

August 17, 2006

Technical Specification 5.5.12.d

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Report of Changes to Technical Specifications Bases

This report is submitted in accordance with Palisades Technical Specification 5.5.12.d, which requires that changes to the Technical Specifications Bases, implemented without prior Nuclear Regulatory Commission (NRC) approval, be provided to the NRC on a frequency consistent with 10 CFR 50.71(e). Enclosure 1 provides a listing of all bases changes since issuance of the previous report, dated August 22, 2005, and identifies the affected sections and nature of the changes. Enclosure 2 provides page change instructions and a copy of the current Technical Specifications Bases List of Effective Pages, Title Page, Table of Contents, and the revised Technical Specification Bases sections listed in Enclosure 1.

Summary of Commitments

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



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Enclosures (2)

CC Administrator, Region III, USNRC
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ENCLOSURE 1
TECHNICAL SPECIFICATION BASES CHANGE CHRONOLOGY

DATE	AFFECTED SECTION(S)	CHANGE(S)
12/15/05	B 3.7.6	Clarification of power limit.
05/01/06	B 3.4.6 B 3.4.7 B 3.4.8 B 3.9.4 B 3.9.5	Clarification of shutdown cooling train definition.
05/03/06	B 3.6.6	Removal of containment air cooler (CAC) fan V-4 from the Bases.
07/13/06	B 3.8.4	Clarification of load requirements.

ENCLOSURE 2

REVISED TECHNICAL SPECIFICATIONS BASES

Page Change Instructions

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B 3.4.6, B 3.4.7, B 3.4.8, B 3.6.6,

B 3.7.6, B 3.8.4, B 3.9.4, B 3.9.5

(All pages are double-sided except Page Change Instructions and Title Page)

31 Pages Follow

TECHNICAL SPECIFICATIONS BASES CHANGES: September 2006
FACILITY OPERATING LICENSE DPR-20
DOCKET NO. 50-255
Page Change Instructions

Revise your copy of the Palisades Technical Specifications Bases with the attached revised pages. The revised pages are identified by amendment number or revision date at the bottom of the pages and contain vertical lines in the margin indicating the areas of change.

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PALISADES PLANT
FACILITY OPERATING LICENSE DPR-20
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B 3.4 PRIMARY COOLANT SYSTEM (PCS)

B 3.4.6 PCS Loops - MODE 4

BASES

BACKGROUND In MODE 4, the primary function of the primary coolant is the removal of decay heat and transfer of this heat to the Steam Generators (SGs) or Shutdown Cooling (SDC) heat exchangers. The secondary function of the primary coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 4, either Primary Coolant Pumps (PCPs) or SDC trains can be used for coolant circulation. The intent of this LCO is to provide forced flow from any one (of the four) PCP or one SDC train for decay heat removal and transport. The flow provided by one PCP loop or SDC train is adequate for heat removal. The other intent of this LCO is to require that two paths be available to provide redundancy for heat removal.

APPLICABLE SAFETY ANALYSES The boron concentration must be uniform throughout the PCS volume to prevent stratification of primary coolant at lower boron concentrations which could result in a reactivity insertion. Sufficient mixing of the primary coolant is assured if one PCP is in operation. PCS circulation is considered in the determination of the time available for mitigation of the inadvertent boron dilution event. By imposing a minimum flow through the reactor core of 2810 gpm, sufficient time is provided for the operator to terminate a boron dilution under asymmetric flow conditions. Due to its system configuration (i.e., no throttle valves) and large volumetric flow rate, a minimum flow rate is not imposed on the PCPs.

PCS Loops - MODE 4 satisfies Criterion 4 of 10 CFR 50.36(c)(2).

LCO The purpose of this LCO is to require that two loops or trains, PCS or SDC, be OPERABLE in MODE 4 and one of these loops or trains to be in operation. The LCO allows the two loops that are required to be OPERABLE to consist of any combination of PCS and SDC System loops. Any one PCS loop in operation, or SDC in operation with a flow ≥ 2810 gpm through the reactor core, provides enough flow to remove the decay heat from the core with forced circulation and provide sufficient mixing of the soluble boric acid. An additional loop or train is required to be OPERABLE to provide redundancy for heat removal.

BASES

LCO

A SDC train may be considered OPERABLE (but not necessarily in operation) during re-alignment to, and when it is re-aligned for, LPSI service or for testing, if it is capable of being (locally or remotely) realigned to the SDC mode of operation and is not otherwise inoperable. Since SDC is a manually initiated system, it need not be considered inoperable solely because some additional manual valve realignments must be made in addition to the normal initiation actions. Because of the dual functions of the components that comprise the LPSI and shutdown cooling systems, the LPSI alignment may be preferred.

Note 1 permits all PCPs and SDC pumps to not be in operation ≤ 1 hour per 8 hour period. The Note prohibits boron dilution when forced flow is stopped because an even concentration distribution cannot be ensured. Core outlet temperature is to be maintained at least 10°F below saturation temperature so that no vapor bubble may form and possibly cause a natural circulation flow obstruction. The response of the PCS without the PCPs or SDC pumps depends on the core decay heat load and the length of time that the pumps are stopped. As decay heat diminishes, the effects on PCS temperature and pressure diminish. Without cooling by forced flow, higher heat loads will cause the primary coolant temperature and pressure to increase at a rate proportional to the decay heat load. Because pressure can increase, the applicable system pressure limits (Pressure and Temperature (P/T) limits or Low Temperature Overpressure Protection (LTOP) limits) must be observed and forced SDC flow or heat removal via the SGs must be re-established prior to reaching the pressure limit. The circumstances for stopping both PCPs or SDC pumps are to be limited to situations where:

- a. Pressure and temperature increases can be maintained well within the allowable pressure (P/T limits and LTOP) and 10°F subcooling limits; or
- b. An alternate heat removal path through the SGs is in operation.

In MODE 4, it is sometimes necessary to stop all PCPs or SDC forced circulation. This is permitted to change operation from one SDC train to the other, perform surveillance or startup testing, perform the transition to and from SDC, or to avoid operation below the PCP minimum net positive suction head limit. The time period is acceptable because natural circulation is acceptable for decay heat removal, the primary coolant temperature can be maintained subcooled, and boron stratification affecting reactivity control is not expected.

BASES

LCO (continued)

Note 2 requires that one of the following conditions be satisfied before forced circulation (starting the first PCP) may be started:

- a. SG secondary temperature is $\leq T_c$;
- b. SG secondary temperature is $< 100^\circ\text{F}$ above T_c , and shutdown cooling is isolated from the PCS, and PCS heatup/cooldown rate is $\leq 10^\circ\text{F}/\text{hour}$; or
- c. SG secondary temperature is $< 100^\circ\text{F}$ above T_c , and shutdown cooling is isolated from the PCS, and pressurizer level is $\leq 57\%$.

Satisfying any of the above conditions will preclude a large pressure surge in the PCS when the PCP is started. Energy additions from the steam generators could occur if a PCP was started when the steam generator secondary temperature is significantly above the PCS temperature. The maximum pressurizer level at which credit is taken for having a bubble (57%, which provides about 700 cubic feet of steam space) is based on engineering judgement and verified by LTOP analysis. This level provides the same steam volume to dampen pressure transients as would be available at full power.

Note 3 specifies a limitation on the simultaneous operation of primary coolant pumps P-50A and P-50B which allows the pressure limits in LCO 3.4.3, "PCS Pressure and Temperature Limits," and LCO 3.4.12, "Low Temperature Overpressure Protection System," to be higher than they would be without this limit. This is because the pressure in the reactor vessel downcomer region when primary coolant pumps P-50A and P-50B are operated simultaneously is higher than the pressure for other two primary coolant pump combinations.

An OPERABLE PCS loop consists of any one (of the four) OPERABLE PCP and an SG that has the minimum water level specified in SR 3.4.6.2 and is OPERABLE in accordance with the Steam Generator Tube Surveillance Program. PCPs are OPERABLE if they are capable of being powered and are able to provide forced flow through the reactor core.

An OPERABLE SDC train is composed of an OPERABLE SDC pump and an OPERABLE SDC heat exchanger. The two SDC heat exchangers operate as a single heat exchanger comprised of two partial capacity units. A single OPERABLE SDC heat exchanger may be credited to either OPERABLE SDC train or to both OPERABLE SDC trains simultaneously, provided 100% of the heat removal requirements can be demonstrated with the single OPERABLE SDC heat exchanger. SDC pumps are OPERABLE if they are capable of being powered and are able to provide forced flow through the reactor core.

BASES

APPLICABILITY In MODE 4, this LCO applies because it is possible to remove core decay heat and to provide proper boron mixing with either the PCS loops and SGs, or the SDC System.

Operation in other MODES is covered by:

LCO 3.4.4, "PCS Loops-MODES 1 and 2";

LCO 3.4.5, "PCS Loops-MODE 3";

LCO 3.4.7, "PCS Loops-MODE 5, Loops Filled";

LCO 3.4.8, "PCS Loops-MODE 5, Loops Not Filled";

LCO 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation-High Water Level" (MODE 6); and

LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation-Low Water Level" (MODE 6).

ACTIONS

A.1

If only one PCS loop is OPERABLE and in operation with no OPERABLE SDC trains, redundancy for heat removal is lost. Action must be initiated immediately to restore a second PCS loop or one SDC train to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for decay heat removal.

B.1

If only one SDC train is OPERABLE and in operation with no OPERABLE PCS loops, redundancy for heat removal is lost. The plant must be placed in MODE 5 within the next 24 hours. Placing the plant in MODE 5 is a conservative action with regard to decay heat removal. With only one SDC train OPERABLE, redundancy for decay heat removal is lost and, in the event of a loss of the remaining SDC train, it would be safer to initiate that loss from MODE 5 ($\leq 200^{\circ}\text{F}$) rather than MODE 4 ($> 200^{\circ}\text{F}$ to $< 300^{\circ}\text{F}$). The Completion Time of 24 hours is reasonable, based on operating experience, to reach MODE 5 from MODE 4, with only one SDC train operating, in an orderly manner and without challenging plant systems.

BASES

ACTIONS
(continued)

C.1, C.2.1, and C.2.2

If no PCS loops or SDC trains are OPERABLE, or no PCS loop is in operation and the SDC flow through the reactor core is < 2810 gpm, except during conditions permitted by Note 1 in the LCO section, all operations involving reduction of PCS boron concentration must be suspended. Action to restore one PCS loop or SDC train to OPERABLE status and operation shall be initiated immediately and continue until one loop or train is restored to operation and flow through the reactor core is restored to ≥ 2810 gpm. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of decay heat removal.

SURVEILLANCE
REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that one required loop or train is in operation. This ensures forced flow is providing heat removal and mixing of the soluble boric acid. Verification may include flow rate (SDC only), or indication of flow, temperature, or pump status for the PCP. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess PCS loop/SDC train status. In addition, control room indication and alarms will normally indicate loop/train status.

SR 3.4.6.2

This SR requires verification every 12 hours of secondary side water level in the required SG(s) $\geq -84\%$ using the wide range level instrumentation. An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the primary coolant. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify SG status.

BASES

**SURVEILLANCE
REQUIREMENTS**
(continued)

SR 3.4.6.3

Verification that the required pump is OPERABLE ensures that an additional PCS loop or SDC train can be placed in operation, if needed to maintain decay heat removal and primary coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump that is not in operation such that the pump is capable of being started and providing forced PCS flow if needed. Proper breaker alignment and power availability means the breaker for the required pump is racked-in and electrical power is available to energize the pump motor. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

None

B 3.4 PRIMARY COOLANT SYSTEM (PCS)

B 3.4.7 PCS Loops - MODE 5, Loops Filled

BASES

BACKGROUND

In MODE 5 with the PCS loops filled, the primary function of the primary coolant is the removal of decay heat and transfer this heat either to the Steam Generator (SG) secondary side coolant via natural circulation (Ref. 1) or the Shutdown Cooling (SDC) heat exchangers. While the principal means for decay heat removal is via the SDC System, the SGs via natural circulation are specified as a backup means for redundancy. Even though the SGs cannot produce steam in this MODE, they are capable of being a heat sink due to their large contained volume of secondary side water. If heatup of the PCS were to continue, the contained inventory of the SGs would be available to remove decay heat by producing steam. As long as the SG secondary side water is at a lower temperature than the primary coolant, heat transfer will occur. The rate of heat transfer is directly proportional to the temperature difference. The secondary function of the primary coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 5 with PCS loops filled, the SDC trains are the principal means for decay heat removal. The number of trains in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one SDC train for decay heat removal and transport. The flow provided by one SDC train is adequate for decay heat removal. The other intent of this LCO is to require that a second path be available to provide redundancy for decay heat removal.

The LCO provides for redundant paths of decay heat removal capability. The first path can be an SDC train that must be OPERABLE and in operation. The second path can be another OPERABLE SDC train, or through the SGs, via natural circulation each having an adequate water level. "Loops filled" means the PCS loops are not blocked by dams and totally filled with coolant.

BASES

APPLICABLE SAFETY ANALYSES The boron concentration must be uniform throughout the PCS volume to prevent stratification of primary coolant at lower boron concentrations which could result in a reactivity insertion. Sufficient mixing of the primary coolant is assured if one SDC pump is in operation. PCS circulation is considered in the determination of the time available for mitigation of the inadvertent boron dilution event. By imposing a minimum flow through the reactor core of 2810 gpm, sufficient time is provided for the operator to terminate a boron dilution under asymmetric flow conditions.

PCS Loops - MODE 5 (Loops Filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2).

LCO The purpose of this LCO is to require one SDC train be OPERABLE and in operation with either an additional SDC train OPERABLE or the secondary side water level of each SG \geq -84%. SDC in operation with a flow through the reactor core \geq 2810 gpm, provides enough flow to remove the decay heat from the core with forced circulation and provide sufficient mixing of the soluble boric acid. The second SDC train is normally maintained OPERABLE as a backup to the operating SDC train to provide redundant paths for decay heat removal. However, if the standby SDC train is not OPERABLE, a sufficient alternate method to provide redundant paths for decay heat removal is two SGs with their secondary side water levels \geq -84%. Should the operating SDC train fail, the SGs could be used to remove the decay heat via natural circulation.

A SDC train may be considered OPERABLE (but not necessarily in operation) during re-alignment to, and when it is re-aligned for, LPSI service or for testing, if it is capable of being (locally or remotely) realigned to the SDC mode of operation and is not otherwise inoperable. Since SDC is a manually initiated system, it need not be considered inoperable solely because some additional manual valve realignments must be made in addition to the normal initiation actions. Because of the dual functions of the components that comprise the LPSI and shutdown cooling systems, the LPSI alignment may be preferred.

Note 1 permits all SDC pumps to not be in operation \leq 1 hour per 8 hour period. The Note prohibits boron dilution when forced flow is stopped because an even concentration distribution cannot be ensured. Core outlet temperature is to be maintained at least

BASES

LCO (continued)

10°F below saturation temperature so that no vapor bubble may form and possibly cause a natural circulation flow obstruction. The response of the PCS without the SDC pumps depends on the core decay heat load and the length of time that the pumps are stopped.

As decay heat diminishes, the effects on PCS temperature and pressure diminish. Without cooling by forced flow, higher heat loads will cause the primary coolant temperature and pressure to increase at a rate proportional to the decay heat load. Because pressure can increase, the applicable system pressure limits (Pressure and Temperature (P/T) limits or Low Temperature Overpressure Protection (LTOP) limits) must be observed and forced SDC flow or heat removal via the SGs must be re-established prior to reaching the pressure limit.

In MODE 5 with loops filled, it is sometimes necessary to stop all SDC forced circulation. This is permitted to change operation from one SDC train to the other, perform surveillance or startup testing, perform the transition to and from the SDC, or to avoid operation below the PCP minimum net positive suction head limit. The time period is acceptable because natural circulation is acceptable for decay heat removal, the primary coolant temperature can be maintained subcooled, and boron stratification affecting reactivity control is not expected.

Note 2 allows both SDC trains to be inoperable for a period of up to 2 hours provided that one SDC train is in operation providing the required flow, the core outlet temperature is at least 10°F below the corresponding saturation temperature, and each SG secondary water level is $\geq 84\%$. This permits periodic surveillance tests or maintenance to be performed on the inoperable trains during the only time when such evolutions are safe and possible.

Note 3 requires that one of the following conditions be satisfied before forced circulation (starting the first PCP) may be started:

- a. SG secondary temperature is equal to or less than the reactor inlet temperature (T_c);
- b. SG secondary temperature is $< 100^\circ\text{F}$ above T_c , and shutdown cooling is isolated from the PCS, and PCS heatup/cooldown rate is $\leq 10^\circ\text{F}/\text{hour}$; or
- c. SG secondary temperature is $< 100^\circ\text{F}$ above T_c , and shutdown cooling is isolated from the PCS, and pressurizer level is $\leq 57\%$.

BASES

LCO (continued)

Satisfying any of the above conditions will preclude a large pressure surge in the PCS when the PCP is started. Energy additions from the steam generators could occur if a PCP was started when the steam generator secondary temperature is significantly above the PCS temperature. The maximum pressurizer level at which credit is taken for having a bubble (57%, which provides about 700 cubic feet of steam space) is based on engineering judgement and verified by LTOP analysis. This level provides the same steam volume to dampen pressure transients as would be available at full power.

Note 4 specifies a limitation on the simultaneous operation of primary coolant pumps P-50A and P-50B which allows the pressure limits in LCO 3.4.3, "PCS Pressure and Temperature Limits," and LCO 3.4.12, "Low Temperature Overpressure Protection System," to be higher than they would be without this limit.

Note 5 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting SDC trains to not be in operation when at least one PCP is in operation. This Note provides for the transition to MODE 4 where a PCP is permitted to be in operation and replaces the PCS circulation function provided by the SDC trains.

An OPERABLE SDC train is composed of an OPERABLE SDC pump and an OPERABLE SDC heat exchanger. The two SDC heat exchangers operate as a single heat exchanger comprised of two partial capacity units. A single OPERABLE SDC heat exchanger may be credited to either OPERABLE SDC train or to both OPERABLE SDC trains simultaneously, provided 100% of the heat removal requirements can be demonstrated with the single OPERABLE SDC heat exchanger. SDC pumps are OPERABLE if they are capable of being powered and are able to provide forced flow through the reactor core.

An SG can perform as a heat sink via natural circulation when:

- a. SG has the minimum water level specified in SR 3.4.7.2.
- b. SG is OPERABLE in accordance with the SG Tube Surveillance Program.
- c. SG has available method of feedwater addition and a controllable path for steam release.
- d. Ability to pressurize and control pressure in the PCS.

If both SGs do not meet the above provisions, then LCO 3.4.7 item b (i.e. the secondary side water level of each SG shall be \geq -84%) is not met.

BASES

APPLICABILITY In MODE 5 with PCS loops filled, this LCO requires forced circulation to remove decay heat from the core and to provide proper boron mixing. One SDC train provides sufficient circulation for these purposes.

Operation in other MODES is covered by:

LCO 3.4.4, "PCS Loops-MODES 1 and 2";

LCO 3.4.5, "PCS Loops-MODE 3";

LCO 3.4.6, "PCS Loops-MODE 4";

LCO 3.4.8, "PCS Loops-MODE 5, Loops Not Filled";

LCO 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation-High Water Level" (MODE 6); and

LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation-Low Water Level" (MODE 6).

BASES

ACTIONS

A.1 and A.2

If one SDC train is inoperable and any SG has a secondary side water level < -84% (refer to LCO Bases section), redundancy for heat removal is lost. Action must be initiated immediately to restore a second SDC train to OPERABLE status or to restore the water level in the required SGs. Either Required Action A.1 or Required Action A.2 will restore redundant decay heat removal paths. The immediate Completion Times reflect the importance of maintaining the availability of two paths for decay heat removal.

B.1 and B.2

If no SDC trains are OPERABLE or SDC flow through the reactor core is < 2810 gpm, except as permitted in Note 1, all operations involving the reduction of PCS boron concentration must be suspended. Action to restore one SDC train to OPERABLE status and operation shall be initiated immediately and continue until one train is restored to operation and flow through the reactor core is restored to ≥ 2810 gpm. Boron dilution requires forced circulation for proper mixing and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification every 12 hours that one SDC train is in operation. Verification of the required flow rate ensures forced flow is providing heat removal and mixing of the soluble boric acid. The 12-hour Frequency has been shown by operating practice to be sufficient to regularly assess SDC train status. In addition, control room indication and alarms will normally indicate train status.

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.4.7.2

This SR requires verification every 12 hours of secondary side water level in the required SGs \geq -84% using the wide range level instrumentation. An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the primary coolant. The Surveillance is required to be performed when the LCO requirement is being met by use of the SGs. If both SDC trains are OPERABLE, this SR is not needed. The 12-hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify SG status.

SR 3.4.7.3

Verification that the second SDC train is OPERABLE ensures that redundant paths for decay heat removal are available. The requirement also ensures that the additional train can be placed in operation, if needed, to maintain decay heat removal and primary coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump that is not in operation such that the SDC pump is capable of being started and providing forced PCS flow if needed. Proper breaker alignment and power availability means the breaker for the required SDC pump is racked-in and electrical power is available to energize the SDC pump motor. The Surveillance is required to be performed when the LCO requirement is being met by one of two SDC trains, e.g., both SGs have $<$ -84% water level. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

1. NRC Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation"
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B 3.4 PRIMARY COOLANT SYSTEM (PCS)

B 3.4.8 PCS Loops - MODE 5, Loops Not Filled

BASES

BACKGROUND

In MODE 5 with the PCS loops not filled, the primary function of the primary coolant is the removal of decay heat and transfer of this heat to the Shutdown Cooling (SDC) heat exchangers. The Steam Generators (SGs) are not available as a heat sink when the loops are not filled. The secondary function of the primary coolant is to act as a carrier for the soluble neutron poison, boric acid. A loop is considered "not filled" if it has been drained so air has entered the loop which has not yet been removed.

In MODE 5 with loops not filled, only the SDC System can be used for coolant circulation. The number of trains in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one SDC train for decay heat removal and transport and to require that two paths be available to provide redundancy for heat removal.

APPLICABLE SAFETY ANALYSES

The boron concentration must be uniform throughout the PCS volume to prevent stratification of primary coolant at lower boron concentrations which could result in a reactivity insertion. Sufficient mixing of the primary coolant is assured if one SDC pump is in operation. PCS circulation is considered in the determination of the time available for mitigation of the inadvertent boron dilution event. By imposing a minimum flow through the reactor core of ≥ 2810 gpm, or a minimum flow through the reactor core ≥ 650 gpm with two of the three charging pumps incapable of reducing the boron concentration in the PCS below the minimum value necessary to maintain the required SHUTDOWN MARGIN, sufficient time is provided for the operator to terminate a boron dilution under asymmetric flow conditions.

PCS loops - MODE 5 (Loops Not Filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2).

BASES

LCO

The purpose of this LCO is to require a minimum of two SDC trains be OPERABLE and one of these trains be in operation. SDC in operation with a flow rate through the reactor core of ≥ 2810 gpm, or with a flow rate through the reactor core of ≥ 650 gpm with two of the three charging pumps incapable of reducing the boron concentration in the PCS below the minimum value necessary to maintain the required SHUTDOWN MARGIN, provides enough flow to remove the decay heat from the core with forced circulation and provide sufficient mixing of the soluble boric acid. The restriction on charging pump operations only applies to those cases where the potential exists to reduce the PCS boron concentration below minimum the boron concentration necessary to maintain the required SHUTDOWN MARGIN. It is not the intent of this LCO to restrict charging pump operations when the source of water to the pump suction is greater than or equal to the minimum boron concentration necessary to maintain the required SHUTDOWN MARGIN. An additional SDC train is required to be OPERABLE to meet the single failure criterion.

A SDC train may be considered OPERABLE (but not necessarily in operation) during re-alignment to, and when it is re-aligned for, LPSI service or for testing, if it is capable of being (locally or remotely) realigned to the SDC mode of operation and is not otherwise inoperable. Since SDC is a manually initiated system, it need not be considered inoperable solely because some additional manual valve realignments must be made in addition to the normal initiation actions. Because of the dual functions of the components that comprise the LPSI and shutdown cooling systems, the LPSI alignment may be preferred.

Note 1 permits all SDC pumps to not be in operation for ≤ 1 hour. The Note prohibits boron dilution when forced flow is stopped because an even concentration distribution cannot be ensured. Core outlet temperature is to be maintained at least 10°F below saturation temperature so that no vapor bubble may form and possibly cause a flow obstruction. Operations which could drain the PCS and thereby cause a loss of, or failure to regain SDC capability are also prohibited.

In MODE 5 with loops not filled, it is sometimes necessary to stop all SDC forced circulation. This is permitted to change operation from one SDC train to the other, and to perform surveillance or startup testing. The time period is acceptable because the primary coolant will be maintained subcooled, and boron stratification affecting reactivity control is not expected.

BASES

LCO
(continued)

Note 2 allows one SDC train to be inoperable for a period of 2 hours provided that the other train is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable train during the only time when these tests are safe and possible.

An OPERABLE SDC train is composed of an OPERABLE SDC pump and an OPERABLE SDC heat exchanger. The two SDC heat exchangers operate as a single heat exchanger comprised of two partial capacity units. A single OPERABLE SDC heat exchanger may be credited to either OPERABLE SDC train or to both OPERABLE SDC trains simultaneously, provided 100% of the heat removal requirements can be demonstrated with the single OPERABLE SDC heat exchanger. SDC pumps are OPERABLE if they are capable of being powered and are able to provide forced flow through the reactor core.

APPLICABILITY

In MODE 5 with PCS loops not filled, this LCO requires forced circulation to remove decay heat from the core and to provide proper boron mixing. One SDC train provides sufficient circulation for these purposes.

Operation in other MODES is covered by:

LCO 3.4.4, "PCS Loops-MODES 1 and 2";

LCO 3.4.5, "PCS Loops-MODE 3";

LCO 3.4.6, "PCS Loops-MODE 4";

LCO 3.4.7, "PCS Loops-MODE 5, Loops Filled";

LCO 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation-High Water Level" (MODE 6); and

LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation-Low Water Level" (MODE 6).

ACTIONS

A.1

If one SDC train is inoperable, redundancy for heat removal is lost. Action must be initiated immediately to restore a second train to OPERABLE status. The Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

BASES

ACTIONS
(continued)

B.1 and B.2

If no SDC trains are OPERABLE or SDC flow through the reactor core is not within limits, except as provided in Note 1, all operations involving the reduction of PCS boron concentration must be suspended. Action to restore one SDC train to OPERABLE status and operation shall be initiated immediately and continue until one train is restored to operation and flow through the reactor core is restored to within limits. Boron dilution requires forced circulation for proper mixing and the margin to criticality must not be reduced in this type of operation. The immediate Completion Time reflects the importance of maintaining operation for decay heat removal.

**SURVEILLANCE
REQUIREMENTS**

SR 3.4.8.1 and SR 3.4.8.2

These SRs require verification every 12 hours that one SDC train is in operation. Verification of the required flow rate ensures forced circulation is providing heat removal and mixing of the soluble boric acid. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess SDC train status. In addition, control room indications and alarms will normally indicate train status.

SR 3.4.8.1 and SR 3.4.8.2 are each modified by a Note to indicate the SR is only required to be met when complying with the applicable portion of the LCO. Therefore, it is only necessary to perform either SR 3.4.8.1, or SR 3.4.8.2 based on the method of compliance with the LCO.

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.4.8.3

This SR requires verification every 12 hours that two of the three charging pumps are incapable of reducing the boron concentration in the PCS below the minimum value necessary to maintain the required SHUTDOWN MARGIN. Making the charging pumps incapable reducing the boron concentration in the PCS may be accomplished by electrically disabling the pump motors, blocking potential dilution sources to the pump suction, or by isolating the pumps discharge flow path to the PCS. Verification may include visual inspection of the pumps configuration (e.g., pump breaker position or valve alignment), or the use of other administrative controls. The 12 hour Frequency is based on engineering judgement considering operating practice, administrative control available, and the unlikeness of inadvertently aligning a charging pump for PCS injection during this period.

SR 3.4.8.3 is modified by a Note to indicate the SR is only required to be met when complying with LCO 3.4.8.b. When SDC flow through the reactor core is ≥ 2810 gpm, there is no restriction on charging pump operation.

SR 3.4.8.4

Verification that the required number of trains are OPERABLE ensures that redundant paths for heat removal are available and that additional trains can be placed in operation, if needed, to maintain decay heat removal and primary coolant circulation. Verification is performed by verifying proper breaker alignment and indicated power available to the required pump that is not in operation such that the SDC pump is capable of being started and providing forced PCS flow if needed. Proper breaker alignment and power availability means the breaker for the required SDC pump is racked-in and electrical power is available to energize the SDC pump motor. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

None

B 3.6 CONTAINMENT SYSTEMS

B 3.6.6 Containment Cooling Systems

BASES

BACKGROUND

The Containment Spray and Containment Air Cooler systems provide containment atmosphere cooling to limit post accident pressure and temperature in containment to less than the design values. Reduction of containment pressure reduces the release of fission product radioactivity from containment to the environment, in the event of a Main Steam Line Break (MSLB) or a large break Loss of Coolant Accident (LOCA). The Containment Spray and Containment Air Cooler systems are designed to the requirements of the Palisades Nuclear Plant design criteria (Ref. 1).

The Containment Air Cooler System and Containment Spray System are Engineered Safety Feature (ESF) systems. They are designed to ensure that the heat removal capability required during the post accident period can be attained. The systems are arranged with two spray pumps powered from one diesel generator, and with one spray pump and three air cooler fans powered from the other diesel generator. The Containment Spray System was originally designed to be redundant to the Containment Air Coolers (CACs) and fans. These systems were originally designed such that either two containment spray pumps or three CACs could limit containment pressure to less than design. However, the current safety analyses take credit for one containment spray pump when evaluating cases with three CACs, and no air cooler fans in cases with two spray pumps and both Main Steam Isolation Valve (MSIV) bypass valves closed. If an MSIV bypass valve is open, 2 service water pumps and 2 CACs are also required to be OPERABLE in addition to the 2 spray pumps for containment heat removal.

To address this dependency between the Containment Spray System and the Containment Air Cooler System the title of this Specification is "Containment Cooling Systems," and includes both systems. The LCO is written in terms of trains of containment cooling. One train of containment cooling is associated with Diesel Generator 1-1 and includes Containment Spray Pumps P-54B and P-54C, Containment Spray Valve CV-3001 and the associated spray header. The other train of containment cooling is associated with Diesel Generator 1-2 and includes Containment Spray Pump P-54A, Containment Spray Valve CV-3002 and the associated spray header, and CACs VHX-1, VHX-2, and VHX-3 and their associated safety related fans, V-1A, V-2A, and V-3A.

BASES

BACKGROUND (continued)

If reliance is placed solely on one spray pump and three CACs, at least two service water pumps must be OPERABLE to provide the necessary service water flow to assure OPERABILITY of the CACs. Additional details of the required equipment and its operation is discussed with the containment cooling system with which it is associated.

Containment Spray System

The Containment Spray System consists of three half-capacity (50%) motor driven pumps, two shutdown cooling heat exchangers, two spray headers, two full sets of full capacity (100%) nozzles, valves, and piping, two full capacity (100%) pump suction lines from the Safety Injection and Refueling Water Tank (SIRWT) and the containment sump with the associated piping, valves, power sources, instruments, and controls. The heat exchangers are shared with the Shutdown Cooling System. SIRWT supplies borated water to the containment spray during the injection phase of operation. In the recirculation mode of operation, containment spray pump suction is transferred from the SIRWT to the containment sump.

Normally, both Shutdown Cooling Heat Exchangers must be available to provide cooling of the containment spray flow in the event of a Loss of Coolant Accident. If the Containment Spray side (tube side) of one SDC Heat Exchanger is out of service, 100% of the required post accident cooling capability can be provided, if other equipment outages are limited (refer to Bases for Required Action C.1).

The Containment Spray System provides a spray of cold borated water into the upper regions of containment to reduce the containment pressure and temperature during a MSLB or large break LOCA event. In addition, the Containment Spray System in conjunction with the use of trisodium phosphate (LCO 3.5.5, "Trisodium Phosphate,") serve to remove iodine which may be released following an accident. The SIRWT solution temperature is an important factor in determining the heat removal capability of the Containment Spray System during the injection phase.

BASES

BACKGROUND Containment Spray System (continued)

In the recirculation mode of operation, heat is removed from the containment sump water by the shutdown cooling heat exchangers.

The Containment Spray System is actuated either automatically by a Containment High Pressure (CHP) signal or manually. An automatic actuation opens the containment spray header isolation valves, starts the three containment spray pumps, and begins the injection phase. Individual component controls may be used to manually initiate Containment Spray. The injection phase continues until an SIRWT Level Low signal is received. The Low Level signal for the SIRWT generates a Recirculation Actuation Signal (RAS) that aligns valves from the containment spray pump suction to the containment sump. RAS opens the HPSI subcooling valve CV-3071, if the associated HPSI pump is operating. After the containment sump valve CV-3030 opens from RAS, HPSI subcooling valve CV-3070 will open, if the associated HPSI pump is operating. RAS will close containment spray valve CV-3001, if containment sump valve CV-3030 does not open. The Containment Spray System in recirculation mode maintains an equilibrium temperature between the containment atmosphere and the recirculated sump water. Operation of the Containment Spray System in the recirculation mode is controlled by the operator in accordance with the emergency operating procedures.

The containment spray pumps also provide a required support function for the High Pressure Safety Injection pumps as described in the Bases for specification 3.5.2. The High Pressure Safety Injection pumps alone may not have adequate NPSH after a postulated accident and the realignment of their suctions from the SIRWT to the containment sump. Flow is automatically provided from the discharge of the containment spray pumps to the suction of the High Pressure Safety Injection (HPSI) pumps after the change to recirculation mode has occurred, if the HPSI pump is operating. The additional suction pressure ensures that adequate NPSH is available for the High Pressure Safety Injection pumps.

BASES

BACKGROUND (continued)

Containment Air Cooler System

The Containment Air Cooler System includes four air handling and cooling units, referred to as the Containment Air Coolers (CACs), which are located entirely within the containment building. Three of the CACs (VHX-1, VHX-2, and VHX-3) are safety related coolers and are cooled by the critical service water. The fourth CAC (VHX-4) is not taken credit for in maintaining containment temperature within limit (the service water inlet valve for VHX-4 is closed by an SIS signal to conserve service water flow), but is used during normal operation along with the three CACs to maintain containment temperature below the design limits.

The DG which powers the fans associated with VHX-1, VHX-2, and VHX-3 (V-1A, V-2A and V-3A) also powers two service water pumps. This is necessary because if reliance is placed solely on the train with one spray pump and three CACs, at least two service water pumps must be OPERABLE to provide the necessary service water flow to assure OPERABILITY of the CACs.

Each CAC has two vaneaxial fans with direct connected motors which draw air through the cooling coils. Both of these fans are normally in operation, but only one fan and motor for each CAC is rated for post accident conditions. The post accident rated "safety related" fan units, V-1A, V-2A, and V-3A, serve to provide forced flow for the associated cooler. A single operating safety related spray header will provide enough air flow to assure that there is adequate mixing of unsprayed containment areas to assure the assumed iodine removal by the containment spray. In post accident operation following a SIS, all four Containment air coolers are designed to change automatically to the emergency mode.

The CACs are automatically changed to the emergency mode by a Safety Injection Signal (SIS). This signal will trip the normal rated fan motor in each unit, open the high-capacity service water discharge valve from VHX-1, VHX-2, and VHX-3, and close the high-capacity service water supply valve to VHX-4. The test to verify the service water valves actuate to their correct position upon receipt of an SIS signal is included in the surveillance test performed as part of Specification 3.7.8, "Service Water System." The safety related fans and the V-4A non-safety related fan are normally in operation and only receive an actuation signal through the DBA sequencers following an SIS in conjunction with a loss of offsite power. This actuation is tested by the surveillance which verifies the energizing of loads from the DBA sequencers in Specification 3.8.1, "AC Sources-Operating."

BASES

APPLICABLE SAFETY ANALYSES

The Containment Spray System and Containment Air Cooler System limit the temperature and pressure that could be experienced following either a Loss of Coolant Accident (LOCA) or a Main Steam Line Break (MSLB). The large break LOCA and MSLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients.

The Containment Cooling Systems have been analyzed for three accident cases (Ref. 2). All accidents analyses account for the most limiting single active failure.

1. A Large Break LOCA,
2. An MSLB occurring at various power levels with both MSIV bypass valves closed, and
3. An MSLB occurring at 0% RTP with both MSIV bypass valves open.

The postulated large break LOCA is analyzed, in regard to containment ESF systems, assuming the loss of offsite power and the loss of one ESF bus, which is the worst case single active failure, resulting in one train of Containment Cooling being rendered inoperable (Ref. 6).

The postulated MSLB is analyzed, in regard to containment ESF systems, assuming the worst case single active failure.

The MSLB event is analyzed at various power levels with both MSIV bypass valves closed, and at 0% RTP with both MSIV bypass valves open. Having any MSIV bypass valve open allows additional blowdown from the intact steam generator.

The analysis and evaluation show that under the worst-case scenario, the highest peak containment pressure and the peak containment vapor temperature are within the intent of the design basis. (See the Bases for Specifications 3.6.4, "Containment Pressure," and 3.6.5, "Containment Air Temperature," for a detailed discussion.) The analyses and evaluations considered a range of power levels and equipment configurations as described in Reference 2. The peak containment pressure case is the 0% power MSLB with initial (pre-accident) conditions of 140°F and 16.2 psia. The peak temperature case is the 102% power MSLB with initial (pre-accident) conditions of 140°F and 15.7 psia. The analyses also assume a response time delayed initiation in order to provide conservative peak calculated containment pressure and temperature responses.

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The external design pressure of the containment shell is 3 psig. This value is approximately 0.5 psig greater than the maximum external pressure that could be developed if the containment were sealed during a period of low barometric pressure and high temperature and, subsequently, the containment atmosphere was cooled with a concurrent major rise in barometric pressure.

The modeled Containment Cooling System actuation from the containment analysis is based on a response time associated with exceeding the Containment High Pressure setpoint to achieve full flow through the CACs and containment spray nozzles. The spray lines within containment are maintained filled to the 735 ft elevation to provide for rapid spray initiation. The Containment Cooling System total response time of < 60 seconds includes diesel generator startup (for loss of offsite power), loading of equipment, CAC and containment spray pump startup, and spray line filling.

The performance of the Containment Spray System for post accident conditions is given in Reference 3. The performance of the Containment Air Coolers is given in Reference 4.

The Containment Spray System and the Containment Cooling System satisfy Criterion 3 of 10 CFR 50.36(c)(2).

LCO

During an MSLB or large break LOCA event, a minimum of one containment cooling train is required to maintain the containment peak pressure and temperature below the design limits (Ref. 2). One train of containment cooling is associated with Diesel Generator 1-1 and includes Containment Spray Pumps P-54B and P-54C, Containment Spray Valve CV-3001 and the associated spray header. This train must be supplemented with 2 service water pumps and 2 containment air coolers if an MSIV bypass valve is open. The other train of containment cooling is associated with Diesel Generator 1-2 and includes Containment Spray Pump P-54A, Containment Spray Valve CV-3002 and the associated spray header, and CACs VHX-1, VHX-2, and VHX-3 and their associated safety related fans, V-1A, V-2A, and V-3A. To ensure that these requirements are met, two trains of containment cooling must be OPERABLE. Therefore, in the event of an accident, the minimum requirements are met, assuming the worst-case single active failure occurs.

BASES

LCO
(continued)

The Containment Spray System portion of the containment cooling trains includes three spray pumps, two spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the SIRWT upon an ESF actuation signal and automatically transferring suction to the containment sump.

The Containment Air Cooler System portion of the containment cooling train which must be OPERABLE includes the three safety related air coolers which each consist of four cooling coil banks, the safety related fan which must be in operation to be OPERABLE, gravity-operated fan discharge dampers, instruments, and controls to ensure an OPERABLE flow path.

CAC fans V-1A, V-2A, and V-3A, must be in operation to be considered OPERABLE. These fans only receive a start signal from the DBA sequencer; they are assumed to be in operation, and are not started by either a CHP or an SIS signal.

APPLICABILITY

In MODES 1, 2, and 3, a large break LOCA event could cause a release of radioactive material to containment and an increase in containment pressure and temperature requiring the operation of the containment spray trains and containment cooling trains.

In MODES 4, 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Thus, the Containment Spray and Containment Cooling systems are not required to be OPERABLE in MODES 4, 5 and 6.

ACTIONS

A.1

Condition A is applicable whenever one or more containment cooling trains is inoperable. Action A.1 requires restoration of both trains to OPERABLE status within 72 hours. The 72-hour Completion Time for Condition A is based on the assumption that at least 100% of the required post accident containment cooling capability (that assumed in the safety analyses) is available. If less than 100% of the required post containment accident cooling is available, Condition C must also be entered.

Mechanical system LCOs typically provide a 72 hour Completion Time under conditions when a required system can perform its required safety function, but may not be able to do so assuming an additional failure. When operating in accordance with the Required Actions of an LCO Condition, it is not necessary to be able to cope with an additional single failure.

BASES

ACTIONS

A.1 (continued)

The Containment Cooling systems can provide one hundred percent of the required post accident cooling capability following the occurrence of any single active failure. Therefore, the containment cooling function can be met during conditions when those components which could be deactivated by a single active failure are known to be inoperable. Under that condition, however, the ability to provide the function after the occurrence of an additional failure cannot be guaranteed. Therefore, continued operation with one or more trains inoperable is allowed only for a limited time.

B.1 and B.2

Condition B is applicable when the Required Actions of Condition A cannot be completed within the required Completion Time. Condition A is applicable whenever one or more trains is inoperable. Therefore, when Condition B is applicable, Condition A is also applicable. (If less than 100% of the post accident containment cooling capability is available, Condition C must be entered as well.) Being in Conditions A and B concurrently maintains both Completion Time clocks for instances where equipment repair allows exit from Condition B while the plant is still within the applicable conditions of the LCO.

If the inoperable containment cooling trains cannot be restored to OPERABLE status within the required Completion Time of Condition A, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to 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.

C.1

Condition C is applicable with one or more trains inoperable when there is less than 100% of the required post accident containment cooling capability available. Condition A is applicable whenever one or more trains is inoperable. Therefore, when this Condition is applicable, Condition A is also applicable. Being in Conditions A and C concurrently maintains both Completion Time clocks for instances where equipment repair restores 100% of the required post accident containment cooling capability while the LCO is still applicable, allowing exit from Condition C (and LCO 3.0.3).

BASES

ACTIONS

C.1 (continued)

Several specific cases have been analyzed in the safety analysis to provide operating flexibility for equipment outages and testing. These analyses show that action A.1 can be entered under certain circumstances, because 100% of the post accident cooling capability is maintained. These specific cases are discussed below.

One hundred percent of the required post accident cooling capability can be provided with both MSIV bypass valves closed if either;

1. Two containment spray pumps, and two spray headers are OPERABLE, or
2. One containment spray pump, two spray headers, and three safety related CACs, are OPERABLE (at least two service water pumps must be OPERABLE if CACs are to be relied upon).

One hundred percent of the required post accident cooling capability can be provided for operation with a MSIV bypass valve open or closed if either;

1. Two containment spray pumps, two spray headers, and two safety related CACs, are OPERABLE (at least two service water pumps must be OPERABLE if CACs are to be relied upon), or
2. One containment spray pump, one spray header, and three safety related CACs are OPERABLE (at least three service water pumps must be OPERABLE to provide the necessary service water flow to assure OPERABILITY of the CACs).

If the Containment Spray side (tube side) of SDC Heat Exchanger E-60B is out of service, 100% of the required post accident cooling capability can be provided, if other equipment outages are limited. One hundred percent of the post accident cooling can be provided with the Containment Spray side of SDC Heat Exchanger E-60B out of service if the following equipment is OPERABLE: three safety related Containment Air Coolers, two Containment Spray Pumps, two spray headers, CCW pumps P-52A and P-52B, two SWS pumps, and both CCW Heat Exchangers, and if

1. One CCW Containment Isolation Valve, CV-0910, CV-0911, or CV-0940, is OPERABLE, and
2. Two CCW isolation valves for the non-safety related loads outside the containment, CV-0944A and CV-0944 (or CV-0977B), are OPERABLE.

BASES

ACTIONS

C.1 (continued)

With less than 100% of the required post accident containment cooling capability available, the plant is in a condition outside the assumptions of the safety analyses. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE
REQUIREMENTS

SR 3.6.6.1

Verifying the correct alignment for manual, power operated, and automatic valves, excluding check valves, in the Containment Spray System provides assurance that the proper flow path exists for Containment Spray System operation. This SR also does not apply to valves that are locked, sealed, or otherwise secured in position since these were verified to be in the correct positions prior to being secured. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This SR does not require any testing or valve manipulation. Rather, it involves verification that those valves outside containment and capable of potentially being mispositioned, are in the correct position.

SR 3.6.6.2

Operating each safety related Containment Air Cooler fan unit for ≥ 15 minutes ensures that all trains are OPERABLE and are functioning properly. The 31-day Frequency was developed considering the known reliability of the fan units, the two train redundancy available, and the low probability of a significant degradation of the containment cooling train occurring between surveillances.

SR 3.6.6.3

Verifying the containment spray header is full of water to the 735 ft elevation minimizes the time required to fill the header. This ensures that spray flow will be admitted to the containment atmosphere within the time frame assumed in the containment analysis. The 31-day Frequency is based on the static nature of the fill header and the low probability of a significant degradation of the water level in the piping occurring between surveillances.

SR 3.6.6.4

Verifying a total service water flow rate of ≥ 4800 gpm to CACs VHX-1, VHX-2, and VHX-3, when aligned for accident conditions, provides assurance the design flow rate assumed in the safety analyses will be achieved (Ref. 8). Also considered in selecting this Frequency were the

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.6.4 (continued)

known reliability of the cooling water system, the two train redundancy, and the low probability of a significant degradation of flow occurring between surveillances.

SR 3.6.6.5

Verifying that each containment spray pump's developed head at the flow test point is greater than or equal to the required developed head ensures that spray pump performance has not degraded during the cycle. Flow and differential pressure are normal tests of centrifugal pump performance required by Section XI of the ASME Code (Ref. 5).

Since the containment spray pumps cannot be tested with flow through the spray headers, they are tested on recirculation flow. This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice inspections confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The Frequency of this SR is in accordance with the Inservice Testing Program.

SR 3.6.6.6 and SR 3.6.6.7

SR 3.6.6.6 verifies each automatic containment spray valve actuates to its correct position upon receipt of an actual or simulated actuation signal. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. SR 3.6.6.7 verifies each containment spray pump starts automatically on an actual or simulated actuation signal. The 18-month Frequency is based on the need to perform these Surveillances under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillances were performed with the reactor at power.

Operating experience has shown that these components usually pass the Surveillances when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

Where the surveillance of containment sump isolation valves is also required by SR 3.5.2.5, a single surveillance may be used to satisfy both requirements.

SR 3.6.6.8

This SR verifies each safety related containment cooling fan actuates upon receipt of an actual or simulated actuation signal. The 18-month Frequency is

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.6.8 (continued)

based on engineering judgement and has been shown to be acceptable through operating experience. See SR 3.6.6.6 and SR 3.6.6.7, above, for further discussion of the basis for the 18 month Frequency.

SR 3.6.6.9

With the containment spray inlet valves closed and the spray header drained of any solution, an inspection of spray nozzles, or a test that blows low-pressure air or smoke through test connections can be completed. Performance of this SR demonstrates that each spray nozzle is unobstructed and provides assurance that spray coverage of the containment during an accident is not degraded. Verification following maintenance which could result in nozzle blockage is appropriate because this is the only activity that could lead to nozzle blockage.

REFERENCES

1. FSAR, Section 5.1
 2. FSAR, Section 14.18
 3. FSAR, Sections 6.2
 4. FSAR, Section 6.3
 5. ASME, Boiler and Pressure Vessel Code, Section XI
 6. FSAR, Table 14.18.1-3
 7. FSAR, Table 14.18.2-1
 8. FSAR, Table 9-1
 9. EA-MSLB-2001-01 Rev. 1, Containment Response to a MSLB Using CONTEMPT-LT/28, January 2002.
 10. EA-LOCA-2001-01 Rev. 1, Containment Response to a LOCA Using CONTEMPT-LT/28, January 2002.
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B 3.7 PLANT SYSTEMS

B 3.7.6 Condensate Storage and Supply

BASES

BACKGROUND

The Condensate Storage and Supply provides a safety grade source of water to the steam generators for removing decay and sensible heat from the Primary Coolant System (PCS). The Condensate Storage Tank (CST) and the Primary Makeup Storage Tank (T-81) provide a passive flow of water, by gravity, to the Auxiliary Feedwater (AFW) System (LCO 3.7.5, "Auxiliary Feedwater (AFW) System"). Three AFW pumps take a suction from a common line from the CST. T-81 provides makeup to the CST either by use of a pump or by gravity flow. Backup sources from the Service Water System (SWS) and Fire Water System provide additional water supply to the AFW pump suctions if the normal source is lost. SWS provides an emergency source to AFW pump P-8C, and the Fire Water System provides an emergency source to AFW pumps P-8A and P-8B. The steam produced is released to the atmosphere by the Main Steam Safety Valves (MSSVs) or the atmospheric dump valves. The AFW pumps operate with a continuous recirculation to the CST.

When the main steam isolation valves are open, the preferred means of heat removal is to discharge steam to the condenser by the nonsafety grade path of the turbine bypass valve. This has the advantage of conserving condensate while minimizing releases to the environment.

Because the CST is a principal component in removing residual heat from the PCS, it is designed to withstand earthquakes. The tornado protected supply is provided by the SWS and Fire Water System. The CST is designed to Seismic Category I requirements to ensure availability of the feedwater supply.

A description of the Condensate Storage and Supply is found in the FSAR, Section 9.7 (Ref. 1).

BASES

APPLICABLE SAFETY ANALYSES The Condensate Storage and Supply provides condensate to remove decay heat and to cool down the plant following all events in the accident analysis, discussed in the FSAR, Chapters 5 and 14. For anticipated operational occurrences and accidents which do not affect the OPERABILITY of the steam generators, the analysis assumption is generally 30 minutes at MODE 3, steaming through the MSSVs followed by a cooldown to Shutdown Cooling (SDC) entry conditions at the design cooldown rate.

The Condensate Storage and Supply satisfies Criterion 3 of 10 CFR 50.36(c)(2).

LCO

To satisfy accident analysis assumptions, the CST and T-81 must contain sufficient cooling water to remove decay heat for 8 hours following a reactor trip from 2580.6 MWth. This amount of time allows for cool down of the PCS to SDC entry conditions, assuming a coincident loss of offsite power and the most adverse single failure. In doing this the CST and T-81 must retain sufficient water to ensure adequate net positive suction head for the AFW pumps, and makeup for steaming required to remove decay heat.

The combined CST and T-81 level required is a usable volume of at least 100,000 gallons, which is based on holding the plant in MODE 3 for 4 hours, followed by a cooldown to SDC entry conditions at approximately 75°F per hour. This basis was established by the Systematic Evaluation Program.

OPERABILITY of the Condensate Storage and Supply System is determined by maintaining the combined tank levels at or above the minimum required volume.

APPLICABILITY

In MODES 1, 2, and 3, and in MODE 4, when steam generator is being relied upon for heat removal, the Condensate Storage and Supply is required to be OPERABLE.

In MODES 5 and 6, the Condensate Storage and Supply is not required because the AFW System is not required.

BASES

ACTIONS

A.1 and A.2

If the condensate volume is not within the limit, the OPERABILITY of the backup water supplies must be verified by administrative means within 4 hours and once every 12 hours thereafter.

OPERABILITY of the backup feedwater supplies must include verification of the OPERABILITY of flow paths from the Fire Water System and SWS to the AFW pumps, and availability of the water in the backup supplies. The Condensate Storage and Supply volume must be returned to OPERABLE status within 7 days, as the backup supplies may be performing this function in addition to their normal functions. The 4 hour Completion Time is reasonable, based on operating experience, to verify the OPERABILITY of the Fire Water System and SWS. Additionally, verifying the backup water supplies every 12 hours is adequate to ensure the backup water supplies continue to be available. The 7 day Completion Time is reasonable, based on OPERABLE backup water supplies being available, and the low probability of an event requiring the use of the water from the CST and T-81 occurring during this period.

As stated in SR 3.0.2, the 25% extension allowed by SR 3.0.2 may be applied to Required Actions whose Completion Time is stated as "once per . . ." however, the 25% extension does not apply to the initial performance of a Required Action with a periodic Completion Time that requires performance on a "once per . . ." basis. The 25% extension applies to each performance of the Required Action after the initial performance. Therefore, while Required Action 3.7.6 A.1 must be initially performed within 4 hours without any SR 3.0.2 extension, subsequent performances at the "Once per 12 hours" interval may utilize the 25% SR 3.0.2 extension.

B.1 and B.2

If the condensate volume cannot be restored to OPERABLE status within the associated Completion Time, 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, without reliance on steam generator for heat removal, 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

**SURVEILLANCE
REQUIREMENTS**

SR 3.7.6.1

This SR verifies that the combination of CST and T-81 contain the required useable volume of cooling water. (This volume $\geq 100,000$ gallons.) The 12 hour Frequency is based on operating experience, and the need for operator awareness of plant evolutions that may affect the Condensate Storage and Supply inventory between checks. The 12 hour Frequency is considered adequate in view of other indications in the control room, including alarms, to alert the operator to abnormal CST and T-81 level deviations.

REFERENCES

1. FSAR, Section 9.7
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3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources - Operating

BASES

BACKGROUND

The station DC electrical power system provides the AC power system with control power. It also provides control power to selected safety related equipment and power to the preferred AC Buses (via inverters). As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure.

The 125 V DC electrical power system consists of two independent and redundant safety related Class 1E DC power sources. Each DC source consists of one 125 V battery, one battery charger, and the associated control equipment and interconnecting cabling. While each station battery has two associated battery chargers, one powered by the associated AC power distribution system (the directly connected chargers), and one powered from the opposite AC power distribution system (the cross connected chargers), the cross connect chargers are not required to be OPERABLE and cannot be credited to meet this LCO. The battery chargers are normally operated in pairs, either both direct connected chargers or both cross connected chargers, to assure a diverse AC supply.

During normal operation, the 125 V DC load is powered from the battery chargers with the batteries floating on the system. In case of loss of normal power from the battery charger, the DC load continues to be powered from the station batteries.

The DC power distribution system is described in the Bases for LCO 3.8.9, "Distributions System - Operating."

Each battery has adequate storage capacity to carry the required load continuously for at least 4 hours as discussed in the FSAR, Chapter 8 (Ref. 2).

Each 125 V battery is separately housed in a ventilated room apart from its charger and distribution centers. Each DC source is separated physically and electrically from the other DC source to ensure that a single failure in one source does not cause a failure in a redundant source.

BASES

BACKGROUND (continued)

The batteries for the DC power sources are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 125.7 V per battery discussed in the FSAR, Chapter 8 (Ref. 2). The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 3).

Each DC electrical power source has ample power output capacity for the steady state operation of connected loads during normal operation, while at the same time maintaining its battery fully charged. Each battery charger also has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in the FSAR, Chapter 8 (Ref. 2).

APPLICABLE SAFETY ANALYSES

A description of the Safety Analyses applicable in MODES 1, 2, 3, and 4 is provided in the Bases for LCO 3.8.1, "AC Sources - Operating."

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

LCO

The DC power sources, each consisting of one battery, one directly connected battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the train are required to be OPERABLE to ensure the availability of DC control power and Preferred AC power to shut down the reactor and maintain it in a safe condition.

An OPERABLE DC electrical power source requires its battery to be OPERABLE and connected to the associated DC bus. In order for the battery to remain OPERABLE for any extended period of time, at least one charger must be in service. Without a charger in service, the DC loads would reduce the battery charge to the point where the battery would become inoperable. Disconnecting a charger, however, does not, in itself, make a battery inoperable.

The LCO requires chargers ED-15 and ED-16 because those chargers are powered by the AC power distribution system and DG associated with the battery they supply. If only the cross connected chargers were available, and a loss of off-site power should occur concurrently with the loss of one DG, both safeguards trains would eventually become disabled. One train would be disabled by the lack of AC motive power;

BASES

LCO
(continued)

the other would become disabled when the battery, whose only OPERABLE charger is fed by the failed DG, became depleted.

The required chargers, ED-15 and ED-16, must be OPERABLE, but need not actually be in service because the probability of a concurrent loss of offsite power with loss of one DG is low, and battery charging current is not needed immediately after an accident.

APPLICABILITY

The DC sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that redundant sources of DC power are available to support engineered safeguards equipment and plant instrumentation in the event of an accident or transient. The DC sources also support the equipment and instrumentation necessary for power operation, plant heatups and cooldowns, and shutdown operation.

The DC source requirements for MODES 5 and 6, and during movement of irradiated fuel assemblies are addressed in LCO 3.8.5, "DC Sources - Shutdown."

ACTIONS

A.1 and A.2

With one of the required chargers (ED-15 or ED-16) inoperable, the cross-connected charger must be placed in service within 2 hours, if it is not already in service, to maintain the battery in OPERABLE status. If the cross-connect charger is not placed in service within 2 hours, Condition C would be entered.

Additionally for the cross-connected charger to be considered "functional," the cross-connected charger must have been surveilled and satisfied the same performance test required for the directly connected charger (i.e., SR 3.8.4.6) within the required Frequency.

In order to limit the time when the DC source is not capable of continuously meeting the single failure criterion, the required charger must be restored to OPERABLE status within 7 days.

The 7 day Completion Time was chosen to allow trouble shooting, location of parts, and repair.

BASES

ACTIONS (continued)

B.1 and B.2

With one battery inoperable, the associated DC system cannot meet its design. It lacks both the surge capacity and the independence from AC power sources which the battery provides if offsite power is lost.

Placing the second battery charger in service provides two benefits:

1) restoration of the capacity to supply a sudden DC power demand, and 2) restoration of adequate DC power in the affected train as soon as either AC power distribution system is re-energized following a loss of offsite power. If the cross-connect charger is not placed in service within 2 hours, Condition C would be entered. Additionally for the cross-connected charger to be considered "functional," the cross-connected charger must have been surveilled and satisfied the same performance test required for the directly connected charger (i.e., SR 3.8.4.6) within the required Frequency.

In order to restore the DC source to its design capability, the battery must be restored to OPERABLE status within 24 hours. The 24 hour Completion Time is a feature of the original Palisades licensing basis and reflects the availability to provide two trains of DC power from either AC distribution system. Furthermore, it provides a reasonable time to assess plant status as a function of the inoperable DC electrical power source and, if the battery is not restored to OPERABLE status, to prepare to effect an orderly and safe plant shutdown.

C.1 and C.2

If the inoperable DC electrical power source cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to an operating condition in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 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

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous current required to overcome the internal losses of a battery and maintain the battery in a fully charged state. The specified voltage is the nominal rating of the battery. Surveillance voltage measurements may be adjusted for cable losses and for installed plant instrumentation to ensure that battery terminal voltage requirements are satisfied. At that terminal voltage, the battery has sufficient charge to provide the analyzed capacity for either accident loading or station blackout loading. The 7 day Frequency is consistent with manufacturer and IEEE-450 (Ref. 4) recommendations.

SR 3.8.4.2

Visual inspection to detect corrosion of the battery terminals and connectors, or measurement of the resistance of each inter-cell and terminal connection, provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

The specified limits of $\leq 50 \mu\text{ohm}$ for inter-cell connections and terminal connections, and $\leq 360 \mu\text{ohms}$ for inter-tier and inter-rack connections are in accordance with the manufacturers recommendations. The $50 \mu\text{ohm}$ value is based on the minimum battery design voltage. Battery sizing calculations show the first minute load on the ED-02 battery as the load that determines battery size, hence, battery voltage will be at its lowest value while the battery supplies this current. Calculations also show that at a minimum temperature and end of life (80% battery performance), battery voltage during this first minute load will be about 1.815 V per cell, assuming nominal connection resistance. But if all the connections were at the ceiling value of $50 \mu\text{ohms}$, the battery manufacturer indicates that the additional voltage drop would result in a battery voltage of about 1.79 V per cell, which is still above the minimum design voltage (Ref. 5).

The $360 \mu\text{ohm}$ value is based on 120% of the nominal cumulative resistance of the components which make up the connections: resistance of the connecting cable, and for each end of the cable, the battery post to cable lug connection, the cable lug itself, and the lug to cable connection.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.2 (continued)

The resistance values determined during initial battery installation are recorded with the battery replacement specifications, FES 95-206-ED-01 and FES 95-206-ED-02.

The Surveillance Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical damage or deterioration does not necessarily represent a failure of this SR, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function).

The 12 month Frequency for this SR is consistent with IEEE-450 (Ref. 4), which recommends detailed visual inspection of cell condition and rack integrity on a yearly basis.

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of inter-cell and terminal connections provide an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anticorrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection. The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR provided visible corrosion is removed during performance of SR 3.8.4.4.

The specified limits for connection resistance are discussed in the Bases for SR 3.8.4.2.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.4 and SR 3.8.4.5 (continued)

The Surveillance Frequencies of 12 months is consistent with IEEE-450 (Ref. 4), which recommends cell to cell and terminal connection resistance measurement on a yearly basis.

SR 3.8.4.6

This SR requires that each required battery charger be capable of supplying 180 amps at 125 V for ≥ 8 hours. These requirements are based on the design capacity of the chargers. The chargers are rated at 200 amps; the specified 180 amps provides margin between the charger rating and the test requirement.

The specified Frequency requires each required battery charger to be tested each 18 months. The Surveillance Frequency is acceptable, given the other administrative controls existing to ensure adequate charger performance during these 18 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

SR 3.8.4.7

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements as specified in FSAR Chapter 8 (Ref. 2).

The Surveillance Frequency of 18 months is consistent with the recommendations of RG 1.32 (Ref. 6) and RG 1.129 (Ref. 7), which state that the battery service test should be performed during refueling operations, or at some other outage, with intervals between tests not to exceed 18 months.

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

The reason for the restriction that the plant be outside of MODES 1, 2, 3, and 4 is that performing the Surveillance requires disconnecting the battery from the DC distribution buses and connecting it to a test load resistor bank. This action makes the battery inoperable and completely unavailable for use.

SR 3.8.4.8

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the "as found" condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

The modified performance discharge test is a simulated duty cycle that envelopes the Service Test Profile, is approved by the battery manufacturer, and is consistent with IEEE Standards. Since the ampere-hours removed by the initial loads represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will often confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.8 (continued)

The acceptance criteria for this Surveillance are consistent with the recommendations of IEEE-450 (Ref. 4) and IEEE-485 (Ref. 3). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity \geq 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 4), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is \geq 10% below the manufacturer's rating. These Frequencies are consistent with the recommendations in IEEE-450 (Ref. 4).

The reason for the restriction that the plant be outside of MODES 1, 2, 3, and 4 is that performing the Surveillance requires disconnecting the battery from the DC distribution buses and connecting it to a test load resistor bank. This action makes the battery inoperable and completely unavailable for use.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17
 2. FSAR, Chapter 8
 3. IEEE-485-1983, June 1983
 4. IEEE-450-1995
 5. Letter; Graham Walker, C&D Charter Power Systems, Inc to John Slinkard, Consumers Power Company, 12 July 1996
 6. Regulatory Guide 1.32, February 1977
 7. Regulatory Guide 1.129, December 1974
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B 3.9 REFUELING OPERATIONS

B 3.9.4 Shutdown Cooling (SDC) and Coolant Circulation - High Water Level

BASES

BACKGROUND The purposes of the SDC System in MODE 6 are to remove decay heat and sensible heat from the Primary Coolant System (PCS) as required by the Palisade Nuclear Plant design, to provide mixing of borated coolant, to provide sufficient coolant circulation to minimize the effects of a boron dilution accident, and to prevent boron stratification (Ref. 1). Heat is removed from the PCS by circulating primary coolant through the SDC heat exchanger(s), where the heat is transferred to the Component Cooling Water System. The coolant is then returned to the PCS via the PCS cold leg(s). Operation of the SDC System for normal cooldown or decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of primary coolant through the SDC heat exchanger(s). Mixing of the primary coolant is maintained by this continuous circulation of primary coolant through the SDC System.

APPLICABLE SAFETY ANALYSES If the primary coolant temperature is not maintained below 200°F, boiling of the primary coolant could result. This could lead to inadequate cooling of the reactor fuel due to the resulting loss of coolant in the reactor vessel. Additionally, boiling of the primary coolant could lead to a reduction in boron concentration in the coolant due to the boron plating out on components near the areas of the boiling activity, and because of the possible addition of water to the reactor vessel with a lower boron concentration than is required to keep the reactor subcritical.

The loss of primary coolant and the reduction of boron concentration in the primary coolant would eventually challenge the integrity of the fuel cladding, which is a fission product barrier. One train of the SDC System is required to be in operation in MODE 6, with the refueling cavity water level greater than or equal to the 647 ft elevation, to prevent this challenge. The LCO allows the removal of an SDC train from operation for short durations under the condition that the boron concentration of the primary coolant is not reduced.

This conditional allowance does not result in a challenge to the fission product barrier.

SDC and Coolant Circulation - High Water Level satisfies Criterion 4 of 10 CFR 50.36(c)(2).

BASES

LCO

Only one SDC train is required for decay heat removal in MODE 6, with the refueling cavity water level greater than or equal to the 647 ft elevation. Only one SDC train is required because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one SDC train must be OPERABLE and in operation to provide:

- a. Removal of decay heat;
- b. Mixing of borated coolant to minimize the possibility of a criticality; and
- c. Indication of reactor coolant temperature.

An OPERABLE SDC train consists of an SDC pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the PCS temperature. The two SDC heat exchangers operate as a single heat exchanger comprised of two partial capacity units. A single OPERABLE SDC heat exchanger may be credited to either OPERABLE SDC train or to both OPERABLE SDC trains simultaneously, provided 100% of the heat removal requirements can be demonstrated with the single OPERABLE SDC heat exchanger. The flow path starts in the Loop 2 PCS hot leg and is returned to at least one PCS cold leg.

A SDC train may be considered OPERABLE (but not necessarily in operation) during re-alignment to, and when it is re-aligned for, LPSI service or for testing, if it is capable of being (locally or remotely) realigned to the SDC mode of operation and is not otherwise inoperable. Since SDC is a manually initiated system, it need not be considered inoperable solely because some additional manual valve realignments must be made in addition to the normal initiation actions. Because of the dual functions of the components that comprise the LPSI and shutdown cooling systems, the LPSI alignment may be preferred.

The LCO is modified by two Notes. Note 1 allows the required operating SDC train to not be in operation for up to 1 hour in each 8 hour period, provided no operations are permitted that would cause a reduction of the PCS boron concentration. Boron concentration reduction is prohibited because uniform concentration distribution cannot be ensured without forced circulation. This permits operations such as core mapping or alterations in the vicinity of the reactor vessel hot leg nozzles, and PCS to SDC isolation valve testing.

During this 1 hour period, decay heat is removed by natural circulation to the large mass of water in the refueling cavity. Note 2 allows the required SDC train to be made inoperable for ≤ 2 hours per 8 hour period for

BASES

testing and maintenance provided one SDC train in operation providing flow through the reactor core, and the core outlet temperature is $\leq 200^{\circ}\text{F}$. The purpose of this Note is to allow the heat flow path from the SDC heat exchanger to be temporarily interrupted for maintenance or testing on the Component Cooling Water or Service Water Systems.

LCO
(continued)

During this 2 hour period, the core outlet temperature must be maintained $\leq 200^{\circ}\text{F}$. Requiring one SDC train to be in operation ensures adequate mixing of the borated coolant.

APPLICABILITY

One SDC train must be OPERABLE and in operation in MODE 6, with the refueling cavity water level greater than or equal to 647 ft elevation, to provide decay heat removal. The 647 ft elevation was selected because it corresponds to the elevation requirement established for fuel movement in LCO 3.9.6, "Refueling Cavity Water Level." Requirements for the SDC System in other MODES are covered by LCOs in Section 3.4, "Primary Coolant System (PCS)." SDC train requirements in MODE 6, with the refueling cavity water level less than the 647 ft elevation are located in LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level."

ACTIONS

SDC train requirements are met by having one SDC train OPERABLE and in operation, except as permitted in the Note to the LCO.

A.1

If one required SDC train is inoperable or not in operation, actions shall be immediately initiated and continued until the SDC train is restored to OPERABLE status and to operation. An immediate Completion Time is necessary for an operator to initiate corrective actions.

A.2

If SDC train requirements are not met, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Reduced boron concentrations can occur through the addition of water with a lower boron concentration than that contained in the PCS. Therefore, actions that reduce boron concentration shall be suspended immediately.

BASES

ACTIONS
(continued)

A.3

If SDC train requirements are not met, actions shall be taken immediately to suspend loading irradiated fuel assemblies in the core. With no forced circulation cooling, decay heat removal from the core occurs by natural circulation to the heat sink provided by the water above the core. A minimum refueling cavity water level equivalent to the 647 ft elevation provides an adequate available heat sink. Suspending any operation that would increase the decay heat load, such as loading a fuel assembly, is a prudent action under this condition.

A.4

If SDC train requirements are not met, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed to prevent fission products, if released by a loss of decay heat removal event, from escaping to the environment. The 4 hour Completion Time is based on the low probability of the coolant boiling in that time and allows time for fixing most SDC problems.

SURVEILLANCE
REQUIREMENTS

SR 3.9.4.1

This Surveillance demonstrates that the SDC train is in operation and circulating primary coolant. The flow rate is sufficient to provide decay heat removal capability and to prevent thermal and boron stratification in the core. The 1000 gpm flow rate has been determined by operating experience rather than analysis. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator in the control room for monitoring the SDC System.

REFERENCES

1. FSAR, Sections 6.1 and 14.3
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B 3.9 REFUELING OPERATIONS

B 3.9.5 Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level

BASES

BACKGROUND The purposes of the SDC System in MODE 6 are to remove decay heat and sensible heat from the Primary Coolant System (PCS), as required by the Palisades Nuclear Plant design, to provide mixing of borated coolant, to provide sufficient coolant circulation to minimize the effects of a boron dilution accident, and to prevent boron stratification (Ref. 1). Heat is removed from the PCS by circulating primary coolant through the SDC heat exchanger(s), where the heat is transferred to the Component Cooling Water System via the SDC heat exchanger(s). The coolant is then returned to the PCS via the PCS cold leg(s). Operation of the SDC System for normal cooldown or decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of primary coolant through the SDC heat exchanger(s) and bypassing the heat exchanger(s). Mixing of the primary coolant is maintained by this continuous circulation of primary coolant through the SDC System.

APPLICABLE SAFETY ANALYSES If the primary coolant temperature is not maintained below 200°F, boiling of the primary coolant could result. This could lead to inadequate cooling of the reactor fuel due to the resulting loss of coolant in the reactor vessel. Additionally, boiling of the primary coolant could lead to a reduction in boron concentration in the coolant due to the boron plating out on components near the areas of the boiling activity, and because of the possible addition of water to the reactor vessel with a lower boron concentration than is required to keep the reactor subcritical.

The loss of primary coolant and the reduction of boron concentration in the primary coolant would eventually challenge the integrity of the fuel cladding, which is a fission product barrier. Two trains of the SDC System are required to be OPERABLE, and one train is required to be in operation in MODE 6, with the refueling cavity water level less than the 647 ft elevation to prevent this challenge.

SDC and Coolant Circulation - Low Water Level satisfies Criterion 4 of 10 CFR 50.36(c)(2).

BASES

LCO

In MODE 6, with the refueling cavity water level less than the 647 ft elevation, both SDC trains must be OPERABLE. Additionally, one train of the SDC System must be in operation in order to provide:

- a. Removal of decay heat;
- b. Mixing of borated coolant to minimize the possibility of a criticality; and
- c. Indication of primary coolant temperature.

An OPERABLE SDC train consists of an SDC pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the PCS temperature. The two SDC heat exchangers operate as a single heat exchanger comprised of two partial capacity units. A single OPERABLE SDC heat exchanger may be credited to either OPERABLE SDC train or to both OPERABLE SDC trains simultaneously, provided 100% of the heat removal requirements can be demonstrated with the single OPERABLE SDC heat exchanger. The flow path starts in one of the PCS hot legs and is returned to the PCS cold legs.

A SDC train may be considered OPERABLE (but not necessarily in operation) during re-alignment to, and when it is re-aligned for, LPSI service or for testing, if it is capable of being (locally or remotely) realigned to the SDC mode of operation and is not otherwise inoperable. Since SDC is a manually initiated system, it need not be considered inoperable solely because some additional manual valve realignments must be made in addition to the normal initiation actions. Because of the dual functions of the components that comprise the LPSI and shutdown cooling systems, the LPSI alignment may be preferred.

Both SDC pumps may be aligned to the safety injection refueling water tank to support filling the refueling cavity or for performance of required testing.

APPLICABILITY

Two SDC trains are required to be OPERABLE, and one SDC train must be in operation in MODE 6, with the refueling cavity water level less than the 647 ft elevation to provide decay heat removal. Requirements for the SDC System in other MODES are covered by LCOs in Section 3.4, "Primary Coolant System." MODE 6 requirements, with the refueling cavity water level greater than or equal to the 647 ft elevation are covered in LCO 3.9.4, "Shutdown Cooling and Coolant Circulation - High Water Level."

BASES

ACTIONS

A.1 and A.2

If one SDC train is inoperable, action shall be immediately initiated and continued until the SDC train is restored to OPERABLE status, or until a water level of greater than or equal to the 647 ft elevation is established. When the water level is established at the 647 ft elevation or greater, the plant conditions will change so that LCO 3.9.4, "Shutdown Cooling and Coolant Circulation - High Water Level," is applicable, and only one SDC train is required to be OPERABLE and in operation. An immediate Completion Time is necessary for an operator to initiate corrective actions.

B.1

If no SDC train is in operation or no SDC trains are OPERABLE, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Reduced boron concentrations can occur by the addition of water with lower boron concentration than that contained in the PCS. Therefore, actions that reduce boron concentration shall be suspended immediately.

B.2

If no SDC train is in operation or no SDC trains are OPERABLE, action shall be initiated immediately and continued without interruption to restore one SDC train to OPERABLE status and operation. Since the plant is in Conditions A and B concurrently, the restoration of two OPERABLE SDC trains and one operating SDC train should be accomplished expeditiously.

B.3

If no SDC train is in operation, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed immediately. With the SDC train requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures that dose limits are not exceeded.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.9.5.1

This Surveillance demonstrates that one SDC train is operating and circulating primary coolant. The flow rate is sufficient to provide decay heat removal capability and to prevent thermal and boron stratification in the core.

In addition, during operation of the SDC train with the water level in the vicinity of the reactor vessel nozzles, the SDC train flow rate determination must also consider the SDC pump suction requirements. The 1000 gpm flow rate has been determined by operating experience rather than analysis. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator to monitor the SDC System in the control room.

SR 3.9.5.2

Verification that the required pump is OPERABLE ensures that an additional SDC pump can be placed in operation, if needed, to maintain decay heat removal and primary coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

1. FSAR, Sections 6.1 and 14.3
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