3.4 STEAM AND POWER CONVERSION SYSTEM

Applicability

Applies to the operability of the turbine cycle during normal operation and for the removal of decay heat.

Objective

To specify minimum conditions of the turbine cycle equipment necessary to assure the required steam relief capacity during normal operation and the capability to remove decay heat from the reactor core.

Specification

3.4.1 The reactor shall not remain above 280F with irradiated fuel in the pressure vessel unless the following conditions are met.

107> 3.4.1.1 Capability to supply feedwater to at least one steam generator from at least one of the following means. <

A. A condensate pump and a main feed pump, or

B. A condensate pump or

C. An auxiliary feedwater pump.

107>< The required flow rate is 760 gpm at less than 120°F.

3.4.1.2 Two steam system safety valves are operable per steam generator.

3.4.1.3 The turbine bypass system to the condenser shall have one valve operable or the atmospheric dump system shall have a minimum of 1 of 3 valves operable per steam generator.

3.4.1.4 A minimum of 250,000 gallons of water shall be available in the condensate storage tank.

3.4.2 In addition to the requirements of 3.4.1, the reactor shall not remain critical unless the following conditions are met:

3.4.2.1 Seventeen of the eighteen main steam system safety valves are operable.

3.4.2.2 When two independent 100% capacity auxiliary feedwater flow paths are not available, the capacity shall be restored within 72 hours or the plant shall be placed in a cooling mode which does not rely on steam generators for cooling within the next 12 hours.

3.4.2.3 When at least one 100% capacity auxiliary feedwater flow path is not available, the reactor shall be made subcritical within four hours and the facility placed in a shutdown cooling mode which does not rely on steam generators for cooling within next 12 hours.

Bases

The feedwater system and the turbine bypass system are normally used for decay heat removal and cooldown above 280 F. Feedwater makeup is supplied by operation of a condensate pump and main feedwater pump. In the event of complete loss of electrical power, feedwater is supplied by a turbine driven auxiliary feedwater pump which takes suction from the condensate storage tank. Steam relief would be through the system's atmospheric relief valves.

If neither main feed pump is available, feedwater can be supplied to the steam generators by an auxiliary feedwater pump and steam relief would be through the turbine bypass system to the condenser.

107→ The auxiliary feedwater system is designed to provide sufficient flow on loss of main feedwater to match decay heat plus Reactor Coolant Pump heat input to ← the RCS before solid pressurizer operation could occur. The requirement for two steam system safety valves per steam generator provides a steam relief capability of over 10 percent per steam generator (1,341,938 lb/h). In addition, two turbine bypass valves to the condenser or two atmospheric dump valves will provide the necessary capacity.

107→ The 250,000 gallons of water in the condensate storage tank is sufficient to remove decay heat (plus RC pump heat for two pumps) for approximately 13 hours. This volume would also allow hot shutdown for approximately 5.5 hours ← with cooldown to DHR system changeover at 50F/hr. (1)

The minimum relief capacity of seventeen steam system safety valves is 13,329,163 lb/hr.(2) This is sufficient capacity to protect the steam system under the design overpower condition of 112 percent. (3)

REFERENCES

107→ (1) B&W Document 32-1141727-00, "Heat Removal Capability of SMUD CST," ← March 1984.

(2) FSAR paragraph 10.3.4

(3) FSAR Appendix 3A, Answer to Question 3A.5

4.8 AUXILIARY FEEDWATER PUMP PERIODIC TESTING

Applicability

Applies to the periodic testing of the turbine and motor driven auxiliary feedwater pumps.

Objective

To verify that the auxiliary feedwater pump and associated valves are operable.

Specification

4.8.1 At least every 92 days on a staggered test basis at a time when the average reactor coolant system temperature is $\geq$305°F, the turbine/motor driven and motor driven auxiliary feedwater pumps shall be operated on recirculation to the condenser to verify proper operation.

The 92-day test frequency requirement shall be brought current within 72 hours after the average reactor coolant system temperature is $\geq$305°F.

Acceptable performance will be indicated if the pump starts and
107> operates for fifteen minutes at the design flow of 760 gpm.

< 4.8.2 At least once per refueling interval:

1. Verify that each automatic valve in the flow path actuates to its correct position upon receipt of each auxiliary feedwater actuation test signal.

2. Verify that each auxiliary feedwater pump starts as designed automatically upon receipt of each auxiliary feedwater actuation test signal.

4.8.3 All valves, including those that are locked, sealed, or otherwise secured in position, are to be inspected monthly to verify they are in the proper position.

4.8.4 Prior to startup following a refueling shutdown or any cold shutdown of longer than 30 days duration, conduct a test to demonstrate that the motor-driven AFW pumps can pump water from the CST to the steam generator.

Bases

The quarterly test frequency will be sufficient to verify that the turbine/motor driven and motor driven auxiliary feedwater pumps are operable. Verification of correct operation will be made both from the control room instrumentation and direct visual observation of the pumps.

The OPERABILITY of the auxiliary feedwater system ensures that the Reactor Coolant System can be cooled down to less than 305 F from normal operating conditions in the event of a total loss of off-site power.

Each electric driven auxiliary feedwater pump is capable of delivering a total
107>< feedwater flow of 760 gpm at a pressure of 1050 psig to the entrance of the steam generators. The steam driven auxiliary feedwater pump is capable of
107>< delivering a total feedwater flow of 760 gpm at a pressure of 1050 psig to the entrance of the steam generators. This capacity is sufficient to ensure that adequate feedwater flow is available to remove decay heat and reduce the Reactor Coolant System temperature to less than 300 F when the Decay Heat Removal System may be placed into operation.

107> The auxiliary feedwater pumps are tested to verify they automatically start as designed upon receipt of each auxiliary feedwater actuation test signal. At least once per refueling interval, the auxiliary feedwater pumps are started on the loss of four Reactor Coolant Pumps signal and also on SFAS initiation. The monthly surveillance test demonstrates proper auxiliary feedwater pump
< response to a low main feedwater pressure signal.

ATTACHMENT III

BWNP-20032A-8 (6-82)

PAGE ____ OF

CONTRACT NO.	PLANT	DOCUMENT RELEASE NOTICE (DRN)
701-7179	SMUD	
CHARGE NO.	RELEASE DATE MAR 29 1983	

PART-MARK/TASK-GROUP-SEQ.	B&W DOCUMENT NO.	DOCUMENT TITLE	SAFETY/NON-SAFETY	PUL STAT.	RRL NO.
~~01-01-001~~	32-1141727-00	HEAT REMOVAL CAPABILITY OF SMUD CST	S	N/A	N/A
TASK 218					
SMUD AWF					
UPGRADE					
PHASE III					

MAR 25 1983

REQUIRED DISTRIBUTION ORGANIZATION OR TE	NO. COPIES CDS	DRN	DOC	INFORMATION COPIES INDIVIDUAL'S NAME	NO. COPIES CDS	DRN	DOC	INFORMATION COPIES INDIVIDUAL'S NAME	NO. COPIES CDS	DRN	DOC
[redacted]		1	1	RT BIANOT		1	1				
				NS GOULDING		1	1				
				DC HOLT		1	1				
				JW KELLY		1	—				
				JE LEMON		1	—				
				WN PRILLAMAN		1	1				
				→ RETURN ORIGINAL							

RELEASED BY: WH Williamson 3/25/83

REVIEWED BY: Rand S Gouldin 3/25/83

CALCULATION DATA/TRANSMITTAL SHEET

DOCUMENT IDENTIFIER

CALC. 32 - 1141727 - 00

TRANS. 86 - _____ - _____

TYPE: ___RESEARCH & DEVELOPMENT ___SAFETY ANALYSIS REPORT ___NUC. SERV. INPUT ✓ DESIGN RQMT. ___DESIGN VERIF. ___OTHER

TITLE HEAT REMOVAL CAPABILITY OF SMUD CST

PREPARED BY W.H. Williamson REVIEWED BY Nigel S Goulding

TITLE PRIN. ENGR. DATE 3/25/83 TITLE Engr II DATE 3/25/83

PURPOSE:

1. DETERMINE THE TIME RANCHO SECO CAN STAY AT HOT SHUTDOWN ON AFN WITH THE MINIMUM AVAILABLE CONDENSATE STORAGE TANK (CST) VOLUME.

2. DETERMINE THE TIME TO COOL THE PLANT TO THE DHS CUT-IN TEMPERATURE WITH MINIMUM AVAILABLE CST.

SUMMARY OF RESULTS (INCLUDE DOC. ID'S OF PREVIOUS TRANSMITTALS & SOURCE CALCULATIONAL PACKAGES FOR THIS TRANSMITTAL)

TIME TO DEPLETE CST, HRS:

TO REMOVE DH ONLY AT HOT SHUTDOWN = ~13 HRS.

TO REMOVE DH PLUS COOLDOWN = ~10.5 HRS.

DISTRIBUTION

R. T. BRANDT
P.M. MYERS
N.S. GOULDING
D.C. HOLT

Babcock & Wilcox
a McDermott company
Nuclear Power Generation Division

GENERAL CALCULATIONS

OBJECTIVE: FOR SMUD

1. DETERMINE THE TIME THE PLANT CAN STAY AT HOT SHUTDOWN WITH THE MINIMUM AVAILABLE STORAGE VOLUMES (DH + RCP HEAT FOR 2 PUMPS MUST BE REMOVED)

2. DETERMINE THE TIME AVAILABLE TO COOL THE PLANT TO THE DECAY HEAT SYSTEM CUT-IN [DH, RCP HEAT FOR 2 PUMPS + SENSIBLE HEAT (533 TO 280 °F) MUST BE REMOVED]

REFERENCES:

1. COMPUTER CODE DEHE, USED TO CALCULATE DH PRODUCED FOLLOWING REACTOR SHUTDOWN (ANS 5.1 x 1.0) CALC. FILE 32-1119527-00

2. PRIMARY SYSTEM SENSIBLE HEAT FOR COOLDOWN USED IS 1.256E6 BTU/°F PER CALC. FILE 32-4125

3. CONDENSATE STORAGE TANK CAPACITY, 32-1127434-00

PREPARED BY WH DATE 3/25/83

DOC. NO.

ASSUMPTIONS:

1. HEAT REMOVAL CAPACITY IS BASED ON SUBCOOLED WATER @ 100°F HEATED TO SATURATED STEAM @ 1065 x 1.01 = 1075 PSIA (MAIN STEAM LINE SAFETY VALVE SETPOINT).

2. RCP COMBINATION IS 1/1 – ONE RCP RUNNING IN EACH LOOP @ 8 MWt ~~EACH~~. TOTAL.

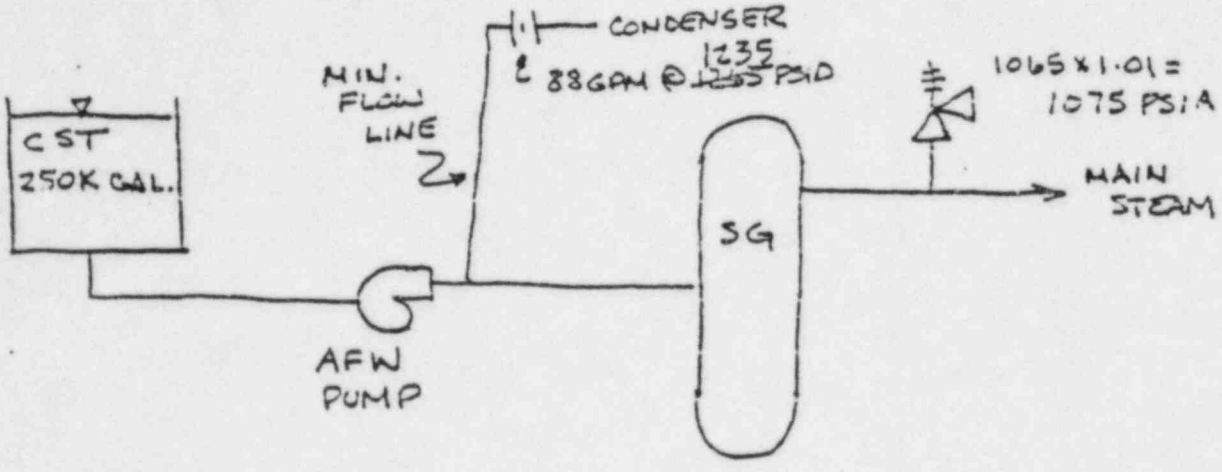
3. MINIMUM AVAILABLE VOLUME IN CONDENSATE STORAGE TANK (CST) AT RANCHO SECO IS 250,000 GALLONS.

4. AFW PUMPS AT RANCHO SECO DO NOT RECIRCULATE BACK TO CST. MINIMUM FLOW IS ROUTED TO CONDENSER. MIN. FLOW = 88 GPM @ 1235 PSID ACROSS ORIFICE.

5. LET TWO AFW PUMPS OPERATE FOR ONE HOUR, THEN THEREAFTER ASSUME ONE AFW PUMP OPERATION.

6. COOLDOWN @ 50°F/HR.

7. DESIGN POWER LEVEL = 2772 MWt x 1.02 = 2827 MWt.



$$Q = w(h_{OUT} - h_{in})\,\rho_{AFW} / 7.48052$$

WHERE Q = POWER LEVEL, BTU/MIN
w = FLOW RATE, GPM
h = ENTHALOY, BTU/lbm
ρ_{AFW} = DENSITY OF AFW, GAL/FT^3 = ~~8.0613~~ 7.48052
v = SPECIFIC VOLUME, FT^3/LBm = ~~7.48052~~ 0.0613

@ 100°F, 14.7 PSIA $h = 68$ BTU/LBm

$t_{SAT} = 553$°F, $P_{SAT} = 1075$ PSIA, $h = 1190.5$ BTU/LBm

$\Delta h = 1190.5 - 68$
$\Delta h = 1122.5$ BTU/LBm

PREPARED BY wmp DATE 3/25/83 DOC. NO.

$$\left(\frac{BTU}{MIN}\right)\left(\frac{GAL}{MIN}\right)\left(\frac{BTU}{LB_m}\right)\left(\frac{FT^3}{GAL}\right)\left(\frac{LB_m}{FT^3}\right)$$

$$Q_{(t)} = W \times \Delta h \times \frac{1}{\rho} \times \frac{1}{\rho}$$

$$W = \frac{Q_{(t)}\,\rho\,\rho}{\Delta h}$$

$$= \frac{Q_{(t)}}{1122.5 \times \frac{1}{7.48052} \times \frac{1}{0.01613}}$$

$$= \frac{Q_{(t)}}{9303}\left(\frac{BTU}{GAL}\right)$$

$$Q_{(t)} = \left(E/P_o \overset{MW-SEC}{\times} \text{CORE POWER}\right) \times 3.41214E6 \frac{BTU}{HR \cdot MW} \times \frac{1}{3600} \frac{HR}{SEC} = BTU$$

FOR COOLDOWN, TO REMOVE SENSIBLE HEAT:

$$Q = MC_p\,\Delta t$$
$$= 1.256E6\,(579 - 280) = 375.5E6\ BTU$$

$$W = \frac{375.5E6\ BTU}{9303\ \frac{BTU}{GAL}} = 40{,}368\ GAL$$

FOR 50°F/HR COOLDOWN RATE

$$W\,(GPM) = \frac{1.256E6\ \frac{BTU}{°F} \times 50\ \frac{°F}{HR}}{1122.5\ \frac{BTU}{LB_m}} \times \frac{1}{60}\ \frac{HR}{MIN} \times 0.01613\ \frac{FT^3}{LB_m} \times 7.48052\ \frac{GAL}{FT^3}$$

$$= 112.5\ GPM$$

PREPARED BY WVP DATE 3/25/83 DOC. NO

FOR 2 RCP OPERATION, 8 MWt IS ADDED TO DECAY HEAT

$$Q = 8\ \text{MWt} \times 3.412141E6 \times \frac{1}{60} = 454{,}952\ \frac{\text{BTU}}{\text{MIN}}$$

$$\omega = \frac{Q\ \frac{\text{BTU}}{\text{MIN}}}{9303\ \frac{\text{BTU}}{\text{GAL}}} = \frac{454{,}952}{9303} = 48.9\ \text{GPM}$$

HRS TIME	E/Po	$Q_{(t)}$ DH (BTU)	GALS EVAP	GALS PUMP HEAT	GALS TO COND.	GALS TOTAL
15	522	1.40E9	150,490	44,010	84480	278,980
14	497	1.33E9	142,960	41,076	79200	263,236
13.2 — 13	471	1.26E9	135,440	38,142	73920	247,502 — 250000
12	444	1.19E9	127,920	35,208	68640	231,768
11	418	1.12E9	120,390	32,274	63360	216,024
10	389	1.04E9	111,790	29,340	58080	199,210
9	361	9.673E9	103,976	26,406	52800	183,182

FOR COOLDOWN

t	DH+2RCP	COOLDOWN	TOTAL GALS.
12	231,768	40,368	272,136
10.6 — 11	216,024	40,368	256,392 — 250000
10	199,210	40,368	239,578
9	183,182	40,368	223,550

TIME TO DEPLETE CONDENSATE STORAGE TANK, HRS:
TO REMOVE DH ONLY AT HOT SHUTDOWN ~ 13 HOURS
TO REMOVE DH PLUS COOLDOWN ~ 10.5 HOURS

FOR 2 RCP OPERATION, 8 MWt IS ADDED TO DECAY HEAT

$$Q = 8\ MWt \times 3.412141E6 \times \frac{1}{60} = 454{,}952\ \frac{BTU}{MIN}$$

$$W = \frac{Q\ \frac{BTU}{MIN}}{9303\ \frac{BTU}{GAL}} = \frac{454{,}952}{9303} = 48.9\ GPM$$

① TIME	② E/P	③ CORE POWER	④ Q= DH (BTU)	⑤ GALS EVAP	⑥ GALS PUMP HEAT	⑦ GALS ~~BOIL-OFF~~ TOTAL	GALS
15	522	2827	1.40E9	150,490	44010	~~73720~~ 84490	278980
14	497	2827	1.33E9	142,960	41,076	79200	263,236
13	471	2827	1.26E9	135,440	38,142	73920	247,502
12	444	2827	1.19E9	127,920	35,208	68640	231,768
11	418	2827	1.12E9	120,390	32,274	63360	216,024
10	389	2827	1.04E9	111,790	29,340	58080	199,210
9	361	2827	9.673E8	103,976	26,406	52800	183,182

MIN. FLOW LOST DURING COOLDOWN = $\frac{533 - 280\ °F}{50\ °F/HR} \times 88\ \frac{GPM}{MIN/HR} \times 60$

= 26,717 gALS.

12 HRS 231,768 + 26,717 = 258,485 + 40,368* = 298853
11 HRS 216,024 + 26,717 = 242,741 + 40,368 = 283,109
10 HRS 199,210 + 26,717 = 225,927 + 40,368 = 266,295
9 HRS 183,182 + 26,717 = 209,899 + 40,368 = 250,267

TIME TO DEPLETE CST, HRS:
TO REMOVE DH ONLY AT HOT SHUTDOWN ~13 HRS
TO REMOVE DH + COOLDOWN ~9 HRS

* 40,368 GALS REQ'D FOR COOLDOWN PER 32-1127434-00

PREPARED BY [illegible] DATE 3/25/83 DOC. NO

ATTACHMENT IV

ECN No. A-3622 REV 2

Sheet 1 of 2

SUS

ENGINEERING CHANGE NOTICE

Prepared By	Highest QA Class
D. TZOUROS 9/24/82 (DATE)	1
D. TZOUROS — GENERATION ENGINEERING COGNIZANT ENGINEER	9/24/82 DATE
R. Wichert — NUCLEAR OPERATIONS DESIGNATED ENGINEER	3-8-82 DATE
Work Order No. 104130	NCR No.
TYPE ECN: SINGULAR ☑ MAJOR ☐ SUB ☐	

☑ THE FOLLOWING SYSTEM(S) WILL BE AFFECTED BY THIS CHANGE

AUXILIARY FEEDWATER SYSTEM (FLOW INDICATION)

☑ REASON FOR CHANGE

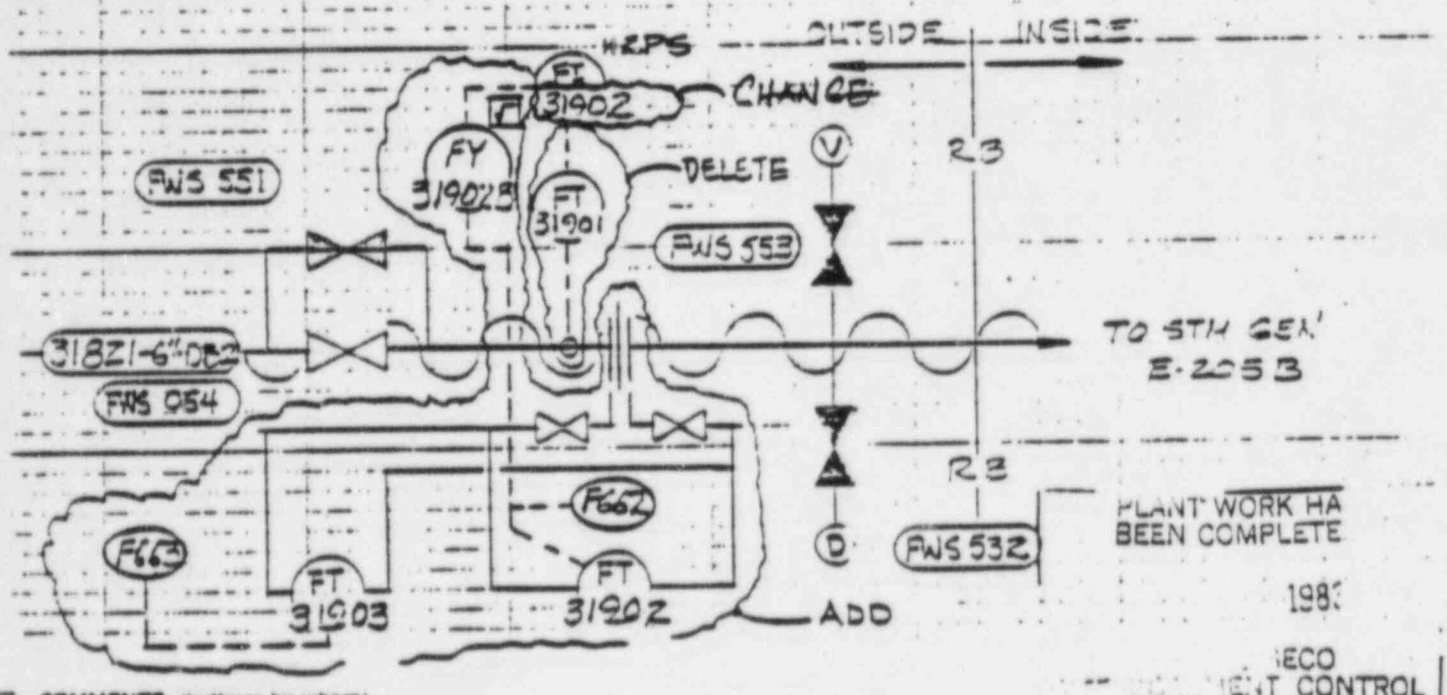
Change is required to meet the requirements of RG Guide 1.97 (to monitor operation) and NUREG 0737, II.E.1.2.C (safety grade Flow Indication)

☑ DESCRIPTION OF THIS CHANGE

PROVIDE A DETAILED DESCRIPTION AND ITS AFFECT ON PLANT OPERATION. INCLUDE SKETCHES AND OTHER PERTINENT INFORMATION TO COMPLETELY DESCRIBE AND ILLUSTRATE HOW CHANGE IS TO FUNCTION AS WELL AS ILLUSTRATE INTERFACE(S) WITH EXISTING EQUIPMENT. INDICATE WHAT NEW COMPONENT(S) ARE REQUIRED, DRAWINGS AFFECTED AND ESTIMATED MATERIAL COSTS.

This ECN includes all necessary Electrical work to complete the task.

Estimated cost: $70,000±



☑ COMMENTS (Indicate by whom)

☑ Engineering & Quality Control Supervisor — 10 CFR 50.59? Yes ☑ No ☐			☑ Manager, Nuclear Operations
10-5-82 DATE	If 'Yes', Log No. 329		10/5/82 DATE
Generation Engineering Staff Approval: Is Required ☒ Is Not Required ☐	Design Basis Report (DBR): Is Required ☒ Is Not Required ☐	☑ Manager, Generation Engineering 10/11/82 DATE	GENERATION ENGINEERING APPROVALS AS INDICATED BY ☑

☑ Mechanical	☑ Electrical	☐ Civil	☐ Nuclear	☑ Instrumentation	☑ Licensing
10-12-82 DATE	10/17/82 DATE	DATE	DATE	10-12-82 DATE	10/22/82 DATE

☐ Change Disapproved By: (see comments)	☑ Issued for Work	☑ Work Complete	☐ Work Complete
RETURN TO SEC OR ENG DATE	SUC Date	Start-up Engineering Date	COGNIZANT ENGINEER DATE
	10-26-82	7/8/83	7-4-83

ECN No. A-3662 KEY

Sheet 2 of 2

SU

ENGINEERING CHANGE NOTICE

Prepared By	Highest QA Class
DATE	
GENERATION ENGINEERING COGNIZANT ENGINEER	DATE
NUCLEAR OPERATIONS DESIGNATED ENGINEER	DATE
Work Order No.	NCR No.
TYPE ECN	
SINGULAR ☐ MAJOR ☐ SUB ☐	

☒ THE FOLLOWING SYSTEM(S) WILL BE AFFECTED BY THIS CHANGE

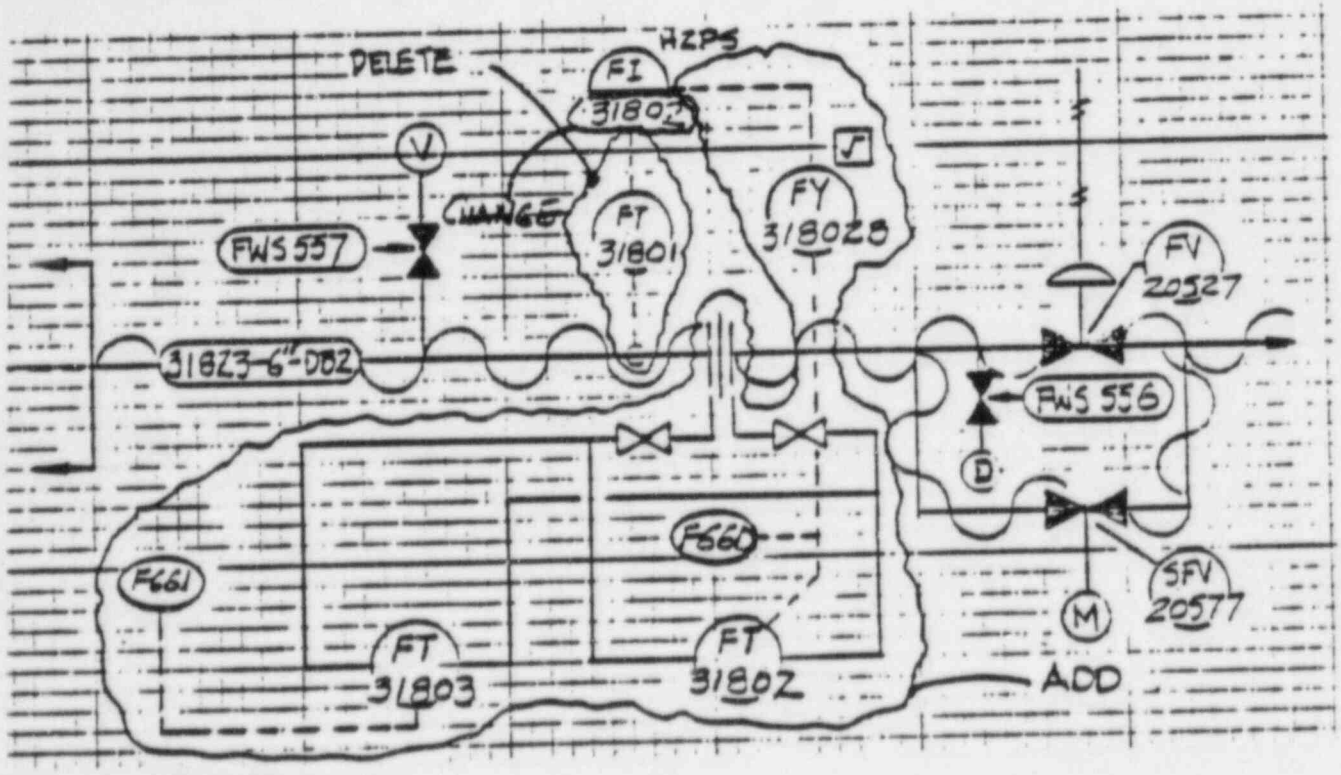
AUXILIARY FEEDWATER SYSTEM (FLOW INDICATION)

☒ REASON FOR CHANGE

Change is required to meet the requirements of Reg Guide 1.97 (To monitor operations) and NUREG 0737 II.F.1.2.C. (Safety Grade Indications Flow)

☒ DESCRIPTION OF THIS CHANGE

PROVIDE A DETAILED DESCRIPTION AND ITS AFFECT ON PLANT OPERATION. INCLUDE SKETCHES AND OTHER PERTINENT INFORMATION TO COMPLETELY DESCRIBE AND ILLUSTRATE HOW CHANGE IS TO FUNCTION AS WELL AS ILLUSTRATE INTERFACE(S) WITH EXISTING EQUIPMENT. INDICATE WHAT NEW COMPONENT(S) ARE REQUIRED, DRAWINGS AFFECTED AND ESTIMATED MATERIAL COSTS.



☒ COMMENTS *(indicate by whom)*

RANCHO SECO
SITE DOCUMENT CONTROL

☐ Engineering & Quality Control Supervisor — DATE

10 CFR 50.59? Yes ☐ No ☐ If 'Yes', Log No. _____

☐ Manager, Nuclear Operations — DATE

Generation Engineering Staff Approval	Design Basis Report (DBR)	☐ Manager, Generation Engineering	GENERATION ENGINEERING APPROVALS AS INDICATED BY ☑
Is Required ☐ Is Not Required ☐	Is Required ☐ Is Not Required ☐	DATE	

☐ Mechanical	☐ Electrical	☐ Civil	☐ Nuclear	☐ Instrumentation	☐ Licensing
DATE	DATE	DATE	DATE	DATE	DATE

☐ Change Disapproved By: *(see comments)*	☐ Issued For Work	☐ Work Complete	☐ Work Complete
RETURN TO SEC OR SDC — DATE	SDC Date	Start-up Engineering Date	COGNIZANT ENGINEER DATE

SAFETY ANALYSIS FORMAT

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

ECN A-3622 Rev 1 NCR _____ Work Request _____

DESCRIPTION: Add safety grade indication of auxiliary feedwater flow to each steam generator and provide AFW flow indication in the Control Room.

REASON FOR CHANGE: To meet the requirements of Reg. Guide 1.97 (to monitor operation) and NUREG 0737, II.E.1.2.2.C (Safety Grade Flow Indication)

EVALUATION AND BASIS FOR THE SAFETY FINDINGS: The change will provide dual flow rate indicators for each steam generator, thus a single failure will not eliminate indication for a AFW piping train. This change improves the capability for monitoring AFW flow. A technical specification change will be required and a post implementation review is required by NUREG 0737.

[X] The proposed change will not increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR or create the possibility for an accident or malfunction of a different type than any evaluated previously in the FSAR or reduce the margin of safety as defined in the basis for any Technical Specification.

SAFETY FINDING:

[X] The proposed change does ~~not~~ involve a change in the Technical Specifications ~~or an unreviewed safety question~~. Tech. Spec. change required by NUREG-0737.

FINAL WORK HAS BEEN COMPLETED
ON JUL 19 1983
RANCHO SECO
SITE DOCUMENT CONTROL

Licensing Engineer Robert Leehl Date 9/15/82

Review Engineer L.K. Stephenson Date 10-1-82

DESIGN BASIS REPORT

ECN A-3622 REV I NCR N/A WORK REQUEST 104130

DISCIPLINE I & C DATE 2/24/92

I. PURPOSE OF DESIGN CHANGE:

The purpose of this design change is to implement the requirements of NUREG 0737, item II.E.1.2.2, auxiliary feedwater flow indication and Regulatory Guide 1.97 Table 2, Type D, Auxiliary or Emergency Feedwater Flow.

This is further defined in NUREG 0737 II.E.1.2 Part 2 by stating that safety grade auxiliary feedwater flow indication is required to meet the 10CFR part 50, Appendix A Criterion 13.

1. Safety-grade indicaton of auxiliary feedwater flow to each steam generator shall be provided in the Control Room.

2. The auxiliary feedwater flow instrument channels shall be powered from the emergency buses consistent with satisfying the emergency power divercity requirements of the auxiliary feedwater system set forth in Auxiliary Sytems Branch Technical Position 10-1 of the Standard Review Plan, Section 10.4.9."

II. DESIGN CRITERIA USED:

1. The flow transmitters shall be Class IE and shall meet the requirements with respect to separation, seismic, and environmental qualifications.

2. The power supply and isolation cabinet shall be Class IE and shall meet the requirements with respect to separation, seismic, and environmental qualification.

3. Signals to Control Room for indication will not be IE in interim modification during the (1)2 ~~September 1992~~ outage, therefore, the indication in the Control Room is not Class IE and shall utilize existing non IE indicators and the computer for displaying the information. Conformance to NUREG 0737 will be achieved when major control room modifications are implemented.

WORK HAS BEEN COMPLETED

ON JUL 1 1993

4. The following codes and standards are applicable, except as indicated in II.3 above, to flow transmitter purchase and installation, power supply and distribution cabinet purchase and installation and cable and wire routing to the IE portion of the system:

Sponsor Number	Subject
IEEE 279	Criteria for Nuclear Power Generating Station protection systems.
IEEE 323	Qualifying Class IE equipment for Nuclear Power Generating Stations.
IEEE 344	Recommended practices for seismic qualification of Class IE equipment for Nuclear Power Generating Stations.
IEEE 384	Criteria of separation of Class IE equipment and circuits.
IEEE 379	Trail Use Guide for Application of Single Failure Nuclear Power Generating Station Protective Systems.

III. CALCULATIONS AND DESIGN INFORMATION:

1. Installation of the flow transmitters and the power supply/isolation cabinet meet the requirements of Class IE safety grade.

2. Conduit and cable trays from the transmitter and power source to the power supply/isolation cabinet meet the requirements of Class IE safety grade.

3. Each of the auxiliary feedwater piping train will have redundant flow measuring and indication devices to meet the single failure criterion.

IV. FAILURE MODE:

An electrical failure of any channel (power failure short circuit or open circuit) will result in a single flow rate indication for each auxiliary feedwater piping train. The Control Room will be able to ascertain the actual performance of each AFWS train at all times.

A tubing failure will result in the loss of flow rate indication of the damaged auxiliary feedwater piping train.

V. COMMENTS:

The design meets the requirements of 10 CFR Part 50 Appendix A, criterion 13 and is in compliance with the requirements of NUREG 0737 and Regulatory Guide 1.97.

Design Engineer D. TZOUROS Date 3-4-82

Review Engineer Lt. Stephenson Date 3-30-82

WORK HAS BEEN COMPLETED ON JUL 15 1983 RANCHO SECO SITE DOCUMENT CONTROL

Log No. 335

SAFETY ANALYSIS FORMAT

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

ECN A-3094 Rev. 2 NCR _____ Work Request _____

DESCRIPTION:

Install flanges and orifice plates on lines 31821-6"-DB2 and 31823-6"-DB2. Relocate the Auxiliary Feedwater (AFW) pump test line. ECN A-3622 will install the flow transmitter and controls.

REASON FOR CHANGE:

To improve the reliability of the Auxiliary Feedwater system as committed in our December 17, 1979 submittal to the NRC and to implement the requirements of NUREG 0737, item II.E.1.2.2.

EVALUATION AND BASIS FOR THE SAFETY FINDINGS:

This change will provide safety grade indication of AFW flow to each steam generator. The changes are quality and seismic Class I.

PLANT WORK HAS BEEN COMPLETED
ON AUG - 1 1985
RANCHO SECO SITE DOCUMENT CONTROL

[X] The proposed change will not increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR or create the possibility for an accident or malfunction of a different type than any evaluated previously in the FSAR or reduce the margin of safety as defined in the basis for any Technical Specification.

SAFETY FINDING:

[X] The proposed change does ~~not~~ involve a change in the Technical Specifications ~~or an unreviewed safety question~~. Required by NUREG 0737.

Licensing Engineer R Rochelle Date 11/29/82

Review Engineer Phil Smith Date 11/30/82

SMUD-0913 9/80

DESIGN BASIS REPORT

ECN A-3094 NCR N/A Work Request 10430

Discipline Mechanical Date 10.25.82

I. PURPOSE OF DESIGN CHANGE:

The purpose of this design change is to implement the requirements of NUREG 0737, item II.E.1.2.2, auxiliary flow indication.

II. DESIGN CRITERIA USED:

1. Material to be Quality Class I, compatible with existing boundary material.

2. Design configuration shall be analyzed to satisfactorily withstand a Seismic Category I event.

3. Flow resistance resulting from flow orifice installation shall be analyzed to show no adverse effect on ability to supply auxiliary feedwater to the OTSG's at the required flow and pressure.

4. Piping will be installed to SMUD drawing M-870 and ASME Section XI, class 3.

III. CALCULATIONS AND DESIGN INFORMATION:

1. Dead weight, thermal and seismic analysis is acceptable (see attached).

2. The addition of the flow orifice will result in 157.6 inches of H_2O pressure differential across the orifice at a flow rate of 1,000 gpm (see attached calculation). This converts to a 13.13' TDH/5.7 psi loss across the orifice.

   B & W Doc. ID No. 15-1120580-02 Title: System Description Auxiliary Feedwater System requires a minimum flow of 780 gpm to one or both OTSG at a OTSG pressure of 1050 psig.

   The (attached) AFW system resistance curve indicates a line resistance of 75 ft. at 780 gpm.

   The flow orifice resistance at 780 gpm = $\Delta P_2 = \Delta P_1 (\frac{Q2}{Q1})^2$

   $$\Delta P_2 = 13.13 \ (\frac{780}{1000})^2$$

   $$\Delta P_2 = 7.98 \text{ ft TDH}$$

Total resistance = 75 + 7.98 = 83.0 ft TDH @ 780 gpm.

The minimum available TDH @ 780 gpm is 2700 ft. TDH from P-318 (see attached pump curves).

2700' - 83.0' = 2617.0' TDH available for delivery.

2617.0' TDH = 1130.0 psig

Therefore, the line can supply 780 gpm to the OTSG at 1133 psig. This is greater than the minimum required. This calculation is conservative because the (attached) curve indicates that a flow orifice with a β of 0.76029 will result in a 42% loss of the actual differential.

IV. FAILURE MODE:

1. The configuration has been analyzed to withstand a Seismic Category I event. (See attached report).

V. COMMENTS:

1. Installation will be done in accordance with applicable approved procedures.
2. SP-210.01 A and B must reflect increased pressure drop.

Design Engineer K. Varma / J G Iorio Date 10 25 82

Review Engineer Ralf Smith Date 10-26-82

N.O. Designated Engineer RPL Puhert Date 10-29-82

PLANT WORK HAS BEEN COMPLETED
ON AUG - 1 1985
RANCHO SECO
SITE DOCUMENT CONTROL