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June 22, 1979

Director of Nuclear Reactor Regulation
Attention: Mr. D. L. Ziemann, Chief
Operating Reactors Branch #2
Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

REGULATORY DOCKET FILE COPY

Gentlemen:

Subject: Docket No. 50-206
Systematic Evaluation Program
San Onofre Nuclear Generating Station
Unit 1

In response to Mr. R. Snaider's telephone request on May 4, 1979, for information pertaining to Systematic Evaluation Program (SEP) Topics III-12, Environmental Qualification of Safety-Related Equipment and VI-3, Containment Pressure and Heat Removal Capability, the following information is offered. The majority of this information is taken from our report "Containment Post Accident Pressure Reanalysis" forwarded to the NRC by letter dated January 19, 1977.

The containment is a sphere with mean radius of 70 feet. The containment sphere free volume is 1.21 x 10^6 cubic feet.

The containment passive heat sinks are listed in Table 3, page 1-11 through 1-14 of the Containment Post Accident Pressure Reanalysis report.

The initial containment conditions used in the post accident pressure reanalysis were:

a. Temperature = 120°F
b. Pressure = 14.7 psia
c. Relative humidity = 100%

Containment spray is initiated on Safety Injection System actuation signal and 10 psig containment pressure. The containment spray pumps (refueling water pumps) are part of the second group of equipment to be loaded onto the diesel/generator. Therefore, the pumps are loaded onto the diesel at 20 seconds after a loss of coolant accident coincident with a loss of offsite power (LOCA/LOP). By 21 seconds, the pumps are running and coming up to speed.

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At 44.1 seconds after LOCA/LOP, the spray header is filled (assuming one spray pump is operating). An additional 4.2 seconds (48.3 seconds total) is required for the spray to fall from the header to the operating deck. Since the spray pumps cannot be operated from diesel power earlier than 20 seconds, the time to activate the spray system, instrument lag time and the time to open the spray isolation valves are not significant (all are completed in much less than 20 seconds).

The containment spray flow rate varies with containment pressure and RWST water level. The minimum value is 1080 gpm with the RWST empty, containment pressure at 46.4 psig and one spray pump operating. The minimum flow rate with two pumps operating is 1300 gpm with the RWST empty and 46.4 psig containment pressure. The spray water temperature is assumed to be 80°F, the ambient temperature of the RWST.

The spray system heat exchanger (recirculation heat exchanger) is a shell and U-tube type with a heat transfer area of 595 square feet. The design overall heat transfer coefficient for the heat exchanger is 335 BTU/hr-°F- ft^2. The recirculation heat exchanger is cooled by component cooling water at 73.7°F and 1000 gpm flow rate.

The containment fan coolers operate continuously during normal operation. The heat removal rate (design) is 7.5×10^4 BTU/hr for each of the four Containment Sphere Cooling and Filtering System Units and 5×10^5 BTU/hr for each of three Air Conditioning System units. Since turbine plant cooling water is required, no credit is taken for their heat removal capability. The containment has no other heat removal systems for which credit is taken.

The Containment Post Accident Pressure Reanalysis report, previously mentioned, contains mass/energy release rate information for large break LOCA. That table is attached. No mass/energy release rate data is available for a Main Steam Line Break or small break LOCA.

The list below provides additional information, as requested.

1. Rated reactor power is 1347 MW_t.

2. Steam flow rate at full power is 5.7×10^6 lb/hr at 710 psia and 0.25% moisture.

3. The fluid mass in each steam generator is:

   29,673 lb at full power
   69,128 lb at hot shutdown.

4. The fluid energy in each steam generator is:

   14.6×10^6 BTU at full power
   34.1×10^6 BTU at hot shutdown.

5. The steam line flow area is 2.66 ft^2.

6. The main steam line isolation valves (24"-600-27BG) are manually operated. Therefore, the normal means for main steam line isolation is by the turbine stop valves. The stop valve closure time is approximately 0.25 seconds.

7. Since the main steam lines are manually isolated using valves 24"-600-27BG, credit for these valves is not taken. The volume of unisolatable steam was assumed to be the volume of the steam lines from the steam generators to the turbine stop valves and included unisolatable tributary lines larger than 2". The steam volume was calculated to be approximately 2030 ft^3.

8. If a turbine stop valve fails to close, the next closed valves are the turbine control valves. The turbine stop valves are adjacent to the turbine control valves. The volume of steam between these valves is negligible.

9. The main feedwater line flow area is 0.52 ft^2. This area is for lines 391-10"-EG, 392-10"-EG and 393-10"-EG. These are the main feedwater lines inside containment.

10. The main feedwater enthalpy is calculated to be 394.4 BTU/lb at the exit of the first point (high pressure) feedwater heater at maximum warranted steam flow.

11. The main feedwater lines are isolated by the main feedwater regulator valves. Their closure times were measured to be:

FCV 456	9.0 sec.
FCV 457	10.5 sec.
FCV 458	12.5 sec.

There is a redundant feedwater isolation valve immediately upstream of the FCVs listed above. However, these valves do not automatically isolate from any signal; operator action is required. The closure times of these valves were measured to be:

MOV 20	50 sec.
MOV 21	50 sec.
MOV 22	51 sec.

The next isolation valves with automatic action are HV 852A and HV 852B. These valves close in 5 seconds on SIAS to divert flow from the feedwater pumps to the primary system (safety injection).

12. The mass of feedwater between the steam generators and the first isolation valves is calculated to be approximately 242 ft^3 and its temperature is 417°F at maximum warranted steam flow.

13. MOV 20, MOV 21 and MOV 22 are immediately upstream of FCV456, FCV457 and FCV458. Therefore, the additional feedwater volume between these valves is negligible.

The feedwater volume between the FCVs and HV 852A and HV 852B is calculated to be approximately 1872 ft^3. This includes the feedwater in the 1st point (high pressure) feedwater heaters. The feedwater temperature at the exit of the 1st point heater is approximately 417°F. The feedwater temperature into the heater is approximately 340°F. The latent heat in the 1st point heater, which would continue to heat feedwater after extraction steam is terminated, cannot be easily determined. Therefore, it in conservative for this analysis to assume all the feedwater leaving the 1st point heater is at 417°F.

14. On SIAS, the feedwater system is isolated from the steam generators by automatic closure of FCV456, FCV457, FCV458, HV 852A and HV 852B and the feedwater pumps are used for safety injection to the primary system. Without loss of off-site power, the maximum time to isolate the feedwater system from the steam generators is 12.5 seconds, the closure time of FCV458 and assuming failure of either HV 852A or HV 852B to close. With loss of off-site power, the feedwater pumps would trip. The diesel generator would start and be available at 10 seconds. The FCVs receive dc power and will close on SIAS, regardless of the status of off-site power. Therefore, the steam generators would be open to the feedwater system for 12.5 seconds and the feedwater pumps would not be operating during most of this time.

15. The auxiliary feedwater system is manually initiated. The motor operated auxiliary feedwater system can be placed in operation in approximately 2 to 3 minutes. The steam driven system requires approximately 9 to 10 minutes.

16. The auxiliary feedwater system delivers 235 gpm from the motor driven pump and 300 gpm from the steam driven pump. The auxiliary feedwater temperature is nominally 80°F.

17. The safety injection system (core flooding system) begins to inject water at 20.7 seconds after a LOCA.

18. The fluid mass in the reactor system at full power is 298,060 lb. Assuming the same volume of water at hot shutdown (conservative), the mass is calculated to be 317,000 lb.

19. The energy in the reactor system at full power, based on the above mass and a temperature of 575°F, is calculated to be 174.45×10^6 BTU. The energy at hot shutdown, based on the above mass and a temperature of 535°F, is calculated to be 168×10^6 BTU.

20. The hot leg flow area is 2.77 ft^2 (lines 5001-27.5"-2501R, 5007-27.5"-2501R and 5012-27.5"-2501R). The cold leg flow area for lines between the steam generators and reactor coolant pumps (5005-29"-2501R, 5009-29"-2501R and 5015-29"-2501R) is 3.09 ft^2. The cold leg flow area for lines between the reactor coolant pumps and reactor pressure vessel (5006-27.5"-2501R, 5010-27.5"-2501R and 5017-27.5"-2501R) is 2.77 ft^2.

21. The safety injection (core flooding) flow rate is 44.9 ft^3/sec. (maximum pumped safety injection for two trains) at an assumed 80°F, RWST water temperature.

22. The sensible heat in the core and reactor system metal above 240°F at full power is:

Core stored = 13.71 x 10^6 BTU
Thin metal = 12.06 x 10^6 BTU
Thick metal = 15.27 x 10^6 BTU
Steam generator = 131.58 x 10^6 BTU (For all three steam generators including secondary water).

23. The hot and cold leg temperatures are assumed to be 603.3°F and 557°F, respectively, at the start of the transient. This includes a +4°F allowance for instrument dead band and error.

If you have any questions concerning this information, please let me know.

Very truly yours,

J. G. Haynes/DHP

J. G. Haynes
Chief of Nuclear Engineering