Commitments Relevant to Steam Driven Auxiliary Feedwater Pump (P-8B)

This attachment provides a listing of significant correspondence in which information relevant to the Auxiliary Feedwater System was provided to NRC, or NRC action was taken. Major commitments associated with the evolution of the Auxiliary Feedwater System design in general, and the steam turbine driven pump in particular, are highlighted. Note that the Auxiliary Feedwater System as originally licensed was a single train system with one motor-driven and one steam turbine driven pump. The turbine received steam through a single supply line which connected to the main steam lines downstream of the Main Steam Isolation Valves (MSIVs). Both pumps were physically located side by side in the same room.

CPCo letter May 1, 1973 Analysis of Postulated High Energy Line Breaks Outside of Containment

Submitted analysis of high energy line breaks (HELB) outside of containment. Report concluded that failure of the existing single steam supply line to the turbine driven auxiliary feedwater pump (P-8B) or any failure that caused both Main Steam Isolation Valves to close, when coupled with a single failure of the existing single motor driven auxiliary feedwater pump, would fail to meet acceptance criteria. The proposed corrective action as specified in report section 9.3 was specified as, "To qualify the turbine driven auxiliary feedwater pump as the redundant backup to the motor driven pump, it will be necessary to connect line EB-13-4" [P-8B steam supply line] to each main steam line upstream of the main steam isolation valves."

NRC letter September 13, 1979 Followup Actions Resulting from the NRC Staff Reviews Regarding the Three Mile Island Unit 2 Accident

Established requirements for all licensees to implement recommendations in NUREG 0578. Required implementation of item 2.1.7.a, AFW autostart (control grade by 1/1/80 and safety grade by 1/1/81) and 2.1.7.b AFW flow indication (by 1/1/80)

CPCo letter October 17, 1979 Requirements Resulting from NRC Staff Review of Three Mile Island 2 Accident - Commitments On

Provided commitments to make modifications requested by NRC 9/13/79 letter.

NRC letter October 30, 1979 NRC Requirements for Auxiliary Feedwater Systems at Palisades Nuclear Plant

Transmitted requirements identified by the NRR Bulletins and Orders Task Force applicable to Palisades and requested additional information. Attachment 1 to this letter appears identical to Pages X-87 to X-107 of NUREG 0635 issued December, 1980. Letter identified numerous concerns with existing single-train

system, including single failure vulnerabilities, potentially limited air system capability to keep steam admission valves open to turbine driven pump, HELB concerns, and concern that P-8B turbine was not seismically qualified. Letter also raises concern with potential failure of single controller for all four steam generator atmospheric dump valves (two per steam generator) which might depressurize both steam generators below required operating pressure for steam driven auxiliary feed pump, thereby rendering pump incapable of operation. The general system description provided in X.6.1.3 did note that turbine driven pump could obtain steam from either steam generator, and that steam supply valves could be manually opened. Letter required response from CPCo.

CPCo letter of December 11, 1979 Response to Recommendations Concerning Auxiliary Feedwater Systems

Responded to NRC letter of 10/30/79. Letter provided a number of commitments for short term actions. Specific commitments relevant to steam driven AFW pump design were not made. Letter made overall commitment to perform AFW reliability study to determine what modifications would be appropriate to address stated NRC concerns.

CPCo letter of December 27, 1979 Requirements Resulting from Review of Three Mile Island 2 Accident - Actions Taken In Response To

Submitted specific responses to NUREG 0578 items 2.1.7.a(1) -(7) and 2.1.7.b(1) -(2), and docketed Combustion Engineering report CEN-125 which, in part, provided generic conceptual design information to support conversion of manual AFW initiation to "control grade" automatic initiation at all applicable CE plants. Typical two pump system equivalent to Palisades' system (Fig 7.1-2) was shown as having only single steam supply line to turbine driven AFW pump. Information does not specifically address need for multiple steam supplies to turbine driven pump. Letter reaffirmed commitments to make system modifications by requested dates, but modification details were not provided.

CPCo letter of March 4, 1980 Requirements Resulting from Review of TMI-2 Accident - Actions Taken in Response: Revision 1

Provided update to CPCo 12/27/79 letter. No changes were made to 2.1.7.a or b.

NRC letter of April 3, 1980 Automatic Initiation of Auxiliary Feedwater System (AFWS) Flow Palisades Plant

Specified that short term modifications of NUREG 0578 were to be implemented without NRC review. Clarified that automatic initiation circuitry was to be designed such that a single failure would not cause the loss of automatic initiation capability of the AFW system.

CPCo letter of April 22, 1980 Automatic Initiation of Auxiliary Feedwater System Update

Letter followed up a 3/31/80 meeting with NRC and provided updates to several responses and commitments submitted in CPCo 12/11/79 letter. Commitment was made for short term procedure changes to address failure of turbine driven pump steam admission valves simultaneously with water flow control valves, but no modifications were identified pending further investigation.

CPCo letter of April 23, 1980 Automatic Initiation of Auxiliary Feedwater System (AFWS) for Palisades Plant

Letter confirmed that NUREG 0578 short term requirements of 2.1.7.a would be implemented without NRC approval as specified in NRC letter of 4/3/80.

NRC letter of October 31, 1980 Post TMI Requirements

Letter issued NUREG 0737. Previous requirements of NUREG 0578 and NUREG 0660 were consolidated and superseded. Auxiliary Feedwater requirements were revised and renumbered as II.E.1.1 and II.E.1.2.

CPCo letter of December 19, 1980 Response to NUREG 0737, Clarification of TMI Action Plan Requirements

Letter provided response to NUREG 0737 and superseded previous submittals on equivalent items from NUREG 0578, 0635, and 0660 except where specifically noted. Previously submitted information and various commitments relating to Auxiliary Feedwater were revised. Reliability study was submitted that concluded that single atmospheric steam dump controller and common steam admission valve/flow control valve power supplies did not contribute significantly to AFW system unreliability. The eight most significant contributors to AFW unavailability were listed; steam supplies to the turbine driven pump were not included in this list. The letter noted that a deterministic review was being performed against SRP 10.4.9 and BTP ASB 10.1, and committed to provide for NRC review a conceptual design description and bases for system modifications following this work.

CPCo letter of May 29, 1981 NUREG 0737 Item II.E.1.1 - Additional Information

Letter submitted preliminary conceptual design for improved Auxiliary Feedwater System as committed in CPCo 12/19/80 letter, and AFW system flow rate design Basis as requested in NRC letter of 10/30/79. This letter proposed changes to the existing two-pump design, but acknowledged that the location of both pumps in the same room could potentially subject both to common mode failures. It stated that additional design refinements to address this concern were still being considered.

CPCo letter of November 2, 1981 Update to NUREG 0737 Item II.E.1.1, Auxiliary Feedwater System Evaluation

Letter replaced conceptual design in CPCo 5/29/81 letter with new design that incorporated a third AFW pump into a new, second AFW train. Third AFW pump would be converted from then-existing third HPSI pump. System description specified that the two motor driven AFW pumps would be sequentially started in response to an automatic initiation signal; and they would be backed up by the existing turbine driven AFW pump. The discussions of system design bases, system description, and system evaluation did not discuss steam supplies to the turbine driven pump. Meeting was requested with NRC to discuss design.

CPCo letter of August 11, 1982 Auxiliary Feedwater System Modification (Additional Information)

Submittal to follow up meeting between NRC and CPCo on 12/1/1981, and telephone call on March 25, 1982. Letter provides revised AFW flow analysis, and logic drawings for new automatic AFW initiation system. Turbine driven AFW pump is shown as being automatically started only on steam supply from Steam Generator E-50A via opening of CV-0522B. No discussion is provided of manual backup steam supply line to the turbine driven AFW pump.

CPCo letter of September 30, 1982 Auxiliary Feedwater System Modification - Additional Information - AFW Pump Diesel Loading

Letter responded to NRC question to confirm that the motor driven AFW pumps would be automatically sequenced on to the emergency diesel generators when required by a loss of off-site power.

NRC letter of December 16, 1982 Auxiliary Feedwater System Automatic Initiation and Flow Indication (TMI Action Plan Item II.E.1.2)

Letter transmits NRC SER and Franklin Research Center TER which conclude that the Palisades AFW system automatic initiation and flow indication systems will comply with NRC long term safety grade requirements when modifications are complete, and are acceptable. Note that the Franklin TER does include in its general description of the AFW system a statement that the turbine driven pump can receive steam from either steam generator, but there is no indication that manual backup steam supply line had any effect on the review. In its review of the initiation logic which automatically supplies steam to the turbine driven pump from one steam generator, Franklin concluded that their review, "... revealed no credible single malfunction that would prevent proper protective action at the system level when required."

CPCo letter of August 29, 1983 Proposed Technical Specifications Change Request - Emergency Core Cooling System

Requested TS change to eliminate third HPSI pump as described previously in CPCo letter of 11/2/81 regarding AFW System modifications.

NRC letter of June 19, 1984 Technical Specification Changes Related to the Design Features of the Emergency Core Cooling System

Issued Amendment 83 which deleted third HPSI pump from Technical Specifications.

CPCo letter of September 17, 1984 Proposed Technical Specification Change Request - Auxiliary Feedwater System

Submitted TS changes to reflect the redesigned two-train AFW system. Table 4.1.3, Item 16 specified that "Auxiliary Feed Pump Auto Initiation" was to be tested monthly. Footnote (3), as requested, specified that the monthly pump test starts under this item were to be alternated between, "... the control room hand switch, from the breaker and from the pump test-key switch in a three month period." No Basis or other discussion is provided to explain the intent of this alternating starting provision.

CPCo letter of October 28, 1985 Consolidation of Previous Technical Specification Change Request - Auxiliary Feedwater System

Letter states that the proposed changes consolidate information from four previous submittals and include minor revisions to resolve concerns raised by the NRC Project Manager. The wording of Footnote (3) of Table 4.1.3 Item 16 "Auxiliary Feed Pump Auto Initiation" was revised in this submittal to specify that monthly pump test starts under this item were to be alternated between, "... the control room hand switch, from the breaker (or alternate steam supply) and from the pump test-key switch in a three month period." No explanation was given for this addition of "(or alternate steam supply)."

NRC letter of January 30, 1986 Auxiliary Feedwater System - Technical Specifications

Issued Amendment 96 to incorporate changes related to AFW system.

CPCo letter of March 21, 1986 Auxiliary Feedwater System Reliability Analysis

Letter submitted new AFW system reliability analysis based on the guidelines of NUREG 0635. Analysis was performed as follow up to 5/23/85 meeting between NRC and CPCo. Results indicated that the overall AFW system unavailability (indicated by Loss of Feedwater event results) meets SRP 10.4.9 guidelines.

ENCLOSURE 3

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

A REVIEW OF PROBABILISTIC SAFETY ANALYSES AND FAILURE EFFECTS ON THE AUXILIARY FEEDWATER SYSTEM.

A Review of Probabilistic Safety Analyses And Failure Effects on the Auxiliary Feedwater System

In 1990 as part of our design basis document development effort for the auxiliary feedwater system, an analysis was performed to examine the results of single failures of all safety related components in the auxiliary feedwater system. This effort consisted of a failure analysis of mechanical components and a failure analysis of electrical components. Due to the design of the system, with motor driven pump P-8A and steam turbine driven pump P-8B residing in one train while motor driven pump P-8C resides in an independent train, no single failure was identified which causes failure in the redundant train. The analysis concluded that the two independent trains are physically separated to prevent single mechanical component failures which could affect both trains. The analysis also concluded that the two trains are electrically separated (P-8A & P-8B train fed by left channel with P-8C train fed by right channel) to prevent single failure from affecting both trains. These conclusions would not be affected by removal of the backup manual steam supply through CV-0522A to P-8B.

The 1990 analysis that was performed as part of the design basis development effort did not include the effects of several significant modifications that were performed on the system. The 10CFR50.62 ATWS modification was completed to diversify the control power for the steam admission valve CV-0522B to cause automatic opening of the normal above ground steam supply to P-8B upon complete loss of DC control power, which increased reliability of the system. A modification was completed to add redundant instrument power supplies for the low suction pressure trip instrument loops on P-8A & P-8B, which increased reliability of the system. A modification was completed to de-energize the "feed only good generator" motor operated valves in the open position to prevent spurious closure during various potential situations, which increased reliability of the system. A modification was also performed to improve reliability of the steam turbine pump P-8B that removed a pressure control valve from the steam supply and replaced the steam isolation valves with pressure controlling valves, installed a moisture separator in the steam supply to prevent condensate induced turbine overspeed trips and replaced the steam supply relief valve with two larger capacity relief valves to address a postulated maximum pressurization scenario. Overall, this modification resulted in negligible impact on the reliability of the system. Therefore, none of the modifications performed on the auxiliary feedwater system that were not considered in the 1990 analysis would affect the conclusions with or without the backup manual steam supply to P-8B available.

To reconfirm the results of the 1990 analysis, the plant PSA model was used to evaluate single failures with the current plant configuration. The attached table summarizes results of this single failure evaluation only considering the availability of the two electric motor driven pumps. The results show that no single failure will render the auxiliary feedwater system incapable of performing its function.

The PSA model shows that permanent removal of the steam supply from the backup steam supply valve CV-0522A to P-8B and credit for the alternate shutdown panel to control steam supply through CV-0522B to P-8B results in an increase in at-power, internal events core damage frequency (CDF) <1E-6/yr and a corresponding increase in large early release frequency (LERF) <1E-7/yr. These increases meet the Regulatory Guide thresholds as not significant. The IPEEE model also shows that there would be no significant risk impact for fire and seismic events. Furthermore, results from the preliminary model for low power/shutdown and flooding also show no significant risk impact. Therefore, this change to the plant is not considered significant from a PSA perspective.

PSA FMEA of the AFW System for P-8A and P-8C

Failed Comp	AFW Eq Failed	AFW Support Systems Failed	AFW Eq Available	AFW Support Systems Available	Comments
Bus 1C	AFW pump P 8A	Bus 1C	AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Bus ED-20L is lost if the tie breaker between ED-20L and ED-20R is open, however, no AFW equipment is lost if this breaker is open.
Bus 1D	AFW pump P 8C	Bus 1D	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal	Bus 1C, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Bus ED-10L is lost if the tie breaker between ED-10L and ED-10R is open, however, no AFW equipment is lost if this breaker is open.
125VDC Train 1	AFW pump P 8A	125VDC Train 1, EY-10, EY-30	AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train2, EY-20, EY-40, IA, N2 Station 1	The 125VDC Train 1 includes the battery (ED-01) and all DC buses connected to it (ED-11-1, ED-11-2, ED-10R, ED-10L, ED-11A)
125VDC Train 2	AFW pump P 8C	125VDC Train 2, EY-20, EY-40	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal	Bus 1C, Bus 1D, 125VDC train 1, EY-10, EY-30, IA, N2 Station 1	The 125VDC Train 2 includes the battery (ED-02) and all DC buses connected to it (ED-21-1, ED-21-2, ED-20R, ED-20L, ED-21A)
Bus EY-10	none	Bus EY-10	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-20, EY-30, EY-40, IA, N2 Station 1	Loss of EY-10 fails 1 of 2 auto start signal power supplies for P-8A, but the auto start signal is also powered from EY-30 which is available.
Bus EY-20	AFW pump P 8C	Bus EY-20	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-30, EY-40, IA, N2 Station 1	loss of EY-20 fails the auto start signal for P-8C, but local manual start capability exists.
Bus EY-30	none	Bus EY-30	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-40, IA, N2 Station 1	Loss of EY-30 fails 1 of 2 auto start signal power supplies for P-8A, but the auto start signal is also powered from EY-10 which is available.
Bus EY-40	none	Bus EY-40	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C, P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, IA, N2 Station 1	
Instrument Air	none	Instrument Air	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, N2 Station 1	Failure of IA fails both P-8C injection valves open with no controlling ability. The injection valves for P-8A have nitrogen backup to maintain their controlling function.

Nitrogen Station 1	none	Nitrogen Station 1	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA	All four AFW injection valves use IA to maintain their controlling function. Failure of nitrogen station 1 fails the backup supply for the injection valves for P-8A.
AFAS-SGA	AFAS-SGA	none	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Failure of auto start signal from SG A will fail 1 of 2 independent start signals for both pumps P-8A&C. Both pumps will receive an auto start signal from SG B relays and instrumentation.
AFAS-SGB	AFAS-SGB	none	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Failure of auto start signal from SG B will fail 1 of 2 independent start signals for both pumps P-8A&C. Both pumps will receive an auto start signal from SG A relays and instrumentation.
Condensate Storage Tank (T-2) and associated CST makeup (T-81, T-939)	Condensate Storage Tank (T-2)	none	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	The common suction source for both P-8A&C will be lost. However, each pump train has an independent suction supply system (FPS for P-8A, SWS for P-8C).
CK-FW0703	CK-FW0703	none	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Failure of this check valve exposes SG B or P-8A discharge pressure in the P-8C discharge line downstream of P-8C discharge check valve. No function is lost.
CK-FW0704	CK-FW0704	none	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Failure of this check valve exposes SG A or P-8A discharge pressure in the P-8C discharge line downstream of P-8C discharge check valve. No function is lost.
CK-FW0728	CK-FW0728	none	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Failure of this check valve exposes SG B or P-8C discharge pressure in the P-8A discharge line downstream of P-8A discharge check valve. No function is lost.
CK-FW0729	CK-FW0729	none	AFW pump P-8A (including suction source), P-8A valves (CV-0727/0749), P-8A auto start signal, AFW pump P-8C (including suction source), P-8C valves (CV-0736A/0737A), P-8C auto start signal	Bus 1C, Bus 1D, 125VDC train 1, 125VDC train2, EY-10, EY-20, EY-30, EY-40, IA, N2 Station 1	Failure of this check valve exposes SG A or P-8C discharge pressure in the P-8A discharge line downstream of P-8A discharge check valve. No function is lost.

ENCLOSURE 4

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

A REVIEW OF THE FSAR CHAPTER 14 SAFETY ANALYSES RELIANCE ON
THE AUXILIARY FEEDWATER SYSTEM

Review of FSAR Chapter 14 Safety Analyses Reliance on Auxiliary Feedwater

A review was performed to identify all FSAR Chapter 14 safety analyses that relied upon the auxiliary feedwater system. The review revealed only three design basis accidents that either credit or assume operation of the auxiliary feedwater system. These design basis accidents are: Loss of Normal (Main) Feedwater, Steam Generator Tube Rupture (SGTR), and Main Steam Line Break (MSLB). For all three, auxiliary feedwater is necessary to preclude steam generator dry-out, thereby ensuring that the PCS heat removal safety function is met. Further, the containment response analysis to the MSLB assumes auxiliary feedwater addition to the faulted steam generator as a portion of the blowdown source to containment.

Loss of Normal (Main) Feedwater

The analysis was performed consistent with the Palisades' auxiliary feedwater system design basis minimum flow rate and demonstrated that the auxiliary system design is adequate to remove decay heat, to maintain a primary-to-secondary heat sink throughout the event and to prevent pressurizer level from exceeding acceptable limits. The analysis conservatively models the steam generator blowdown, the operating auxiliary feedwater pump capacity, and the purging of standing hot feedwater from the affected portion of the auxiliary feedwater piping.

Three cases were analyzed. The first case assumed that offsite power and hence primary coolant system forced circulation were available and that secondary side heat removal was via the steam generator code safety valves. A second case with offsite power available was run with the atmospheric steam dump and turbine bypass valves enabled. A third case was run, assuming a loss of offsite power as the initiating event. Each case used biased design basis initial conditions (102% power, maximum allowed positive reactivity feedback, and maximum pressurizer level) to provide bounding analyses. The initiating event for each scenario was an instantaneous loss of main feedwater. The limiting single failure assumed for each case was loss of motor-driven auxiliary feedwater pump P-8A. No credit was taken for the steam-driven auxiliary feedwater pump (P-8B). This left only motor-driven pump P-8C to supply auxiliary feedwater flow following an auxiliary feedwater actuation signal (AFAS) on low steam generator level. For all three cases analyzed, all required acceptance criteria were demonstrated to be met.

Main Steam Line Break (MSLB)

The analysis for the MSLB is performed for two cases: the response of the primary coolant system and subsequent challenge to DNB, and the containment response portion of the analysis.

The MSLB primary coolant system response case assumes a coincident loss of offsite power (with only one train of emergency power available accounting for single failure) since the loss of forced circulation provides a greater challenge to DNB than if primary coolant pumps were to remain in service. For purposes of this analysis, accounting for auxiliary feedwater flow and higher flow rates is conservative in the presence of the assumed negative moderator temperature coefficient, to ensure maximum return to power and challenge to DNB. Since assuming that auxiliary feedwater is available to the faulted steam generator is more conservative that loss of auxiliary feedwater for this event, no specific auxiliary feedwater pump assumptions need to be made for this overcooling event and the analysis does not require auxiliary feedwater availability.

The containment response case for a MSLB does not assume loss of offsite power to occur coincident with the event. Maintaining offsite power and hence forced circulation maximizes the heat removal to the secondary, which in turn maximizes the blowdown energy through the faulted steam generator. Again for this analysis, it is conservative to assume auxiliary feedwater is available since that assumption maximizes energy release to the containment building through the faulted steam generator. Since the assumption is conservative, no specific auxiliary feedwater pump assumptions need to be made and the analysis does not require auxiliary feedwater availability.

Steam Generator Tube Rupture (SGTR)

The SGTR event is analyzed to provide input data for offsite dose calculations. For the SGTR, loss of offsite power (with only one train of emergency power available accounting for single failure) is assumed to occur immediately following reactor trip. Auxiliary feedwater flow is conservatively assumed to initiate to both steam generators until action is taken to isolate the faulted steam generator. In the early stages of the event, accounting for auxiliary feedwater flow is conservative since it requires maximum steaming of the faulted steam generator to prevent overfill, which maximizes radiological release from the event. Based upon the initial conditions and assumptions required for this analysis, one of the two electric motor driven auxiliary feedwater pumps (from the available train of emergency power) would be available, but no specific auxiliary feedwater pump assumptions are made.

Summary

For most of the FSAR Chapter 14 events, long term control of auxiliary feedwater is not analyzed because the analysis terminates long before steam generator dry-out or overfill could be a concern. The exception to this statement is the SGTR analysis, which specifically credits long term operator action per the Emergency Operating Procedures. However, for all design basis accidents considered in FSAR Chapter 14, one of the electric motor driven pumps would be available from the available train of emergency power. Sufficient guidance also exists in the Emergency Operating Procedures for the operators to manually control auxiliary feedwater via pump operation and/or local control valve operation if necessary.