September 6, 1981

Docket No. 50-255
LS05-81-09-019

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SEP 11 1981
U.S. NUCLEAR REGULATORY COMMISSION

Mr. David P. Hoffman
Nuclear Licensing Administrator
Consumers Power Company
1945 W Parnall Road
Jackson, Michigan 49201

Dear Mr. Hoffman:

SUBJECT: SEP TOPIC IX-3, STATION SERVICE AND COOLING WATER SYSTEMS PALISADES

Enclosed is a copy of our final evaluation of Systematic Evaluation Program Topic IX-3, Station Service and Cooling Water Systems.

This assessment compares your facility as described in Docket No. 50-255 with the criteria currently used by the regulatory staff for licensing new facilities. Your comments on our draft evaluation have been incorporated as we deemed appropriate. Our comments regarding your submittal are as follows:

1) Table I, which was inadvertently left out of the draft evaluation, has been included in this report.

2,3) The containment heat load of 229E6 Btu/hr is based on the FSAR Section 14.11 using vapor and liquid energy as an upper envelope. Based on information in a more recent containment analysis (SEP Topic Evaluations VI-2.D and VI-3) this heat load figure is correct as an approximation. With the assumed failure of Emergency Diesel Generator 1-2, the Palisades system has been found capable of removing this heat load provided that service water flow to the three inoperable containment air coolers is terminated. Your calculation of service water flow requirements assumed that flow to the inoperable air coolers had been cut off. As mentioned in our draft evaluation no plant operating procedures exist to ensure the isolation of the inoperable air coolers, diesel generator, and engineered safeguards air coolers from the service water system. Addition of the proper operator actions to plant procedures wil ensure sufficient heat removal capacity in a post-accident situation.

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4) The containment spray heat load is defined on page thirteen of our draft evaluation as the post-accident heat load (229E6 Btu/hr) minus the design heat removal capacity of one containment air cooler (76.7E6 Btu/hr). The resultant containment spray heat load is 152E6 Btu/hr.

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SURNAME ▶	8109140196 810906 PDR ADOCK 05000255 P PDR						
DATE ▶							

5) The 170 F value for SW temperature is based on staff analysis performed with information obtained from the FSAR. Unless you demonstrate by analysis that our conclusion is too conservative we have no basis to modify it.

6) The loading of two service water pumps on emergency diesel generator 1-2 is confirmed.

7) Upon failure of Emergency Diesel Generator 1-2, service water flow to the 3 inoperable air coolers must be diverted to the component cooling water heat exchangers to prevent exceeding CCW design temperatures. Documentation of proper operator procedure to isolate the inoperable air coolers from the Service Water System (if not accomplished automatically) is required.

This evaluation will be a basic input to the integrated safety assessment for your facility. This topic assessment may be changed in the future if your facility design is changed or if NRC criteria relating to this topic are modified before the integrated assessment is completed.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

*See previous yellow for additional concurrences.

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NRC FORM 318 (10-80) NRCM 0240 **OFFICIAL RECORD COPY** USGPO: 1981—335-960

5) The 170°F valve for SW temperature is based on staff analysis performed with information obtained from the FSAR. Unless you demonstrate by analysis that our conclusion is to conservative we have no basis to modify it.

6) The loading of two service water pumps on emergency diesel generator 1-2 is confirmed.

7) Upon failure of Emergency Diesel Generator 1-2 service water flow to the 3 inoperable air coolers must be diverted to the component cooling water heat exchangers to prevent exceeding CCW design temperatures. Documentation of proper operator procedure to isolate the inoperable air coolers from the Service Water System (if not accomplished automatically) is required.

This evaluation will be a basic input to the integrated safety assessment for your facility. This topic assessment may be changed in the future if your facility design is changed or if NRC criteria relating to this topic are modified before the integrated assessment is completed.

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SEP REVIEW

OF

STATION SERVICE AND COOLING

WATER SYSTEMS

TOPIC IX-3

FOR THE

PALISADES NUCLEAR PLANT

I. INTRODUCTION

The safety objective of Topic IX-3 is to assure that the cooling water systems have the capability, with adequate margin, to meet design objectives and, in particular, to assure that:

a. systems are provided with adequate physical separation such that there are no adverse interactions among those systems under any mode of operation;

b. sufficient cooling water inventory has been provided or that adequate provisions for makeup are available;

c. tank overflow cannot be released to the environment without monitoring and unless the level of radioactivity is within acceptable limits;

d. vital equipment necessary for achieving a controlled and safe shutdown is not flooded due to the failure of the main condenser circulating water system.

II. REVIEW CRITERIA

The current criteria and guidelines used to determine if the plant systems meet the topic safety objectives are those provided in Standard Review Plan (SRP) Sections 9.2.1, "Station Service Water System", and 9.2.2 "Reactor Auxiliary Cooling Water Systems".

III. RELATED SAFETY TOPICS AND INTERFACES

The scope of review for this topic was limited to avoid duplication of effort since some aspects of the review were performed under related topics. The related topics and the subject matter are identified below. Each of the related topic reports contains the acceptance criteria and review guidance for its subject matter.

II-2.A - Severe Weather Phenomena

II-3.B.1 - Flooding of Equipment

III-3.B - Flooding of Equipment (Failure of Underdrain System)

VI-7.D - Flooding of Equipment (Long Term Passive Failures)

III-3.C - Inservice Inspection of Water Control Structures

III-4.C - Internally Generated Missiles

III-5 - Mass and Energy Releases (High Energy Line Break)

VI-2.D - Mass and Energy Releases

III-6 - Seismic Qualification

III-12 - Environmental Qualification

VI-7.C.1 - Independence of Onsite Power

VII-3 - Systems Required for Safe Shutdown

VIII-2 - Diesel Generators

IX-1 - Fuel Storage

IX-6 - Fire Protection

The following topics are dependent on the present topic information for completion:

VI-3 - Containment Pressure and Heat Removal Capability

IX-5 - Ventilation Systems

XV-7 - Reactor Coolant Pump Rotor Seizure

IV. REVIEW GUIDELINES

In addition to the guidelines of SRP Sections 9.2.1 and 9.2.2, in determining which systems to evaluate under this topic the staff used the definition of "systems important to safety" provided in Reference 1. The definition states systems important to safety are those necessary to ensure (1) the integrity of the reactor coolant pressure boundary*, (2) the capability to shutdown the reactor and maintain it in a safe condition, or (3) the capability to prevent, or mitigate the consequences of, accidents that could result in potential offsite exposures comparable to the guidelines of 10 CFR Part 100, "Reactor Site Criteria". This definition was used to determine which systems or portions of systems were "essential". Systems or portions of systems which perform functions important to safety were considered to be essential. It should be noted that this topic will be updated if future SEP reviews identify additional cooling water systems that are important to safety.

V. EVALUATION

The systems reviewed under this topic are the Reactor Primary Shield Cooling System, Charging Pump Seal Lubrication System, Component Cooling Water System, and the Service Water System. The Spent Fuel Pool Cooling System is discussed in the SEP review of Topic IX-1, "Fuel Storage."

V.I. REACTOR PRIMARY SHIELD COOLING SYSTEM

The Reactor Primary Shield Cooling System (RPSCS) is a closed loop system with two full-capacity sets of shield cooling coils, two full-capacity pumps, a heat exchanger and a surge tank (Reference 2, Section 9.2). The system, which is located inside containment, transfers heat from the shield wall to the Component Cooling Water System.

*Reactor Coolant Pressure Boundary is defined in 10 CFR Part 50 §50.2(v).

The design function of the RPSCS is to limit thermal stresses in the concrete shield wall surrounding the reactor vessel. Thermal stresses are the result of convective and radiative heat losses from the primary coolant system and heat generated in the wall itself from the absorption of gamma and neutron radiation. Palisades technical specification 3.15 requires one RPSCS pump and cooling coil to be in operation whenever cooling is required to keep the shield temperature below approximately 165°F. The basis for this specification states that the RPSCS function prevents weakening of the shield wall through loss of moisture.

V.II. CHARGING PUMP SEAL LUBRICATION SYSTEM

Palisades has two constant speed and one variable speed charging pump. The variable speed drive requires 26 gpm. Each pump package requires 5 gpm. (The total cooling requirement for the variable speed pump is 31 gpm.)

The constant speed charging pumps can be operated intermittently without cooling flow. Normally cooling flow is provided by the component cooling water system.

V.III. COMPONENT COOLING WATER SYSTEM

The Component Cooling Water System (CCW) is described in Section 3.2 of the SEP Review of Safe Shutdown Systems for the Palisades Plant (Reference 3). The system removes heat from various components and transfers this heat to the Service Water System. The components cooled by the CCW system are:

1. Reactor Primary Shield Cooling Heat Exchanger
2. Chemical and Volume Control System (CVCS) Letdown Heat Exchanger
3. CVCS Charging Pumps
4. Shutdown Cooling System Heat Exchangers

5. Emergency Core Cooling System High Pressure Safety Injection, Low Pressure Safety Injection and Containment Spray Pumps (primary cooling system, Service Water System is the backup cooling system)
6. Spent Fuel Pool Heat Exchangers
7. Control Rod Drive Motors
8. Primary Coolant Pumps
9. Primary Sample Cooler
10. Vacuum Degas Seal Water Cooler
11. Waste Gas Compressors
12. Radwaste Evaporators

During normal operation, one (of three) pumps and one (of two) CCW heat exchangers can accomodate heat removal requirements. Pumps A and C are powered by 2.4kV bus 1C; pump B by 2.4kV bus 1D. When the Shutdown Cooling System is placed in operation during a plant cooldown, two pumps and both heat exchangers are normally used; however, if one heat exchanger were inoperable, the cooldown could continue but at a slower rate.

The staff reviewed the heat removal requirements of the CCW system during post-accident conditions. The accidents considered were the Loss of Coolant Accident (LOCA) and the Main Steam Line Break (MSLB) Inside Containment because these two events result in the greatest potential accident heat loads on the CCW system. The containment air coolers are also discussed here because they complement the CCW system in the post-accident containment heat removal function.

Section 14.18 of Reference 2 provides an analysis of the containment response to a LOCA. Some part of the energy released to containment following a LOCA must be removed to prevent exceeding the design pressure limit of the containment. Energy is removed by the containment spray (CS) system and the containment air coolers. The containment spray system and the air coolers are fully redundant methods of containment heat removal. The air coolers transfer heat from the containment atmosphere to the service water system (SWS). The CS system removes heat from the containment atmosphere by spraying cool water directly into the atmosphere. This water, now heated, collects in the containment sump. The heat is then transferred to the CCW system through the Shutdown Cooling System (SCS) heat exchangers when the spray system is aligned to remove water from the containment sump during the recirculation mode of ECCS operation. The CS system flow is piped to containment via the SCS heat exchangers (See Chapter 6 of Reference 2). The minimum combination of containment heat removal systems occurs as a result of the assumed loss of offsite power and the single failure of one of the two diesel generators. Using the design parameters of the CS, CCW, and SWS from Reference 2, shown in Table 1, and the containment analysis presented in Section 14.18 of Reference 2*, the heat load which must be removed from containment (229E6 BTU/hr) can be accommodated by the CCW and SWS given the assumed failure of either diesel generator. However, to accomodate the heat load when diesel generator 1-2 is assumed inoperable operator action is required to redirect SWS flow from the inoperable containment air coolers, diesel generator,

*The SEP will reevaluate the post-accident energy balance in containment under Topic VI-2.D, "Mass and Energy Release for Postulated Pipe Breaks Inside Containment".

and engineered safeguards air coolers heat exchangers. If operator action is not taken, the design temperature of the CCW system (140°F) will be exceeded. The required operator actions for this scenario are not presently contained in plant operating procedures. Thus, although the SWS and CCW system have sufficient heat removal capacity for post-accident conditions and assumed single failures, operator action will be required to cope with the postulated single failure of diesel generator 1-2.

For the MSLB inside containment event, the amount of energy added to the containment should be 3.4E6 BTU less than that added for the post-LOCA case. (Ongoing SEP reviews will verify that the assumptions used to determine the magnitude of energy addition to the containment are acceptable.) Because safety injection flow would not be available as a heat sink inside containment following a MSLB, the containment sump would be filled by condensed fluid from the MSLB and CS water; and a higher sump fluid temperature would be achieved earlier in the accident than for the post-LOCA case. This would not affect the heat load on the CCW system however; because if in the unlikely event that recirculation of the containment sump fluid were necessary, it would not be initiated until much later into the MSLB accident sequence when containment sump level would be approximately equivalent to the level when recirculation would be initiated following a LOCA. (Sump recirculation occurs automatically on a low level in the Safety Injection and Refueling Water Storage Tank which supplies water to the CS and safety injection pumps.) Given the similar heat release to containment following a MSLB and approximately equal sump levels at the start of recirculation following both the MSLB and LOCA, the heat load on the CCW system is expected to be no greater than the heat load following a LOCA.

During normal and post accident operation, the CCW system is capable of being powered from both onsite and offsite electrical sources.

During normal CCW system operation, single failures could prevent flow to (1) the services inside containment (Letdown heat exchanger, Primary Coolant Pump (RCP) oil coolers, Reactor Primary Shield Cooling System and Control Rod Drive Motor Seals), (2) the spent fuel pool cooling CCW header (spent fuel pool, radwaste evaporators, primary sample cooler, waste gas compressors and vacuum degas pump), and (3) one CCW heat exchanger. Loss of flow to containment services and the spent fuel pool cooling header does not present an immediate concern; however, the control room operator must take action to prevent equipment damage from high temperatures. The plant emergency procedure for loss of CCW identifies the conditions requiring timely plant shutdown. The limiting components are PCPs and CRDMs; loss of the spent fuel pool cooling header does not require operator action for a few hours. The extended loss of cooling to a running PCP may result in pump shaft seizure because of overheated bearings. (The consequences of a postulated PCP seizure are evaluated as an SEP Design Basis Event.) The licensee has provided information (Reference 4) regarding the loss of CCW to the PCPs. Loss of CCW flow to and high CCW temperature from a PCP are conditions alarmed in the control room. Following the receipt of either of these alarms, the operator has 10 minutes to restore CCW flow to the pumps before the pumps must be stopped. Approximately the same amount of time is available to restore flow to the CRDMs prior to taking action to deenergize them (and thus tripping the reactor). By procedure, the operator is directed to trip the reactor and turbine generator if PCP seal temperature exceeds 170°F, PCP bearing temperature exceeds 175°F, or if all (or most) CRDM seal leakage temperatures exceed 200°F. Plant shutdown following reactor trip is in accordance with established emergency procedures.

The remotely operated valves in the CCW system are air-operated. Upon a postulated failure of the air supply, the valves fail in the appropriate positions to supply CCW flow to all loads except the spent fuel cooling system and the radwaste evaporators to which flow is secured.

During post-accident operation of the CCW system, flow to the containment services and spent fuel pool cooling supply is secured, and flow is started to the ECCS pumps. This is accomplished automatically upon receipt of a safety injection signal. Single failures could result in no flow to the ECCS pumps or failure to secure flow to the spent fuel pool cooling system. The first of these failures is overcome by shifting ECCS pump cooling to the backup supply - the SWS. This can be performed from the control room by the operator who is warned of this condition by low ECCS pump cooling flow alarm. Failure to secure CCW flow to the spent fuel pool would not result in overloading the CCW system because, with two CCW pumps operating, the CCW has enough heat removal capacity at the start of CS recirculation to cope with the post-accident loads and the spent fuel pool.

Isolation of individual leaking CCW components is accomplished by manual valves. Also, although the pumps and heat exchangers are redundant, they are connected by single pipe headers whose failure could disable the system.* This was considered in the POL review of Palisades, and the staff concluded that in a post-LOCA scenario, the Safety Injection (SI) pumps could continue to recirculate spilled reactor coolant with decay heat being removed by the containment air coolers (Reference 5). If the CCW failure occurred during a cooldown of the plant, with the reactor vessel head installed, the plant would return to hot shutdown and decay heat could be removed via the steam generators as described in Reference 3. The plant could remain in hot shutdown while CCW repairs were made.

For decay heat removal when the reactor vessel head is removed, adequate cooling can be provided by keeping the core flooded using various systems such as SCS and CVCS and transferring the heat to the fuel pool while repairs are made to the CCW piping. Therefore, although the CCW system would be disabled by a pipe rupture, the Palisades plant has acceptable alternate means to remove core decay heat for both normal shutdown and post-accident long-term cooling.

During normal and post accident operation, thermal expansion and contraction of the CCW system liquid is accomodated by the CCW surge tank, and leakage into or out of the system can be detected by surge tank level changes. High and low surge tank levels are alarmed in the control room,

*The piping is 18". The leak rate calculated in accordance with Reference 6 for a 24" pipe at 110 psig is 985 gpm. This would result in the loss of the pump net positive suction head approximately 30 seconds.

and a radiation monitor and alarm alerts the control room operator to the leakage of radioactive fluid into the CCW system from components which contain reactor coolant. The surge tank also maintains a positive suction head on the CCW pumps during normal and post accident operation. Since CCW system pressures and temperatures for post accident operation are similar to those for normal operation, no reduction of net positive suction head below that normally present is expected for post accident conditions.

The safety related functions of the CCW system identified in this review are to provide cooling for: the SCS heat exchangers (for post-accident and plant cooldown operations), CVCS charging pumps, ECCS pump cooling (post-accident), the CRDM seals, the PCPs, and the RPSCS. Cooling of the letdown heat exchanger is not required because letdown is not needed to achieve boration for plant cooldown, and spent fuel pool cooling can be accomplished by other systems (see SEP Topic IX-1, "Fuel Storage). Of these functions, only the cooling of the SCS heat exchangers (for plant cooldown) and CVCS charging pump cooling (for reactor system makeup and boration) are considered essential. The other safety related functions can be performed by other systems, or operating procedures provide adequate protection from the effects of losing the function.

It should be noted that, although the CCW functions for shutdown cooling and CVCS charging pump cooling are considered essential, loss of these functions can be tolerated for extended periods of time because (1) as detailed above, upon loss of shutdown cooling alternate means of removing core decay heat are available and (2) the two constant speed charging pumps can be operated intermittently with no CCW cooling flow. So, these functions are more correctly considered to be essential only when they are required to be performed to achieve plant cold shutdown conditions within a certain period of time as required by Branch Technical Position RSB 3-1 which is the basis for the SEP Safe Shutdown Review of Palisades (Reference 3).*

V.IV. SERVICE WATER SYSTEM

The Service Water System (SWS) circulates cooling water from Lake Michigan to various critical and noncritical heat loads throughout the plant. The system has three half-capacity pumps, two of which are powered by 2.4 kV bus 1D. The remaining pump is powered from 2.4 kV bus 1C.

The SWS piping is split into two headers (A and B) which supply redundant critical load trains (see Table 2). Header A supplies train A loads; header B, train B loads. Another header supplies various "noncritical" loads (see Table 3). The noncritical supply header is automatically isolated on a safety injection signal by an air operated valve which also fails closed on loss of air or loss of power to its air control solenoid valve.

During normal plant operation, the SWS supplies flow to all loads except the diesel generators and the engineered safeguards room coolers. During Shutdown Cooling System operation, the system supplies the critical loads (Table 2)(except diesel generators) and the auxiliary building

*See Section 3.2 of Reference 3.

air conditioning condenser, and almost all noncritical loads (Table 3) are removed from the system. Following a LOCA or MSLB, the SWS supplies the critical loads only and, if necessary, supplies backup cooling flow to the ECCS pump seals. The flow requirements under all operating conditions would normally be supplied by two SWS pumps. As described in the previous CCW section, the failure of a diesel generator in a post-accident condition could lead to a degraded SWS operating condition with only one pump operable. This is the most limiting configuration for the SWS since one pump must supply sufficient cooling flow to cool the containment and supply cooling for SWS and CCW system post-accident loads. Although section 9.1.2.2 of Reference 2 states that two pumps are required in the event of an accident, one SWS pump is capable of supplying all post-accident requirements; however, the operator must adjust SWS flow as discussed in the CCW section to prevent exceeding CCW thermal limits. The approximate required SWS flow rates are 1625 gpm to the one containment air cooler, 3300 gpm to each of the CCW heat exchangers, and 630 gpm to other required loads. Assuming a CS heat load of 153E6 BTU/hr, which is the post-accident containment heat load (Section 14.18 of Reference 2) minus the design heat removal rate of one containment air cooler, the SWS temperature at the exit if the CCW heat exchanger approaches 170°F which is well below SWS design temperature (300°F) but which results in CCW temperatures exceeding CCW design temperature. To prevent this, the operator must divert additional SWS flow to the CCW heat exchangers as discussed in the CCW section of this report.

TABLE I - SYSTEM DESIGN PARAMETERS

System/Reference	Parameters
Containment Spray (Ref. 2 Table 6-4)	3 pumps - 1800 gpm each 2 SCS heat exchangers - 83.5E6 BUT/hr each (with 4000 gpm CCW @ 114° and 1420 gpm CS @ 283°)
Component Cooling (Ref. 2 Table 9-5)	3 pumps - 6000 gpm each 2 CCW heat exchangers - 85E6 BTU/hr each (post LOCA) 94.8E6 BUT/hr each (at start of SCS operation)
Service Water (Ref. 2 Table 9-2 and Section 6.3.2)	3 pumps - 8000 gpm each 4 Containment Air Coolers - 76.6E6 BTU/hr each (with 1625 gpm SWS @ 75° and containment temperature @ 283°)

TABLE 2 CRITICAL SWS LOADS

1. Diesel Generators (lube oil and jacket water cooling)
2. Control Room Air Conditioning Condensers
3. Engineered Safeguards Room Coolers
4. Air Compressor Aftercoolers and jackets (service and instrument air)
5. ECCS Pump Seals (backup to CCW system)
6. Containment Air Coolers
7. Component Cooling Heat Exchangers

TABLE 3 - NON-CRITICAL SWS LOADS

1. Condensate pump seals
2. Oily waste backwash
3. Turbine exciter coolers
4. Generator Hydrogen coolers
5. Isolated Phase Bus cooler
6. Seal oil coolers
7. Feed pump lube oil and gland seal coolers
8. Heater Drain Pump seals
9. Electrohydraulic Oil coolers
10. Auxiliary Building air conditioning condenser
11. Steam generator blowdown heat exchanger
12. Turbine Plant Sample coolers
13. Room 12B air conditioning
14. Turbine Lube oil Coolers
15. Radwaste air compressor
16. Aux. building addition air conditioning
17. Ventilation Equipment Room air conditioning
18. Intake Chlorinator
19. Cooling Tower pump cooling
20. Cooling tower makeup
21. Irrigation Discharge
22. Makeup Water System feed
23. Condenser Vacuum Pump cooling

To overcome single failures in the system, each train A load has a counterpart in train B, with the exception of the containment air coolers (supplied by header B alone) and the CCW heat exchangers (supplied by header A alone). However, the containment air coolers and CCW heat exchangers perform fully redundant containment heat removal functions as previously described; and the SWS critical headers can be cross-connected in the screenhouse and in the auxiliary building for additional operational flexibility.

The SWS is susceptible to the single failure of the valve which isolates the noncritical header in the event of an accident which leads to a safety injection signal. If this valve should fail to close, the resulting SWS flows would be approximately 4000 gpm each to the containment air coolers and CCW heat exchangers, and 6000 gpm to the noncritical header. These flowrates to the critical header would not present a problem based on our previous discussion of the flowrates resulting from the postulated failure of a diesel generator. However, isolation valve for the noncritical header can be manually closed locally to increase the flow to the critical headers.

The staff evaluated potential passive failures in the SWS. Even though the headers are joined in the auxiliary building by a double-valved crosstie and header isolation valves which permit the isolation of either header upstream of the crosstie, a rupture of a header downstream of the crosstie could eliminate SWS flow to either the CCW heat exchangers or the containment air coolers, depending upon which header failed. This system design is acceptable because (1) the containment air coolers are fully backed up in the post-accident scenario by the CS system, and (2) the CCW heat exchangers can be lost during all plant operating conditions without significant consequences as described in the CCW section of this report. Since the SWS is a moderate energy piping system, a pipe failure would probably result in a leak rather than a complete pipe rupture. Using the method described in Reference 6, the staff estimates leakage from the 24" header (in the screenhouse or auxiliary building) to be 980 gpm using a SWS pressure of 90 psig. Although a leak rate of 980 gpm may pose a flooding problem, the SWS function would not be significantly impaired by this leak rate. (The capability of the Palisades Plant to withstand the effects of postulated flooding from pipe leaks will be assessed in SEP Topic III-5.B, "Pipe Breaks Outside Containment".

Leak detection for the SWS is provided by header pressure switches, which start the standby SWS pump on low pressure, and by drain sump level alarms in the buildings which house the SWS, with the exception of the screenhouse. Each heat load on the SWS has either an air-operated or manual isolation valve to permit the load to be removed from the system without interrupting flow to other loads. The pump discharge valves, header isolation and crosstie valves, and other valves which isolate SWS loads, as well as the SWS pumps, are operable from the control room. All of the remotely operable valves in the SWS are air-operated. If a failure of the nonsafety grade air system is postulated, these valves fail in the appropriate positions to isolate the noncritical header, crosstie headers A and B, and supply flow to all critical header loads except the engineered safe-guards pumps seal cooling supply which is the backup supply to the CCW engineered safeguards pumps cooling flow.

Power for the SWS pumps is provided by the 2.4 KV buses which can be supplied by the emergency diesels or by offsite power. At least one SWS pump is started on each diesel during post-accident diesel load sequencing.

Licensee Event Reports have noted that CCW heat exchanger tube leaks have occurred on two occasions (4/22/71 and 1/22/75), SWS pump discharge check valves have failed shut on three occasions (2/19/77, 9/20/77, and 4/28/78) and on one occasion the CCW heat exchanger heat transfer coefficients were found to be below the design valves because of SWS-side fouling (6/19/79). With the exception of the discharge check valve failures, these events do not demonstrate any significant failure trends. The licensee discovered these failures during attempts to start SWS pumps. Licensee Event Report 78-15 reported that new valve hinge pins would be installed to correct this problem. The new hinge pins and the monthly testing of the SWS pumps required by the licensee's Inservice Pump and Valve Testing Program provide adequate assurance that (1) the SWS pumps will remain operable, and (2) the efficacy of the hinge pin replacement is demonstrated.

The means of detecting radioactive contamination of the SWS (and CCW system) are evaluated in Reference 7.

Based on our review of the SWS, we consider the components supplied by the critical headers (Table 2) to be the essential loads on the system.

Although our evaluation has shown that one SWS pump can supply all essential loads on the system, we were concerned that the successful functioning of both the SWS and the CCW system may depend on the capacity of one SWS pump if loss of offsite power and failure of diesel generator 1-2 are assumed. To provide additional SWS pumping capacity, the fire protection system pumps (two diesel driven, one electric motor driven, 1500 gpm each) are available and can be connected to the SWS by a manual 12" valve in the screenhouse. Even though the flow from these pumps would not approach that of one SWS pump, the fire system pumps are capable of augmenting the flow of an SWS pump if required.

VI. CONCLUSION

Based on our review of the service and cooling water systems for Palisades we have concluded that the essential systems and functions are:

RPSCS: Cooling for Reactor Primary Shield

CVCS: Pump Seal Lubrication: Cooling of Charging Pumps

CCW: (1) SCS heat exchanger cooling for plant cooldown

(2) CVCS charging pump cooling for reactor system makeup and boration

SWS: (1) All loads supplied by the critical SWS headers.

We have determined that the design of the above systems is in conformance with current regulatory guidelines and with General Design Criterion (GDC) 44 regarding capability and redundancy of the essential functions of the systems with the exception of the CCW system susceptibility to loss of function following certain assumed CCW system pipe breaks.

However, the essential functions of the CCW system can be performed by other systems under all operating conditions. The above systems also meet the requirements of GDC 45 and 46 regarding system design to permit periodic inspections and testing.

To assure the capability of the SWS and CCW systems in a post-accident condition requiring containment cooling and with the postulated single failure of diesel generator 1-2, the licensee should provide, in the plant operating procedures, the required guidance to the operator to prevent exceeding CCW design temperature . (Note, no crdit should be taken for non-safety grade plant air systems.)

VII. REFERENCES

1. Regulatory Guide 1.105, "Instrument Setpoints."
2. Consumers Power Company Palisades Plant Final Safety Analysis Report (FSAR).
3. SEP Review of Safe Shutdown Systems for the Palisades Nuclear Plant (SEP Topics VII-3, V-10.B, V-11.A, V-II.B, X)
4. Amendment No. 14 to the Palisades Plant FSAR, July 17, 1969, Question 4.2.
5. Safety Evaluation by the Directorate of Licensing for the Palisades Plant, Docket No. 50-255, March 6, 1970.
6. Branch Technical Position MEB 3-1 appended to Standard Review Plan 3.6.2.
7. SEP Review of Topic V-10.A, "Residual Heat Removal System Heat Exchanger Tube Failures."