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Director, Office of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Gentlemen:

Subject: Docket No. 50-206
Design Detail Information
San Onofre Nuclear Generating Station
Unit 1

By letter dated October 6, 1980 we committed to provide the NRC staff with the design details for the automated auxiliary feedwater system which will be installed as part of the TMI Lessons Learned Requirements. By letter dated October 9, 1980 we committed to provide the design details for the reactor coolant system vents, also to be installed as part of TMI Lessons Learned Requirements. Accordingly, the required information is provided in Enclosures 1 and 2.

It should be noted that the information provided in this submittal supersedes the information provided in our letter dated June 10, 1980.

If you have any questions or desire additional information please contact me.

Very truly yours,

K P Baskin

Enclosures

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ENCLOSURE 1
AFWS DESIGN DETAILS
SAN ONOFRE UNIT 1

I. Introduction

The Auxiliary Feedwater System (AFWS) will be modified to achieve automatic initiation of both the turbine and motor driven pumps, remote flow control capability and redundant pump discharge trains. The proposed system is shown on enclosed drawing SK-10-14-80.

II. System Description

The steam driven pump (G-10) will be provided with all automatically operated valves required to start the turbine. A pneumatically operated on-off valve (CV 3201) will be installed downstream of existing pressure reducing valve (CV 113), in line 69-3-EG. The existing manual valve will be retained. Isolation valves are provided to allow maintenance on the pneumatic valve. A orificed continuous drain and an intermittent drain controlled by a solenoid valve (SV 3211) are provided upstream of CV 3201. An orificed bypass controlled by solenoid valve SV 3200 or a manual valve is provided for turbine warm-up. The turbine drains are orificed continuous drains and are routed down to a sump. In parallel with these drains solenoid valves (SV 3202, SV 3203, and SV 3204) are provided in lines routed out of the turbine building. This arrangement allows high rate draining during turbine warm-up and also provides a turbine drain system without water pockets.

A pump cooling water supply is controlled by solenoid valve SV 3205. At the suction of pump G-10, a fire water connection for back-up cooling water is provided.

On the discharge of motor driven pump G-10S, a motor operated discharge valve (MOV 1202) will be installed. On the discharge of the turbine driven pump G-10, a pneumatically operated valve (CV 3203) will be installed. Pump G-10S also has a motor operated valve (MOV 1204) discharging to the main feedwater line downstream of feedwater heater E-6B. Individual discharge lines 397A-4"-EG and 381A-4"-EG are provided from the pumps to the control valve manifold. At the control valve manifold each discharge line splits into three lines. Each of the six lines is provided with an isolation valve and a check valve. The six lines are then recombined into three lines 381A-3"-EG, 381B-3"-EG, and 381C-3"-EG so that both pumps are capable of providing flow to each steam generator. Each of the three lines has a flow element (FE 3453, FE 3454, and FE 3455) to provide flow indication in the control room. Four remotely operated control valves (FCV 3300, FCV 3301, FCV 2300, and FCV 2301) are provided in the three lines. The valves are arranged so that lines 381A-3"-EG and 381C-3"-EG each have one valve, and that line 381B-3"-EG has two valves.

Downstream of the control valves, check valves and isolation valves are provided in each line. The lines are then connected to the three main feedwater lines.

The system design and materials will meet the original system design specifications and code.

III. System Operation

A. Automatic Initiation Logic

The AFWS has the capability to be initiated automatically or remote manually from the Main Control Room (MCR). Local manual control capability of the system is retained. Automatic initiation is based on a low steam generator level signal processed from the newly installed level transmitters associated with each of the steam generators.

In order to avoid any spurious and unwanted actuations, the automatic initiation logic will be based on a two out of three (2/3) low level signal logic. Remote manual initiation is accomplished by manual actuation of a control switch in the MCR. Appropriate indication and annunciation is provided in the MRC when automatic or manual initiation of the AFW system occurs. In addition, remote control capability to operate components of the system from the MCR are provided.

The AFWS consists of independent and redundant pump and valve trains providing AFW flow to the steam generators. The automatic initiation signals and circuits are designed such that a single failure will not result in the loss of AFWS function.

Each of the automatic initiating circuits which are powered from station vital power sources receives independent signals from the level transmitters associated with each of the steam generators. The level transmitters supply signals to the logic rack installed in the MCR area, where a low level signal and a 2/3 logic is developed. A control board in the MCR provides monitoring and manual control capability of the system. When the steam generator low level signal through 2/3 logic is initiated, the operator will be informed through appropriate status indication and annunciation in the MCR. However no operator action is required to initiate flow since the system is automatically initiated. AFW flow to each of the steam generators is controlled remote manually by throttling the AFW flow control valves. Appropriate annunciation is provided alerting the operator that the system has been automatically initiated and that flow to the steam generators should be throttled by the operator. The logic is designed such that once the automatic signal is initiated, actuation will occur and the system will remain in the actuation mode until the system is reset when the steam generators achieve normal level. In case the automatic system fails, a system level manual initiation will achieve the same function. This system level manual and automatic initiation capability is independent of individual component control capability from the MCR.

B. Motor Driven Pump

The motor driven pump G10S and motor operated control valve MOV-1202 are designed to operate automatically upon receipt of the automatic initiation signal. When the system is in the auto mode, upon receipt of the auxiliary feedwater acutation signal, the pump will start automatically and open the discharge control valve MOV-1202. This introduces the auxiliary feedwater flow into the steam generators through the pre-positioned flow control valves without any operator intervention. The pump and the discharge valves are powered from the emergency buses and are part of simultaneous or sequential loading under postulated conditions. Under a loss of power (LOP) condition, the pump will trip and the valve will fail as is. Upon resumption of power, the pump will automatically start after a 20-second time delay if the demand is present. The valve will remain in its last position and thus, flow will resume as the pump builds speed. Under the condition SIS occurs simultaneously with LOP, the 20-second time delay provides sequential loading of the pump on the emergency buses.

If manual control is required, the operator can select the manual operating mode from the auxiliary feedwater panel. In this mode, the system will remain operating without change. However, the operator can start or stop the pump and/or open or close the MOV 1202 manually.

The pump is provided with a pump suction pressure sensor to trip the pump in the event of low suction pressure. The pump is tripped when in the automatic mode and a low suction pressure signal is present for longer than 20 seconds.

C. Steam Driven Pump

The steam driven pump G10, turbine control valves, and pump discharge control valves CV-3213 are designed to operate automatically on demand of the auxiliary feedwater initiation signal. When the system is in the auto mode and in receipt of the auxiliary feedwater actuation signal, the following events will occur:

- The lube oil cooler water supply valve is opened to provide cooling water to the pump, simultaneously;

- The main steam drain valves are opened for ten seconds to drain the condensate out of the main steam line. After the line has had ten seconds to drain, the valves are automatically closed, then;

- The main steam bypass valve (mounted in parallel with the main steam valve) is opened to preheat the turbine. After a sufficient preheat period, the main steam valve is opened at a controlled rate.

- Once the main steam valve is opened, the drain valves on the turbine steam chest are closed and the steam turbine is operated at full power under governor control. Positive position indication is provided on all valves to provide valve position on the auxiliary feedwater control panel in the main control room. A position switch is also provided at the steam speed governor control station. This switch will alert the operator in the event that the turbine has tripped on overspeed.

- After the main steam valve is fully opened, the pump discharge valve CV 3213 is opened. This will start the auxiliary feedwater flow to the steam generator through the prepositioned flow control valves.

For the turbine driven pump train the operator can select the manual operating mode from the auxiliary feedwater panel. In this mode, the system will remain operating with no change until the operator takes deliberate action. Once the system has been placed in the manual mode, the operator can start or stop the pump in an automatic time sequence or he can manipulate any of the seven valves manually. The pump is provided with a pump suction pressure sensor to trip the pump in the event of low suction pressure. The pump is tripped when in the automatic mode and a low suction pressure signal is present for longer than 20 seconds.

Additional manual backup is provided locally at the pump. All valves have been provided with manual override or separate manual bypass valves.

The operation of the steam driven pump and associated valve train is independent of offsite or onsite AC power.

IV. Flow Indication and Control

Flow indication and control is included on the auxiliary feedwater panel to provide the operator process feedback information for manual operation of the four (4) remote manual control valves. Two parallel flow transmitters are connected to a single orifice plate for flow measurements. Each of the three headers is provided with flow indication to the steam generators upstream of the flow control valves. This allows the operator to monitor and control the flow to each of the steam generators over a flow range of 30-300 gpm. This flow indication is provided with a backup from steam generator level indication (also on the auxiliary feedwater panel). For train separation, all three flow indicators are on one flow train and level indicators are placed on the redundant train. Thus, in the event that a single train is lost, the status of the steam generators will be provided to the operator on the auxiliary feedwater panel in the main control room area.

The four (4) auxiliary feedwater flow control valves are divided into two redundant trains, thus with a single failure in one train, the other train will control the remaining two flow control valves. This allows flow to continue to at least one of the three steam generators. In addition, the valves can be operated locally (and local steam generator level indication is provided).

V. Alarm Logic

Alarms for both trains are provided on the auxiliary feedwater panel to alert the operators if any components are not in their preset ready position. Additional alarms are provided for the positive position indication of four auxiliary feedwater control valves. If the valves are not in their preset position prior to automatic initiation, annunciation in the main control room will warn the operator of this condition.

VI. Periodic Testing

The automatic system is designed with on line testing capability. In order to avoid unnecessary component operation during periodic testing, the operator is able to test the initiation logic without actuating the pump or valves by means of the auto/manual control switches on the auxiliary feedwater panel. Whenever the system is disabled even for testing, annunciation is provided to indicate that the system is not in automatic initiation mode. If, however, during the testing phase, the automatic system is initiated from real process conditions, the operator will receive an alarm. He can either place the system back to the automatic mode or he can start the system in the manual mode. Flow indicators and steam generator level indicators can be tested by providing simulated signals through the test equipment with the final drive elements disabled.

ENCLOSURE 2
RCS VENTING SYSTEM DESIGN DETAILS
SAN ONOFRE UNIT 1

I. Introduction

The Reactor Coolant System Vents (RCSV) are designed to vent noncondensible gases from the reactor head, hot legs A and B, and the pressurizer. The proposed system is shown on enclosed drawing SK-7-15-80.

II. System Description

The reactor vessel head is provided with redundant sets of vent and block valve combinations. The configuration consists of two parallel block valves (SV 2401 and SV 3402) in series with two parallel vent valves (SV 2401 and SV 3401). The pressurizer venting system similarly consists of two parallel block valves (SV 2404 and SV 3404) in series with two parallel vent valves (SV 2403 and SV 3403). This arrangement provides direction of vented gases from the reactor head and the pressurizer either to the pressurizer relief tank or directly to the containment.

All the valves are solonoid operated with positive position indication provided in the main control room (MCR). Although not required per the lessons learned requirements, each venting location is provided with redundant valves to assure venting when desired as well as to avoid undesired possibility of a valve being stuck open.

Each set of block and vent valves is powered from redundant emergency power buses (vital A.C.). The reactor head venting system valves SV 2402 and SV 3402 and pressurizer venting valves SV 2404 and SV 3404 are powered from vital AC derived from DC bus 1, whereas valves SV 2401 and SV 3401 associated with the reactor head venting and valves SV 2404 and SV 3404 associated with the pressurizer venting are powered from vital AC derived from DC bus 2. This powering arrangement will always assure opening and closing of the vent lines when desired.

The valves are qualified to the latest regulatory and industry standards requirements and their qualification is on file.

As required by NUREG-0578, as clarified, leakage detection must be sufficient to identify the leakage through the vent system. Since the system design includes positive position indication for each vent valve and the leakage path is either to other closed systems or directly to the containment, leakage through the vent systems can be identified as described in Section 3.1.4 of the San Onofre Unit 1 Technical Specifications.

III. System Operation

The RCSV is designed to limit flow to less than 90 gpm. This design allows the venting of approximately 42,000 SCFH. This is the amount of H_2 produced during the first 48 hours following an accident, assuming 17% core metal-water reaction per Westinghouse report WCAP-9636.

To eliminate inadvertent operation, the system design requires that the operator first energize the valve train then separately open each vent and block valve. Thus three separate operations are required to accomplish venting. The operator also has a choice of directing the vented gases either to the pressurizer relief tank or directly to containment. The use of the pressurizer relief tank allows the operator to test the system or make small releases without venting coolant directly to containment. Additionally, since the tank has a rupture disk set at 7 psi, this route can also be used to vent to containment should the other block valve fail. The vent path to containment includes a 10" diameter flash pot to separate liquid and vapor.