REGULATORY DOCKET FILE COPY

MAY 20 1980

Docket Nos.: 50-361
and 50-362

APPLICANTS: SOUTHERN CALIFORNIA EDISON COMPANY (SCE)
SAN DIEGO GAS AND ELECTRIC COMPANY (SDG&E)

FACILITY: SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

SUBJECT: SUMMARY OF SAN ONOFRE MEETING ON AUXILIARY FEEDWATER SYSTEM

On May 15, the NRC staff met with the applicants and their consultants, in Bethesda, Maryland, to discuss the above subject. Attendees at the meeting are given in Enclosure 1. The meeting agenda is given in Enclosure 2. The material presented by the applicants and their consultants at the meeting is given in Enclosure 3.

Much of the discussion at the meeting involved agenda item II, post-seismic condensate storage capacity. The basic problem is that some water from the 500,000 gallon, non-seismic, condensate storage tank (see Figure 4 of Enclosure 3) will be needed to cool the plant down to 350°F, following a postulated SSE and the worst single failure (reference questions 010.65 and 212.139). Various approaches to the problem were discussed, including (1) showing that the Category I tank building can contain sufficient water for the required time or (2) providing a backup source of salt water. The applicant agreed to evaluate the various options and propose a method of solution in the near future.

Original Signed by

Harry Rood, Project Manager
Licensing Branch 3
Division of Licensing

Enclosures:
As stated

cc: See next page

8005280238

Memo 4

HR

GD

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SURNAME	HRood/bm	ASchwencer				
DATE	5/20/80	5/ /80				

NRC FORM 318 (9-76) NRCM 0240 ☆U.S. GOVERNMENT PRINTING OFFICE: 1979-289-369

MEETING SUMMARY DISTRIBUTION

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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ENCLOSURE 1

ATTENDEES, 5-15-80 MEETING

SAN ONOFRE AFW SYSTEM

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D. Thatcher	NRC-ICSB
R. Turk	C-E
M. Cunningham	NRC/RES/PAS

ENCLOSURE 2

SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3

NRC AUXILIARY SYSTEMS BRANCH REVIEW
MAY 15, 1980

I.	INTRODUCTION	M. MEDFORD
II.	POST SEISMIC CONDENSATE STORAGE CAPACITY.....	A. LOPEZ/ H. NAZARIAN
III.	AUXILIARY FEEDWATER SYSTEM MODIFICATIONS	R. PHELPS
IV.	METHODOLOGY OF AUXILIARY FEEDWATER SYSTEM RELIABILITY ASSESSMENT	R. TURK ~~A. SPINELLI~~
V.	CONCLUSION	M. MEDFORD

SONGS UNITS 2 AND 3 AFWS

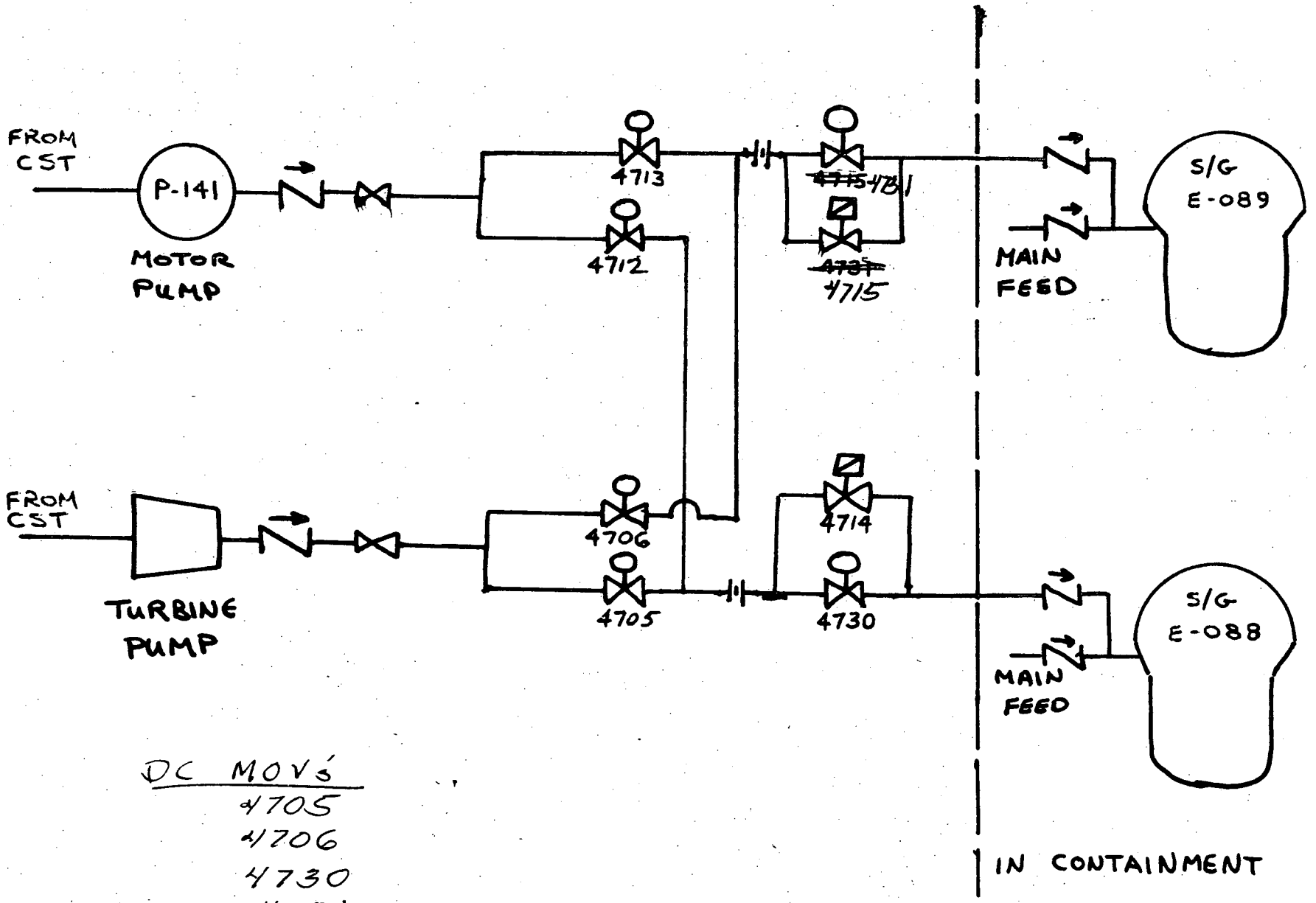
PRESENT DESIGN (2 PUMPS):

1. FULLY AUTOMATIC
2. SAFETY GRADE
3. AUTOMATIC SELECTIVE FEED OF INTACT S.G.
4. MEETS SINGLE ACTIVE FAILURE CRITERIA
5. REDUNDANT, DIVERSE POWER (ELECTRIC AND STEAM)
6. COMPLIES WITH LESSONS LEARNED (NUREG 0578) RECOMMENDATIONS - SECTION 2.1.7.A

HOWEVER, POSITION 5 OF BTP ASB 10-1 IS NOT SATISFIED:

PROVIDE AFW FOR ANY AFWS PIPE BREAK PLUS CONCURRENT SINGLE ACTIVE FAILURE

Enclosure 3



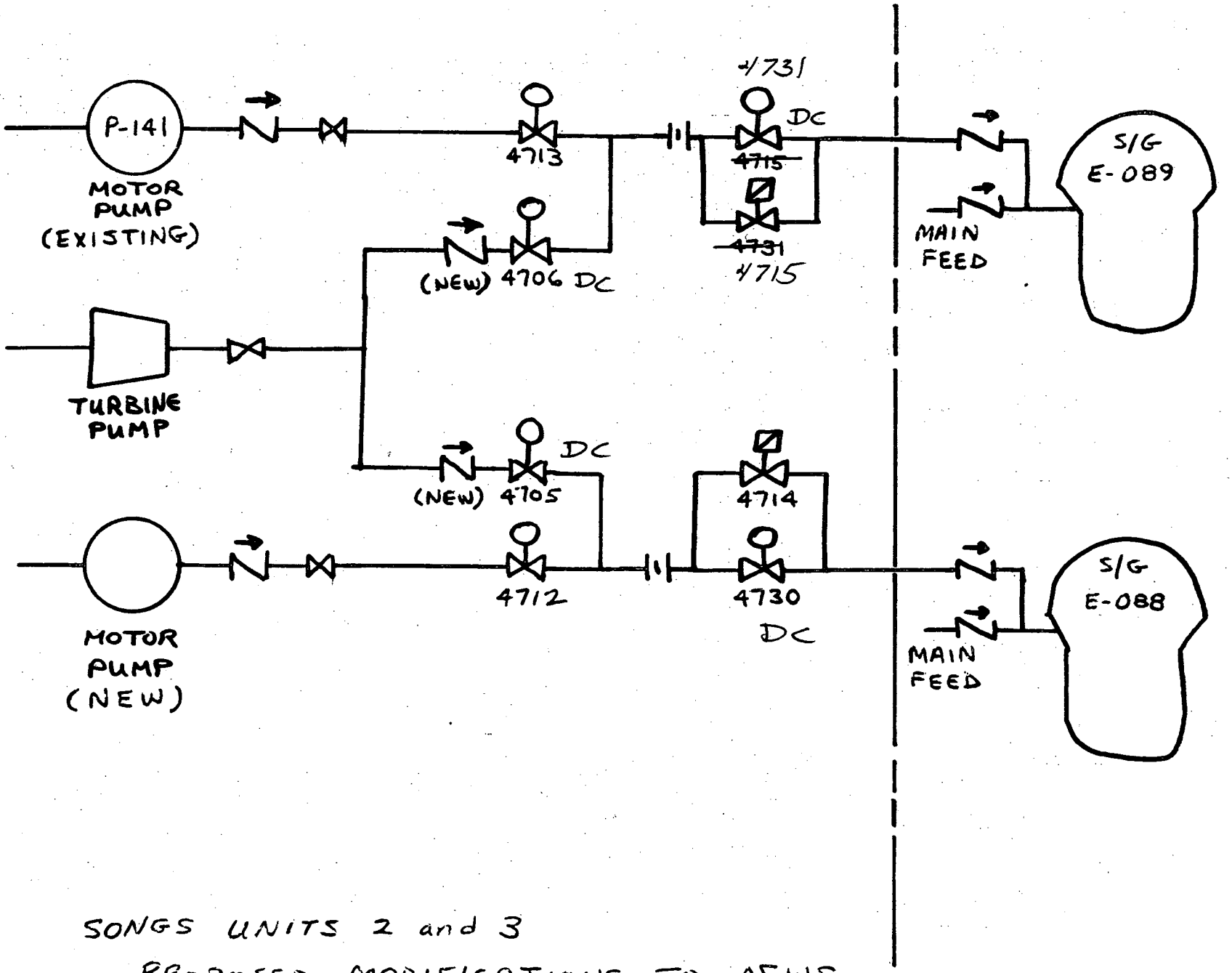
DC MOV's
4705
4706
4730
4731

SONGS UNITS 2 and 3 EXISTING AFWS

(FIG. 1)

PROPOSED CHANGES TO SONGS 2 AND 3 AFWS

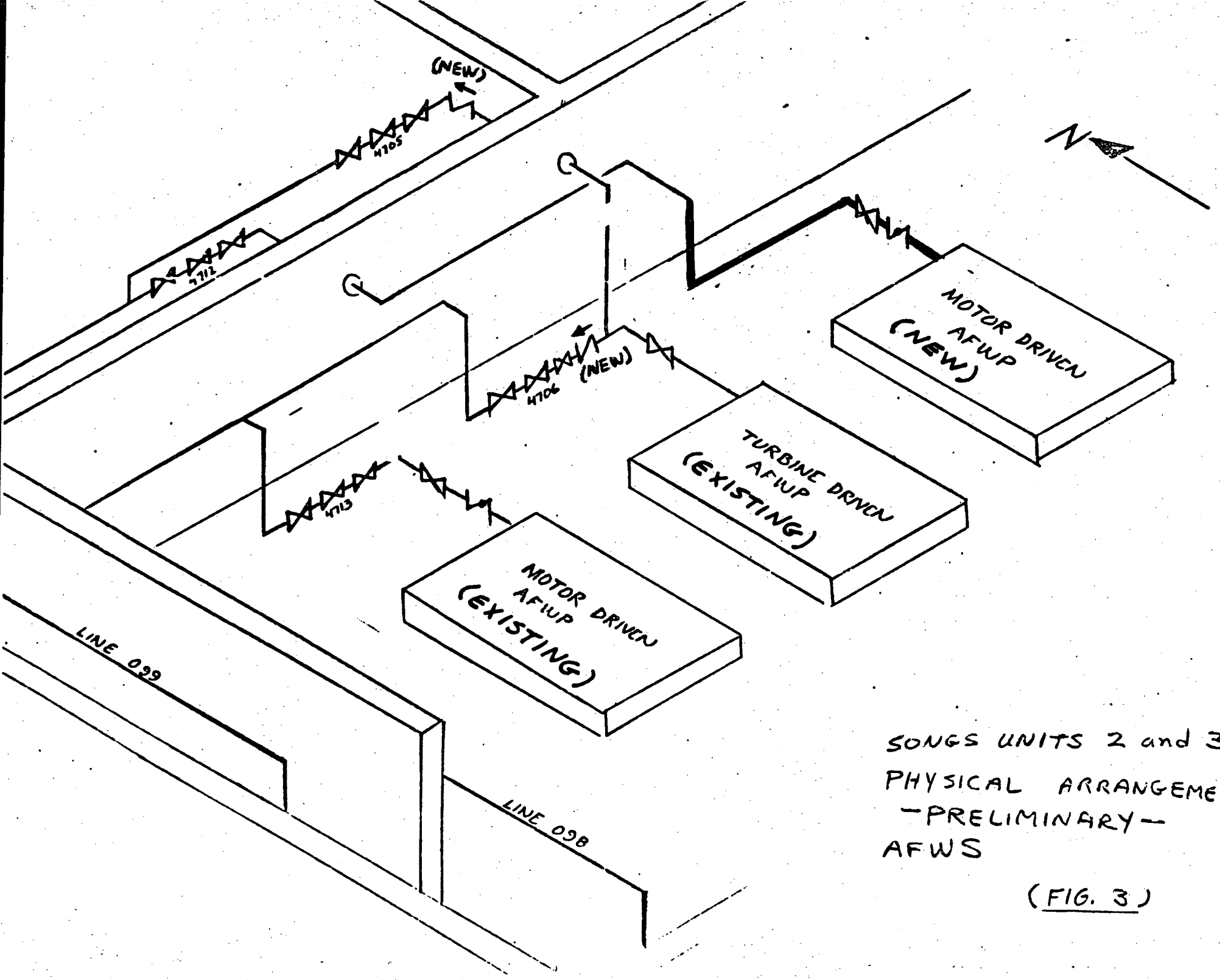
1. A THIRD, MOTOR DRIVEN PUMP WILL BE INSTALLED
2. POWER FROM DIESEL SEPARATE FROM EXISTING MOTOR PUMP
3. AUTOMATIC ACTUATION
4. SAFETY GRADE
5. FOR CERTAIN BREAKS, OPERATOR ACTION IS REQUIRED TO ISOLATE THE BREAK
6. FMEA TO BE PERFORMED ON PROPOSED SYSTEM



SONGS UNITS 2 and 3

PROPOSED MODIFICATIONS TO AFWS
-PRELIMINARY DESIGN-

(FIG. 2)



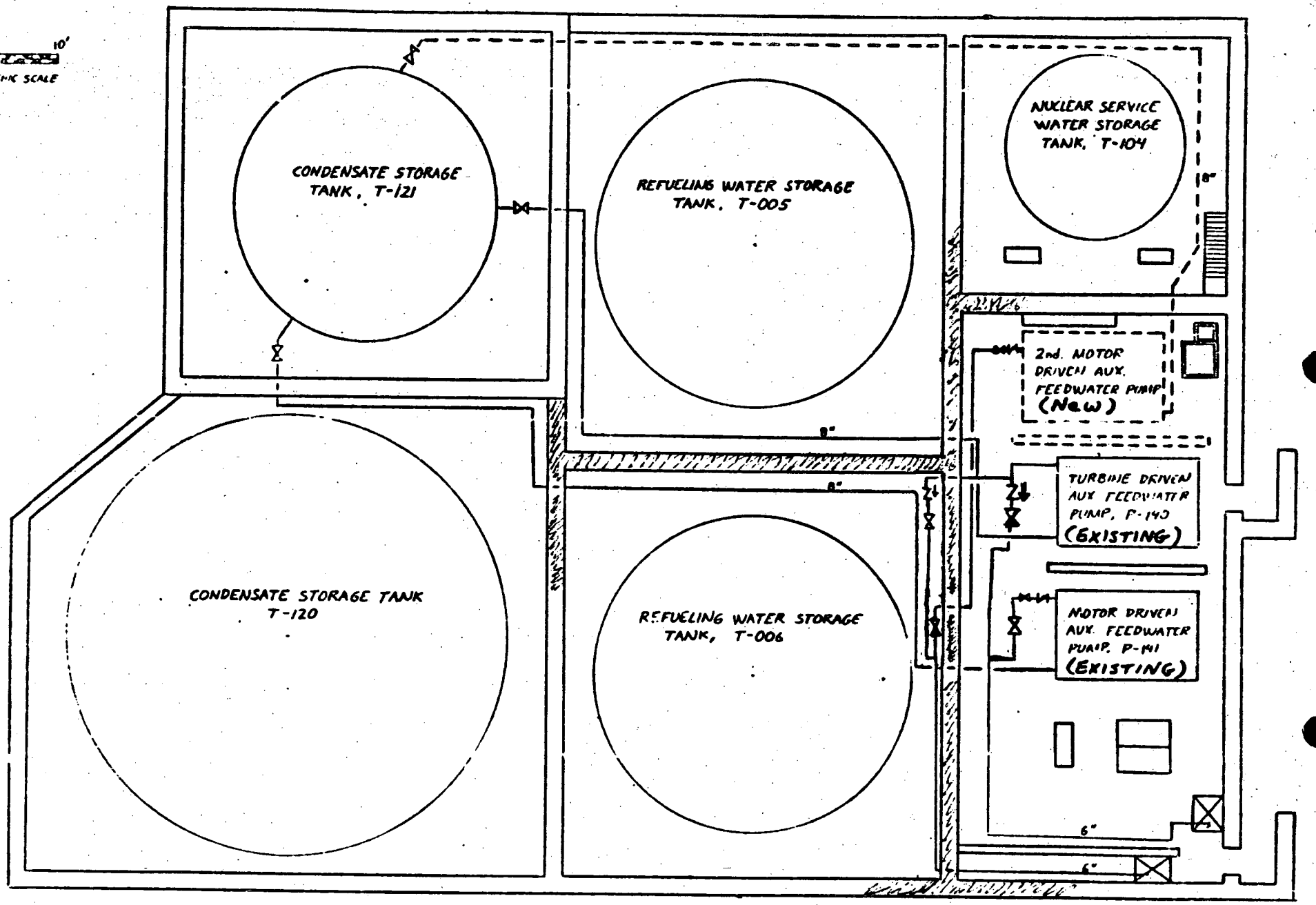
SONGS UNITS 2 and 3

PHYSICAL ARRANGEMENT

—PRELIMINARY—

AFWS

(FIG. 3)



SONGS UNITS 2 and 3
AFWS PLAN VIEW
-PRELIMINARY-

(FIG. 4)

AUXILIARY FEEDWATER SYSTEM EVALUATION

1. DETERMINISTIC REVIEW
2. RELIABILITY EVALUATION
3. DESIGN BASES REVIEW
4. ADDRESSAL OF OPERATING PLANT REQUIREMENTS

DETERMINISTIC REVIEW

CRITERIA

1. STANDARD REVIEW PLAN 10.4.9
2. BRANCH TECHNICAL POSITION 10-1
3. ANSI/ANS 51.10-1979

RESULTS

1. SHOW HOW EACH REQUIREMENT IS MET.
2. PROVIDE TECHNICAL BASES FOR ANY EXCEPTION OR DEVIATION.

RELIABILITY EVALUATION

OBJECTIVE:

1. IDENTIFY AND ADDRESS:
   - POTENTIAL COMMON MODE FAILURES
   - POTENTIAL SINGLE POINT FAILURES
   - ANY DOMINANT CAUSE OF LOW SYSTEM RELIABILITY

2. PROVIDE AN ASSESSMENT OF OVERALL SYSTEM RELIABILITY RELATIVE TO EVALUATION OF OPERATING PLANTS.

REFERENCE STUDY

ANO2 AFWS RELIABILITY STUDY OF NUREG 0635.

BASES:

1. SIMILAR FLUID SYSTEM CONFIGURATION
2. SIMILAR ACTUATION LOGIC
3. SIMILAR NSSS PERFORMANCE

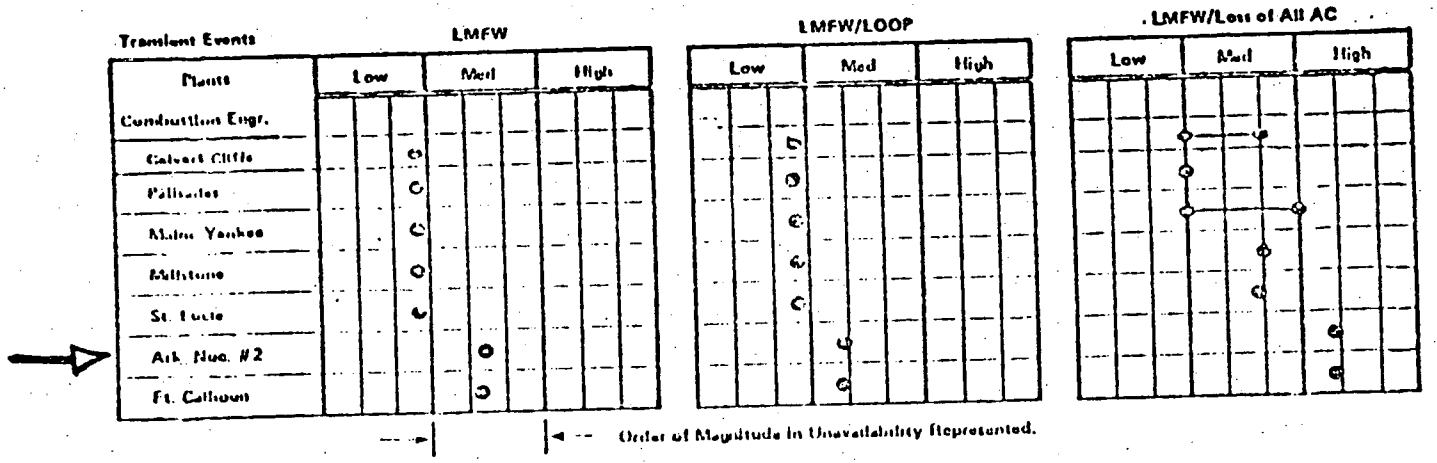


Figure III 6 Reliability Characterizations for AFWS Designs in Plants Using the Combustion Engineering NSSS.

X.1.2 Reliability Evaluation ANO-2

X.1.2.1 Dominant Failure Modes

X.1.2.1.1 Loss of Main feedwater (LOFW)

No single failure was identified which would make both feedwater trains unavailable. Thus the dominant failure modes were combinations of two independent failures, each failing one subsystem.

X.1.2.1.2 LOFW With Loss of Offsite AC Power

The dominant failure modes are the same as those identified above in the case of loss of main feedwater only.

X.1.2.1.3 LOFW with Only DC Power Available

The dominant failure modes for this event are failure of the turbine driven pump subsystem due to test and maintenance outages, hardware failure, or human error.

Since the motor driven EFW pump would not be available upon loss of all AC power, auxiliary feedwater flow would be dependent on the single turbine driven pump subsystem. Single valve or pump failure, or a manual valve being left in the closed position, or the subsystem being out due to test and maintenance are all significant contributors to the unavailability of the EFWS during this event.

X.1.2.1.4 Potential Interactions

None

Table III-4 (CE)

Plant	Generic Recommendations: Short Term								Generic Recommendations: Long Term					Plant Specific Recommendations: Short Term	Plant Specific Recommendations: Long Term
	GS-1: Elect Spec LCO Train Outage Time Limit	GS-2: Test Spec-Single Flow Path Manual Valves	GS-3: AFWS Flow Throttling-Water Hammer	GS-4: Emergency Procedure-Backup Water Supplies	GS-5: Emergency Procedure-AC Power Blackout	GS-6: On-Line Test Verification	GS-7: Non-Safety Grade AFWS Automatic Start Signals	GS-8: Automatic Actuation of AFWS	GL-1: Automatic Actuation of AFWS	GL-2: Single Flow Path-Manual Valves	GL-3: Eliminate AC Power Dependency of One Train	GL-4: Motor Driven Pump Protection-Natural Phenomena	GL-5: Non-Safety Grade AFWS Automatic Start Signals		
Arkansas 2 1-elect pump 1-turbine pump Automatic initiation						X	X						X	Propose technical specification revision to provide pressure/flow criteria for electric pump periodic tests	-Evaluate postulated break in AFW discharge lines concurrent with a single active failure to 1) determine necessary change in AFWS design or procedures or 2) describe how plant can be safely shutdown by use of other available systems. -Evaluate capability to isolate a break downstream of turbine pump steam admission valve concurrent with single active failure of D-C emergency Division II bus.
Calvert Cliffs 1&2 2 turbine pumps per unit Manual Initiation		X		X	X	X		X	X	X	X			Propose revised Tech Specs to require periodic testing of manual valves	-Motor operated inlet valves and associated equipment should be qualified for environment resulting from main steam or feed line break.

METHOD

1. EVENT TREES

   EVENTS OF NUREG 0635

   - LMFW
   - LMFW W/LOOP
   - LMFW W/LOSS OF ALL AC

   ADDITIONALLY AFWS LINE BREAK

2. FAULT TREES

   - SIMILAR TO NUREG 0635
   - IDENTIFY FAILURE MODES RELATIVE TO ANO2
   - INCLUDE ACTUATION AND CONTROL LOGIC

3. FAILURE MODES AND EFFECTS ANALYSIS

   EXPAND FSAR TABLE 10.4-5

RESULTS

1. A SEMI QUANTITATIVE ASSESMENT OF OVERALL SYSTEM RELIABILITY RELATIVE TO THE SCALE OF NUREG 0635.

2. A SPECIFIC LISTING OF POTENTIAL FAILURE MODES RELATIVE TO ANO2 JUSTIFYING THE ASSESSMENT OF 1 ABOVE.

3. A REVISED FAILURE MODES AND EFFECTS ANALYSIS.

DESIGN BASES REVIEW

ENCLOSURE 2 REQUEST

RESPONSE BASIS

1. FOR FSAR EVENTS WILL REFERENCE FSAR ANALYSES

2. FOR NON FSAR EVENTS WILL SUPPLY BEST ESTIMATE RESULTS

ADDRESSAL OF OPERATING PLANT RECOMMENDATIONS

CONSIDERATION OF:

1. CHANGES TO AFWS PROCEDURES
2. ALTERNATIVE PLANT EMERGENCY PROCEDURES
3. MODIFICATION OF AFAS LOGIC
4. PIPING, VALVE OR PUMP CHANGES IN NON SAFETY CLASS SYSTEMS (EG. MFW)
5. PIPING AND VALVE CHANGES IN AFWS
6. INCREASED AFWS PUMPING CAPACITY

AFW REQUIREMENTS AND RECOMMENDATIONS

NUREG 0578 (Lessons Learned)

- Automatic Actuation
- Safety Grade Flow Indication

NUREG 0635 (Bulletins & Orders)

Generic Short Term

- Tech Spec Limit On Train Outage
- Tech Spec on Control of Manual Valves
- Water Hammer Flow Limits
- EP's for Backup Water Supplies
- EP's for Total Blackout
- Flow Path Verification
- Safety Grade Initiating Signals
- Automatic Initiation
- CST Low Level Alarm
- Pump Endurance Test
- Flow Indication
- Availability During Surveillance Testing

Generic Long Term

- Auto Initiation
- Single Valves in Flow Path
- Design for Total Blackout
- Multiple Pump Damage due to Loss of Suction
- Safety Grade Initiation Signals

Plant Specific (Typical)

- High Energy Pipe Break Criteria
- Steam Line Breaks Associated With AFW Pump Turbine
- Common Discharge Lines
- Wide Range Level Indication
- Increase of Required Seismic I CST
- Penumatic Controlled Valves

NRC Letter to Operating Plants

Enclosure 1: transmitted Sandia results as outlined above.

Enclosure 2: requested detailed information regarding AFW design bases.

NRC Action Plan

1. System evaluation by licensee
   - reliability analyses
   - deterministic review with respect to SRP 10.4.9, BTP 10-1
   - re=evaluate system flow design bases and criteria
2. Automatic flow initiation and AFW system flow indication
3. NRC to revise SRP - develop regulatory guide.