4.2 SAFETY INJECTION AND CONTAINMENT SPRAY SYSTEM

62
4/20/81

4.2.1 SAFETY INJECTION AND CONTAINMENT SPRAY SYSTEM PERIODIC TESTING

APPLICABILITY: Applies to testing of the Safety Injection System and the Containment Spray System.

OBJECTIVE: To verify that the Safety Injection System and the Containment Spray System will respond promptly and properly if required.

SPECIFICATION: I. System Test

A. Safety Injection System

(1) During reactor shutdown at intervals not longer than the normal plant refueling intervals, a "no-flow" system test shall be conducted to demonstrate proper availability of the system. The test shall be performed in accordance with the following procedure:

34
4/1/77

(a) The feedwater, safety injection, charging, condensate, and heater drain pumps shall not be operating. Their respective breakers shall be racked-out to the test position with control power available.

(b) The flow path for condensate shall be positively blocked prior to the test.

(c) Injection and recirculation system operation shall be initiated by instrumentation and controls installed in the control room.

(2) The test will be considered satisfactory if control board indication and visual observations indicate all components have operated and sequenced properly. That is, the appropriate pump breakers have opened and closed, and all valves have completed their travel.

(3) A test of the trisodium phosphate additive shall be conducted to demonstrate the availability of the system. The test shall be performed in accordance with the following procedure:

(a) The three (3) storage racks are visually observed to have maintained their integrity.

(b) The three (3) racks, each with a storage capacity of 1800 pounds of anhydrous trisodium phosphate additive, are visually observed to be full.

(c) Trisodium phosphate from one of the sample storage racks inside containment shall be submerged, without agitation, in 25±0.5 gallons of 150°F to 175°F distilled water borated to 3900±100 ppm boron. 44 10/31/78

(4) The test shall be considered satisfactory if the racks have maintained their integrity, the racks are visually observed to be full, and the trisodium phosphate dissolves to the extent that a minimum pH of 7.0 is reached within 4 hours of the start of the test.

B. Containment Spray System

(1) During reactor shutdown at intervals not longer than the normal plant refueling intervals, a "no-flow" system test shall be conducted to demonstrate proper availability of the system. The test shall be performed either by closing a manual valve in the system or electrically disabling the refueling water pumps and initiating the system by tripping the normal actuation instrumentation. 34 4/1/77

The test will be considered satisfactory if visual observations indicate all components have operated satisfactorily.

(2) At least once every second refueling outage an air flow test shall be performed to demonstrate the absence of blockage at each containment spray nozzle. 44 10/31/78

II. Component Tests

A. In addition to the above test, when the reactor is critical, the safety injection pumps and recirculation pumps shall be started at intervals not to exceed one month to verify that they are in satisfactory running order. The spray additive pumps and refueling water pumps shall be started at intervals not to exceed one month whenever the reactor coolant system temperature is above 200°F. When periods of reactor subcriticality or reactor shutdown extend the test interval beyond one month, these pumps shall be tested prior to a return to criticality or prior to increasing the temperature above 200°F, as appropriate.

B. Acceptable levels of performance shall be as follows:

(1) The safety injection pumps shall reach and be capable of maintaining 95% of their rated shutoff head within 10 seconds after starting.

(2) The refueling water pumps shall be capable of maintaining 90% of their rated shutoff head. 34 4/1/77

(3) The recirculation pumps shall be run dry. Proper starting of the pump is confirmed by observation of the running current on the ammeter.

(4) The spray additive pumps shall be capable of maintaining their rated flow at a discharge pressure not less than 90% of their rated discharge pressure.

C. The recirculation loop outside containment (including the Containment Spray System) shall be pressurized at a pressure equal to or greater than the operating pressure under accident conditions at intervals not to exceed the normal plant refueling interval. Visual inspections for leakage shall be made and if leakage can be detected, measurements of such leakage shall be made. In addition, pumps and valves of the recirculation loop outside containmnet which are used during normal operation, shall be visually inspected for leakage at intervals not to exceed once every six months. If leakage can be detected, measurements of such leakage shall be made.

D. The non-redundant Containment Spray System piping shall be visually inspected at intervals not to exceed the normal plant refueling interval. Observations made as part of compliance with Paragraph C, above, or Paragraph I.B(2) of Technical Specification 4.2 will be acceptable as visual inspection of portions of non-redundant Containment Spray System piping. 44 10/31/78

BASIS:

The Safety Injection System is a principal plant safeguard. It provides means to insert negative reactivity and limits core damage in the event of a loss of coolant or steam break accident. (1) (2) (3)

Preoperational performance tests of the components are performed in the manufacturer's shop. An initial system flow test demonstrates proper dynamic functioning of the system. Thereafter, periodic tests demonstrate that all components are functioning properly. For these tests, flow through the system is not required. 34 4/1/77

The tests specified above will demonstrate that all components which do not normally and routinely operate will operate properly and in sequence if required. The portion of the Recirculation system outside the containment sphere is effectively an extension of the boundary of the containment. The measurement of the recirculation loop leakage ensures that the calculated EAB 0-2 hr. thyroid dose does not exceed 10 CFR 100 limits.

The trisodium phosphate stored in storage racks located in the containment is provided to minimize the possibility of stress corrosion cracking of metal components during operation of the ECCS following a LOCA. The trisodium phosphate provides this protection by dissolving in the sump water and causing its final pH to be raised to 7.0 - 7.5. The requirement to dissolve trisodium phosphate from one of the sample storage racks in distilled water heated and borated, to the extent recirculating post LOCA sump water is projected to be heated and borated, provides assurance that the stored trisodium phosphate will dissolve as required following a LOCA. The sample storage racks are sized to contain 0.5 pounds of trisodium phosphate. Trisodium phosphate stored in the sample storage racks has a surface area to volume ratio of 1.33 whereas the trisodium phosphate stored in the main racks has a surface area to volume ratio of 1.15. 44 10/31/78

Visual inspection of the non-redundant piping in the Containment Spray System provides additional assurance of the integrity of that system.

References:

(1) Final Engineering Report and Safety Analysis, Paragraph 5.1.

(2) "San Onofre Nuclear Generating Station", report forwarded by letter dated December 29, 1971 from Jack B. Moore to Director, Division of Reactor Licensing, USAEC, subject: Emergency Core Cooling System Performance, San Onofre Nuclear Generating Station, Unit 1. 34 4/1/77

(3) USAEC Safety Evaluation of ECCS Performance Analysis for San Onofre Unit 1, forwarded by letter dated March 6, 1974 from Mr. Donald J. Skovholt to Mr. Jack B. Moore.

4.2.3 SAFETY INJECTION SYSTEM HYDRAULIC VALVE TESTING (SURVEILLANCE REQUIREMENT)

An interim surveillance testing program shall be conducted during the remainder of the current fuel cycle which began in June 1981. At the next refueling outage, the interim program shall be supplanted by a long term surveillance testing program. It is intended that this long term program will be developed and submitted to the NRC for review and approval at least 60 days prior to the next refueling outage. 63 11/5/81

The interim surveillance program shall be as follows:

1. At least once every 92 days, (except when the inverval lapses while in mode 5 or 6, in which case the test may be delayed until a mode 3 or 4 operation prior to the next entry into mode 2) the unit shall be placed in mode 3 or 4 and a Hot SIS functional test (with the MOV-850 A, B&C valves locked closed) shall be performed. This test shall include a determination of the force required to open valves HV-851 A&B and the margin to available actuation force. This test shall be evaluated on the basis of the following criteria: 67 9/24/82

   a. If the measured actuator force for both the HV-851 A&B valves is less than 10,000 lb_f*, the unit may be returned to power.

   b. If the measured actuator force of either HV-851 A or B is between 10,000 and 22,000 lb_f, the Hot SIS test for both valves shall be repeated to again determine required opening force and available margin. The prediction will assume a straight line extrapolation from the following equation: 63 11/5/81

$$T = \frac{(22{,}000 - F_2)}{(F_1 - F)/T_L}$$

where F_1 = measured actuator force from the first Hot SIS test during the current surveillance test (lb_f)

F_2 = measured actuator force from the second Hot SIS test during the current surveillance test (lb_f)

*Upon receipt of satisfactory data from continuing testing and analysis, the NRC staff will consider a request from Southern California Edison Company to change this number to more accurately reflect existing conditions.

TL = time (in days) since the last surveillance testing

F = the actuator force from the previous surveillance test (lb_f)*

If the calculated value of T does not exceed 92 days, the next surveillance test must be performed before T days had elapsed. 63 11/5/81

c. If the measured actuator force of either HV-851 A or B is greater than 22,000 lb_f, the valve(s) shall be declared inoperable. Test results shall be reported to the NRC pursuant to Specification 6.6 along with proposed corrective actions and NRC approval obtained prior to returning the unit to service. 91 11/14/85

2. The first test shall be performed not less than 14 days nor more than 21 days following return to power from the current outage which began September 3, 1981.

*For the first surveillance test, the value of F shall be the average actuator force of HV-851 A&B valves from pre-operation testing (3135 lb_f). All subsequent surveillance testing shall assume the F_2 value from the previous surveillance test for each valve. If an F_2 was not required during the previous surveillance test, the F_1 value for each valve shall be assumed.

ATTACHMENT 2

4.2 SAFETY INJECTION AND CONTAINMENT SPRAY SYSTEM

4.2.1 SAFETY INJECTION AND CONTAINMENT SPRAY SYSTEM PERIODIC TESTING

APPLICABILITY: Applies to testing of the Safety Injection System and the Containment Spray System.

OBJECTIVE: To verify that the Safety Injection System and the Containment Spray System will respond promptly and properly if required.

SPECIFICATION: I. System Tests

A. Hot Safety Injection System Test

(1) When the plant is planned to be shut down from MODE 1 operation and is planned to enter MODE 5 operation, a Hot SIS Test shall be performed in MODE 3 while RCS pressure is above 1500 psi but not more often than once every 9 months. The test shall include a determination of the force required to open valves HV 851 A and B and the margin of available actuation force.

(2) The test will be considered satisfactory if:

(a) control board indication and visual observations indicate all components have operated and sequenced properly. That is, the appropriate pumps have started and/or stopped and started, and all valves have completed their travel.

(b) the measured actuator force for both the HV-851 A and B valves is equal to or less than 10,000 lb_f.*

(3) If the measured actuator force of either HV-851 A or B is between 10,000 and 22,000 lb_f, the HV-851 A and B valves shall be considered OPERABLE but the future testing interval shall be accelerated as determined by the following equation:

---

*Upon receipt of satisfactory data from continuing testing and analysis, the NRC staff will consider a request from Southern California Edison Company to change this number to more accurately reflect existing conditions.

$$T = T_L \frac{(22{,}000 - F)}{12{,}000}$$

where: T = maximum time in days of operation allowed before next surveillance test is required

T_L = time in days of operation since the last surveillance test

F = measured actuator force

(4) If the measured actuator force of either HV-851 A or B is greater than 22,000 lb_f, test results shall be reported to the NRC pursuant to Specification 6.9.2 along with proposed corrective actions. NRC approval shall be obtained prior to returning the unit to service.

B. Trisodium Phosphate Test

(1) A test of the trisodium phosphate additive shall be conducted once every refueling to demonstrate the availability of the system. The test shall be performed in accordance with the following procedure:

(a) The three (3) storage racks are visually observed to have maintained their integrity.

(b) The three (3) racks, each with a storage capacity of 1800 pounds of anhydrous trisodium phosphate additive, are visually observed to be full.

(c) Trisodium phosphate from one of the sample storage racks inside containment shall be submerged, without agitation, in 25±0.5 gallons of 150°F to 175°F distilled water borated to 3900±100 ppm boron.

(2) The test shall be considered satisfactory if the racks have maintained their integrity, the racks are visually observed to be full, and the trisodium phosphate dissolves to the extent that a minimum pH of 7.0 is reached within 4 hours of the start of the test.

C. Containment Spray System Test

(1) During reactor shutdown at intervals not longer than the normal plant refueling intervals, a "no-flow" system test shall be conducted to demonstrate proper availability of the system. The test shall be performed either by closing a manual valve in the system or electrically disabling the refueling water pumps and initiating the system by tripping the normal actuation instrumentation.

(2) The test will be considered satisfactory if visual observations indicate all components have operated satisfactorily.

(3) At least once every second refueling outage an air flow test shall be performed to demonstrate the absence of blockage at each containment spray nozzle.

II. Component Tests

A. Pump Tests

(1) In addition to the above test, the safety injection, recirculation, spray additive and refueling water pumps shall be started at intervals not to exceed one month to verify that they are in satisfactory running order.

(2) Acceptable levels of performance shall be as follows:

(1) The safety injection pumps shall reach and be capable of maintaining 95% of their rated shutoff head within 10 seconds after starting.

(2) The refueling water pumps shall be capable of maintaining 90% of their rated shutoff head.

(3) The recirculation pumps shall be run dry. Proper starting of the pump is confirmed by observation of the running current on the ammeter.

(4) The spray additive pumps shall be capable of maintaining their rated flow at a discharge pressure not less than 90% of their rated discharge pressure.

B. Leakage Testing

(1) The recirculation loop outside containment (including the Containment Spray System) shall be pressurized at a pressure equal to or greater than the operating pressure under accident conditions at intervals not to exceed the normal plant refueling interval. Visual inspections for leakage shall be made and if leakage can be detected, measurements of such leakage shall be made. In addition, pumps and valves of the recirculation loop outside containmnet which are used during normal operation, shall be visually inspected for leakage at intervals not to exceed once every six months. If leakage can be detected, measurements of such leakage shall be made.

(2) The non-redundant Containment Spray System piping shall be visually inspected at intervals not to exceed the normal plant refueling interval. Observations made as part of compliance with Paragraph C, above, or Paragraph I.C(2) of Technical Specification 4.2 will be acceptable as visual inspection of portions of non-redundant Containment Spray System piping.

BASIS: The Safety Injection System is a principal plant safeguard. It provides means to insert negative reactivity and limits core damage in the event of a loss of coolant or steam break accident. (1)(2)(3)

Preoperational performance tests of the components are performed in the manufacturer's shop. An initial system flow test demonstrates proper dynamic functioning of the system. Thereafter, periodic tests demonstrate that all components are functioning properly. For these tests, flow through the system is generally not required. However, in the case of the "Hot SIS Test," actual conditions of an SI event are simulated. This test is performed to assure that long-term set of the valve seat faces on HV-851 A and B has not caused the valves to become inoperable. The test is required to be performed as the plant is shutting down from MODE 1 in order to assure that the valves have not been disturbed (i.e., the long-term set is still in effect) and that full dynamic conditions that would occur during an actual SI event are simulated. When possible the test should be performed prior to stopping the feedwater pumps (this is not a requirement). This will further assure that the valves will be in the same condition as when required for an actual Safety Injection event since the discharge pressure of the feedwater pumps acting on the valves will keep them seated even considering any backpressure built up in the downstream SI header. The

equation used to determine future intervals if actuator force is between 10,000 lbf and 22,000 lbf is developed by shortening the interval in direct proportion to the degree to which the force exceeds 10,000 lbf. During the test, all components are verified to have operated and sequenced properly.

The tests required in this specification will demonstrate that all components which do not normally and routinely operate will operate properly and in sequence if required. The portion of the Recirculation system outside the containment sphere is effectively an extension of the boundary of the containment. The measurement of the recirculation loop leakage ensures that the calculated EAB 0-2 hr. thyroid dose does not exceed 10 CFR 100 limits.

The trisodium phosphate stored in storage racks located in the containment is provided to minimize the possibility of stress corrosion cracking of metal components during operation of the ECCS following a LOCA. The trisodium phosphate provides this protection by dissolving in the sump water and causing its final pH to be raised to 7.0 - 7.5. The requirement to dissolve trisodium phosphate from one of the sample storage racks in distilled water heated and borated, to the extent recirculating post LOCA sump water is projected to be heated and borated, provides assurance that the stored trisodium phosphate will dissolve as required following a LOCA. The sample storage racks are sized to contain 0.5 pounds of trisodium phosphate. Trisodium phosphate stored in the sample storage racks has a surface area to volume ratio of 1.33 whereas the trisodium phosphate stored in the main racks has a surface area to volume ratio of 1.15.

Visual inspection of the non-redundant piping in the Containment Spray System provides additional assurance of the integrity of that system.

REFERENCES:

(1) Final Engineering Report and Safety Analysis, Paragraph 5.1.

(2) "San Onofre Nuclear Generating Station", report forwarded by letter dated December 29, 1971 from Jack B. Moore to Director, Division of Reactor Licensing, USAEC, subject: Emergency Core Cooling System Performance, San Onofre Nuclear Generating Station, Unit 1.

(3) USAEC Safety Evaluation of ECCS Performance Analysis for San Onofre Unit 1, forwarded by letter dated March 6, 1974 from Mr. Donald J. Skovholt to Mr. Jack B. Moore.

(4) Letter, K. P. Baskin, SCE, to D. M. Crutchfield, NRC, dated October 16, 1981.

This Page Intentionally Left Blank

This Page Intentionally Left Blank