2.0 LIMITING CONDITIONS FOR OPERATION

2.3 Emergency Core Cooling System (Continued)

(3) Protection Against Low Temperature Overpressurization

The following limiting conditions shall be applied during scheduled heatups and cooldowns. Disabling of the HPSI pumps need not be required if the RCS is vented through at least a 0.94 square inch or larger vent.

Whenever the reactor coolant system cold leg temperature is below 385°F, at least one (1) HPSI pump shall be disabled.

Whenever the reactor coolant system cold leg temperature is below 320°F, at least two (2) HPSI pumps shall be disabled.

Whenever the reactor coolant system cold leg temperature is below 270°F, all three (3) HPSI pumps shall be disabled.

In the event that no charging pumps are operable when the reactor coolant system cold leg temperature is below 270°F, a single HPSI pump may be made operable and utilized for boric acid injection to the core, with flow rate restricted to no greater than 120 gpm.

(4) Trisodium Phosphate (TSP) Dodecahydrate

During operating Modes 1 and 2, the TSP baskets shall contain ≥ 126 ft^3 of active TSP. |

a. With the above TSP requirements not within limits, the TSP shall be restored within 72 hours.

b. With Specification 2.3(4)a required action and completion time not met, the plant shall be in hot shutdown within the next 6 hours and cold shutdown within the following 36 hours.

Basis

The normal procedure for starting the reactor is to first heat the reactor coolant to near operating temperature by running the reactor coolant pumps. The reactor is then made critical. The energy stored in the reactor coolant during the approach to criticality is substantially equal to that during power operation and therefore all engineered safety features and auxiliary cooling systems are required to be fully operable.

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With respect to the core cooling function, there is functional redundancy over most of the range of break sizes.[3][4]

The LOCA analysis confirms adequate core cooling for the break spectrum up to and including the 32 inch double-ended break assuming the safety injection capability which most adversely affects accident consequences and are defined as follows. The entire contents of all four safety injection tanks are assumed to be available for emergency core cooling, but the contents of one of the tanks is assumed to be lost through the reactor coolant system. In addition, of the three high-pressure safety injection pumps and the two low-pressure safety injection pumps, for both large break analysis and small break analysis it is assumed that one high pressure pump and one low pressure pump operate[5]; and also that 25% of their combined discharge rate is lost from the reactor coolant system out of the break. The transient hot spot fuel clad temperatures for the break sizes considered are shown in USAR Section 14.

The restriction on HPSI pump operability at low temperatures, in combination with the PORV setpoints ensure that the reactor vessel pressure-temperature limits would not be exceeded in the case of an inadvertent actuation of the operable HPSI and charging pumps.

Removal of the reactor vessel head, one pressurizer safety valve, or one PORV provides sufficient expansion volume to limit any of the design basis pressure transients. Thus, no additional relief capacity is required.

Technical Specification 2.2(1) specifies that, when fuel is in the reactor, at least one flow path shall be provided for boric acid injection to the core. Should boric acid injection become necessary, and no charging pumps are operable, operation of a single HPSI pump would provide the required flow path. The HPSI pump flow rate must be restricted to that of three charging pumps in order to minimize the consequences of a mass addition transient while at low temperatures.

Trisodium Phosphate (TSP) dodecahydrate is required to adjust the pH of the recirculation water to ≥ 7.0 after a loss of coolant accident (LOCA). This pH value is necessary to prevent significant amounts of iodine, released from fuel failures and dissolved in the recirculation water, from converting to a volatile form and evolving into the containment atmosphere. Higher levels of airborne iodine in containment may increase the releases of radionuclides and the consequences of the accident. A pH of ≥ 7.0 is also necessary to prevent stress corrosion cracking (SCC) of austenitic stainless steel components in containment. SCC increases the probability of failure of components.

Radiation levels in containment following a LOCA may cause the generation of hydrochloric and nitric acids from radiolysis of cable insulation and sump water. TSP will neutralize these acids.

The required amount of TSP is represented in a volume quantity converted from the Reference 7 mass quantity using the manufactured density. Verification of this amount during surveillance testing utilizes the measured volume.

2.0 LIMITING CONDITIONS FOR OPERATION

2.8 Refueling

2.8.2 Refueling Operations - Containment

2.8.2(3) Ventilation Isolation Actuation Signal (VIAS)

Applicability

Applies to operation of the Ventilation Isolation Actuation Signal (VIAS) during CORE ALTERATIONS and REFUELING OPERATIONS inside containment.

Objective

To minimize the consequences of an accident occurring during CORE ALTERATIONS or REFUELING OPERATIONS that could affect public health and safety.

Specification

VIAS including manual actuation capability shall be OPERABLE with two gaseous radiation monitors OPERABLE and supplied by independent power supplies.

Required Actions

(1) With less than two radiation monitors OPERABLE, or VIAS manual actuation capability inoperable, immediately suspend CORE ALTERATIONS and REFUELING OPERATIONS.

2.8.2(4) Control Room Ventilation System

Applicability

Applies to operation of the control room ventilation system during CORE ALTERATIONS and REFUELING OPERATIONS inside containment.

Objective

To minimize the consequences of a fuel handling accident to the control room staff.

Specification

The control room ventilation system shall be IN OPERATION and in the Filtered Air mode.

Required Actions

(1) If the control room ventilation system is not IN OPERATION or not in the Filtered Air mode, immediately suspend CORE ALTERATIONS and REFUELING OPERATIONS.

2.0 **LIMITING CONDITIONS FOR OPERATION**

2.8 Refueling

2.8.3 Refueling Operations - Spent Fuel Pool

2.8.3(5) Control Room Ventilation System

Applicability

Applies to operation of the control room ventilation system during REFUELING OPERATIONS in the spent fuel pool area. The provisions of Specification 2.0.1 for Limiting Conditions for Operation are not applicable.

Objective

To minimize the consequences of a fuel handling accident to the control room staff.

Specification

(1) The control room ventilation system shall be IN OPERATION and in the Filtered Air mode.

(2) A spent fuel pool area radiation monitor shall be IN OPERATION.

Required Actions

(1) If the control room ventilation system is not IN OPERATION or not in Filtered Air mode, immediately suspend REFUELING OPERATIONS.

(2) If a spent fuel pool area radiation monitor is not IN OPERATION, immediately suspend REFUELING OPERATIONS.

Bases (Continued)

2.8.2(4) Control Room Ventilation System

Operating the control room ventilation system in the Filtered Air mode is a conservative measure to reduce control room operator exposure. This allows the radiological consequences analysis for a fuel handling accident to credit the Filtered Air mode at the time of the accident. When "immediately" is used as a completion time, the required action should be pursued without delay and in a controlled manner. Suspension of CORE ALTERATIONS and REFUELING OPERATIONS shall not preclude completion of movement of a component to a safe, conservative position.

2.8.3(1) Spent Fuel Assembly Storage

The spent fuel pool is designed for noncriticality by use of neutron absorbing material. The restrictions on the placement of fuel assemblies within the spent fuel pool, according to Figure 2-10, and the accompanying LCO, ensures that the k_{eff} of the spent fuel pool always remains < 0.95 assuming the pool to be flooded with unborated water.

A spent fuel assembly may be transferred directly from the reactor core to the spent fuel pool Region 2 provided an independent verification of assembly burnups has been completed and the assembly burnup meets the acceptance criteria identified in Figure 2-10. When the configuration of fuel assemblies stored in Region 2 (including the peripheral cells) is not in accordance with Figure 2-10, immediate action must be taken to make the necessary fuel assembly movement(s) to bring the configuration into compliance with Figure 2-10. Acceptable fuel assembly burnup is not a prerequisite for Region 1 storage because Region 1 will maintain any type of fuel assembly that the plant is licensed for in a safe, coolable, subcritical geometry.

The provisions of Specification 2.0.1 for Limiting Conditions for Operations are not applicable. If moving fuel assemblies while in MODES 4 or 5, LCO 2.0.1 would not specify any actions. If moving fuel assemblies in MODES 1, 2, or 3, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown. When "immediately" is used as a completion time, the required action should be pursued without delay and in a controlled manner.

Bases (Continued)

2.8.3(2) Spent Fuel Pool Water Level

The minimum water level in the spent fuel pool meets the assumption of iodine decontamination factors following a fuel handling accident. When the water level is lower than the required level, the movement of irradiated fuel assemblies in the spent fuel pool is immediately suspended. This effectively precludes a fuel handling accident from occurring in the spent fuel pool. Suspension of REFUELING OPERATION shall not preclude completion of movement of a component to a safe, conservative position. The provisions of Specification 2.0.1 for Limiting Conditions for Operations are not applicable. If moving fuel assemblies while in MODES 4 or 5, LCO 2.0.1 would not specify any actions. If moving fuel assemblies in MODES 1, 2, or 3, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown. When "immediately" is used as a completion time, the required action should be pursued without delay and in a controlled manner.

2.8.3(3) Spent Fuel Pool Boron Concentration

The basis for the 500 ppm boron concentration requirement with Boral poisoned storage racks is to maintain the k_{eff} below 0.95 in the event a misloaded unirradiated fuel assembly is located next to a spent fuel assembly. A misloaded unirradiated fuel assembly at maximum enrichment condition, in the absence of soluble poison, may result in exceeding the design effective multiplication factor. Soluble boron in the spent fuel pool water, for which credit is permitted under these conditions, would assure that the effective multiplication factor is maintained substantially less than the design condition.

This LCO applies whenever unirradiated fuel assemblies are stored in the spent fuel pool. The boron concentration is periodically sampled in accordance with Specification 3.2. Sampling is performed prior to movement of unirradiated fuel to the spent fuel pool and periodically when unirradiated fuel is stored in the spent fuel pool.

The provisions of Specification 2.0.1 for Limiting Conditions for Operations are not applicable. If moving fuel assemblies while in MODES 4 or 5, LCO 2.0.1 would not specify any actions. If moving fuel assemblies in MODES 1, 2, or 3, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

When "immediately" is used as a completion time, the required action should be pursued without delay and in a controlled manner. Suspension of refueling operations shall not preclude completion of movement of a component to a safe, conservative position.

2.0 **LIMITING CONDITIONS FOR OPERATION**

2.8 Refueling

Bases (Continued)

2.8.3(4) Spent Fuel Pool Area Ventilation

The spent fuel pool area ventilation system contains a charcoal filter to prevent release of significant radionuclides to the outside atmosphere. The system does not automatically realign and therefore must be IN OPERATION prior to REFUELING OPERATIONS in the spent fuel pool. When the spent fuel pool area ventilation system is not IN OPERATION, the movement of irradiated fuel assemblies in the spent fuel pool is immediately suspended. This effectively precludes a fuel handling accident from occurring in the spent fuel pool. When "immediately" is used as a completion time, the required action should be pursued without delay and in a controlled manner. Suspension of REFUELING OPERATIONS shall not preclude completion of movement of a component to a safe, conservative position.

The provisions of Specification 2.0.1 for Limiting Conditions for Operations are not applicable. If moving fuel assemblies while in MODES 4 or 5, LCO 2.0.1 would not specify any actions. If moving fuel assemblies in MODES 1, 2, or 3, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

2.8.3(5) Control Room Ventilation System

Operating the control room ventilation system in the Filtered Air mode and requiring a radiation monitor to be IN OPERATION are conservative measures to reduce control room operator exposure. This allows the radiological consequences analysis for a fuel handling accident to credit the Filtered Air mode at the time of the accident.

Radiation monitoring will assure operators are alerted if a radiological incident occurs. This specification can be satisfied by using a permanent spent fuel pool area radiation monitor or a portable area radiation monitor.

When "immediately" is used as a completion time, the required action should be pursued without delay and in a controlled manner. Suspension of REFUELING OPERATIONS shall not preclude completion of movement of a component to a safe, conservative position.

References

(1) USAR Section 9.5
(2) USAR Section 14.18

3.0 **SURVEILLANCE REQUIREMENTS**

3.6 Safety Injection and Containment Cooling Systems Tests

Applicability

Applies to the safety injection system, the containment spray system, the containment cooling system and air filtration system inside the containment.

Objective

To verify that the subject systems will respond promptly and perform their intended functions, if required.

Specifications

(1) Safety Injection System

System tests shall be performed on a refueling frequency. A test safety feature actuation signal will be applied to initiate operation of the system. The safety injection and shutdown cooling system pump motors may be de-energized for this portion of the test.

A second overlapping test will be considered satisfactory if control board indication and visual observations indicate all components have received the safety feature actuation signal in the proper sequence and timing (i.e., the appropriate pump breakers shall have opened and closed, and all valves shall have completed their travel).

(2) Containment Spray System

a. System tests shall be performed on a refueling frequency. The test shall be performed with the isolation valves in the spray supply lines at the containment blocked closed. Operation of the system is initiated by tripping the normal actuation instrumentation.

b. At least every ten years the spray nozzles shall be verified to be open.

c. The test will be considered satisfactory if:

(i) Visual observations indicate that at least 264 nozzles per spray header have operated satisfactorily.

(ii) No more than one nozzle per spray header is missing.

d. Representative samples of Trisodium Phosphate Dodecahydrate (TSP) that have been exposed to the same environmental conditions as that in the mesh baskets shall be tested on a refueling frequency by:

3.0 **SURVEILLANCE REQUIREMENTS**

3.6 Safety Injection and Containment Cooling Systems Tests (continued)

(i) Verifying that the TSP baskets contain $\geq$ 126 ft^3 of granular trisodium phosphate dodecahydrate.

(ii) Verifying that a sample from the TSP baskets provides adequate pH upward adjustment of the recirculation water.

3.0 **SURVEILLANCE REQUIREMENTS**

3.6 Safety Injection and Containment Cooling Systems Tests (Continued)

Operation of the system for 10 hours every month will demonstrate operability of the filters and adsorbers system and remove excessive moisture build-up on the adsorbers.

Demonstration of the automatic initiation capability will assure system availability.

Periodic determination of the volume of TSP in containment must be performed due to the possibility of leaking valves and components in the containment building that could cause dissolution of the TSP during normal operation. A refueling frequency shall be utilized to visually determine that $\geq$ 126 ft^3 of TSP is contained in the TSP baskets. This requirement ensures that there is an adequate quantity of TSP to adjust the pH of the post-LOCA sump solution to a value $\geq$ 7.0.

The periodic verification is required on a refueling frequency. Operating experience has shown this surveillance frequency acceptable due to margin in the volume of TSP placed in the containment building.

Testing must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. A representative sample of 1.80 - 1.83 grams of TSP from one of the baskets in containment is submerged in 0.99 - 1.01 liters of water at a boron concentration of 2445 - 2465 ppm. At a standard temperature of 115 -125°F, without agitation, the solution should be left to stand for 4 hours. The liquid is then decanted and mixed, the temperature adjusted to 75 - 79°F and the pH measured. At this point, the pH must be $\geq$ 7.0. The representative sample weight is based on the minimum required TSP weight of 6,672 lbs_m which, at a manufactured density of at least 53.0 lb_m/ft^3 corresponds to the minimum volume of 126 ft^3, and maximum possible post-LOCA sump volume of 375,143 gallons, normalized to buffer a 1.0 liter sample. The boron concentration of the test water is representative of the maximum possible boron concentration corresponding to the maximum possible post-LOCA sump volume. The post-LOCA sump volume originates from the Reactor Coolant System (RCS), the Safety Injection Refueling Water Tank (SIRWT), the Safety Injection Tanks (SITs) and the Boric Acid Storage Tanks (BASTs). The maximum post-LOCA sump boron concentration is based on a cumulative boron concentration in the RCS, SIRWT, SITs and BASTs of 2445 ppm. Agitation of the test solution is prohibited, since an adequate standard for the agitation intensity cannot be specified. The test time of 4 hours is necessary to allow time for the dissolved TSP to naturally diffuse through the sample solution. In the post-LOCA containment sump, rapid mixing would occur, significantly decreasing the actual amount of time before the required pH is achieved. This would ensure achieving a pH $\geq$ 7.0 by the onset of recirculation after a LOCA.

References

(1) USAR, Section 6.2
(2) USAR, Section 6.3
(3) USAR, Section 14.16
(4) USAR, Section 6.4

3.0 SURVEILLANCE REQUIREMENTS

3.16 Residual Heat Removal System Integrity Testing

Applicability

Applies to determination of the integrity of the residual heat removal (RHR) system and associated components.

Objective

To verify that the leakage from the residual heat removal system components is within acceptable limits.

Specifications

(1) a. The portion of the shutdown cooling system that is outside the containment, and the piping between the containment spray pump suction and discharge isolation valves, shall be examined for leakage at a pressure no less than 250 psig. This shall be performed on a refueling frequency.

b. Piping from valves HCV-383-3 and HCV-383-4 to the suction isolation valves of the low pressure safety injection pumps and containment spray pumps and to the high pressure safety injection pumps shall be examined for leakage at a pressure no less that 82 psig. This shall be performed at the testing frequency specified in (1)a. above.

c. The portion of the high pressure safety injection (HPSI) system that is located outside the containment and downstream of the HPSI pumps shall be examined for leakage when subjected to the discharge pressure of a HPSI pump operating in the minimum recirculation mode. This test shall be performed at the frequency specified in (1)a. above. The leakage contribution from this section shall be the observed leakage from this piping at the test pressure multiplied by the square root of the ratio 1500/P, where P is the test discharge pressure (in psig) of the operating HPSI pump.

d. An internal leakage test shall be performed on a refueling frequency. The test shall measure and quantify the leakage to the safety injection refueling water tank (SIRWT) from applicable water leakage paths.

e. Visual inspection of the system's components shall be performed at the frequency specified in (1)a. above to uncover any significant external leakage to atmosphere (including leakage from valve stems, flanges, and pump seals). The leakage shall be measured by collection and weighing or by any other equivalent method.

(2) a. The sum of leakages from section (1)a, (1)b, (1)c, and (1)d above shall not exceed 3800 cc/hour.

b. Repairs shall be made as required to maintain leakage within the acceptable limits.

3.16 Residual Heat Removal System Integrity Testing (Continued)

Basis

The limiting leakage to atmosphere from the RHR system (3800 cc/hour) is based upon a plant specific leak rate analysis for RHR system components operating after a design basis accident.

The test pressures for sections 3.16(1)a and 3.16(1)b, and the pressure correction factors in sections 3.16(1)c give adequate margins over the highest pressures within the lines after a design basis accident.[1]

A RHR system leakage of 3800 cc/hr will limit off-site exposures due to leakage to insignificant levels relative to those calculated for direct leakage from the containment in the design basis accident. The safety injection system pump rooms are equipped with individual charcoal filters which are placed into operation by means of switches in the control room. The radiation detectors in the auxiliary building exhaust duct are used to detect high radiation level. The 3800 cc/hour leak rate is sufficiently high to allow for reasonable leakage through the pump seals and valve packings, and yet small enough to be readily handled by the pumps and radioactive waste system. Leakage to the safety injection system pump room sumps will be returned to the spent regenerant tanks.[2] Additional makeup water to the containment sump inventory can be readily accommodated via the charging pumps from either the safety injection refueling water tank (SIRWT) or the concentrated boric acid storage tanks.

The analysis for the loss of coolant accident assumed a total (internal and external) leakage from all RHR systems sources of 3800 cc/hour. The internal leakage would leak back into the water remaining in the SIRWT.

References

(1) USAR, Section 9.3
(2) USAR, Section 6.2