SMUD
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June 30, 1982

DIRECTOR OF NUCLEAR REACTOR REGULATION
ATTN DARRELL G EISENHUT DIRECTOR
DIVISION OF LICENSING
U S NUCLEAR REGULATORY COMMISSION
WASHINGTON D C 20555

DOCKET 50-312
RANCHO SECO NUCLEAR GENERATING STATION
UNIT NO 1
NUREG 0737 ITEM II.D.1 RELIEF AND SAFETY VALVE TESTING

The following information is submitted as the plant-specific response for pressurizer relief and safety valve testing related to the Rancho Seco Nuclear Generating Station, Unit No. 1, as required by NUREG 0737, Item II.D.1 as revised on September 29, 1981.

As indicated in the Rancho Seco preliminary response of April 1, 1982, the following documents have been submitted to you by Mr. David Hoffman of Consumers Power Company on behalf of the participating PWR utilities and are incorporated by reference as part of this response:

a) Valve Selection/Justification Report;
b) Test Condition Justification Report;
c) B&W Plant Condition Justification Report;
d) Safety and Relief Valve Test Report;
e) Discharge Piping Load Model Report.

Additionally, on June 1, 1982, R. C. Youngdahl of Consumers Power Company submitted the "EPRI PWR Safety and Relief Valve Test Program, PORV Block Valve Information Package", May, 1982. As indicated in that submittal, this satisfies NUREG 0737, Item II.D.1.B.

A046

At the present time, Teledyne Engineering Services (TES) is under contract with the Sacramento Municipal Utility District to perform the safety and relief valve analysis for Rancho Seco. Attachment I to this letter is the preliminary TES schedule for performing the analysis. As indicated on the schedule, the start date will be the date that TES receives the piping system as-built drawings. SMUD is currently verifying the piping system layout and support locations for this task. We anticipate the as-built piping submittal to TES to occur in the first week of July 1982. Attachment II to this letter is the preliminary assessment of the Rancho Seco Safety and Relief Valves.

As noted, the final assessment requires that the inlet and outlet pressure drops be analyzed by TES. Babcock & Wilcox (B&W) is also under contract with SMUD through the B&W Owners Group to analyze the effects of the increased safety valve blowdown observed in the tests. B&W's preliminary information indicates that the maximum acceptable blowdown value will be greater than that observed in the tests.

The necessity for any piping and/or support modifications will be determined from the output of the thermal-hydraulic analysis. If any changes are necessary, SMUD will inform the NRC of the specific schedule when the thermal-hydraulic analysis is complete.

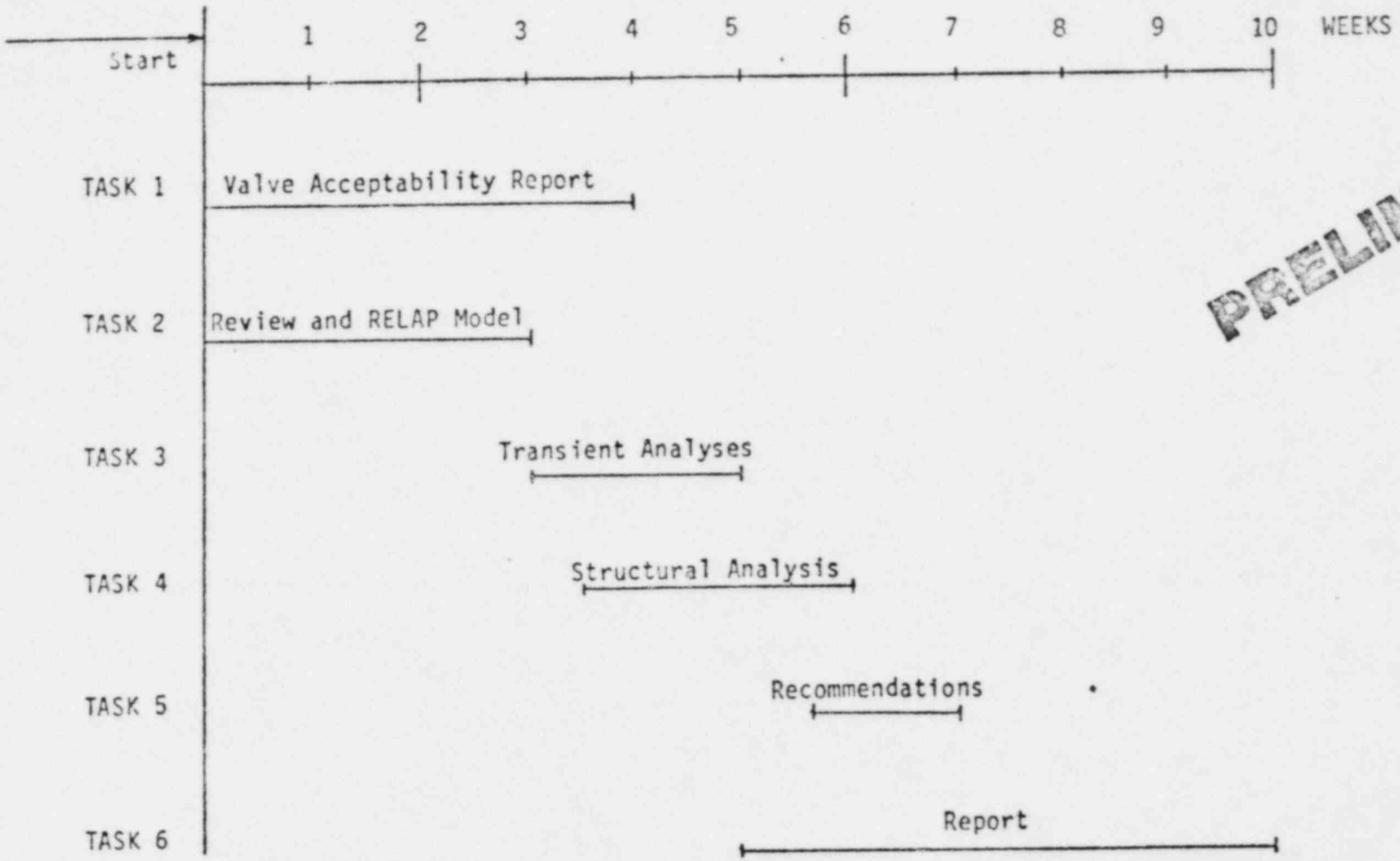
As indicated in our letter of June 4, 1982, we do not expect to have our complete report available for your review until the end of the year. If there is any additional information we can provide at this time, please advise.

John J Mattimoe

John J. Mattimoe
Assistant General Manager
and Chief Engineer

Attachments

SCHEDULE



PRELIMINARY

Note: Committed start date is the date complete as-built dimensions for pressurizer relief system are received by TES Document Control

ATTACHMENT 1

TELEDYNE ENGINEERING SERVICES

ATTACHMENT II

TELEDYNE ENGINEERING SERVICES

PRELIMINARY PLANT SPECIFIC EVALUATION SAFETY AND RELIEF VALVE INSTALLATION RANCHO SECO NUCLEAR POWER PLANT PROJECT 5704

The following submittal is Teledyne Engineering Services preliminary evaluation of the Safety and Relief Valve Installation at the Rancho Seco Nuclear Power Plant. This submittal is limited in scope and perspective because two of the key parameters to safety valve and relief valve evaluation are unavailable at this time. The parameters are inlet piping pressure drop and discharge piping back pressure. At this writing Teledyne does not have available the complete piping documentation and therefore these parameters can not be measured. This will soon be corrected as the date is made available.

It is possible however, to evaluate the EPRI tested valves for the fluid inlet conditions which the Rancho Seco Nuclear Power Plant is subject to (Ref. NSSS Fluid Inlet Condition Report). While the valves of the Rancho Seco type were not tested, valves which are representative of that type were (ref. Valve Justification Report)

This submittal follows the format suggested by the EPRI Guide for application of the valve test program results to plant specific evaluation.

I. DESCRIPTION OF SAVE VALVE INSTALLATION

a. Valve parameters
   1. Two valves
   2. Dresser model No. 31759A
   3. 391,003 lbm/HR ASME rated flow
   4. 3 in., 2500 lbs ANSI Inlet; 6 in. 600 Lbs. ANSI outlet
   5. Set Pressure 2500 psig

b. Inlet Piping Parameters
   1. The valve is mounted on the pressurizer nozzle
   2. There is no loop seal

c. Actuation Transients (Ref. NSSS Fluid Inlet Conditions (See Table 1).

TABLE 1.1 Bounding Safety Valve Inlet Conditions Resulting From FSAR/Reload Events for 177-FA Plants

Limiting Events	Assumed PSV opening setpoints, psig	Possible fluid state on opening	Maximum Pressurizer pressure, psig	Pressurization Rate, psi/s	
				MAX	Min
Rod ejection at HZP	2575	Steam	2662	175	NA

TABLE 1.2 Bounding Safety Valve Inlet Conditions Resulting From Extended Operation of HPI for 177-FA Plants

Limiting Events	Assumed PSV opening setpoints, psig	Possible fluid state on opening[a]	Maximum Pressurizer pressure, psig	Max/Min pressurizer liquid temp. F	Surge Line flow when PSV is passing liquid, lb/min		
					At 400F	At 602F	At 640F
177-FA Plants							
Steam Line break	2500	Steam	2500	602/400	6805	6555	NA
FW line break	2500	Steam	2500	640/602[b]	NA	10400	11520

(a) Initial opening of valve will be on steam. Subsequent openings could possibly be on subcooled liquid.

(b) Without thermal mixing of the surge line liquid with the 650F liquid normally in the pressurizer, the pressurizer safety valves could open of 650F Liquid.

1.1 Description of Relief Valve Installation

a. Valve Parameters

1. One Valve
2. Dresser Model No. 31533VX-30-1
3. 118,909 lbm/HR ASME rated flow
4. 2½ in, 2500 lb. ANSI inlet; 4 in, 600 lb ANSI outlet
5. Set pressure 2450 psig

b. Inlet Piping Parameters

1. The valve is mounted on the pressurizer nozzle
2. There is no loop seal

c. Actuation Transients

(see Table 2.0)

TABLE 2.1 Bounding PORV Inlet Conditions Resulting From FSAR/Reload Events for 177 FA Plants

Limiting Events	Possible Fluid State on opening	Max. pzr Pressure, psig	Max./min. liquid temp. at valve inlet
177-FA Plants			
Rod ejection at HZP	Steam	2662	N/A

TABLE 2.2 Bounding PORV Inlet Conditions Resulting From Extended HPI Operation Following FSAR/Reload Events for 177-FA Plants

Limiting events	Assumed PSV opening setpoints, psig	Possible fluid state on opening[a]	Max. psz pressure, psig	Max. Liquid Temp at valve inlet °F	Min. Liquid Temp at valve inlet °F
177-FA Plants					
Steam Line break	2450	Steam	2500[b]	602	400
FW Line Break [c]	2450	Steam	2500[c]	640[d]	602

(a) Initial opening on steam with possible transition to subcooled water. Subsequent openings possibly on subcooled liquid.

(b) Up to the time of pressurizer fill, the steam relief capacity of the PORV can maintain pressurizer pressure below the PSV lift pressure. When water relief starts, pressurizer pressure would increase to PSV lift setpoint.

(c) Surge flow exceeds the PORV capacity when HPI and system heatup are considered. Valve inlet conditions would be those specified at the PSV lift setpoint of 2500 psig.

(d) Without thermal mixing of the surge line liquid with the 650F liquid normally in the pressurizer the PORV could open on 650F liquid.

TABLE 2.3 PORV Inlet Conditions Resulting From Cold Pressurization Events for 177-FA Plants.

PLANT	Opening/ Closing setpoints, psig	Limiting pressurization event	Possible fluid state at valve inlet	Max. pzs pressure, psig	Max. Liquid Temp at valve inlet °F	Min. Liquid Temp at valve inlet °F
Rancho Seco	550/500	Makeup control valve fails	Sat. Steam @565 psia (a)	550	449	338

(a) Duration of steam relief is 50 seconds followed by 40 to 120 seconds of water relief. The 40 seconds corresponds to depletion of the water in the makeup tank which is the water source. The 120 seconds corresponds to 10 minutes after the event initiation, assuming a different water source for the makeup pump was being used, such as the BWST.

II. RESULTS OF PLANT-SPECIFIC PERFORMANCE EVALUATIONS

2.1 Safety Valve Performance

The Rancho Seco Safety valve must be evaluated by comparison with the Dresser Safety Valve Model 31739A and 31709NA. This comparison is valid (Ref. Valve Justification Report) if the key parameters are the same.

- Valve Ring Setting. Do the ring settings for the plant valve correspond to those specified by the valve manufacturer to obtain similar performance as observed for the test valve.

- Discharge piping backpressure. The plant discharge piping back pressure is not known at this point so a comparison cannot be made.

- Inlet piping pressure drop. The valves are mounted directly on the pressurizer nozzle therefore the inlet pressure drop is not a factor.

- The inlet fluid conditions for the Rancho Seco plant are covered by the EPRI Tests.

2.2 Dresser Safety Valve Model 31739A (Short Inlet Configuration)

Steam Test.

1. Valve behaved in a stable manner
2. Valve opened within $\pm$ 3% of the design set pressure.
3. Rated flow was obtained at 6% accumulation after adjustment to ring setting.
4. Blowdown exceeded 5%

Transition Test

During the high back pressure, steam to water transition test, the valve opened within ±3% of the valve design set pressure, had stable performance and closed with 19% blow down.

Water Tests

Three high back pressure water tests were performed at water temperatures of 650, 550 and 400°F. The valve had stable behavior for all of the tests. During the 650°F water test, the valve opened within ±3% of design set pressure and closed with 16.7% blowdown.

For the 550° water test, the valve opened at 2387 psia and closed with 12.2% blowdown. During the 400°F water test, the valve opened to a partial lift position within 3% of design set pressure. The system pressure continued to accumulate while the valve remained in a partial lift position. The test was terminated when the tank 1 pressure reached 2750 psia.

2.3 Dresser Safety Valve Model 31709NA (Short Inlet Configuration)

Steam Test

1. Valve behaved in a stable manner
2. Valve opened within ±3% of set pressure
3. Rated flow acheived at 6% accumulation
4. Blowdown ranged from a maximum of 14.1% to a minimum of 7.5%

Transition Tests

Two steam-to-water transition tests with an intermediate back pressure (approximately 400 psia) were performed using the highest and lowest middle ring setting of the steam tests. For both tests, the valve opened within ±3% of the valve design set pressure and exhibited stable performance. The valve blowdown ranged from 16.9% to 18.4%.

Water Tests

Four water tests were performed with an intermediate back pressure at water temperatures of 650, 550 and 400F.

During the two 650° water tests which used the highest and lowest middle ring settings of the steam tests, the valve opened at system pressures of 2394-2412 psia and exhibited stable performance. Valve blowdowns ranged from 16.2 to 22.5%.

The two subsequent water tests (550, 400°F) were performed using the highest middle ring setting. For both tests, the valve opened at a system pressure within ±3% of the valve design set pressure. During the 550°water test, the valve opened, had stable behavior and closed with 3.9% blowdown.

During the 400°F water test, the valve opened at 2558 psia and exhibited five partial lift cycles over a period of three seconds. The valve then opened and chattered. Three seconds later in the transient, the valve stopped chattering without manual actuation and then closed. Closing pressure is not available. After the transient, a steam leakage test was attempted. At a system pressure of 2200-2300 psia, the valve partially opened at which point the leak test was terminated.

2.4 Safety Valve Conclusions

1. Adjustments were made to the rings setting of both tested safety valves in order to achieve rated flow. It is most likely that ring setting adjustments must be made to the Rancho Seco valve. Dresser Industries must be consulted for this adjustment.

2. Discharge Piping Back Pressure calculations must be made to properly evaluate ring settings. This will be done as part of the discharge piping analysis.

3. Stable behavior observed on all tests except the 400°F water test for the Model 31709NA. The valve did, however, close on its own.

4. The tested valves all opened within ±3% of the set pressure and achieved rated flow within 6% accumulation. The Rancho Seco technical specification calls for the valve to open at ±1% of the set pressure and rated flow at 3% accumulation. None of the tests exceeded 10% over pressure in the pressure vessel (maximum ASME Code allowable).

5. All blowdowns exceeded the ASME 5% criteria . The maximum blowdown occurred for the 31709NA valve on the 650°F water tests resulting in a system pressure of 1945 psig. This is still above the 1600 psia HPI initiation setpoint.

6. The 31739A valve did not relieve the 400°F subcooled transient and the test was stopped when the tank pressure reached 2750 psia. However, the measured flow at 2750 psia exceeded the 6805 lbm/min required for the steam line break transient.

2.5 Relief Valve Performance

The Rancho Seco valve was not tested in the Marshall Steam Station, Wyle Phase II or Wyle Phase III tests. However, a Dresser 31533VX-30 with a 1-5/16" bore was tested. The only difference between these two valves is the bore size.

Marshall Steam Station Test

The valve was subjected to eleven (11) steam tests, 2500 psi set pressure with varying back pressures up to 900 psig. The valve fully opened and closed on demand for each cycle.

Wyle Phase II

The Phase II tests consisted of five cases which included 2500 psi 646, 506, and 447 water. These are applicable to the Rancho Seco Steam line break and F.W. line break subsequent openings. The valves fully opened on demand and fully closed on demand for each of the five tests.

Wyle Phase III

The Wyle Phase III tests consisted of twelve tests covering steam, water, steam water transition and loop seal simulation. With the exception of the loop seal simulation tests the valve opened and closed on demand. The loop seal simulation tests are not applicable to the Rancho Seco installation.

The single steam to water transition test was performed at 2500 psi. The Rancho Seco Steam to Water transition case occurs at 565 psia. (Makeup control valve fails open) Therefore, the transition test case is not directly

applicable. However, tests 12-DR-3W and 14-DR-2W were performed on subcooled water at 699 psia and 450°F; and 689 psia and 112°F respectively. These tests should adequately cover the transition tests.

Conclusion

A Dresser PORV 31533-VX-30-2 with the same inlet and outlet sizes and the same internals as the Rancho Seco valve opened and closed on demand for all applicable tests. It is reasonable to assume that the Rancho Seco valve will perform as specified.

III. INLET AND DISCHARGE PIPING ADEQUACY

Teledyne Engineering Services has been contracted to perform this analysis.

Teledyne will be using the RELAP 5 MOD 1 computer program with the EPRI suggested guide lines to perform the fluid analysis.

The structural analysis will be performed using the TMRSAP program which is a TES modification of SAP IV.

IV. REFERENCES

1. Safety and Relief Valve Test Reports

2. Valve Selection/Justification Report

3. Plant and Test Conditions Justification Report

V. APPENDICES

When the analysis is complete this appendix will contain:

1. A summary of the report from the valve manufacturer which justifies the ring settings.

2. A summary of the report on the fluid analysis

3. A summary of the report on the discharge piping loads and stresses.

4. A schedule for evaluation and implementation of modifications (if required).

5. A summary of the report by the NSSS vendor which justifies the acceptability of the existing system or modification selected for implementation.