INDEPENDENT DESIGN REVIEW

of the

PALO VERDE NUCLEAR GENERATING STATION

AUXILIARY SYSTEMS I

Before the

AUXILIARY SYSTEMS I REVIEW BOARD

VOLUME II

A P P E N D I X

Phoenix, Arizona
April 8, 1981

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PALO VERDE NUCLEAR GENERATING STATION
AUXILIARY SYSTEMS I REVIEW BOARD

PHOENIX, AZ
APRIL 8, 1981

AUXILIARY SYSTEMS I INDEPENDENT DESIGN REVIEW

4/08/81	BOARD CONVENES FOR BECHTEL PRESENTATION
4/15/81	APS LICENSING REVIEWS TRANSCRIPT
4/22/81	FINAL TRANSCRIPT SENT TO NRC, REVIEW BOARD AND BECHTEL
5/06/81	BECHTEL'S DRAFT RESPONSE SENT TO APS FOR INFORMAL REVIEW
5/13/81	APS COMMENTS ON DRAFT RESPONSE SENT TO BECHTEL
5/27/81	BECHTEL SENDS RESPONSES TO BOARD
6/03/81	APS SENDS BOARD'S COMMENTS ON RESPONSES TO BECHTEL
6/10/81	THOSE BOARD MEMBERS WITH COMMENTS WILL RECONVENE TO MEET WITH BECHTEL*
6/17/81	LETTER TO NRC CLOSING OUT REVIEW

*RECONVENING MAY BE FULFILLED WITH CONFERENCE CALL

SCHEDULE I

AUXILIARY SYSTEMS I RE IEW BOARD AGENDA

I. General Introduction

II. Fuel Pool Cooling and Cleanup
Fuel Storage and Handling

1. Introduction
2. System Overview

A. Design Criteria
B. CESSAR Interfaces
C. System Description
D. Operation

3. Conformance With Regulatory Requirements

A. SRP 9.1.1, 9.1.2, 9.1.3, 9.1.4
B. GDC 2, 3, 4, 5, 44, 45, 46, 61, 62, 63
C. RG 1.13, 1.26, 1.29, 1.102, 1.115, 1.117, 8.8
D. BTP ASB 3-1, ASB 9-1
E. NUREG-0612
F. 10CFR71

III. Essential Cooling Water System (Component Cooling Water System)

1. Introduction
2. System Overview

EXHIBIT i

A. Design Criteria
B. CESSAR Interfaces
C. System Description
D. Operation

3. Conformance With Regulatory Requirements

A. SRP 9.2.2
B. GDC 2, 4, 5, 44, 45, 46
C. RG 1.26, 1.29
D. BTP ASB 3-1

IV. Essential Spray Pond System (Service Water System and Ultimate Heat Sink)

1. Introduction
2. System Overview

A. Design Criteria
B. System Description
C. Operation

3. Conformance With Regulatory Requirements

A. SRP 9.2.1, 9.2.5
B. GDC 2, 4, 5, 44, 45, 46
C. RG 1.26, 1.27, 1.29, 1.72, 1.102, 1.117
D. BTP ASB 3-1, ASB 9-2

AUXILIARY SYSTEMS BRANCH
REVIEW BOARDS

AUXILIARY FEEDWATER SYSTEM	8/21-22/80
AUXILIARY SYSTEMS I	4/8/81

- Fuel Pool Cooling and Cleanup
- Fuel Storage and Handling
- Essential Cooling Water System
- Essential Spray Pond System

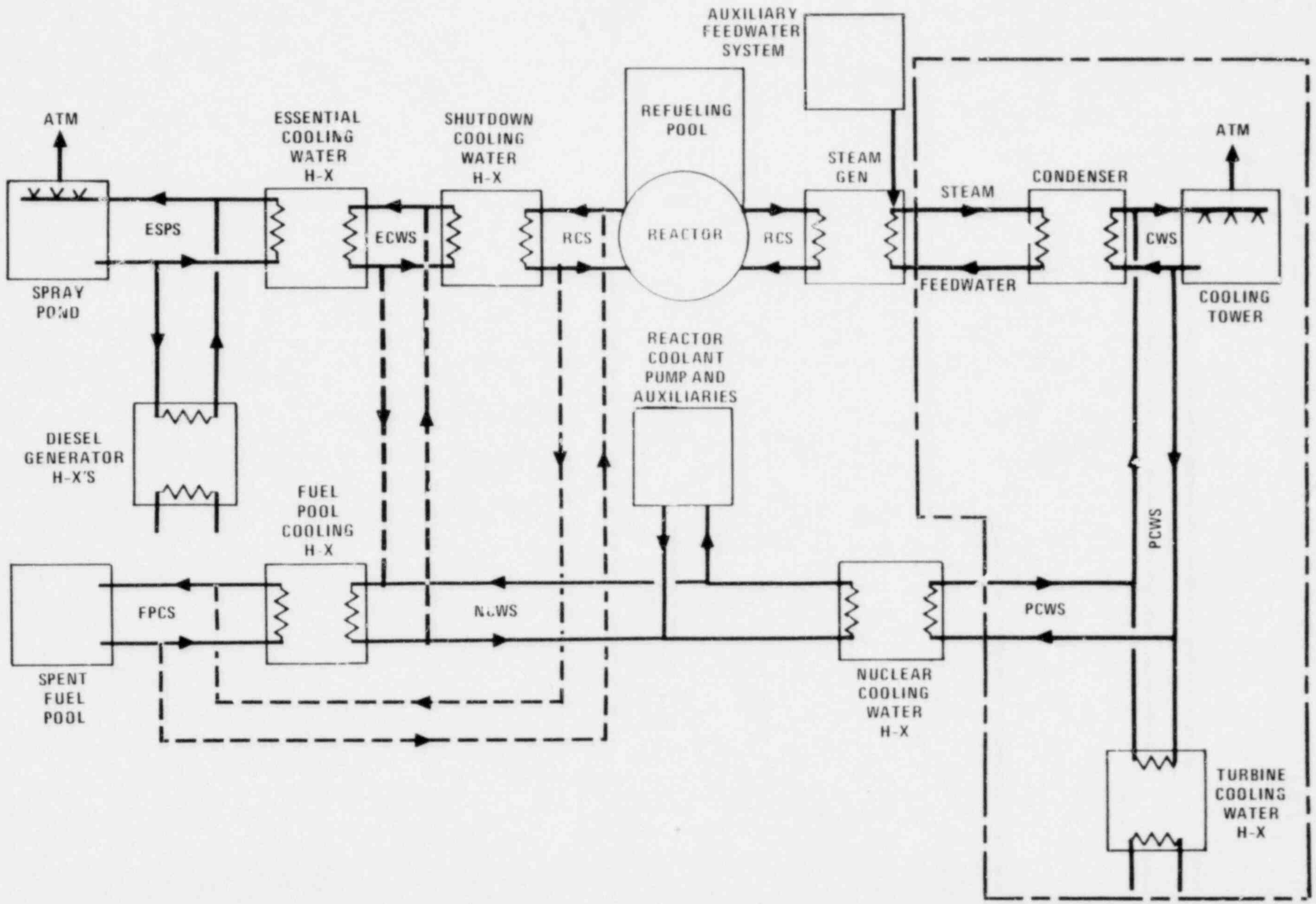
AUXILIARY SYSTEMS II — 8/5/81F

- Reactor Drain Tank
- Demineralized Water System
- Potable and Sanitary Water System
- Condensate Storage
- Compressed Air
- Floor Drainage
- Main Steam
- Circulating Water System
- Condensate and Feedwater
- Heating, Ventilation and Air-Conditioning Systems

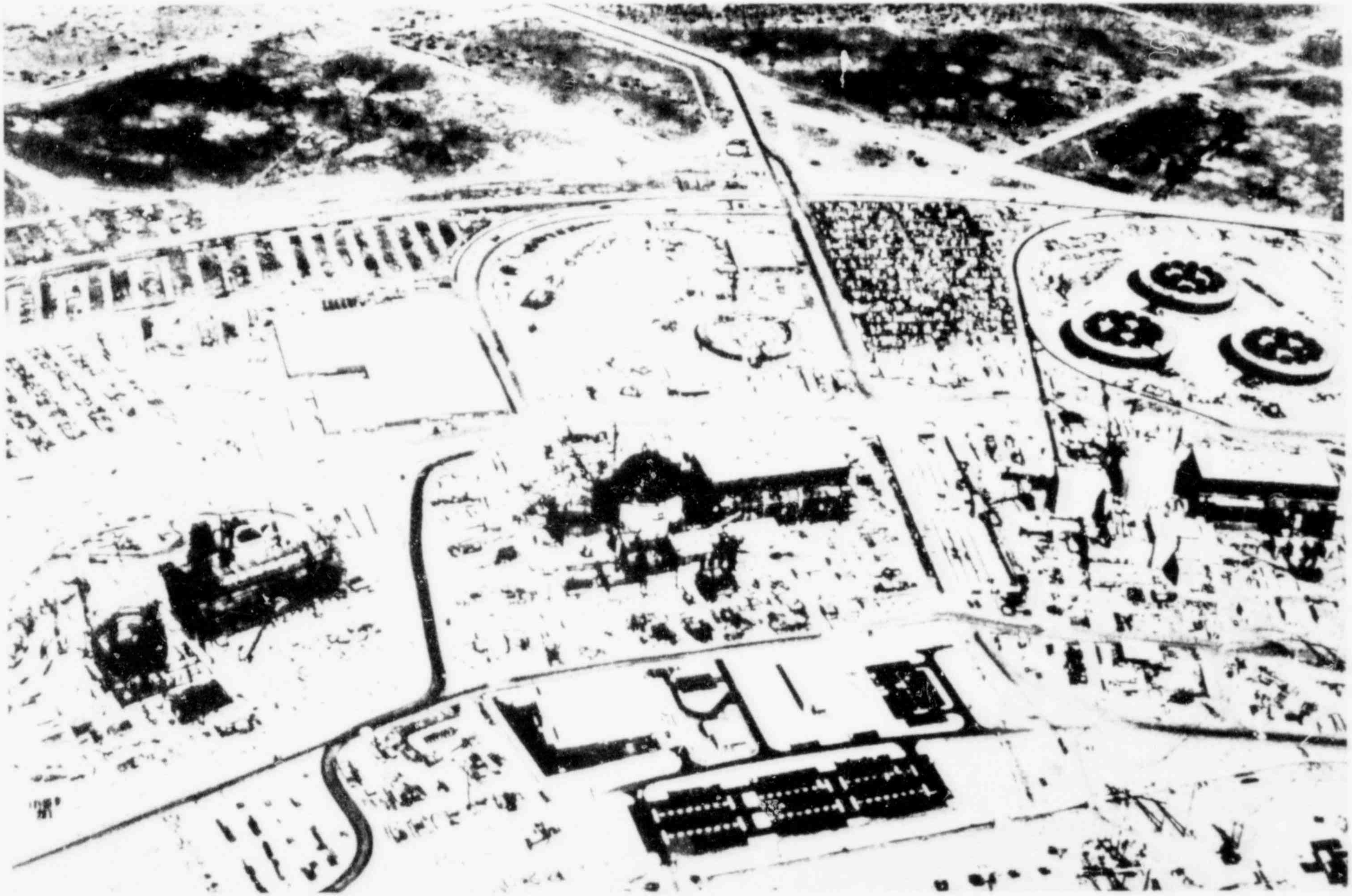
AUXILIARY SYSTEMS III — 9/2/81F

- Flood Protection
- Missile Protection
- High and Moderate Energy Line Breaks

EXHIBIT 1-1



FUEL POOL COOLING SYSTEM (FPCS), ESSENTIAL COOLING WATER SYSTEM (ECWS),
ESSENTIAL SPRAY POND SYSTEM (ESPS),
AND ASSOCIATED SYSTEMS
FIGURE 1-1



SLIDE 1 OVERVIEW OF PVNGS

FUEL STORAGE AND HANDLING
NSSS/BOP SCOPE OF SUPPLY

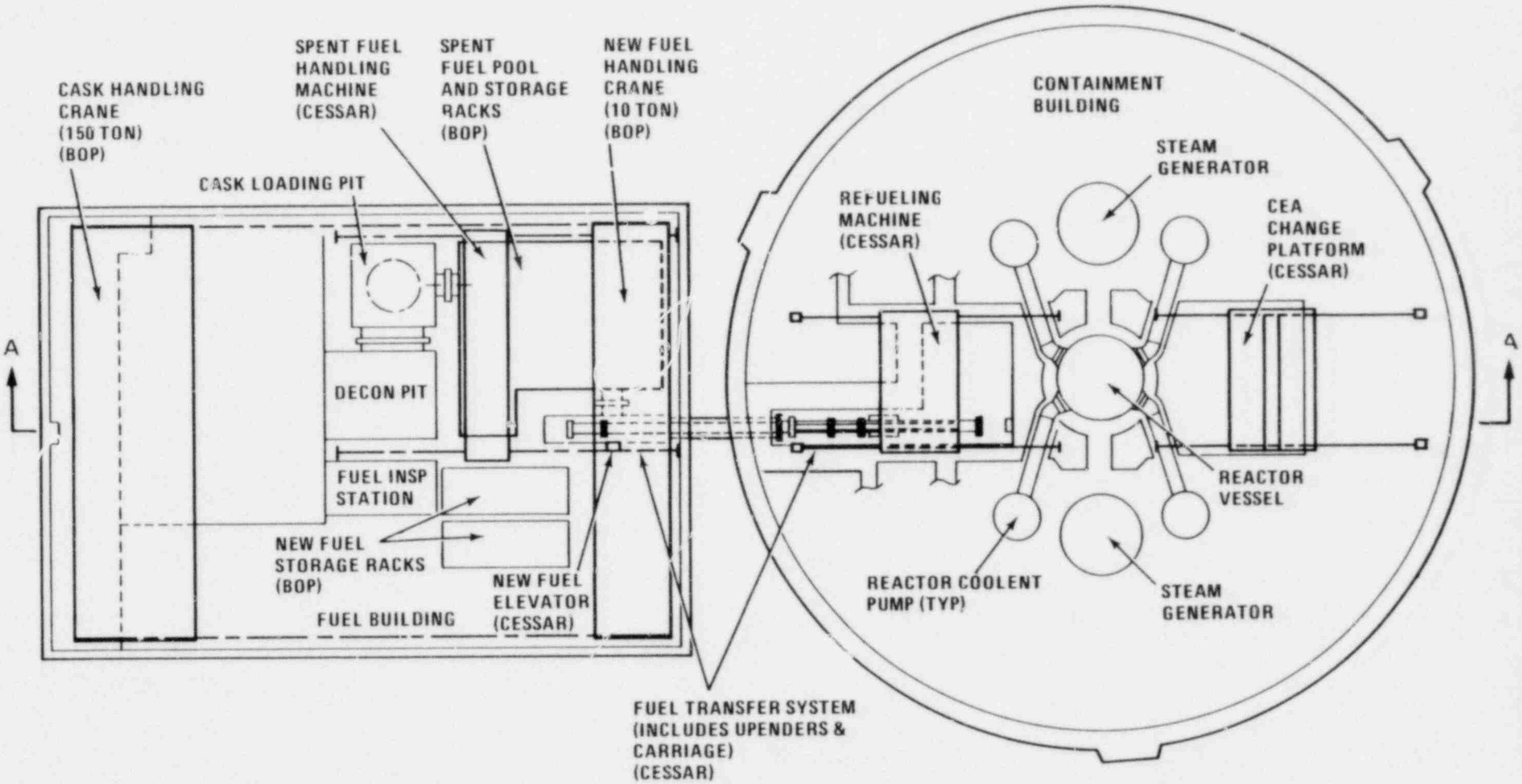
NSSS (CESSAR)

- Refueling machine
- CEA change platform
- Fuel transfer system (includes upenders and carriage)
- Spent fuel handling machine
- New fuel elevator
- Miscellaneous

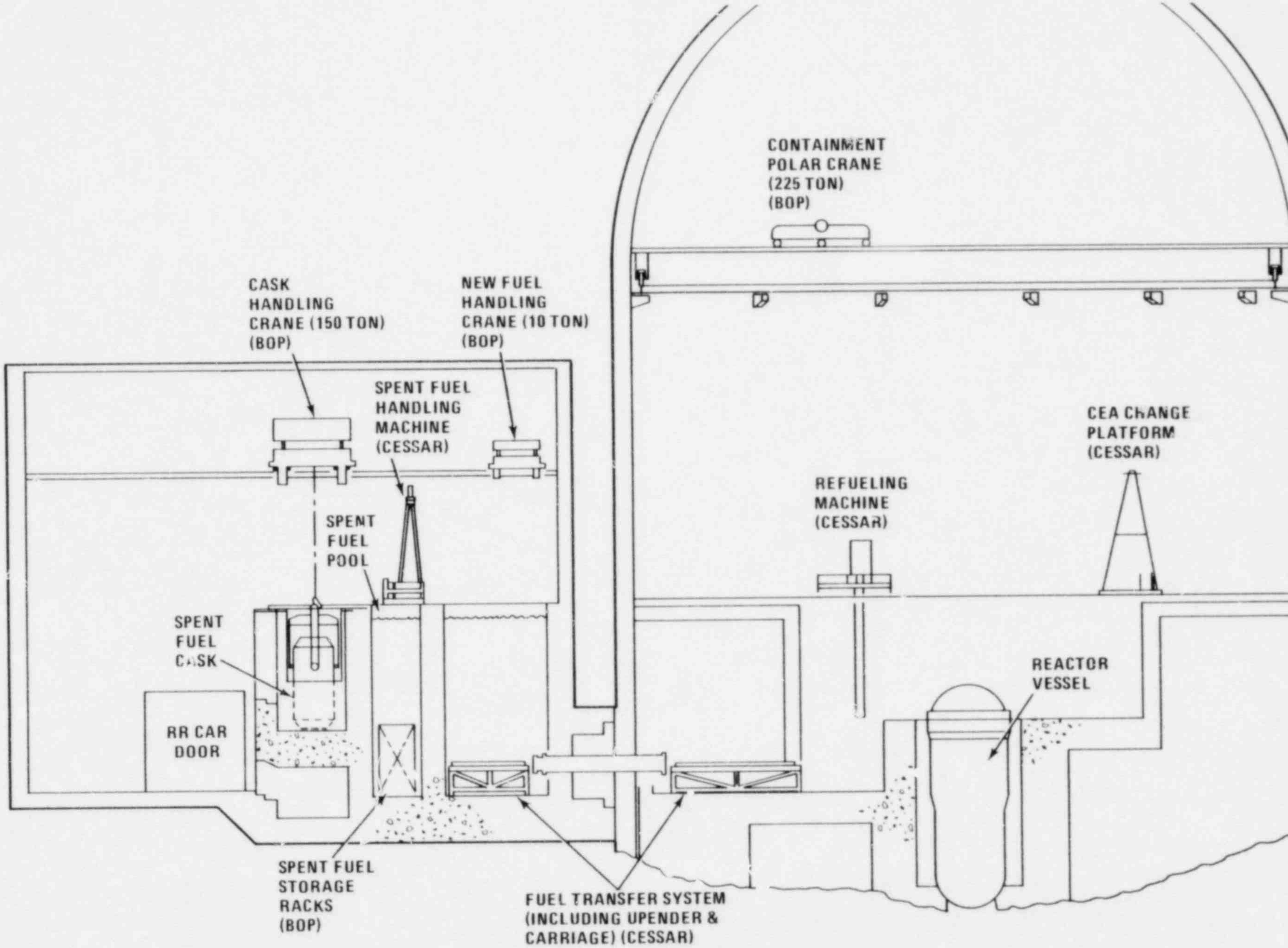
BOP

- New fuel storage racks
- Spent fuel storage racks
- New fuel handling crane
- Cask handling crane
- Containment polar crane

EXHIBIT 1-2



FUEL STORAGE AND HANDLING SYSTEMS – PLAN VIEW
FIGURE 1-2



FUEL STORAGE AND HANDLING SYSTEMS – SECTION "A"
FIGURE 1-3

PVNGS CLASSIFICATIONS

A. Quality Class "Q"

- Full compliance with 10CFR50, Appendix B, Per ANSI N45.2-1971.
  (All Engineered Safety Features (ESF) and/or ASME Section III components are "Q")

B. Quality Class "R"

- Similar to 10CFR50, Appendix B, but requires less extensive documentation.

C. Quality Class "S"

- Industry standard equipment.

D. Seismic Category I

- Remain functional for SSE and functional and within elastic range for OBE

E. Seismic Category II

- Components essential to power generation designed to not malfunction for an equivalent static load of 0.13G horizontal and 0.09G vertical

F. Seismic Category III

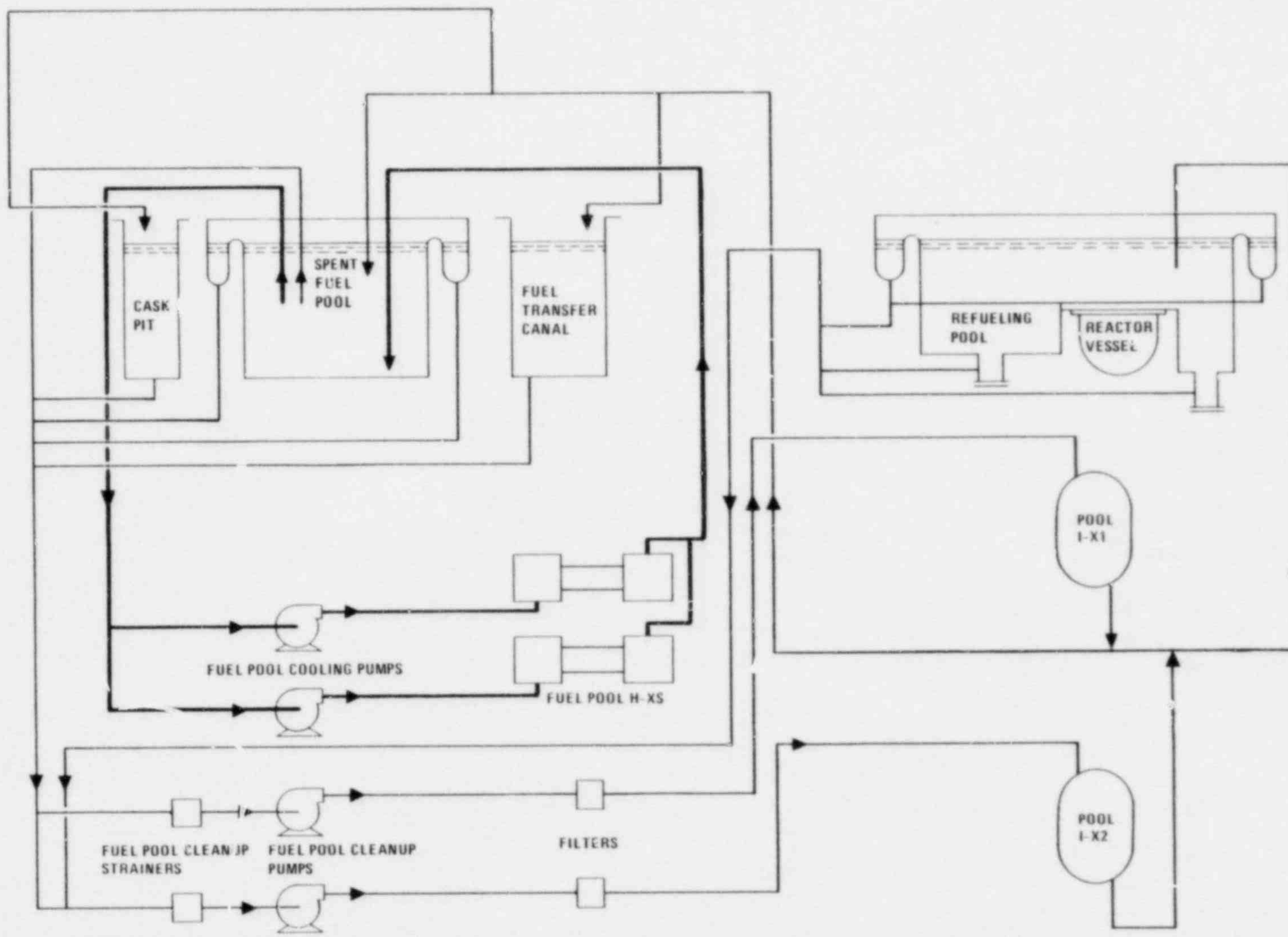
- Designed for an equivalent static load of 0.05G or to meet uniform building code for Seismic Zone 2

G. Seismic Category IX

- Design analyzed for non-collapse for SSE.

EXHIBIT 1-3

II. FUEL POOL COOLING AND CLEANUP
FUEL STORAGE AND HANDLING



FUEL POOL COOLING AND CLEANUP SYSTEM
FIGURE 2-1

DESIGN CRITERIA
FUEL POOL COOLING AND CLEANUP SYSTEM

1. The fuel pool cooling system (FPCS) removes heat from the spent fuel pool (SFP).

2. The fuel pool cleanup system maintains water clarity in the SFP, fuel transfer canal, and refueling pool, and provides cleanup capability for the refueling water tank (RWT).

3. The FPCS is designed to limit the SFP temperature to 125F with 1/3 core of spent fuel placed in the pool 6 days after shutdown, plus the decay heat from 12 one-third cores of spent fuel stored in the pool from the previous 12 refuelings. It shall be assumed that uranium oxide fuel is used. In the event of failure of a single cooling system component, the pool temperature is limited to 145F.

4. The FPCS, in conjunction with the shutdown cooling system (SCS), is designed to limit the SFP temperature to 125F with 1/3 core of 90 day irradiated, 6 day decayed fuel; 1/3 core of 1-1/4 year irradiated, 6 day decayed fuel; 1/3 core of 2-1/2 year irradiated, 6 day decayed fuel; plus 1/3 core assumed to have been in the pool for 90 days from a previous shutdown, and the spent fuel from 12 previous annual refuelings. It shall be assumed that uranium oxide fuel is used.

5. The system design shall not cause the water level to fall below the minimum level of 9 feet above the top of spent fuel assemblies during fuel handling.

EXHIBIT 2-1

DESIGN CRITERIA
FUEL POOL COOLING AND CLEANUP SYSTEM

6. The FPCS is designed to Seismic Category I and the fuel pool cleanup loop is designed to Seismic Category III requirements.

7. Normal makeup to the SFP shall be supplied from the liquid radwaste recycled water. A Seismic Category I makeup source and supply shall be provided to the SFP from the RWT. A backup makeup source shall be available from the condensate storage tank.

8. The SFP shall provide an alternate source of borated water for the chemical and volume control system (CVCS).

9. The fuel pool cleanup system shall be designed for the following water chemistry:

(1)	pH (77F)	4.5 to 10.2
(2)	Boric acid, maximum wt. percent	2.5
(3)	Ammonia, maximum ppm	50
(4)	Lithium, maximum ppm	0 to 0.5
(5)	Dissolved air, maximum	Saturated
(6)	Chloride, maximum ppm	0.15
(7)	Fluoride, maximum ppm	0.1

DESIGN CRITERIA
FUEL POOL COOLING AND CLEANUP SYSTEM

10. The fuel pool cleanup system shall contain two equipment trains. Either or both trains shall be able to clean up the SFP, the refueling pool, or the RWT.

11. The fuel pool cleanup system shall be able to process the contents of the spent fuel pool in 24 hours.

12. The fuel pool cleanup system shall be designed to limit the radiation level in the vicinity of the pool to less than 2.5 mrem/hr. Suction and discharge nozzles shall be located on opposite sides of the pool to facilitate more effective cleanup.

13. Following the loss of offsite power (LOP), the FPCS can be powered from the emergency power supply.

14. The following design codes and standards shall be met:

A. Pumps

- Fuel pool cooling system
  - American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section III, Class 3
- Fuel pool cleanup system
  - ASME Boiler and Pressure Vessel Code, Section VIII, and ANSI B31.1

DESIGN CRITERIA
FUEL POOL COOLING AND CLEANUP SYSTEM

B. HEAT EXCHANGERS

- ASME BOILER AND PRESSURE VESSEL CODE, SECTION III, CLASS 3
- TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION (TEMA)

C. FILTERS AND ION EXCHANGERS

- ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII

D. PIPING

- FUEL POOL COOLING SYSTEM
  - ASME BOILER AND PRESSURE VESSEL CODE, SECTION III, CLASS 3
- FUEL POOL CLEANUP SYSTEM
  - ASME BOILER AND PRESSURE VESSEL CODE, SECTION III (CONTAINMENT ISOLATION: DESIGN REQUIREMENTS SPECIFIED BY DESIGNER WITH APPROPRIATE CONSIDERATION OF THE INTENDED SERVICE AND OPERATING CONDITIONS.)
  - ANSI, B31.1, FOR POWER PIPING

EXHIBIT 2-4

DESIGN CRITERIA
FUEL STORAGE AND HANDLING SYSTEM

1) THE STORAGE OF NEW FUEL SHALL BE DESIGNED IN ACCORDANCE WITH THE FOLLOWING DESIGN BASES:

A. ACCIDENTAL CRITICALITY SHALL BE PREVENTED FOR THE MOST REACTIVE ARRANGEMENT OF NEW FUEL STORED, WITH OPTIMUM MODERATION, BY ASSURING THAT K_{EFF} IS LESS THAN 0.98. THIS DESIGN BASIS SHALL BE MET UNDER ANY NORMAL OR ACCIDENT CONDITIONS.

B. THE REQUIREMENTS OF REGULATORY GUIDE 1.29 SHALL BE MET.

C. THE STORAGE RACKS AND FACILITIES SHALL BE SEISMIC CATEGORY I.

D. STORAGE SHALL BE PROVIDED FOR AT LEAST 1/3 CORE OF NEW FUEL.

EXHIBIT 2-5

DESIGN CRITERIA
FUEL STORAGE AND HANDLING SYSTEM

2) THE STORAGE OF SPENT FUEL SHALL BE DESIGNED IN ACCORDANCE WITH THE FOLLOWING DESIGN BASES:

   A. ACCIDENTAL CRITICALITY SHALL BE PREVENTED FOR THE MOST REACTIVE ARRANGEMENT OF FUEL STORED WITH OPTIMUM MODERATION BY AVOIDING A K_{EFF} GREATER THAN 0.95. THIS DESIGN BASIS SHALL BE MET UNDER ANY NORMAL OR ACCIDENT CONDITIONS.

   B. THE REQUIREMENTS OF REGULATORY GUIDE 1.13 SHALL BE MET.

   C. THE STORAGE RACKS AND FACILITIES SHALL BE SEISMIC CATEGORY I.

   D. STORAGE SHALL BE PROVIDED FOR UP TO 1329 FUEL ASSEMBLIES.

   E. THE STORAGE RACKS AND SPENT FUEL POOL FACILITIES SHALL PREVENT EXTENSIVE BULK BOILING IN THE FUEL RACKS AND PREVENT FUEL ASSEMBLY PEAK CLAD TEMPERATURES FROM EXCEEDING 650F.

   F. SHIELDING OF SPENT FUEL SHALL BE ADEQUATE TO ENSURE THAT THE RADIATION ZONE CRITERIA ARE MET.

3) THE NEW FUEL HANDLING CRANE IS DESIGNED IN ACCORDANCE WITH THE FOLLOWING DESIGN BASES:

A. THE LOAD BEARING MEMBERS OF THE NEW FUEL HANDLING CRANE SHALL BE SEISMIC CATEGORY I.

B. THE CRANE SHALL BE DESIGNED IN ACCORDANCE WITH CMAA SPECIFICATION NO. 70 - ELECTRIC OVERHEAD TRAVELLING CRANES.

C. THE NEW FUEL HANDLING CRANE SHALL BE DESIGNED TO PREVENT TROLLEY OPERATION OVER THE SPENT FUEL POOL EXCEPT BY THE USE OF A KEY-OPERATED INTERLOCK OVERRIDE.

D. HOISTING LOAD LIFT FORCE SHALL BE RESTRICTED TO 5000 POUNDS WHEN FUEL ASSEMBLIES ARE BEING LIFTED.

E. THE NEW FUEL HANDLING CRANE SHALL BE RESTRAINED AND SUPPORTED SUCH THAT IT DOES NOT BECOME A HAZARD, IN THE EVENT OF AN SSE, TO SAFETY GRADE COMPONENTS, SYSTEMS, OR STRUCTURES.

DESIGN CRITERIA
FUEL STORAGE AND HANDLING SYSTEM

4) The cask handling crane is designed in accordance with the following design bases:

A. The load bearing members of the cask handling crane shall be Seismic Category I.

B. The crane shall be designed in accordance with CMAA specification No. 70 - Electric Overhead Travelling Cranes.

C. The cask handling crane shall be designed to meet the drop limit requirements of 10CFR71, Appendix B.

D. The cask handling crane shall be designed not to operate over the spent fuel pool.

E. The cask handling crane shall be restrained and supported such that it does not become a hazard, in the event of an SSE, to safety grade components, systems, or structures.

DESIGN CRITERIA
FUEL STORAGE AND HANDLING SYSTEM

5) THE CONTAINMENT POLAR CRANE IS DESIGNED IN ACCORDANCE WITH THE FOLLOWING DESIGN BASES:

A. THE LOAD-BEARING MEMBERS OF THE CONTAINMENT POLAR CRANE SHALL BE SEISMIC CATEGORY I.

B. THE CRANE SHALL BE DESIGNED IN ACCORDANCE WITH CMAA SPECIFICATION NO. 70 - ELECTRIC OVERHEAD TRAVELLING CRANES.

C. THE CONTAINMENT POLAR CRANE SHALL BE RESTRAINED AND SUPPORTED SUCH THAT IT DOES NOT BECOME A HAZARD, IN THE EVENT OF AN SSE, TO SAFETY GRADE COMPONENTS, SYSTEMS OR STRUCTURES.

D. THE CONTAINMENT POLAR CRANE SHALL BE DESIGNED NOT TO RAISE THE BOTTOM OF THE REACTOR VESSEL HEAD HIGHER THAN 17 FEET ABOVE THE REACTOR VESSEL FLANGE WHILE THE CRANE HOOK IS OVER THE REACTOR VESSEL FLANGE, EXCEPT WITH A KEY-OPERATED INTERLOCK OVERRIDE USED WITH APPROPRIATE OPERATIONAL PROCEDURES.

FUEL SYSTEM DESIGN

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 4.2.5

REQUIREMENT	DESIGN FEATURE
Protection from Natural Phenomena	
• The spent fuel pool shall be a Seismic Category I structure.	In compliance.
• The spent fuel storage racks shall be Seismic Category I.	In compliance.

FUEL SYSTEM DESIGN

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 4.2.5

REQUIREMENT	DESIGN FEATURE
PROTECTION FROM PIPE FAILURE	
• THE FUEL SHALL BE PROTECTED FROM THE EFFECTS OF PIPE WHIP WHILE IN STORAGE.	NOT APPLICABLE AS THERE ARE ONLY MODERATE ENERGY PIPES IN THE FUEL BUILDING.
• SPENT FUEL SHALL BE PROTECTED FROM THE EFFECTS OF PIPE RUPTURE.	IN COMPLIANCE.
PROTECTION FROM MISSILES	
• THE FUEL SHALL BE PROTECTED FROM THE EFFECTS OF MISSILES WHILE IN STORAGE.	IN COMPLIANCE.

EXHIBIT 2-11

FUEL SYSTEM DESIGN

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 4.2.5

REQUIREMENT	DESIGN FEATURE
SEPARATION	
• THE NEW FUEL STORAGE RACKS SHALL BE DESIGNED SUCH THAT FUEL ASSEMBLIES WILL NOT BE INSERTED IN OTHER THAN PRESCRIBED LOCATIONS.	IN COMPLIANCE
• ADEQUATE MARGIN TO CRITICALITY SHALL BE PROVIDED FOR FULL RACK LOADINGS OF FUEL ASSEMBLIES HAVING A MECHANICAL DESIGN SIMILAR TO THAT DESCRIBED IN CESSAR CHAPTER 4.0 AND ENRICHMENTS UP TO 3.7 WITHOUT U-235.	IN COMPLIANCE
• THE DEGREE OF SUBCRITICALITY PROVIDED SHALL BE CONSISTENT WITH THE REQUIREMENTS OF ANSI STANDARD N18.2 SECTION 5.7.4.1.	IN COMPLIANCE

EXHIBIT 2-12

FUEL SYSTEM DESIGN

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 4.2.5

REQUIREMENT	DESIGN FEATURE
THERMAL LIMITATIONS	
• DRAINS, PERMANENTLY CONNECTED SYSTEMS, AND OTHER FEATURES OF THE SPENT FUEL POOL SHALL BE DESIGNED SO THAT NEITHER MALOPERATION NOR FAILURE CAN RESULT IN LOSS OF COOLANT THAT WOULD UNCOVER THE STORED FUEL.	IN COMPLIANCE
MONITORING	
• LOW WATER LEVEL ALARMS SHALL BE PROVIDED FOR THE REFUELING POOL AND THE SPENT FUEL POOL.	IN COMPLIANCE

EXHIBIT 2-13

FUEL SYSTEM DESIGN

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 4.2.5

REQUIREMENT	DESIGN FEATURE
Inspection and Testing	
• Inservice inspection shall be performed in accordance with Section XI of the ASME Code.	In compliance
Related Services	
• For refueling operations, the containment polar crane shall have a minimum capacity of 225 tons.	In compliance
a. A hoisting speed of 6 in/min or less shall be utilized during refueling operations.	In compliance. A hoist speed of 3 in/min is provided.
b. A load measuring device shall be provided for use during heavy lifts.	In compliance

EXHIBIT 2-14

FUEL SYSTEM DESIGN

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 4.2.5

REQUIREMENT	DESIGN FEATURE
C. A LOW INCHING SPEED IS REQUIRED DURING THOSE PORTIONS OF THE LIFT WHEN CLOSE TOLERANCE SURFACES ARE ENGAGING EACH OTHER.	IN COMPLIANCE
• AN OVERHEAD CRANE SHALL BE PROVIDED IN THE NEW FUEL STORAGE AREA TO FACILITATE HANDLING OF NEW FUEL.	IN COMPLIANCE
A. THE CRANE CAPACITY SHALL BE AT LEAST 1 TON TO ACCOMMODATE THE WEIGHT OF A FUEL ASSEMBLY.	IN COMPLIANCE. THE NEW FUEL HANDLING CRANE HAS A 10-TON CAPACITY.
B. A VERTICAL HOISTING SPEED OF 6 FT/MIN OR LESS SHALL BE PROVIDED.	IN COMPLIANCE.
C. THE CRANE LOAD SHALL BE CAPABLE OF BEING LIMITED TO PREVENT THE HOIST LOAD FROM EXCEEDING 5000 POUNDS WHEN HANDLING FUEL ASSEMBLIES.	IN COMPLIANCE.

EXHIBIT 2-15

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

REQUIREMENT	DESIGN FEATURE
Power	
• At least 24.0 kVA shall be provided to power the fuel handling system.	In compliance
• Instrument air and power shall be provided for the refueling equipment.	In compliance
Protection from Natural Phenomena	
• Protection shall be provided in accordance with GDC 2 of 10CFR50, Appendix A.	In compliance
Operational/Controls	
• If a single failure can cause the reactor vessel closure head assembly to drop on the reactor vessel flange, the reactor vessel closure head assembly shall not be raised to a height greater than 17 feet while above the reactor vessel flange.	In compliance

EXHIBIT 2-16

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

REQUIREMENT	DESIGN FEATURE
• A MINIMUM WATER COVERAGE OF 9 FEET ABOVE THE ACTIVE PORTION OF THE FUEL ASSEMBLY SHALL BE MAINTAINED DURING FUEL STORAGE AND HANDLING. A NOMINAL 2-FOOT POOL FREEBOARD SHOULD BE EMPLOYED.	IN COMPLIANCE
SYSTEM/COMPONENT ARRANGEMENT	
• THE DEPTH OF THE SPENT FUEL POOL SHALL BE SUCH THAT A FUEL ROD ASSEMBLY LYING HORIZONTALLY ON THE TOP OF THE FUEL RACKS SHALL BE COVERED BY A WATER DEPTH OF AT LEAST 23 FEET.	A WATER DEPTH OF 22 FEET IS PROVIDED RATHER THAN 23 FEET.

EXHIBIT 2-17

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

REQUIREMENT	DESIGN FEATURE
Related Services	
• Refueling Pool	
A. Embedment and foundation supports within the pool shall be designed to accommodate the design loads from the equipment installed for refueling.	In compliance
B. Adequate underwater areas shall be provided for storage of the internals and tools without interfering with the refueling operation.	In compliance
• Spent Fuel Pool	
A. Embedment and foundation supports within the pool shall be designed to accommodate the design loads from the equipment installed for refueling.	In compliance

EXHIBIT 2-18

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

REQUIREMENT		DESIGN FEATURE
B.	ADEQUATE UNDERWATER AREAS SHALL BE PROVIDED FOR STORAGE OF TOOLS AND EQUIPMENT WITHOUT INTERFERING WITH THE REFUELING OPERATION.	IN COMPLIANCE
C.	DRAINS AND PERMANENTLY CONNECTED SYSTEMS ASSOCIATED WITH THE SPENT FUEL POOL SHALL BE DESIGNED SO THAT MALOPERATION/ FAILURE CANNOT UNCOVER THE STORED FUEL.	IN COMPLIANCE
D.	THE FPCS SHALL BE CAPABLE OF REMOVING THE DECAY HEAT FROM ALL SPENT FUEL PLACED IN THE POOL.	IN COMPLIANCE

EXHIBIT 2-19

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

REQUIREMENT	DESIGN FEATURE
• During reactor operation, the tools and equipment on CESSAR Table 9.1-1 shall be stored in such a manner as to maintain the tools in a safe condition and to prevent them from damaging safety class equipment during a seismic event.	In compliance
• Motion between the fuel transfer tube support points shall be limited to 3/4 inch.	In compliance
A. Supports for the transfer tube shall allow thermal expansion and seismic loadings.	In compliance

EXHIBIT 2-20

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

REQUIREMENT	DESIGN FEATURE
• A FIRE PROTECTION SYSTEM SHALL BE PROVIDED TO PROTECT THE FUEL HANDLING SYSTEM CONSISTENT WITH THE REQUIREMENTS OF GDC 3, AND SHALL INCLUDE, AS A MINIMUM, THE FOLLOWING FEATURES:	
A. FACILITIES FOR FIRE DETECTION AND ALARMING.	IN COMPLIANCE.
B. FACILITIES OR METHODS TO MINIMIZE THE PROBABILITY OF FIRE AND ITS ASSOCIATED EFFECTS.	IN COMPLIANCE.
C. FACILITIES FOR FIRE EXTINGUISHMENT.	IN COMPLIANCE.

EXHIBIT 2-21

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

	REQUIREMENT	DESIGN FEATURE
D.	METHODS OF FIRE PREVENTION SUCH AS USE OF FIRE RESISTANT AND NON-COMBUSTIBLE MATERIALS WHENEVER PRACTICAL, AND MINIMIZING EXPOSURE OF COMBUSTIBLE MATERIALS TO FIRE HAZARDS.	IN COMPLIANCE.
E.	ASSURANCE THAT FIRE PROTECTION SYSTEMS DO NOT ADVERSELY AFFECT THE FUNCTIONAL AND STRUCTURAL INTEGRITY OF SAFETY RELATED STRUCTURES, SYSTEMS, AND COMPONENTS.	IN COMPLIANCE.
F.	CARE SHOULD BE EXERCISED TO ENSURE THAT THE RUPTURE OR INADVERTENT OPERATION OF FIRE PROTECTION SYSTEMS DOES NOT SIGNIFICANTLY IMPAIR THE CAPABILITY OF SAFETY-RELATED STRUCTURES, SYSTEMS, AND COMPONENTS.	IN COMPLIANCE.

FUEL STORAGE AND HANDLING

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 9.1.4.6

REQUIREMENT	DESIGN FEATURE
ENVIRONMENTAL	
• DURING REFUELING OPERATIONS, THE CONTAINMENT VENTILATION SYSTEM MUST BE CAPABLE OF MAINTAINING THE AMBIENT TEMPERATURE WITHIN THE RANGE OF 70F - 100F IN ORDER TO MAINTAIN THE POSITIONAL ACCURACY OF THE REFUELING EQUIPMENT.	IN COMPLIANCE.

SYSTEM DESCRIPTION
FUEL POOL COOLING AND CLEANUP SYSTEM

1) Fuel Pool Cooling System

- Closed-loop system consisting of two trains, each consisting of one pump and one heat exchanger, and piping, valves, controls and instrumentation required to form a complete functional system.

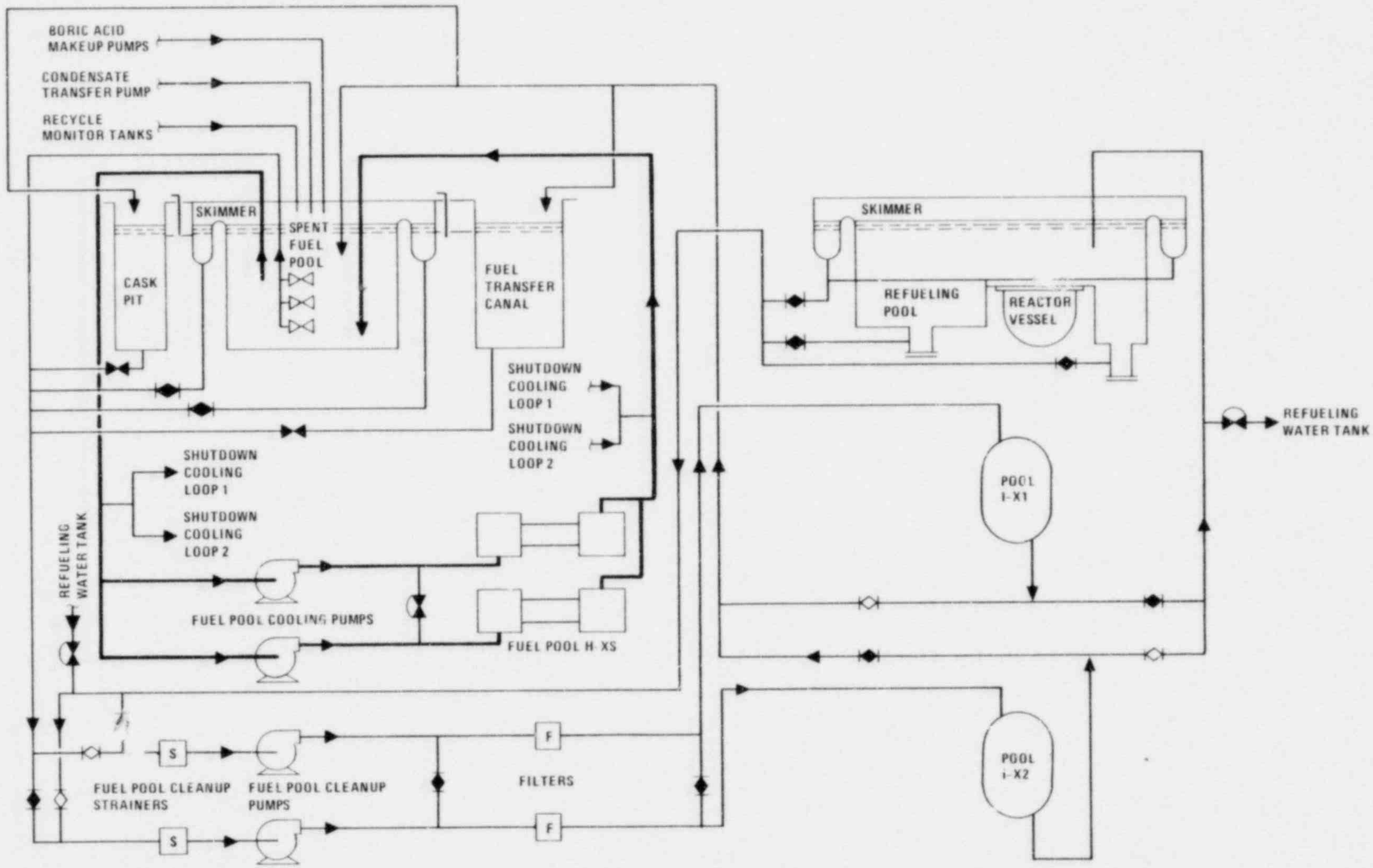
- Pumps are piped in parallel and take suction from the SFP through a common suction header. Each pump discharges, through a separate heat exchanger, into a common discharge header which returns cooled water to the SFP.

2) Fuel Pool Cleanup System

- The fuel pool cleanup system is composed of two flow trains, each consisting of strainer, pump, filter, and mixed bed ion exchanger. Either one or both trains can be aligned to clean water in the SFP, refueling pool, or RWT.

- Provision is made for taking suction from any or all of three different levels, and from the surface skimmer in the SFP.

EXHIBIT 2-24



FUEL POOL COOLING AND CLEANUP SYSTEM
FIGURE 2-2

3) New Fuel Storage

- Rack assemblies are made up of individual racks. Minimum spacing is maintained between assemblies in adjacent rows, allowing for rack fabrication tolerances and predicted deflections resulting from postulated accident conditions.

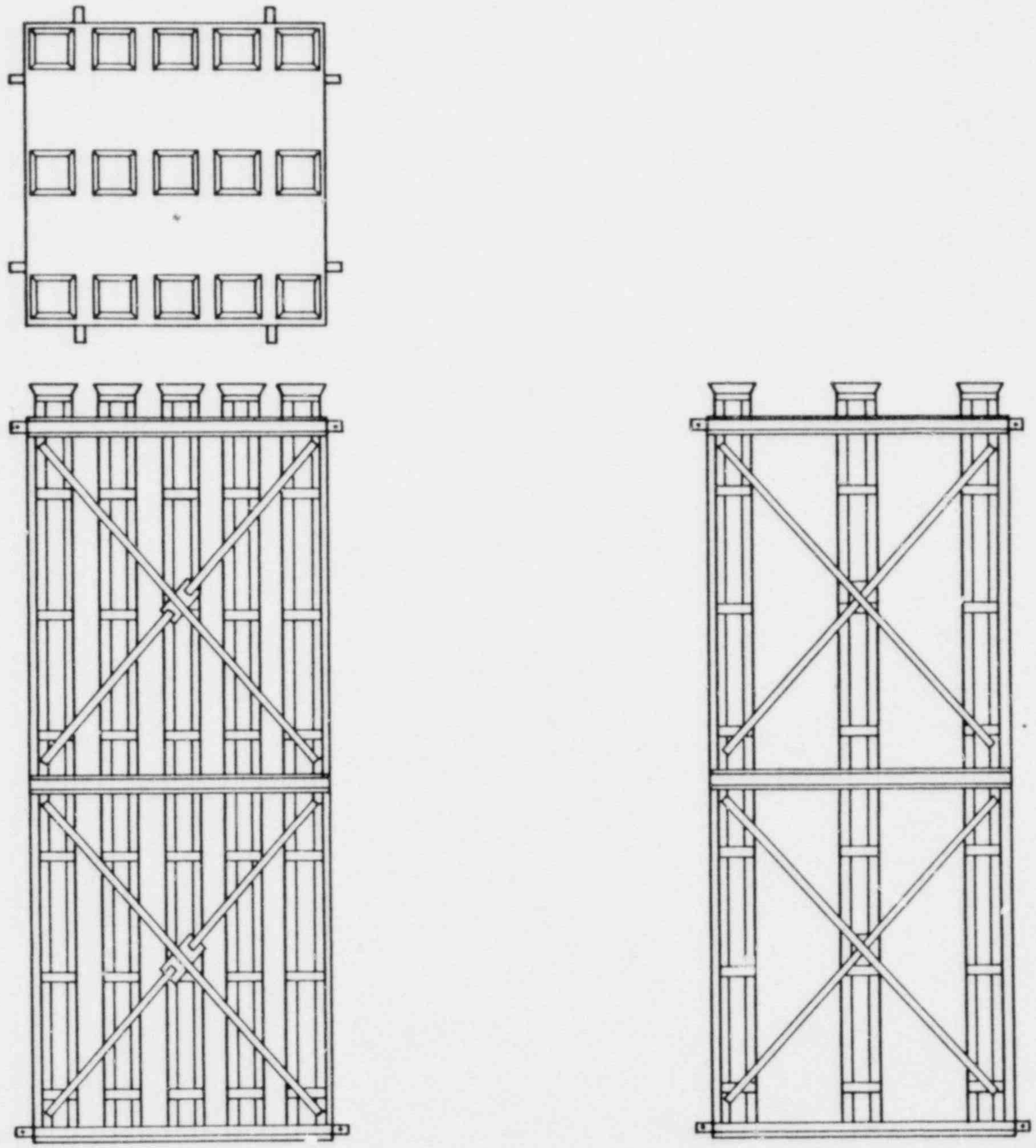
- Stainless steel construction of storage racks is compatible with water and zirconium-clad fuel.

- Top structure of racks has no opening between adjacent fuel cavities as large as the cross-section of the fuel bundle. Outer structure of racks precludes placement of a bundle against the rack closer than prescribed spacing.

4) Spent Fuel Storage

A) Spent Fuel Pool

- The stainless steel-lined, concrete-walled pool is an integral part of the fuel building.



NEW FUEL STORAGE RACK (150" ACTIVE FUEL LENGTH)
FIGURE 2-3

B) SPENT FUEL STORAGE RACKS

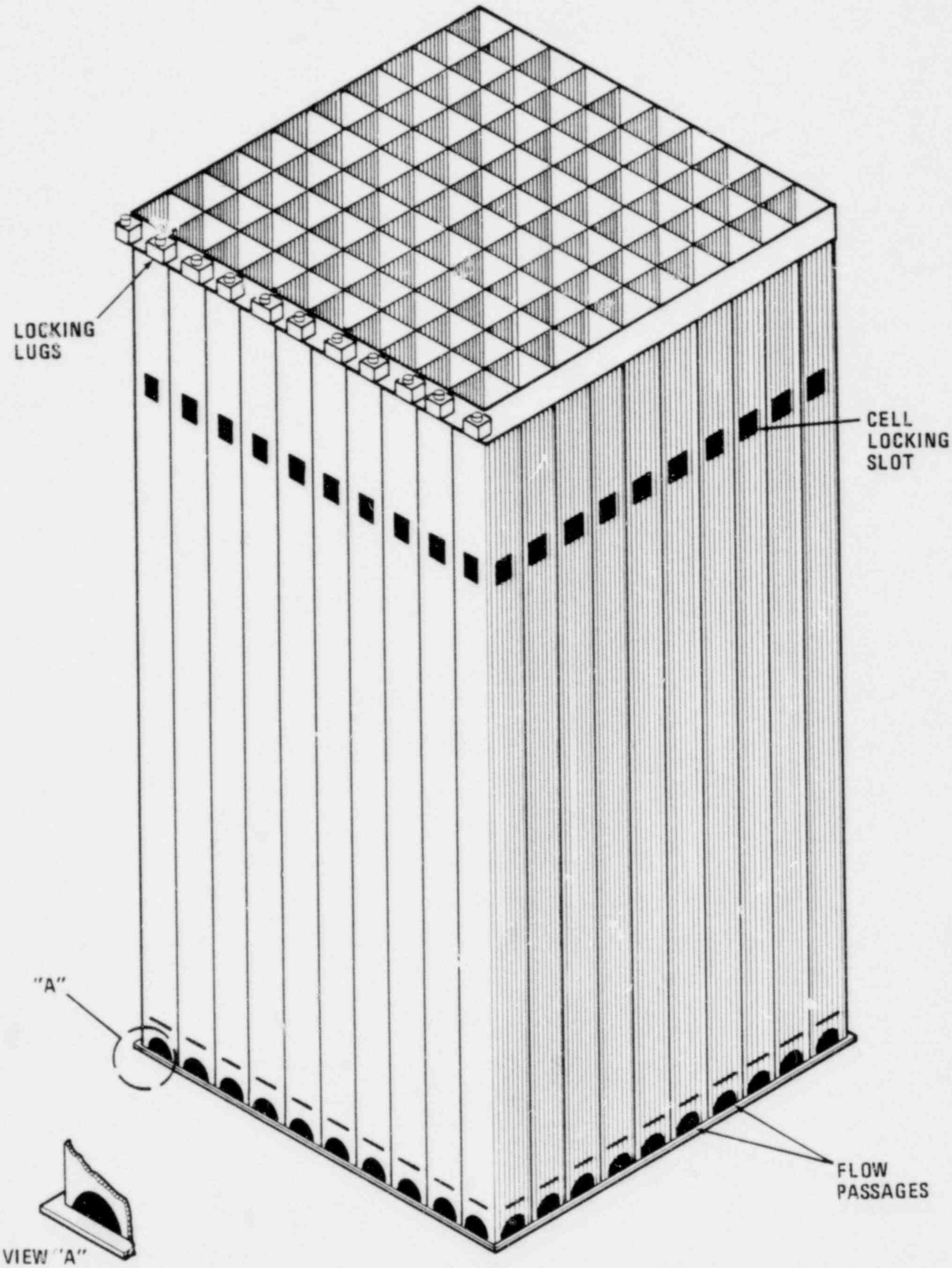
- RACKS ARE COMPRISED OF INDIVIDUAL MODULES. STORAGE RACKS ARE STAINLESS STEEL HONEYCOMB STRUCTURES WITH RECTANGULAR FUEL STORAGE LOCATIONS. STAINLESS STEEL CONSTRUCTION OF STORAGE RACKS IS COMPATIBLE WITH FUEL ASSEMBLY MATERIALS AND SPENT FUEL BORATED WATER ENVIRONMENT. RACKS HAVE THE CAPABILITY TO STORE NEW OR SPENT FUEL IN THREE MODES.

    1. <u>CHECKERBOARD FUEL STORAGE MODE</u>

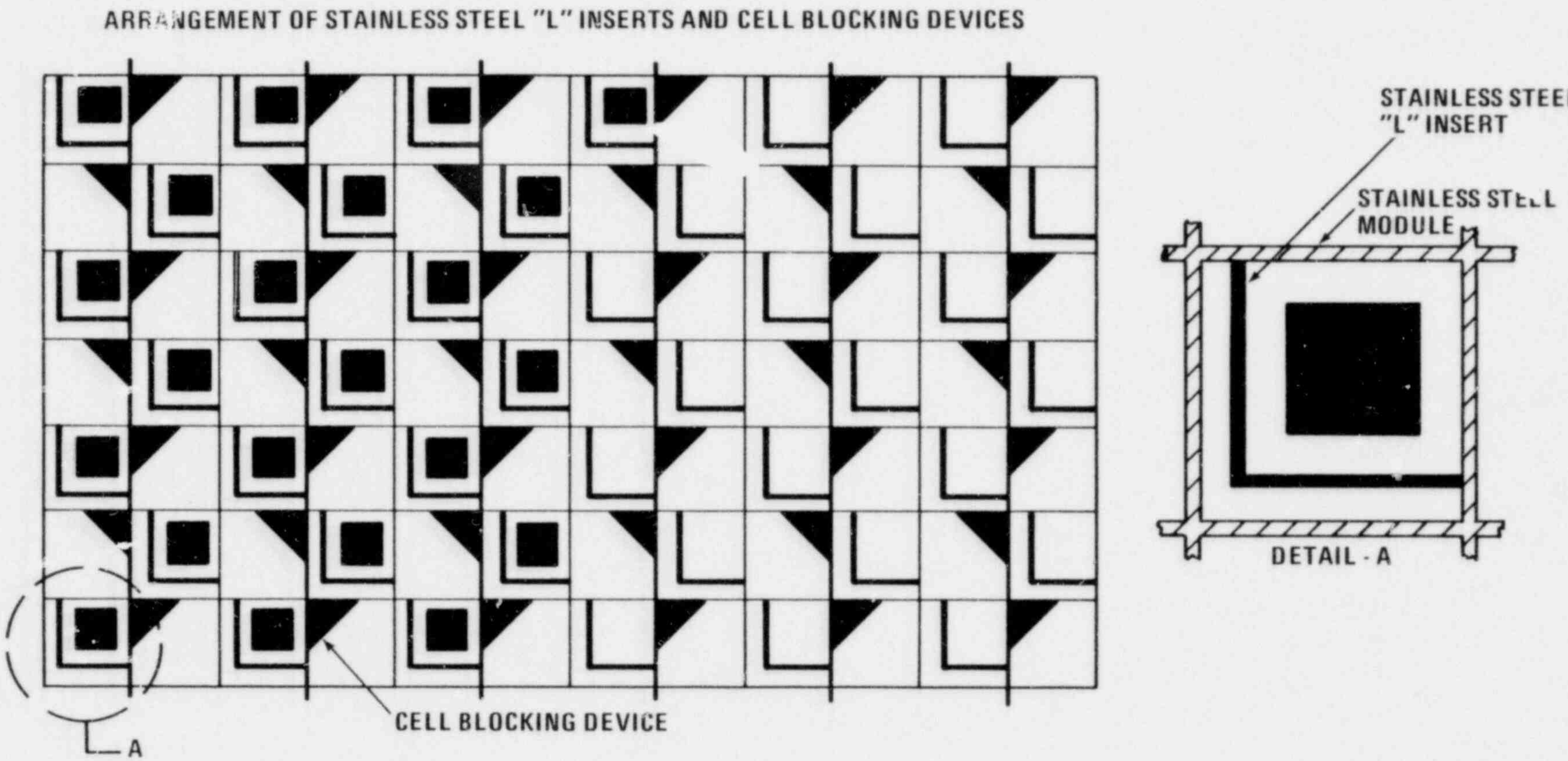
        - MINIMUM EDGE-TO-EDGE SPACING BETWEEN FUEL ASSEMBLIES IS MAINTAINED BY STORING FUEL IN A CHECKERBOARD PATTERN WHILE USING "L" INSERTS TO PROPERLY LOCATE A FUEL ASSEMBLY WITHIN A STORAGE CAVITY.

        - FUEL ASSEMBLY BLOCKING DEVICES ARE USED IN RACK CELLS THAT ARE NOT WITHIN THE ACCEPTABLE CHECKERBOARD STORAGE PATTERN, PREVENTING INSERTION OF A FUEL ASSEMBLY INTO AN INTERSTITIAL POSITION.

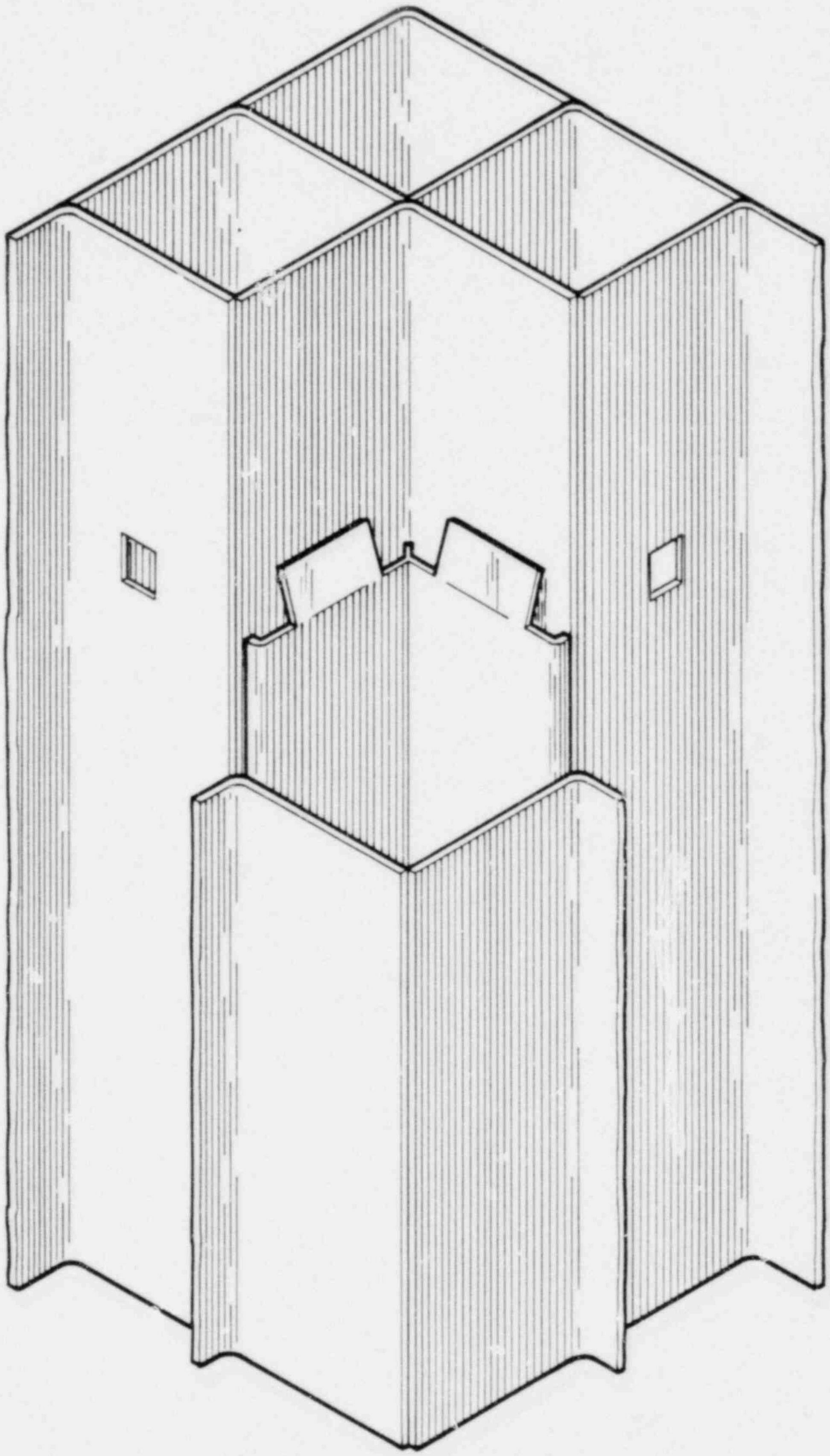
        - STORAGE FOR UP TO 665 NEW OR SPENT FUEL ASSEMBLIES CAN BE PROVIDED IN THIS MODE.



SPENT FUEL STORAGE RACK
FIGURE 2-4



NEW OR SPENT FUEL STORED IN A CHECKERBOARD ARRAY
FIGURE 2-5



CELL DETAILS OF "L" INSERT BOX
FIGURE 2-6

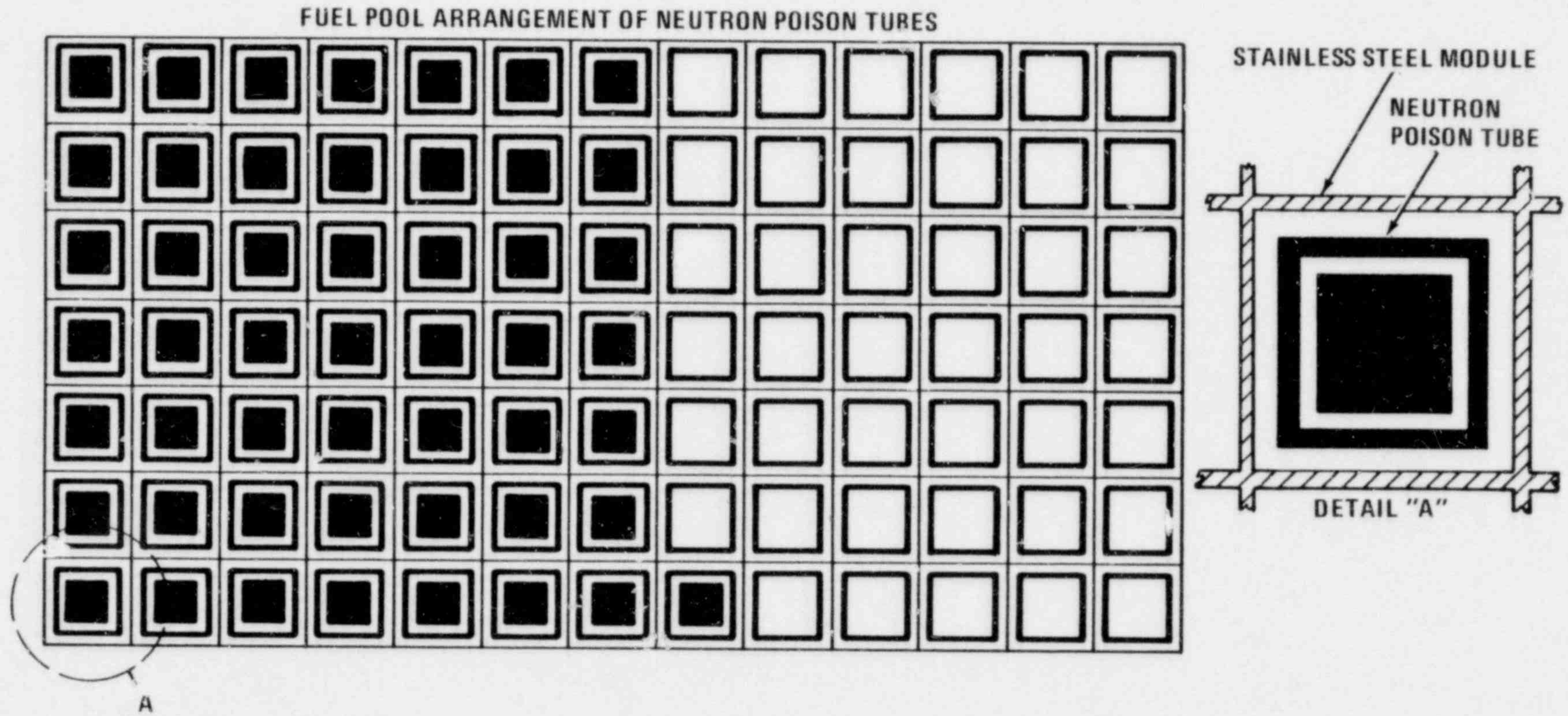
2. <u>Borated Fuel Storage Mode</u>

- Minimum spacing between fuel assemblies is maintained by storing fuel in rack locations that have been lined with a neutron poison tube (e.g., BORAL).

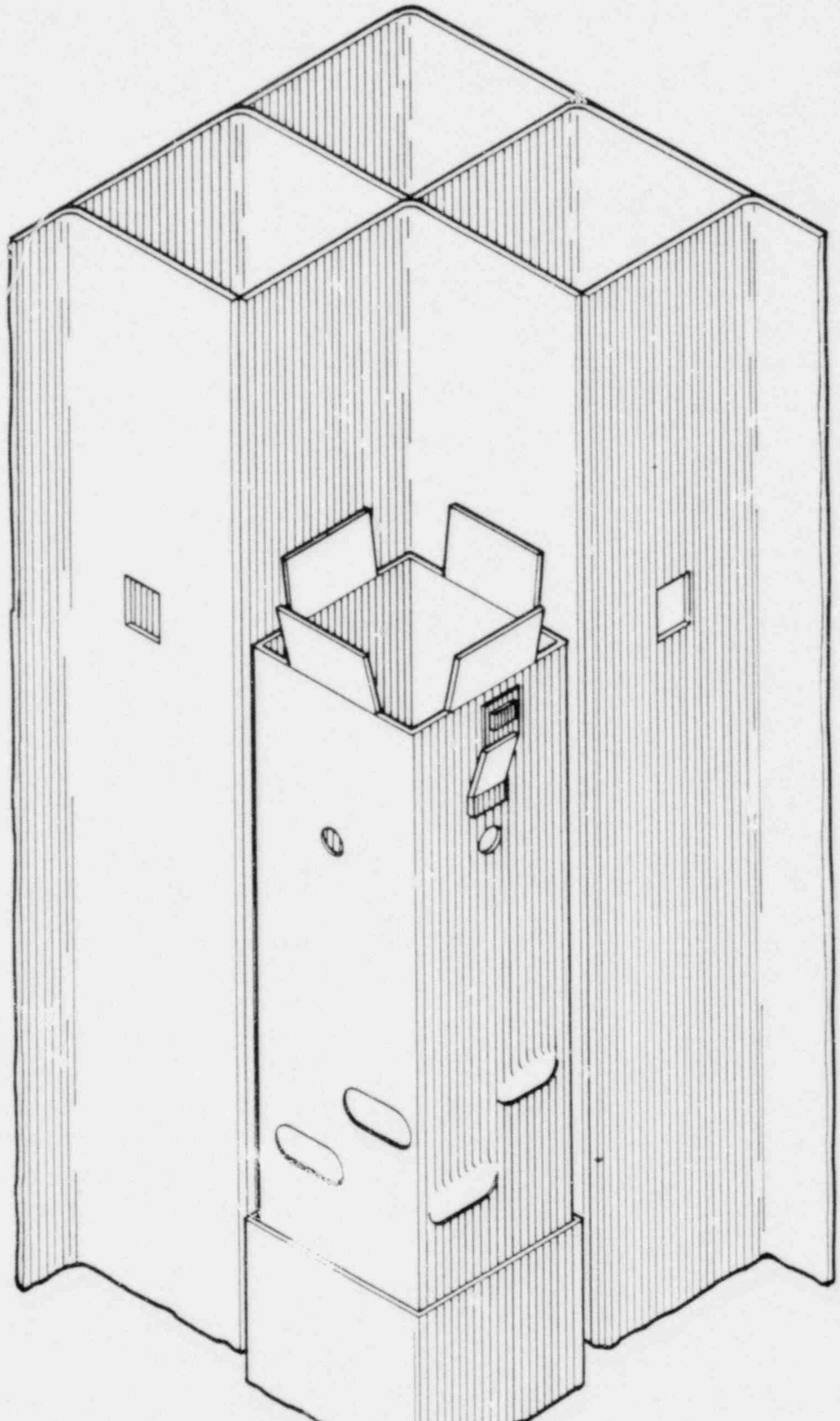
- Storage for up to 1329 new or spent fuel assemblies can be provided in this mode.

3. <u>Mixed Mode Fuel Storage</u>

- This mode uses variable numbers of "L" inserts and cell blocking devices in conjunction with corresponding numbers of neutron poison tubes to provide a segregated mix of checkerboard storage and neutron poison tubes.



NEW OR SPENT FUEL STORED IN ALL LOCATIONS
FIGURE 2-7



CELL DETAILS OF POISON TUBE
FIGURE 2-8

5) Cask Handling Crane

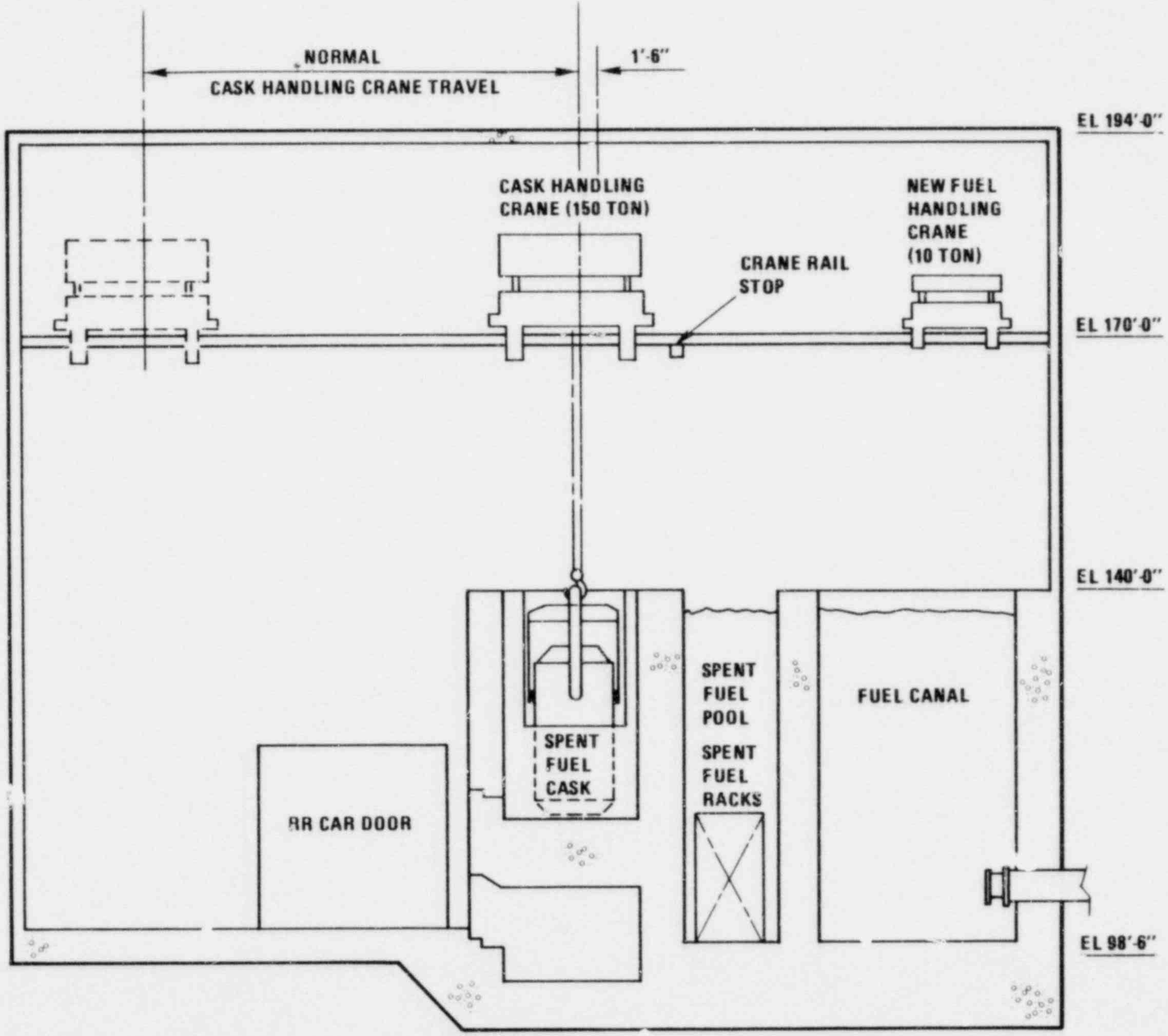
- The 150-ton cask handling crane transfers the spent fuel cask between the cask loading pit, the decontamination pit, and transportation vehicle.

6) New Fuel Handling Crane

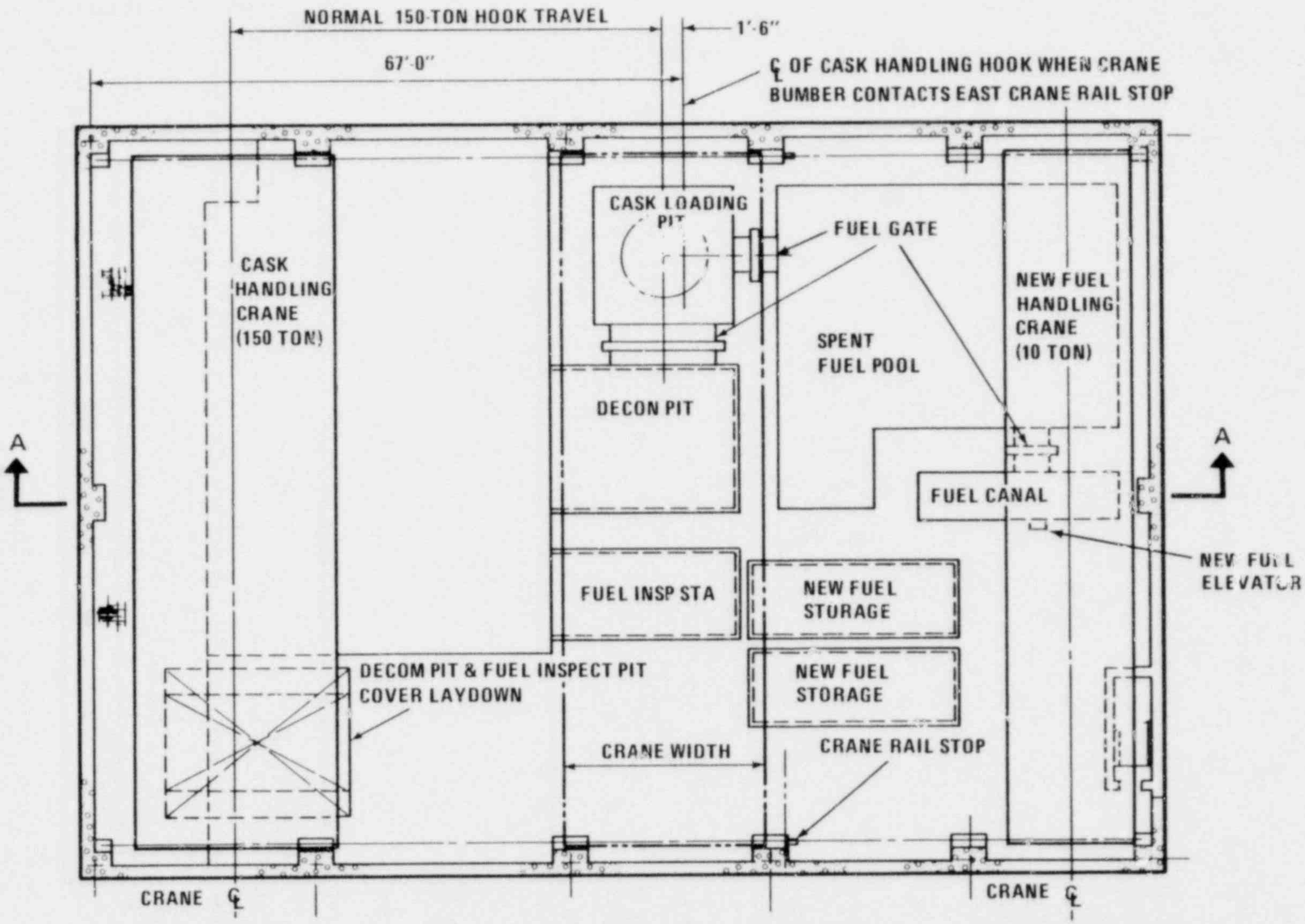
- The 10-ton new fuel handling crane transfers new fuel assemblies between the transportation carrier, new fuel inspection station, new fuel storage facility, and new fuel elevator.

7) Containment Polar Crane

- The 225-ton containment polar crane is used during refueling operations. It may also be used for maintenance operations for the lifting and removal of major items of equipment if required.



FUEL BUILDING FUEL STORAGE AND HANDLING – SECTION "A"
FIGURE 2-9



FUEL BUILDING FUEL HANDLING AND STORAGE
FIGURE 2-10

OPERATION
FUEL POOL COOLING AND CLEANUP SYSTEM

1. Cooling System

- With 13 one-third cores from refuelings in the fuel pool, two fuel pool cooling pumps and two fuel pool heat exchangers are in continuous service. The fuel pool cooling loop can be connected to the shutdown cooling system to provide additional heat removal capacity.

- With 13 one-third cores from refuelings and one complete core from a reactor vessel unloading present in the fuel pool, one fuel pool pump and one fuel pool heat exchanger, plus one low-pressure safety injection pump, one containment spray pump, and one shutdown cooling heat exchanger are in continuous service.

- The system is manually controlled and operation is monitored at the local control panel.

- Nuclear cooling water flow to the fuel pool heat exchangers is initially adjusted to the required flow.

- The ECWS can be manually aligned with the fuel pool heat exchanger on a loss of nuclear cooling water flow.

- Loss of water in the event of a pipe break outside the SFP is prevented by routing pipes over the SFP wall and using siphon breaker holes in pipes which run below the minimum water level.

2. Cleanup System

- Cleanup loops are normally run on an intermittent basis when required by the water conditions from the various sources. It is possible to operate each loop independently.

- The system is manually controlled and the operation monitored at the local control panel.

- One or both cleanup loops can be aligned with the refueling pool during refueling.

- At the end of refueling after the pool level is lowered to the reactor vessel flange, pool cleanup pumps are used to pump down the water contained in the fuel transfer canal and upper guide structure pit.

- Cleanup pumps can also be used to fill or empty the cask pit and the fuel transfer canal.

3. WATER SUPPLY

- MAKEUP OF BORATED WATER CAN BE PROVIDED FROM THE RWT.
- NON-BORATED WATER FROM THE LIQUID RADWASTE SYSTEM RECYCLE MONITOR TANKS CAN BE USED TO MAKE UP EVAPORATION LOSSES.
- CONDENSATE TRANSFER PUMPS CAN FURNISH AN ALTERNATE SUPPLY OF NON-BORATED WATER FROM THE CONDENSATE STORAGE TANK.
- THE CVCS BORIC ACID MAKEUP PUMPS CAN DRAW WATER FROM THE SFP TO PROVIDE AN ALTERNATE SOURCE OF BORATED WATER TO THE CVCS. THE VOLUME OF WATER AVAILABLE IS SUFFICIENT TO EFFECT A SAFE SHUTDOWN TO COLD CONDITION. THE DRAWDOWN OF THE POOL IS LIMITED TO 5 FEET BELOW THE MINIMUM OPERATING WATER LEVEL BY USE OF A SIPHON BREAKER HOLE AT THIS LEVEL.

4. EMERGENCY CONDITIONS

- DURING LOP, FUEL POOL COOLING PUMPS ARE SHED FROM THE POWER SUPPLY BUSES. AFTER DIESEL GENERATORS AND ENGINEERED-SAFEGUARDS EQUIPMENT ARE IN OPERATION, FUEL POOL PUMPS CAN BE OPERATED FROM THE LOCAL CONTROL PANEL TO REMOVE DECAY HEAT.

OPERATION
FUEL HANDLING AND STORAGE SYSTEM

1) New Fuel Handling Crane

- The new fuel handling crane transfers the new fuel container between the rail car and the new fuel container laydown area, and from the shipping container to the new fuel inspection station.

- Upon completion of new fuel inspection, the crane transfers new fuel into the new fuel storage racks.

- During refueling the crane transfers new fuel from the new fuel storage racks to the new fuel elevator.

2) Cask Handling Crane

- The cask handling crane transfers the spent fuel cask between the loading area, decontamination pit, and spent fuel load pit.

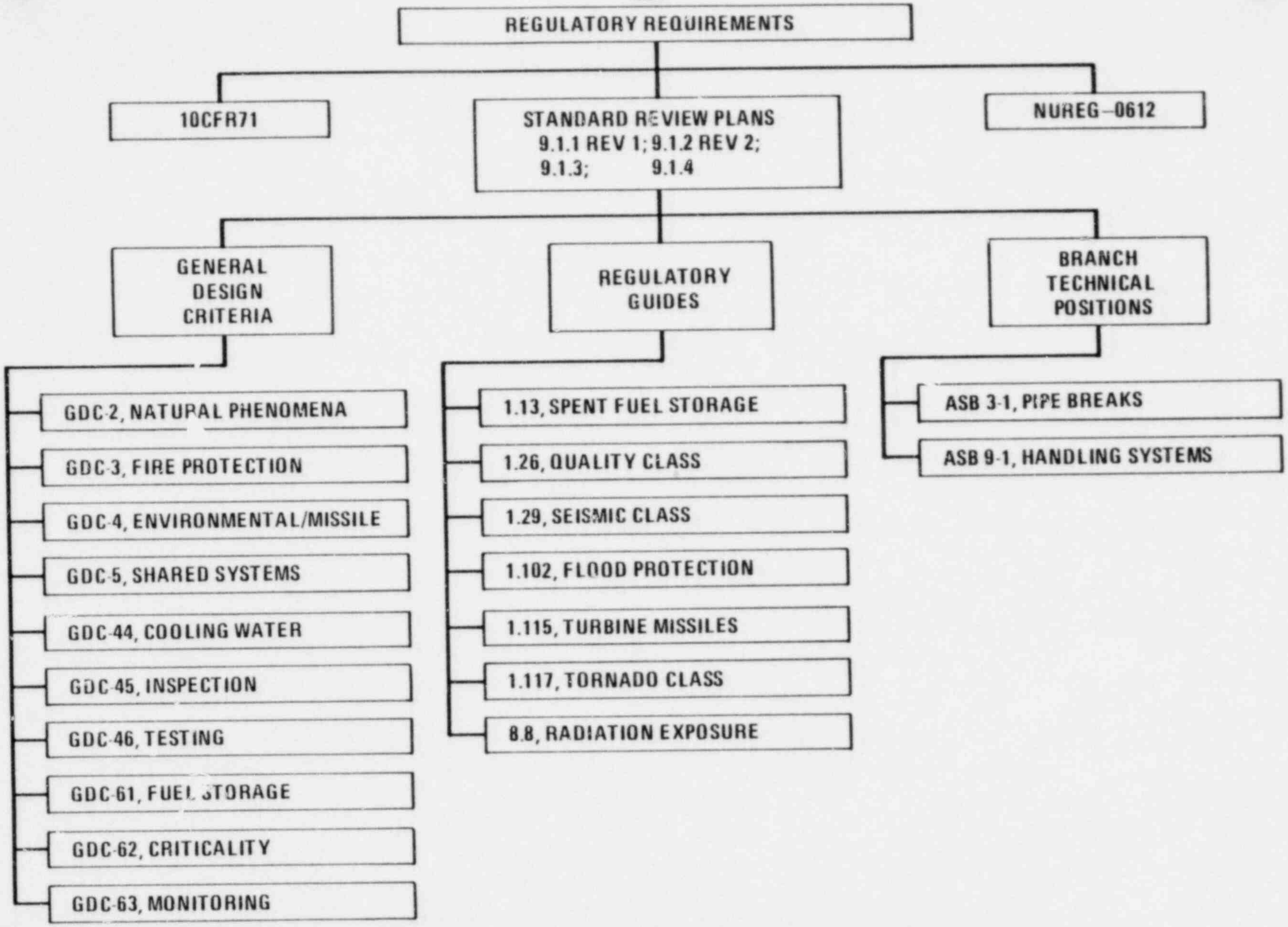
- Upon arrival at the fuel building, the cask is transferred from the rail car into the decontamination pit for washdown. The cask is never more than 30 feet above the floor. The cask is moved from the decontamination pit into the cask loading pit for spent fuel loading. After completion of the spent fuel loading, the cask is returned to the decontamination pit for washdown prior to shipping and subsequently transferred onto the rail car.

3) Containment Polar Crane

- The containment polar crane transfers the control element drive mechanism (CEDM) unit, missile shield, and CEDM essential cooling units between their permanent locations and designated laydown areas during refueling.

- The crane is used during refueling for lifting and lowering the reactor vessel closure head and transferring it between the reactor and the designated laydown area. The reactor vessel closure head is never lifted more than 17 feet above the reactor vessel flange.

- The crane is used for installation or removal of the reactor internals, control element assemblies, upper guide structure, and transfer of these components between their permanent location and designated laydown areas.



STANDARD REVIEW PLANS 9.1.1 REV. 1, 9.1.2 REV. 2, 9.1.3, 9.1.4
FIGURE 2-11

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 2, NATURAL PHENOMENA

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED TO WITHSTAND THE EFFECTS OF NATURAL PHENOMENA SUCH AS EARTHQUAKES, TORNADOES, HURRICANES, FLOODS, AND SEICHES WITHOUT LOSS OF CAPABILITY TO PERFORM THEIR SAFETY FUNCTIONS.	IN COMPLIANCE. THE COMPONENTS OF SPENT FUEL COOLING, AND NEW AND SPENT FUEL STORAGE AND HANDLING IMPORTANT TO SAFETY ARE HOUSED IN SEISMIC CATEGORY I, MISSILE-PROOF STRUCTURES AND DESIGNED TO SEISMIC CATEGORY I REQUIREMENTS. ALL COMPONENTS ARE BEYOND THE EFFECTS OF THE DESIGN BASIS FLOOD, TORNADO AND HURRICANE.

EXHIBIT 2-35

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 3, FIRE PROTECTION

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED AND LOCATED TO MINIMIZE THE PROBABILITY AND EFFECT OF FIRES AND EXPLOSIONS.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 4, ENVIRONMENTAL AND MISSILE DESIGN

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED FOR THE ENVIRONMENTAL CONDITIONS ASSOCIATED WITH NORMAL OPERATION, MAINTENANCE, TESTING AND POSTULATED ACCIDENTS, INCLUDING LOSS-OF-COOLANT ACCIDENTS. THEY SHALL BE APPROPRIATELY PROTECTED AGAINST DYNAMIC EFFECTS, INCLUDING THE EFFECTS OF MISSILES, PIPE WHIPPING, AND DISCHARGING FLUIDS, THAT MAY RESULT FROM EQUIPMENT FAILURES AND FROM EVENTS AND CONDITIONS OUTSIDE THE NUCLEAR POWER UNIT.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 5, SHARED SYSTEMS

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL NOT BE SHARED BETWEEN NUCLEAR POWER UNITS.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 44, COOLING WATER

REQUIREMENT	DESIGN FEATURE
A SAFETY SYSTEM SHALL BE PROVIDED TO TRANSFER THE COMBINED HEAT LOAD OF ESF SYSTEMS UNDER NORMAL OPERATING AND ACCIDENT CONDITIONS TO AN ULTIMATE HEAT SINK. SUITABLE REDUNDANCY IN INTERCONNECTIONS, LEAK DETECTION, AND ISOLATION CAPABILITIES SHALL BE PROVIDED TO ASSURE THAT THE SYSTEM SAFETY FUNCTION CAN BE ACCOMPLISHED, ASSUMING A SINGLE FAILURE WITH OR WITHOUT A LOP.	IN COMPLIANCE. DECAY HEAT FROM SPENT FUEL IS NORMALLY TRANSFERRED BY THE NON-SAFETY RELATED NUCLEAR COOLING WATER SYSTEM (NCWS) TO THE PLANT COOLING TOWERS. DURING LOP, WHEN THE NCWS IS NOT AVAILABLE, COOLING CAN BE MANUALLY RE-ALIGNED TO THE SAFETY-RELATED ECWS OR SCS, PROVIDING REDUNDANT BACKUP SYSTEMS.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 45, INSPECTION

REQUIREMENT	DESIGN FEATURE
THE COOLING WATER SYSTEM SHALL BE DESIGNED TO PERMIT APPROPRIATE PERIODIC INSPECTION OF IMPORTANT COMPONENTS TO ASSURE THE INTEGRITY AND CAPABILITY OF THE SYSTEM.	IN COMPLIANCE. ALL ASME PIPING AND COMPONENTS ARE CAPABLE OF IN-SERVICE-INSPECTION PER ASME SECTION XI. ANSI COMPONENTS AND NON-EMBEDDED ANSI PIPING CAN BE PERIODICALLY INSPECTED.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 46, TESTING

REQUIREMENT	DESIGN FEATURE
THE COOLING WATER SYSTEM SHALL PERMIT APPROPRIATE PERIODIC PRESSURE AND FUNCTIONAL TESTING TO ASSURE (1) STRUCTURAL AND LEAKTIGHT INTEGRITY OF COMPONENTS, (2) OPERABILITY AND PERFORMANCE OF ACTIVE COMPONENTS, AND (3) OPERABILITY OF THE SYSTEM AS A WHOLE AND PERFORMANCE OF THE FULL OPERATIONAL SEQUENCE FOR REACTOR SHUTDOWN AND FOR LOSS-OF-COOLANT ACCIDENTS.	IN COMPLIANCE. INSPECTION AND TESTING OF ASME COMPONENTS WILL BE CONDUCTED IN ACCORDANCE WITH ASME SECTION XI.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 61, FUEL STORAGE AND HANDLING AND RADIOACTIVITY CONTROL

REQUIREMENT	DESIGN FEATURE
THE FUEL STORAGE AND HANDLING SYSTEMS SHALL BE DESIGNED TO ASSURE ADEQUATE SAFETY UNDER NORMAL AND POSTULATED ACCIDENT CONDITIONS. THESE SYSTEMS SHALL BE DESIGNED TO PERMIT PERIODIC INSPECTION AND TESTING OF COMPONENTS IMPORTANT TO SAFETY, WITH SHIELDING FOR RADIATION PROTECTION, APPROPRIATE CONTAINMENT, AND FILTERING SYSTEMS, A RESIDUAL HEAT REMOVAL CAPABILITY AND TO PREVENT REDUCTION IN FUEL STORAGE COOLANT INVENTORY UNDER ACCIDENT CONDITIONS.	IN COMPLIANCE. ALL COMPONENTS ARE HOUSED IN SEISMIC CATEGORY I STRUCTURES. THE CONCRETE COMPARTMENTS/POOLS ASSURE PROTECTION AGAINST RADIATION EXPOSURE. A POOL CLEANUP SYSTEM IS PROVIDED. THE FPCS HAS REDUNDANT COMPONENTS. BACKUP COOLING IS PROVIDED BY THE ECWS AND SCS.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 62, PREVENTION OF CRITICALITY IN FUEL STORAGE AND HANDLING

REQUIREMENT	DESIGN FEATURE
CRITICALITY IN THE FUEL STORAGE AND HANDLING SYSTEM SHALL BE PREVENTED BY PHYSICAL SYSTEMS OR PROCESSES, PREFERABLY BY USE OF GEOMETRICALLY SAFE CONFIGURATIONS.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 63, MONITORING FUEL AND WASTE STORAGE

REQUIREMENT	DESIGN FEATURE
APPROPRIATE SYSTEMS SHALL BE PROVIDED IN FUEL STORAGE SYSTEM AND ASSOCIATED HANDLING AREAS (1) TO DETECT CONDITIONS THAT MAY RESULT IN LOSS OF RESIDUAL HEAT REMOVAL CAPABILITY AND EXCESSIVE RADIATION LEVELS AND (2) TO INITIATE APPROPRIATE SAFETY ACTIONS.	IN COMPLIANCE. THE DESIGN OF THE SPENT FUEL POOL PRECLUDES UNCOVERING THE STORED FUEL. AREA RADIATION MONITORS AND SPENT FUEL POOL TEMPERATURE INSTRUMENTS ARE PROVIDED.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.13, SPENT FUEL STORAGE FACILITY DESIGN BASIS

REQUIREMENT	DESIGN FEATURE
1. The spent fuel storage facility should be designed to Seismic Category I requirements.	1. In compliance.
2. The facility should be designed a) to keep tornadic winds and missiles from causing loss of watertight integrity of the fuel storage pool and b) to keep missiles from contacting fuel within the pool.	2. In compliance.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.13, SPENT FUEL STORAGE FACILITY DESIGN BASIS (CONT'D)

REQUIREMENT	DESIGN FEATURE
3. INTERLOCKS SHOULD BE PROVIDED TO PREVENT CRANES FROM PASSING OVER STORED FUEL WHEN FUEL HANDLING IS NOT IN PROGRESS. DURING FUEL HANDLING OPERATIONS, THE INTERLOCKS MAY BE BYPASSED AND ADMINISTRATIVE CONTROL USED TO PREVENT THE CRANE FROM CARRYING LOADS THAT ARE NOT NECESSARY FOR FUEL HANDLING OVER THE STORED FUEL OR OTHER PROHIBITED AREAS.	3. IN COMPLIANCE.
4. A CONTROLLED LEAKAGE BUILDING SHOULD ENCLOSE THE FUEL POOL. THE BUILDING SHOULD BE EQUIPPED WITH AN APPROPRIATE VENTILATION AND FILTRATION SYSTEM TO LIMIT THE POTENTIAL RELEASE OF RADIOACTIVE IODINE AND OTHER RADIOACTIVE MATERIALS.	4. IN COMPLIANCE. ESSENTIAL HVAC SYSTEMS AND RADIATION MONITORING INSTRUMENTS ARE PROVIDED.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.13, SPENT FUEL STORAGE FACILITY DESIGN BASIS (CONT'D)

REQUIREMENT	DESIGN FEATURE
5. THE SPENT FUEL STORAGE FACILITY SHOULD HAVE AT LEAST ONE OF THE FOLLOWING:	
A. CRANES CAPABLE OF CARRYING HEAVY LOADS SHOULD BE PREVENTED FROM MOVING INTO THE VICINITY OF THE POOL;	A. IN COMPLIANCE.
OR	
B. CRANES SHOULD BE DESIGNED TO PROVIDE SINGLE-FAILURE-PROOF HANDLING OF HEAVY LOADS;	B. NOT APPLICABLE.
OR	
C. THE FUEL POOL SHOULD BE DESIGNED TO WITHSTAND, WITHOUT LEAKAGE THAT COULD UNCOVER THE FUEL, THE IMPACT OF THE HEAVIEST LOAD TO BE CARRIED BY THE CRANE FROM THE MAXIMUM HEIGHT TO WHICH IT CAN BE LIFTED.	C. NOT APPLICABLE.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.13, SPENT FUEL STORAGE FACILITY DESIGN BASIS (CONT'D)

REQUIREMENT	DESIGN FEATURE
6. DRAINS AND PERMANENTLY CONNECTED SYSTEMS THAT BY MALOPERATION OR FAILURE COULD CAUSE LOSS OF COOLANT OVER THE FUEL SHOULD NOT BE INSTALLED. SYSTEMS FOR MAINTAINING WATER QUALITY AND QUANTITY SHOULD BE DESIGNED SO THAT ANY MALOPERATION OR FAILURE OF SUCH SYSTEMS WILL NOT CAUSE FUEL TO BE UNCOVERED.	6. IN COMPLIANCE. ANY PIPING CONNECTION FROM/INTO THE SPENT FUEL POOL IS OVER THE TOP OF THE POOL. SIPHON-BREAKING HOLES PREVENT ACCIDENTAL EMPTYING OF THE POOL BELOW A SAFE LEVEL.
7. RELIABLE AND FREQUENTLY TESTED MONITORING EQUIPMENT SHOULD BE PROVIDED TO ALARM IF THE WATER LEVEL IN THE FUEL STORAGE POOL FALLS BELOW A PREDETERMINED LEVEL OR IF HIGH LOCAL-RADIATION LEVELS ARE EXPERIENCED.	7. IN COMPLIANCE. LEVEL INSTRUMENTATION AND SAFETY-RELATED AREA AND VENTILATION RADIATION MONITORS ARE PROVIDED.

REGULATORY GUIDE 1.13, SPENT FUEL STORAGE FACILITY DESIGN BASIS (CONT'D)

REQUIREMENT	DESIGN FEATURE
8. A Seismic Category I makeup system should be provided to add coolant to the pool. Appropriate redundancy or a backup system for filling the pool from a reliable source should be provided.	8. In compliance. Seismic Category I makeup is available from the refueling storage tank. The condensate storage tank serves as a Seismic Category I backup source.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.26, QUALITY GROUP CLASSIFICATION

REQUIREMENT	DESIGN FEATURE
Cooling water systems important to safety that are designed for residual heat removal from the spent fuel storage pool shall meet the requirements of ASME B&PV Code, Section III, Class 3.	In compliance.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.29, SEISMIC DESIGN CLASSIFICATION

REQUIREMENT	DESIGN FEATURE
The cooling water systems that are required for cooling the spent fuel storage pool shall be designated Seismic Category I and shall be designed to withstand the effects of SSE and remain functional. The quality assurance requirements of Appendix B to 10CFR50 shall apply.	In compliance.

SRP ACCEPTANCE CRITERIA

ɛGULATORY GUIDE 1.102, FLOOD PROTECTION

REQUIREMENT	DESIGN FEATURE
SAFETY SYSTEMS SHOULD BE DESIGNED TO WITHSTAND THE MOST SEVERE FLOOD CONDITIONS RESULTING FROM SEVERE HYDROMETEOROLOGICAL CONDITIONS, SEISMIC ACTIVITY, OR BOTH.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.115, PROTECTION AGAINST LOW-TRAJECTORY TURBINE MISSILES

REQUIREMENT	DESIGN FEATURE
Essential systems of a nuclear power plant should be protected against low-trajectory turbine missiles due to failure of main turbine-generator sets.	In compliance.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.117, TORNADO DESIGN CLASSIFICATION

REQUIREMENT	DESIGN FEATURE
THE SPENT FUEL POOL COOLING SYSTEM SHOULD BE DESIGNED TO MAINTAIN ITS CAPABILITY IN THE EVENT OF A DESIGN BASIS TORNADO.	IN COMPLIANCE.
THE SPENT FUEL STORAGE POOL SHALL BE DESIGNED TO PRECLUDE SIGNIFICANT LOSS OF WATERTIGHT INTEGRITY OF THE STORAGE POOL AND TO PREVENT MISSILES FROM CONTACTING FUEL WITHIN THE POOL.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 8.8, INFORMATION RELEVANT TO ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES AT NUCLEAR POWER STATIONS WILL BE AS LOW AS IS REASONABLY ACHIEVABLE (ALARA)

REQUIREMENT	DESIGN FEATURE
1. Occupational Radiation Exposure	
A management commitment to ALARA that includes 1) qualified radiation protection personnel, 2) a program to train and instruct all workers involved in radiation exposures, and 3) formal review of facility design changes for ALARA shall be established.	In compliance. APS is committed to establish an operational program for radiation protection that will meet ALARA objectives.
2. ALARA Design Features	
a. Calculations of radiation fields due to 0.25% fuel cladding defect source terms shall be used to define access zones. Access control should avoid transit through a higher zone to a lower zone.	In compliance. Radiation levels assume 1% fuel cladding defects, and storage of peak irradiated fuel in the spent fuel pool. These levels allow access to FPCS components.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 8.8, INFORMATION RELEVANT TO ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES AT NUCLEAR POWER STATIONS WILL BE AS LOW AS IS REASONABLY ACHIEVABLE (ALARA) (CONT'D)

REQUIREMENT	DESIGN FEATURE
B. Piping, instrumentation and controls shall be arranged to facilitate operations and maintenance at lowest possible exposure.	In compliance. Multidiscipline reviews were conducted to assure consideration of access, dose, and component design in the plant layout.

SRP ACCEPTANCE CRITERIA

BTP ASB 3-1 PROTECTION AGAINST POSTULATED PIPING FAILURES IN FLUID SYSTEMS OUTSIDE CONTAINMENT

REQUIREMENT

THE SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY SHALL BE APPROPRIATELY PROTECTED AGAINST DYNAMIC EFFECTS, INCLUDING THE EFFECT OF MISSILES, PIPE WHIPPING AND DISCHARGING FLUIDS, THAT MAY RESULT FROM EQUIPMENT FAILURES AND FROM EVENTS AND CONDITIONS OUTSIDE THE CONTAINMENT.

DESIGN FEATURE

IN COMPLIANCE. THE COMPONENTS OF THE FUEL POOL COOLING AND STORAGE SYSTEM ARE HOUSED IN SEISMIC CATEGORY I STRUCTURE. THE SPENT FUEL POOL IS ALSO A SEISMIC CATEGORY I STRUCTURE. PROVISIONS ARE MADE TO PREVENT EMPTYING THE SPENT FUEL POOL. THE SYSTEM IS CLASSIFIED AS A MODERATE ENERGY SYSTEM. THERE ARE NO HIGH ENERGY SYSTEMS IN THE AREA. TWO FUEL POOL COOLING TRAINS ARE PROVIDED.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1 OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS

REQUIREMENT	DESIGN FEATURE
OVERHEAD HANDLING SYSTEMS INTENDED TO PROVIDE SINGLE FAILURE-PROOF HANDLING OF LOADS SHOULD BE DESIGNED SO THAT NO SINGLE FAILURE OR MALFUNCTION WILL RESULT IN DROPPING OR LOSING CONTROL OF THE HEAVIEST LOADS TO BE HANDLED. SUCH HANDLING SYSTEMS SHOULD BE DESIGNED, FABRICATED, INSTALLED, INSPECTED, TESTED, AND OPERATED IN ACCORDANCE WITH THE FOLLOWING:	
1. A. SEPARATE PERFORMANCE SPECIFICATIONS SHOULD BE PREPARED FOR A PERMANENT CRANE WHICH IS TO BE USED FOR CONSTRUCTION PRIOR TO USE FOR PLANT OPERATION.	IN COMPLIANCE. CONSTRUCTION LOADS ON THE CASK HANDLING CRANE AND NEW FUEL HANDLING CRANE WILL NOT EXCEED RATED LOAD. A SPECIAL PERFORMANCE SPECIFICATION DEFINES THE POLAR CRANE CONSTRUCTION REQUIREMENTS. AFTER CONSTRUCTION PHASE, THE CRANES WILL BE RE-CERTIFIED.
B. THE OPERATING ENVIRONMENT SHALL BE DEFINED (PRESSURE, TEMPERATURE, CORROSION ATMOSPHERE, ETC.)	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

	REQUIREMENT	DESIGN FEATURE
	C. The crane shall be classified as Seismic Category I.	In compliance.
	D. All welds should be inspected by non-destructive examination.	In compliance.
	E. A fatigue analysis should be made.	In compliance. The cranes have been designed in accordance with CMAA specification No. 70.
	F. Preheat and postheat treatment temperatures for all welds should be specified.	In compliance.
2.	A. Malfunction of automatic and manual controls will not prevent the handling system from being maintained at a safe, neutral position.	In compliance.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

	REQUIREMENT	DESIGN FEATURE
	B. AUXILIARY OR ANCILLARY SYSTEMS SHOULD BE PROVIDED SUCH THAT IN CASE OF COMPONENT FAILURE THE LOAD WILL BE RETAINED AND HELD IN A SAFE POSITION.	IN COMPLIANCE.
	C. MEANS SHOULD BE PROVIDED TO FACILITATE REPAIR OF FAILED CRANE COMPONENTS WITH THE LOAD SUPPORTED AND RETAINED IN THE SAFE POSITION OR MOVING THE CRANE WITH THE LOAD TO A LAYDOWN AREA.	IN COMPLIANCE. THE CRANES CAN BE MOVED AND THE LOAD MANUALLY LOWERED ONTO A LAYDOWN AREA.
3.	A. DUAL LOAD ATTACHING POINTS SHOULD BE DESIGNED FOR STATIC LOAD OF 3W.	PARTIAL COMPLIANCE. THE CRANE HOOKS ARE DESIGNED FOR 2W. THE NEW FUEL HANDLING AND POLAR CRANES HAVE SINGLE HOOKS. THE CASK HANDLING CRANE HAS A SISTER HOOK.
	B. LIFTING DEVICES SHALL BE REDUNDANT.	LIFTING DEVICES ARE WITHIN CESSAR SCOPE.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

	REQUIREMENT	DESIGN FEATURE
C.	THE VERTICAL HOISTING MECHANISM SHOULD BE DESIGNED WITH REDUNDANT MEANS FOR HOISTING. MAXIMUM HOISTING SPEED TO BE 5 FT/MIN.	PARTIAL COMPLIANCE. THE REDUNDANCY INVOLVES ONLY LOWERING, NOT LIFTING, THE LOAD. THE NEW FUEL HANDLING CRANE HAS CAPABILITY OF MAXIMUM HOIST SPEED OF 10 FT/MIN.
D.	THE HEAD AND LOAD BLOCKS SHOULD HAVE A DUAL REEVING SYSTEM. THE LOAD BLOCK SHOULD BE ABLE TO SUPPORT 3W.	PARTIAL COMPLIANCE. CRANE DESIGN IS IN ACCORDANCE WITH CMAA SPEC. #70 FOR A DUAL REEVING SYSTEM. THE HEAD AND LOAD BLOCKS ARE DESIGNED TO SUPPORT 2W.
E.	THE DESIGN OF THE ROPE REEVING SYSTEM SHOULD BE DUAL.	IN COMPLIANCE.
F.	THE MAXIMUM FLEET ANGLE FROM DRUM TO LEAD SHEAVE IN THE LOAD BLOCK SHOULD NOT EXCEED THREE AND ONE-HALF DEGREES.	IN COMPLIANCE.
G.	THE VERTICAL HOISTING SYSTEM SHOULD BE DESIGNED TO SUSTAIN A LOAD OF 2W.	IN COMPLIANCE.

EXHIBIT 2-61

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

	REQUIREMENT	DESIGN FEATURE
H.	MEANS SHOULD BE PROVIDED TO SENSE ITEMS LIKE ELECTRIC CURRENT, TEMPERATURE, OVER-SPEED, OVERLOADING, OVERTRAVEL.	IN COMPLIANCE.
I.	THE CONTROLS SYSTEM SHOULD BE DESIGNED AS A COMBINATION OF ELECTRICAL AND MECHANICAL SYSTEMS.	IN COMPLIANCE.
J.	THE MECHANICAL AND STRUCTURAL COMPONENTS SHOULD EITHER HAVE STRENGTH TO RESIST FAILURE SHOULD "TWO-BLOCKING" OR "LOAD HANGUP" OCCUR DURING HOISTING, OR CONTROLS SHOULD PROVIDE POSITIVE MEANS TO STOP THE HOISTING DRUMS FROM EXPERIENCING THESE OCCURRENCES.	IN COMPLIANCE. LIMIT SWITCHES AND LOAD CELLS ARE PROVIDED.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

REQUIREMENT		DESIGN FEATURE
K.	THE LOAD HOISTING DRUM ON THE TROLLEY SHOULD BE PROVIDED WITH STRUCTURAL AND MECHANICAL SAFETY DEVICES TO PREVENT THE DRUM FROM DROPPING, DISENGAGING OR ROTATING.	IN COMPLIANCE.
L.	THE HORSEPOWER RATING OF THE ELECTRICAL MOTOR DRIVE SHOULD NOT PROVIDE MORE THAN 110% OF CALCULATED HP TO LIFT DESIGN LOAD AT MAXIMUM SPEED.	IN COMPLIANCE.
M.	THE MINIMUM HOIST BRAKING SYSTEM SHOULD INCLUDE ONE POWER CONTROL BRAKING SYSTEM AND TWO MECHANICAL HOLDING BRAKES.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

	REQUIREMENT	DESIGN FEATURE
N.	THE DYNAMIC AND STATIC ALIGNMENT OF ALL HOISTING COMPONENTS SHOULD BE MAINTAINED THROUGHOUT THE RANGE OF LOADS TO BE LIFTED.	IN COMPLIANCE.
O.	INCREMENT DRIVES FOR HOISTING MAY BE PROVIDED BY STEPLESS CONTROL OR INCHING MOTOR DRIVES.	IN COMPLIANCE. AN INCHING MOTOR DRIVE IS PROVIDED.
P.	CONTROL AND HOLDING BRAKES SHALL EACH BE RATED AT 100% OF THE MAXIMUM DRIVE TORQUE.	IN COMPLIANCE.
Q.	THE COMPLETE OPERATING CONTROL SYSTEM FOR THE OVERHEAD CRANE HANDLING SYSTEM SHOULD BE LOCATED IN THE MAIN CAB ON THE BRIDGE. LIMITING DEVICES SHOULD BE PROVIDED TO INDICATE, CONTROL, PRE-OVERTRAVEL, OVERSPEED OF HOIST AND/OR TROLLEY TRAVEL MOVEMENTS.	IN COMPLIANCE. THE NEW FUEL HANDLING CRANE HAS COMPLETE OPERATING CONTROL PROVIDED ON A PENDANT. THE CASK HANDLING AND CONTAINMENT POLAR CRANES HAVE CONTROLS LOCATED IN THE MAIN CABIN OF THE BRIDGE. RADIO CONTROL IS PROVIDED FOR THE CASK HANDLING AND POLAR CRANES.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

	REQUIREMENT	DESIGN FEATURE
R.	SAFETY DEVICES, SUCH AS LIMIT SWITCHES, SHOULD BE PROVIDED.	IN COMPLIANCE.
S.	THE OPERATING REQUIREMENTS FOR ALL TRAVEL MOVEMENTS SHOULD BE CLEARLY DEFINED IN THE OPERATING MANUAL.	IN COMPLIANCE.
T.	WHEN THE PERMANENT CRANE IS TO BE USED FOR CONSTRUCTION, THE CONSTRUCTION REQUIREMENTS ARE TO BE DEFINED SEPARATELY.	IN COMPLIANCE.
U.	INSTALLATION INSTRUCTIONS SHOULD BE PROVIDED BY THE MANUFACTURER.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

BTP ASB 9-1, OVERHEAD HANDLING SYSTEMS FOR NUCLEAR POWER PLANTS (CONT'D)

REQUIREMENT	DESIGN FEATURE
4. MECHANICAL CHECKS, TESTING AND PREVENTATIVE MAINTENANCE.	IN COMPLIANCE.
A. CHECKING, TESTING AND MAINTENANCE OF CRANE COMPONENTS SHALL BE DONE IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTION MANUAL.	IN COMPLIANCE.
B. THE CRANE SYSTEM SHALL BE PREPARED FOR A STATIC TEST OF 125% OF THE DESIGN RATED LOAD.	IN COMPLIANCE.
C. THE MAXIMUM WORKING LOAD SHALL BE PLAINLY MARKED ON EACH SIDE OF THE CRANE.	IN COMPLIANCE.

10CFR71, PACKAGING OF RADIOACTIVE MATERIAL FOR TRANSPORT AND TRANSPORTATION OF RADIOACTIVE MATERIAL UNDER CERTAIN CONDITIONS

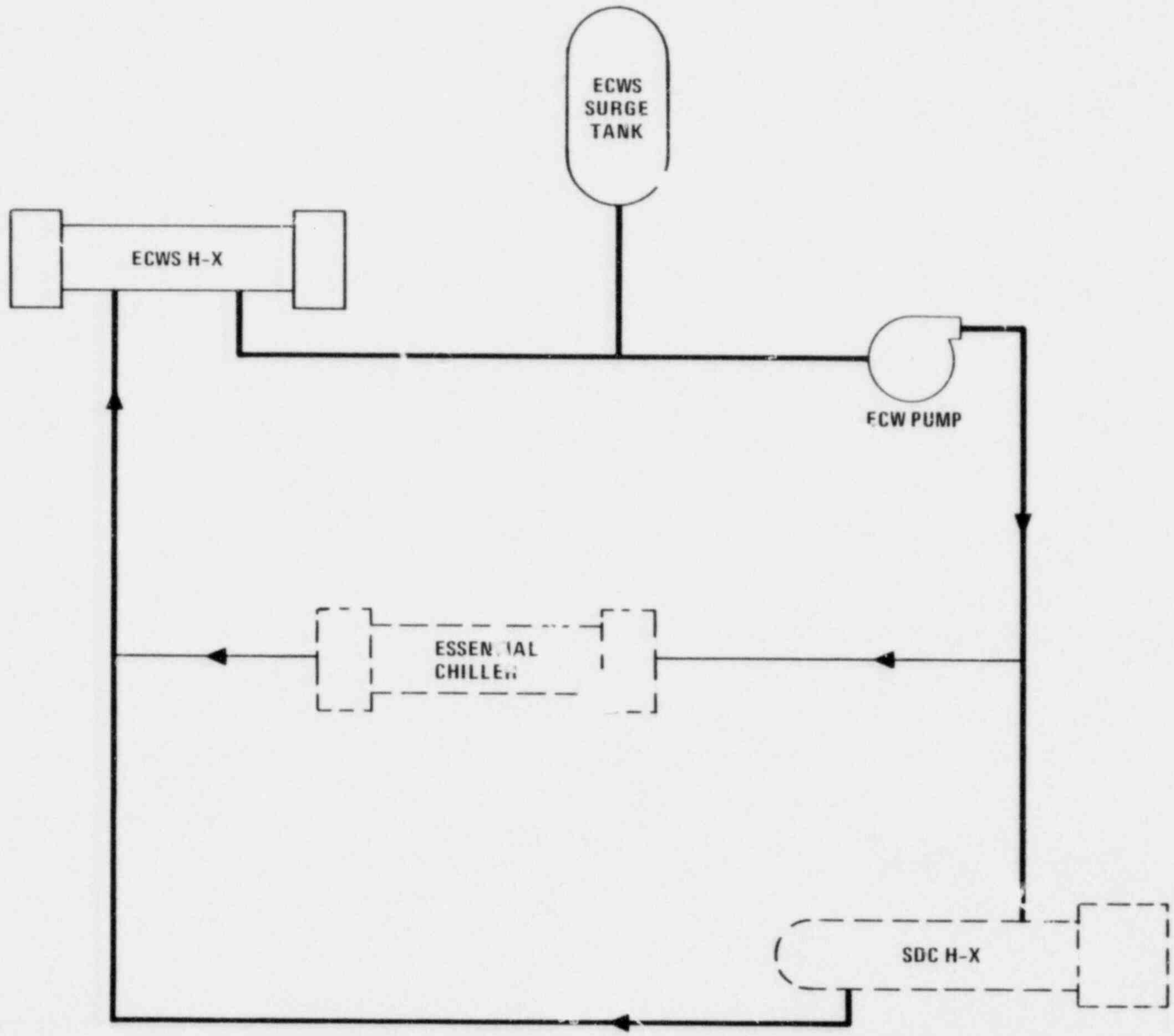
REQUIREMENT	DESIGN FEATURE
A FREE DROP THROUGH A DISTANCE OF 30 FEET ONTO A FLAT, ESSENTIALLY UNYIELDING HORIZONTAL SURFACE, STRIKING THE SURFACE IN A POSITION FOR WHICH MAXIMUM DAMAGE IS EXPECTED, SHOULD BE CONSIDERED.	IN COMPLIANCE. THE CASK HANDLING CRANE IS PROVIDED WITH LIMIT SWITCHES TO ASSURE THE CASK IS NOT RAISED HIGHER THAN 30 FEET FROM THE FLOOR.

NUREG-0612, CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS AND NRC LETTERS "TO ALL LICENSEES OF OPERATING LICENSES AND HOLDERS OF CONSTRUCTION PERMITS" DATED DECEMBER 22, 1980 AND FEBRUARY 3, 1981.

REQUIREMENT		ACTION
NUREG-0612	ENCLOSURE TO LETTERS	
Sec. 5.1.1	Sec. 2.1, "General Requirements for Overhead Handling Systems"	APS will respond by June, 1981
Sec. 5.1.2	Sec. 2.2, "Specific Requirements for Overhead Handling Systems Operating in the Vicinity of Fuel Storage Pools"	APS will respond by September, 1981
Sec. 5.1.3	Sec. 2.3, "Specific Requirements of Handling Systems Operating in the Containment"	APS will respond by September, 1981
Sec. 5.1.5	Sec. 2.4, "Specific Requirements for Overhead Handling Systems Operating in Plant Areas Containing Equipment Required for Reactor Shutdown, Core Decay Heat Removal, or Spent Fuel Pool Cooling"	APS will respond by September, 1981

EXHIBIT 2-68

III. ESSENTIAL COOLING WATER SYSTEM
(COMPONENT COOLING WATER SYSTEM)



ESSENTIAL COOLING WATER SYSTEM (ONE OF TWO TRAINS)
FIGURE 3-1

ESSENTIAL COOLING WATER SYSTEM (ECWS)
DESIGN CRITERIA

1) THE ECWS SHALL CONSIST OF TWO INDEPENDENT IDENTICAL CLOSED-LOOP TRAINS. EACH TRAIN SHALL BE CAPABLE OF REMOVING 100 PERCENT OF THE HEAT LOAD FROM THE SAFETY-RELATED REACTOR AUXILIARIES DURING NORMAL OR FORCED SHUTDOWN OF THE PLANT.

2) HEAT SHALL BE REMOVED FROM THE ECWS BY THE ESSENTIAL SPRAY POND SYSTEM (ESPS) THROUGH THE ECWS HEAT EXCHANGERS. THE ESPS SHALL BE PIPED TO THE TUBE SIDE OF THESE HEAT EXCHANGERS.

3) EACH TRAIN OF THE ECWS, IN CONJUNCTION WITH THE SAFETY INJECTION AND SHUTDOWN COOLING SYSTEM, SHALL BE CAPABLE OF REMOVING SUFFICIENT HEAT FROM THE CONTAINMENT AND SAFETY-RELATED REACTOR AUXILIARIES TO ENSURE SAFE REACTOR SHUTDOWN IN THE EVENT OF A LOSS OF COOLANT ACCIDENT (LOCA) COINCIDENT WITH A LOSS OF OFFSITE POWER (LOP).

4) THE ECWS SHALL BE DESIGNED TO PERMIT THE DETECTION OF LEAKAGE INTO OR OUT OF THE SYSTEM.

5) THE MAXIMUM WATER TEMPERATURE AT THE SHELL SIDE OUTLET OF THE ECWS HEAT EXCHANGERS SHALL NOT EXCEED 105F 27-1/2 HOURS AFTER A NORMAL SHUTDOWN, AND 120F DURING A LOCA. |

6) DESIGN OF THE ECWS SHALL INCLUDE PROVISIONS FOR ACCOMMODATING THE CLOSED-LOOP WATER EXPANSION AND CONTRACTION DUE TO THERMAL CHANGES IN THE SYSTEM.

EXHIBIT 3-1

7) Makeup water to the ECWS shall be provided by the demineralized water system and the condensate storage and transfer system.

8) The ECWS water chemistry shall be controlled for the prevention of long-term corrosion.

9) The ECWS shall be capable of providing cooling water for the fuel pool heat exchangers when their normal cooling system is not available. Train A of the ECWS shall be piped to one heat exchanger, and train B shall be piped to the other heat exchanger. Valves shall be provided to isolate the ECWS from the normal cooling system.

10) The ECWS shall be capable of providing cooling water to the reactor coolant pumps, CEDM normal Air Conditioning Units (ACU), and normal chillers when their normal cooling system is not available. Appropriate valving shall be provided to isolate the ECWS from the normal cooling system during all modes of operation.

11) The operating pressure of the ECWS shall be lower than that of the ESPS at the ECWS heat exchanger interface.

12) The ECWS chemical addition tanks shall be designed to Seismic Category III. Piping for ECWS to the nuclear cooling water system (NCWS) intertie shall be Seismic Category II. All other components, valves, and piping shall be Seismic Category I.

13) The following design codes and standards shall be met:

A. Pumps

- American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section III, Class 3
- Hydraulic Institute (HI) Standards

B. Heat Exchangers

- ASME Boiler and Pressure Vessel Code, Section III, Class 3
- Tubular Exchanger Manufacturer's Association (TEMA), Class R

C. Surge Tanks

- ASME Boiler and Pressure Vessel Code, Section III, Class 3

D. Chemical Addition Tanks

- ASME Boiler and Pressure Vessel Code, Section VIII

E. Piping for NCWS Intertie

- American National Standards Institute (ANSI), B31.1

F. Other Piping

- ASME Boiler and Pressure Vessel Code, Section III, Class 3

G. Valves

- ASME Boiler and Pressure Vessel Code, Section III, Class 3

H. System Testing and Inspection

- ASME Boiler and Pressure Vessel Code, Section XI

ESSENTIAL COOLING WATER SYSTEM

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 5.4.7.1

REQUIREMENT	DESIGN FEATURE
Cooling Water System Requirements	
A. The cooling water system design shall be such that cooling water, consistent with the requirements of B. below, is available to supply the shutdown cooling heat exchangers when an irradiated core is present in the reactor vessel or the spent fuel pool.	In compliance

ESSENTIAL COOLING WATER SYSTEM

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 5.4.7.1

REQUIREMENT	DESIGN FEATURE

B. Cooling water shall be supplied at the following temperatures and be able to remove the heat loads listed for the given conditions:

Shutdown Cooling Heat Exchangers

Situation	Cooling Water Inlet Temperature	Design Heat Load (Million Btu/hour) (includes both heat exchangers)	Expected Range of Cooling Water Inlet Temperature	Design Heat Load (Million Btu/hour) (includes both heat exchangers
Post-LOCA	65 - 120F	290	65 - 120F	290
Shutdown Cooling:				
3-1/2 hours after shutdown	65 - 120F	247	65 - 120F	255
27-1/2 hours after shutdown	65 - 105F	87.6	65 - 105F	87.8

ESSENTIAL COOLING WATER SYSTEM

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 5.4.7.1

REQUIREMENT		DESIGN FEATURE

c. For all conditions, cooling water shall be supplied as follows:

Parameter	Required Value Per Heat Exchanger	Value Per Heat Exchanger
Normal Allowable Delivery Pressure	100 psig	50 psig
Maximum Allowable Delivery Pressure	150 psig	88 psig
Required Flowrate	11,000 gal/min	14,000 gal/min
Maximum Allowable Flowrate	13,000 gal/min	14,000 gal/min

ESSENTIAL COOLING WATER SYSTEM

CESSAR INTERFACE REQUIREMENTS
REFERENCE: CESSAR SECTION 5.4.7.1

REQUIREMENT	DESIGN FEATURE
D. Cooling water piping supplying the shutdown cooling heat exchangers shall be designed and fabricated in accordance with ASME B&PVC, Section III, Class 3 and shall be designed as Seismic Category I, Safety Class 3.	In compliance
E. The cooling water system which services the Shutdown Cooling System (SCS) shall be designed with sufficient redundancy and diversity such that one SCS heat exchanger train will always be supplied cooling water.	In compliance
F. The cooling water system which services the SCS shall be designed consistent with the cooling water chemistry.	In compliance

SYSTEM DESCRIPTION
ESSENTIAL COOLING WATER SYSTEM

1) ECWS CONSISTS OF TWO INDEPENDENT FLOW TRAINS THAT SUPPLY COOLING WATER TO SHUTDOWN COOLING HEAT EXCHANGERS AND ESSENTIAL CHILLERS.

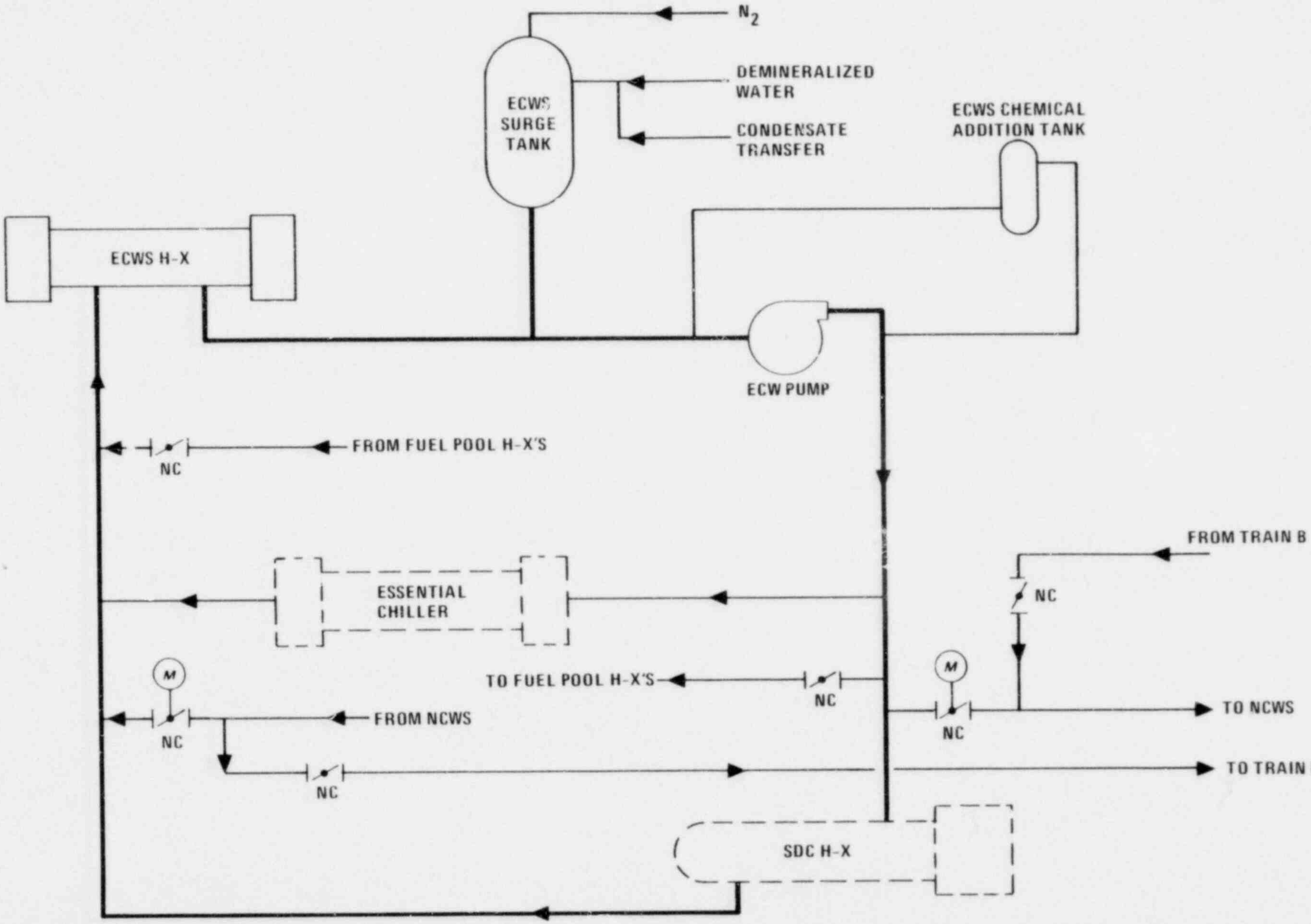
2) EACH FLOW TRAIN INCLUDES A HEAT EXCHANGER, SURGE TANK, PUMP, CHEMICAL ADDITION TANK, PIPING, VALVES, CONTROLS, AND INSTRUMENTATION. EITHER TRAIN WILL SUPPLY SUFFICIENT COOLING WATER TO THE SHUTDOWN COOLING HEAT EXCHANGER TO ALLOW A SAFE PLANT SHUTDOWN.

3) ECWS FLOW TRAINS ARE CONNECTED TO NCWS BY TWO TIE LINES. NCWS CAN THUS BE SERVED BY EITHER FLOW TRAIN OF ECWS IN EVENT NCWS IS NOT AVAILABLE.

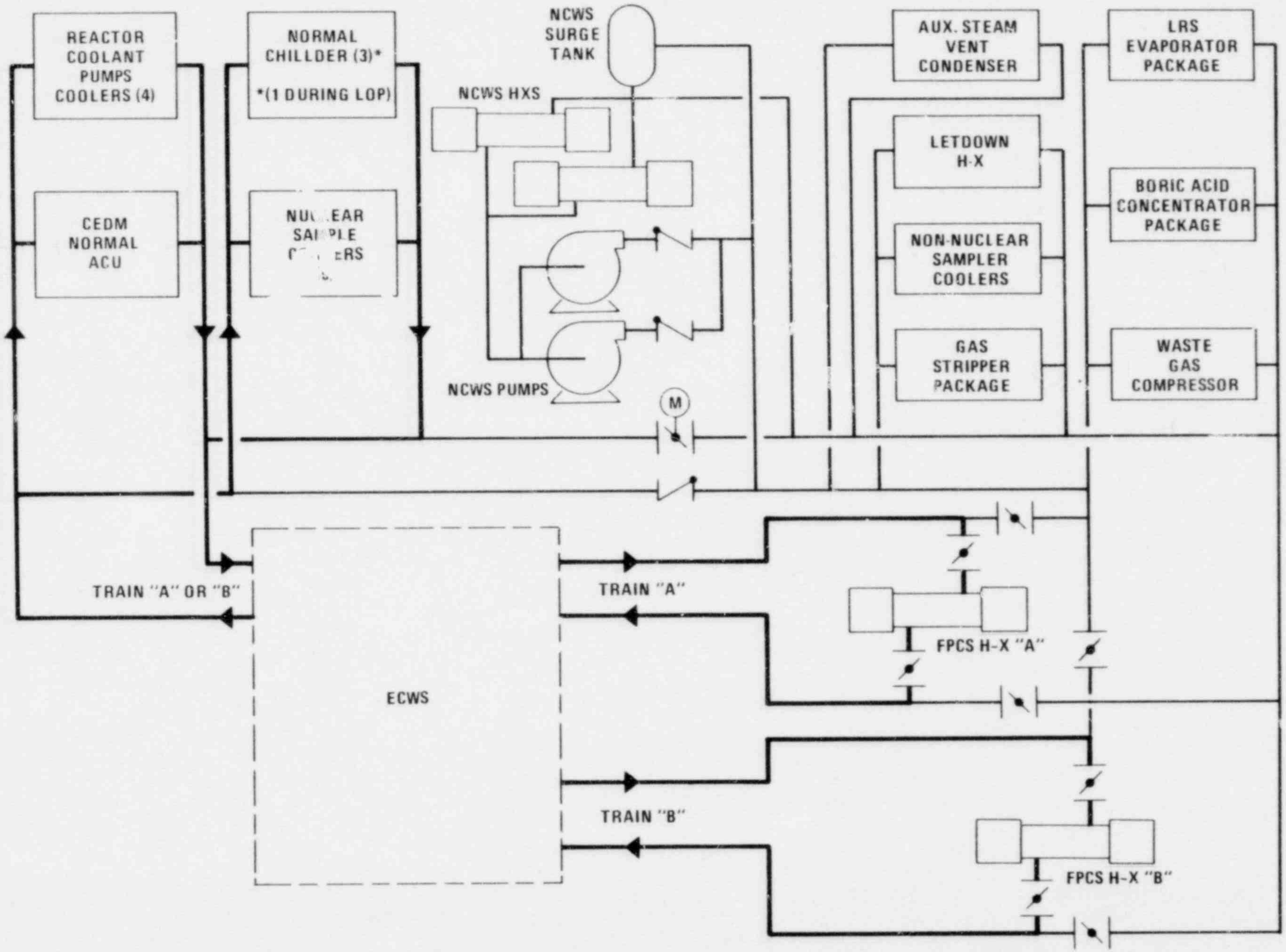
4) EACH ECWS FLOW TRAIN HAS A SUPPLY AND RETURN LINE, WITH NORMALLY CLOSED VALVES, FOR EACH CORRESPONDING FUEL POOL HEAT EXCHANGER TO PROVIDE COOLING WHEN THE NCWS IS NOT AVAILABLE.

5) MAKEUP WATER IS SUPPLIED TO ECWS SURGE TANKS BY THE DEMINERALIZED WATER SYSTEM AND THE CONDENSATE TRANSFER AND STORAGE SYSTEM.

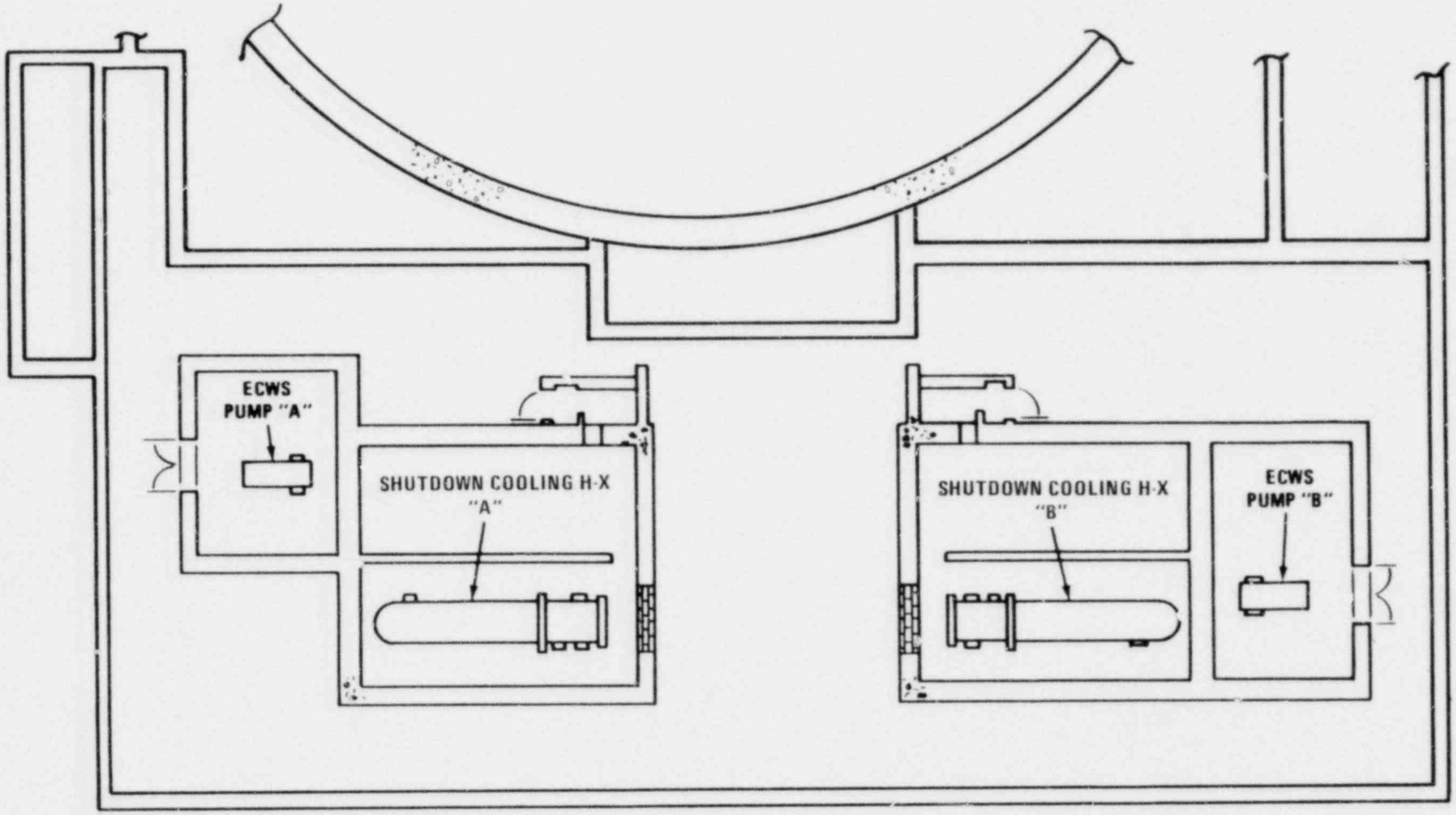
EXHIBIT 3-9



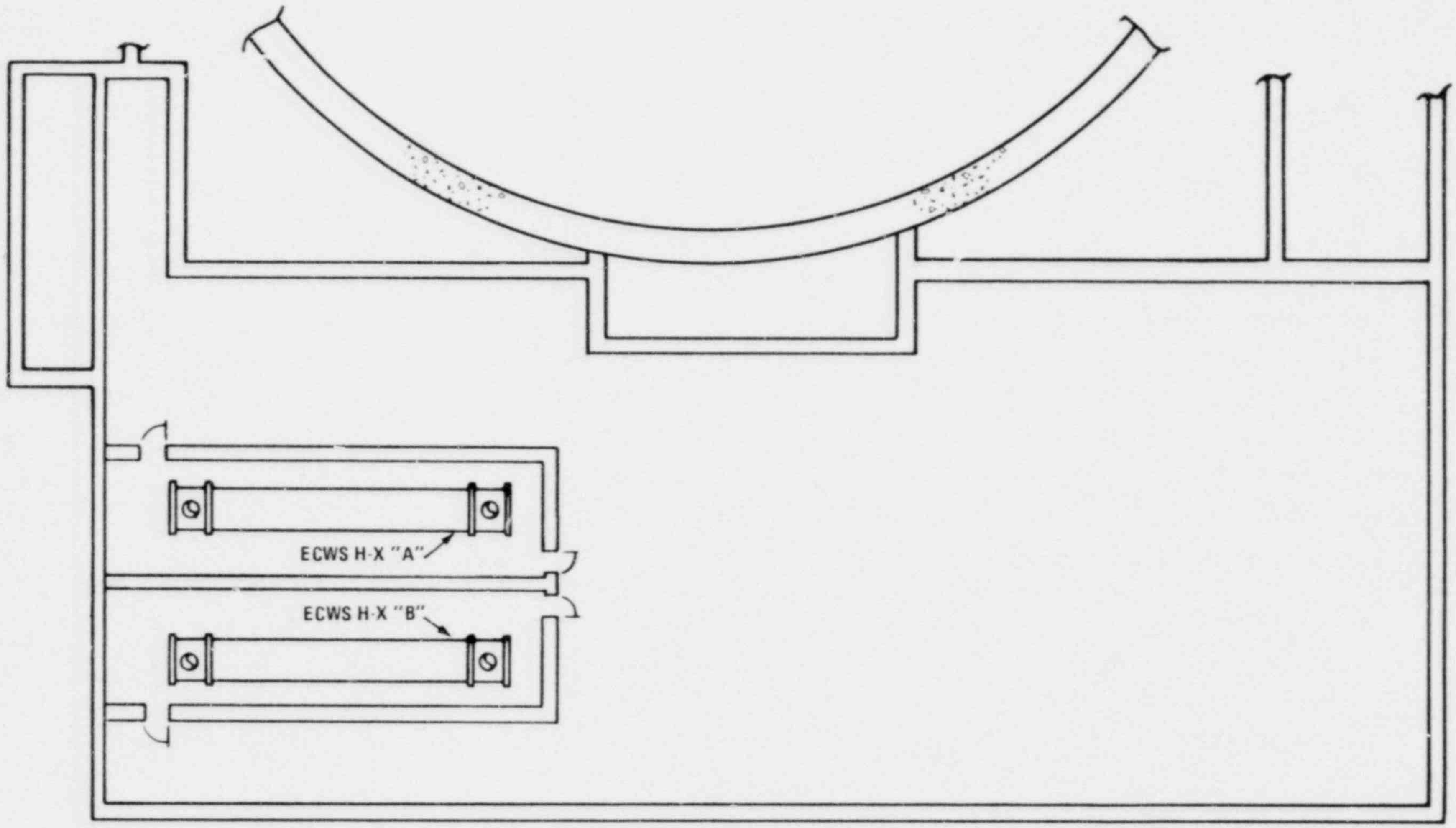
ESSENTIAL COOLING WATER SYSTEM – TRAIN A
FIGURE 3-2



NUCLEAR COOLING WATER SYSTEM DURING LOP
FIGURE 3-3

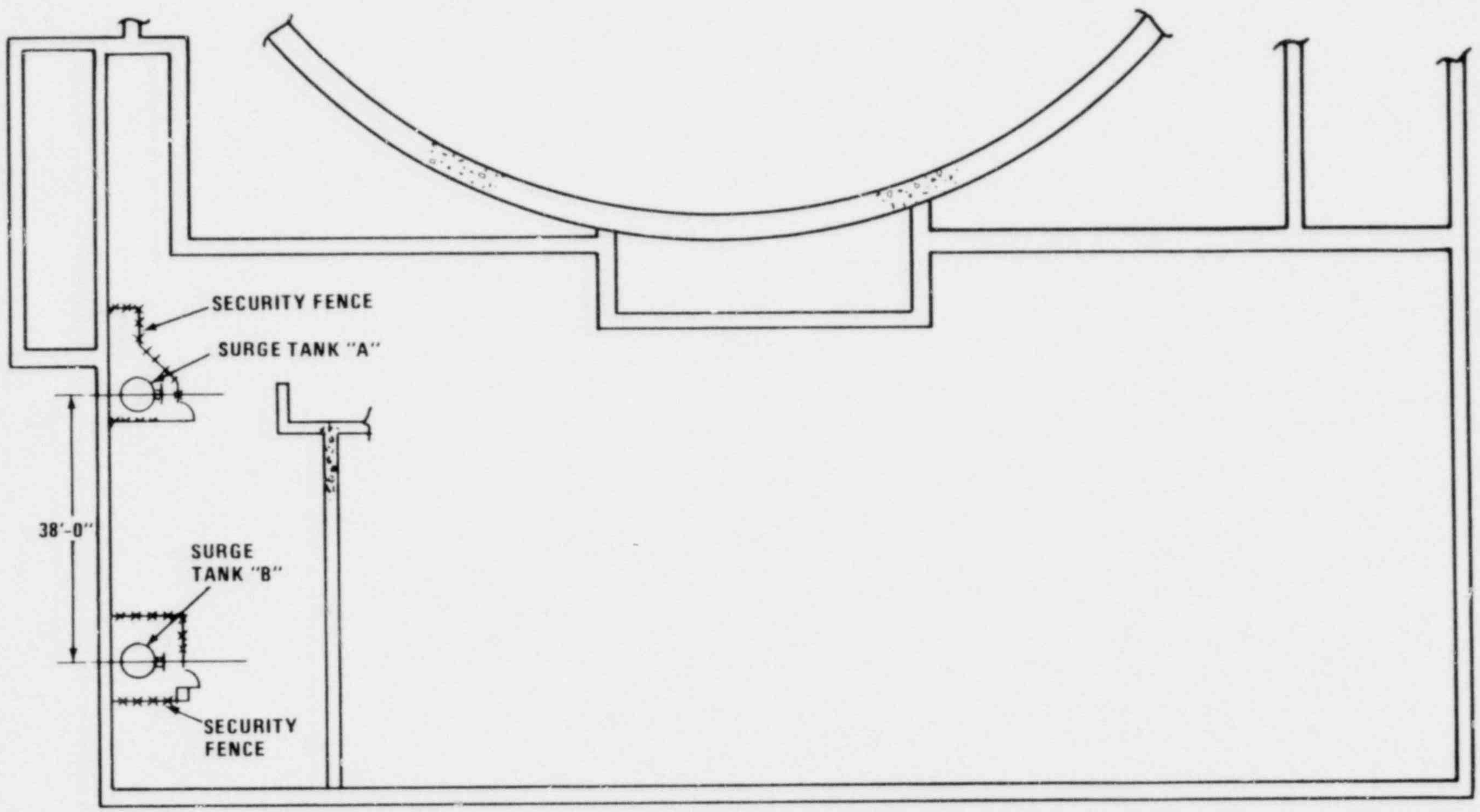


ECWS PUMPS & SHUTDOWN COOLING H-X'S
AUXILIARY BLDG EL. 70'
FIGURE 3-4



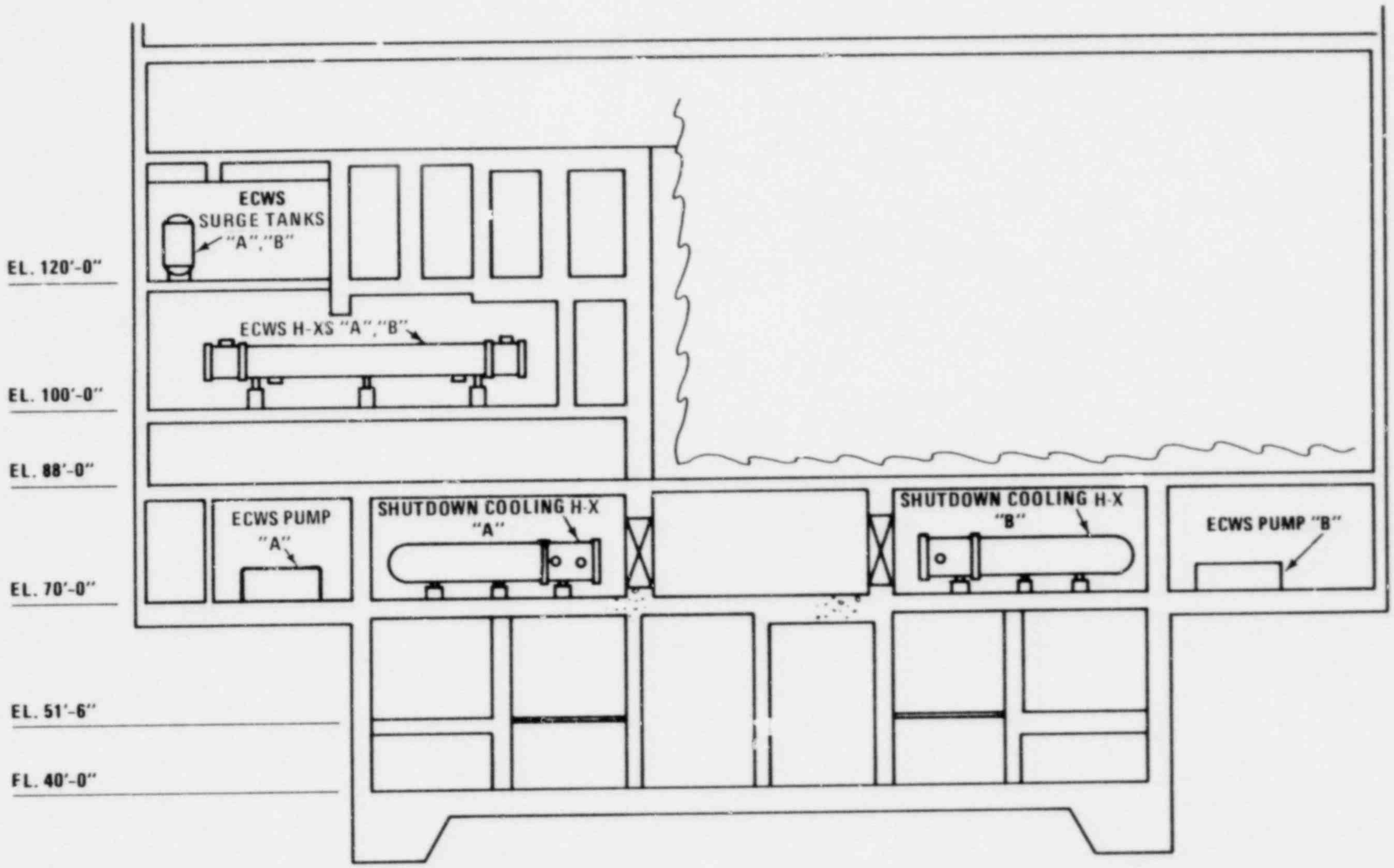
ECWS HEAT EXCHANGERS –
AUXILIARY BLDG EL. 100'

FIGURE 3-5



ECWS SURGE TANKS – AUXILIARY BLDG EL. 120'

FIGURE 3-6



ECWS COMPONENTS – AUXILIARY BLDG SECTION A

FIGURE 3-7

ESSENTIAL COOLING WATER SYSTEM OPERATION

1) The ECWS operates only during cold shutdown, LOP, emergency, or failure of the NCWS.

2) The ECWS is initially supplied water from the demineralized water system. Makeup water is also obtained from this source. An additional source of makeup water is from the condensate storage tanks.

3) Water is added to the system at the surge tanks, which are located at an elevation above the highest component in the train and establish the pressure level of the circuit. They serve as a reservoir for expansion and contraction of the cooling water and as a convenient location to introduce makeup to compensate for any system losses. The makeup line is sized for a nominal flow rate of 50 gal/min. The surge tanks are piped to the suction side of the ECWS pumps. Chemicals for corrosion and pH control are added to the system from the chemical addition tanks.

4) The ECWS has two redundant and separate trains. Each train is connected to its corresponding ESPS train through the ECWS heat exchanger that serves as a pressure barrier between the ESPS and the ECWS. Although either train has a 100-percent heat-dissipation capacity, an emergency reactor shutdown is normally accomplished with the initial operation of both trains of the ECWS and ESPS. Shutdown and cooldown with only one train over an extended period of time is possible and permissible.

EXHIBIT 3-10

5) One ECWS pump is provided for each of the two ECWS trains. The pumps are installed at an elevation below the ECWS surge tank to ensure a flooded suction. Pump motors are connected to separate Class IE 4.16 kV power system buses which have standby diesel-generator power available. In the event offsite power is lost during ECWS operation, the pumps are stopped and restarted in accordance with the engineered safety feature actuation system load sequencing.

6) In the event only one train is in operation and a component in that train fails causing a loss of that train's function, the operator will manually start the other train.

7) In addition to the manual start mode for the ECWS, any one of the following signals will automatically start both ECWS pumps:

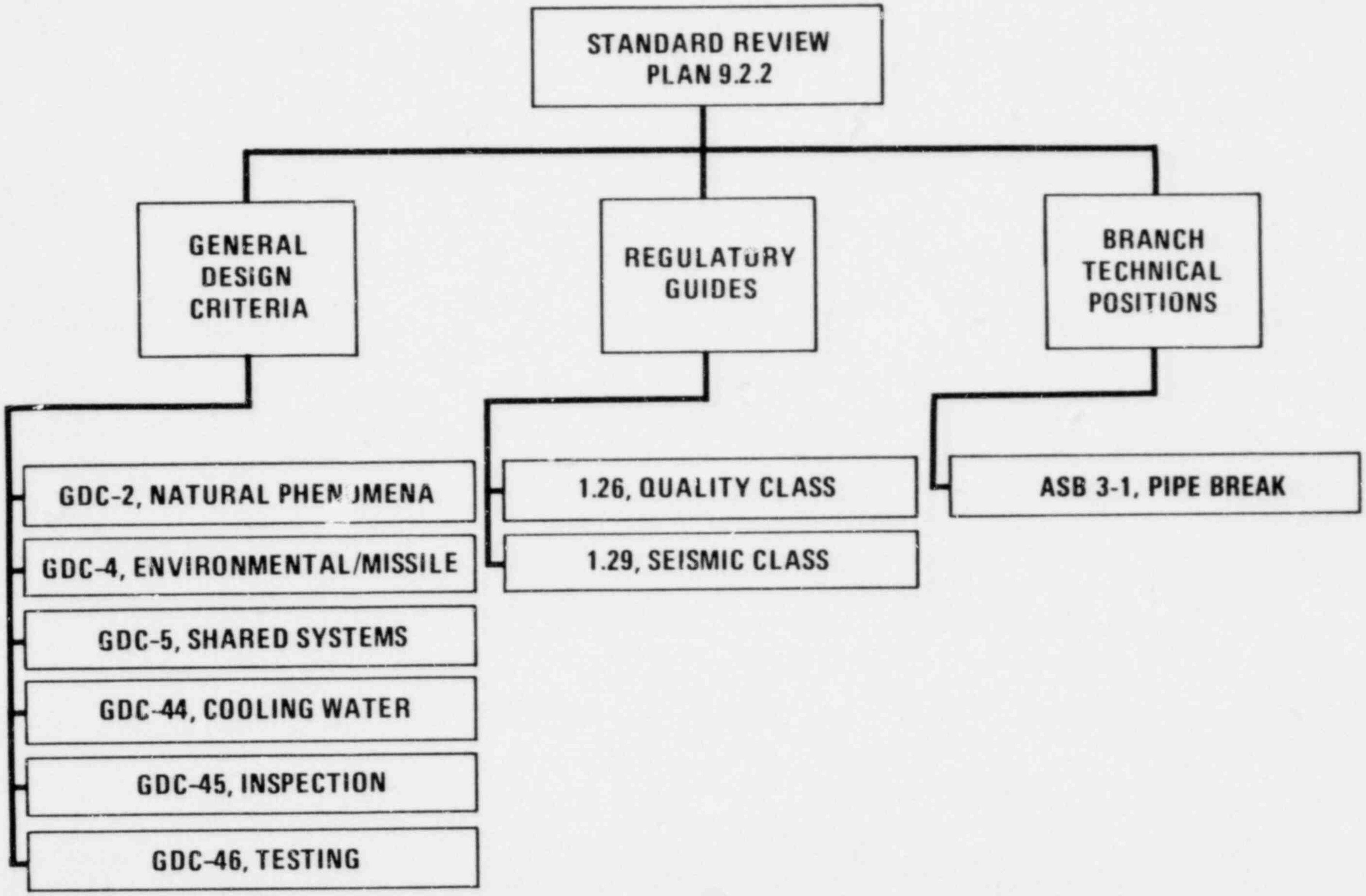
- LOP (Loss of offsite power)
- SIAS (Safety injection actuation signal)
- CREFAS (Control room essential filtration actuation signal)
- CRVIAS (Control room ventilation isolation actuation signal)
- AFAS-1 (Auxiliary feedwater actuation signal 1)
- AFAS-2 (Auxiliary feedwater actuation signal 2)

8) When the cooling water level falls below a preset limit, a level control device located in the ECWS surge tanks will activate a control valve in the demineralized water supply line to the ECWS. A low level signal, indicating a large leak out of the system, will sound an alarm in the control room. A high water level in the surge tank will also alarm in the control room indicating a leak into the system.

9) A RADIATION MONITORING SYSTEM THAT WILL ALARM IN THE CONTROL ROOM IS PROVIDED TO DETECT RADIOACTIVITY IN THE COOLING WATER.

10) THE WATER IN EACH TRAIN IS SAMPLED FOR QUALITY ON A SCHEDULED BASIS BY TAKING SAMPLES AT THE SAMPLING POINT AND THE pH ADJUSTED, IF REQUIRED, BY THE ADDITION OF POTASSIUM HYDROXIDE, KOH.

11) IN THE EVENT THE NCWS FAILS, THE OPERATOR HAS THE OPTION OF STARTING EITHER TRAIN OF THE ECWS AND ESPS WHILE CROSSCONNECTING THE ECWS TO A PORTION OF THE NCWS THAT NORMALLY SUPPLIES COOLING WATER TO THE REACTOR COOLANT PUMPS, CEDM NORMAL ACU'S, AND NORMAL CHILLERS. THIS IS ACCOMPLISHED BY MANUALLY OPENING OR CLOSING THE DESIRED VALVES. THE REMAINDER OF THE NCWS WILL BE ISOLATED FROM THE ECWS WITH APPROPRIATE VALVING DURING THIS MODE OF OPERATION.



STANDARD REVIEW PLAN 9.2.2
FIGURE 3-8

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 2, NATURAL PHENOMENA

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED TO WITHSTAND THE EFFECTS OF NATURAL PHENOMENA SUCH AS EARTHQUAKES, TORNADOES, HURRICANES, FLOODS, AND SEICHES WITHOUT LOSS OF CAPABILITY TO PERFORM THEIR SAFETY FUNCTIONS.	IN COMPLIANCE. ECWS COMPONENTS ARE HOUSED IN A SEISMIC CATEGORY I, MISSILE-PROOF STRUCTURE. ALL COMPONENTS ARE LOCATED BEYOND THE EXTENT OF PROBABLE MAXIMUM FLOODING.

EXHIBIT 3-13

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 4, ENVIRONMENTAL AND MISSILE DESIGN

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED FOR THE ENVIRONMENTAL CONDITIONS ASSOCIATED WITH NORMAL OPERATION, MAINTENANCE, TESTING AND POSTULATED ACCIDENTS, INCLUDING LOSS-OF-COOLANT ACCIDENTS. THEY SHALL BE APPROPRIATELY PROTECTED AGAINST DYNAMIC EFFECTS, INCLUDING THE EFFECTS OF MISSILES, PIPE WHIPPING, AND DISCHARGING FLUIDS, THAT MAY RESULT FROM EQUIPMENT FAILURES AND FROM EVENTS AND CONDITIONS OUTSIDE THE NUCLEAR POWER UNIT.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 5, SHARED SYSTEMS

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL NOT BE SHARED BETWEEN NUCLEAR POWER UNITS UNLESS IT IS SHOWN THAT THEIR ABILITY TO PERFORM THEIR SAFETY FUNCTIONS, INCLUDING, IN THE EVENT OF AN ACCIDENT IN ONE UNIT, AN ORDERLY SHUTDOWN AND COOLDOWN OF THE REMAINING UNITS.	IN COMPLIANCE.

EXHIBIT 3-15

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 44, COOLING WATER

REQUIREMENT	DESIGN FEATURE
A SAFETY SYSTEM SHALL BE PROVIDED TO TRANSFER THE COMBINED HEAT LOAD OF ESF STRUCTURES, SYSTEMS, AND COMPONENTS UNDER NORMAL OPERATING AND ACCIDENT CONDITIONS TO AN ULTIMATE HEAT SINK. SUITABLE REDUNDANCY IN COMPONENTS AND FEATURES, AND SUITABLE INTERCONNECTIONS, LEAK DETECTION, AND ISOLATION CAPABILITIES SHALL BE PROVIDED TO ASSURE THAT THE SYSTEM SAFETY FUNCTION CAN BE ACCOMPLISHED, ASSUMING A SINGLE FAILURE WITH OR WITHOUT A LOSS OF OFFSITE POWER.	IN COMPLIANCE. EITHER OF THE TWO SEPARATE ECWS TRAINS WILL PROVIDE ADEQUATE COOLING WATER FLOW TO THE SHUTDOWN COOLING HEAT EXCHANGERS.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 45, INSPECTION

REQUIREMENT	DESIGN FEATURE
THE COOLING WATER SYSTEM SHALL BE DESIGNED TO PERMIT APPROPRIATE PERIODIC INSPECTION OF IMPORTANT COMPONENTS, SUCH AS HEAT EXCHANGERS AND PIPING, TO ASSURE THE INTEGRITY AND CAPABILITY OF THE SYSTEM.	IN COMPLIANCE.

EXHIBIT 3-17

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 46, TESTING

REQUIREMENT	DESIGN FEATURE
THE COOLING WATER SYSTEM SHALL PERMIT APPROPRIATE PERIODIC PRESSURE AND FUNCTIONAL TESTING TO ASSURE (1) STRUCTURAL AND LEAKTIGHT INTEGRITY OF COMPONENTS, (2) OPERABILITY AND PERFORMANCE OF ACTIVE COMPONENTS, AND (3) OPERABILITY OF THE SYSTEM AS A WHOLE AND PERFORMANCE OF THE FULL OPERATIONAL SEQUENCE FOR REACTOR SHUTDOWN AND FOR LOSS-OF-COOLANT ACCIDENTS.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.26, QUALITY GROUP CLASSIFICATION

REQUIREMENT	DESIGN FEATURE
Cooling water systems that are not part of the reactor coolant pressure boundary and are designed for emergency core cooling, post-accident containment atmosphere cleanup or residual heat removal from the reactor shall meet the requirements of ASME B&PV Code, Section III, Class 3.	In compliance.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.29, SEISMIC DESIGN CLASSIFICATION

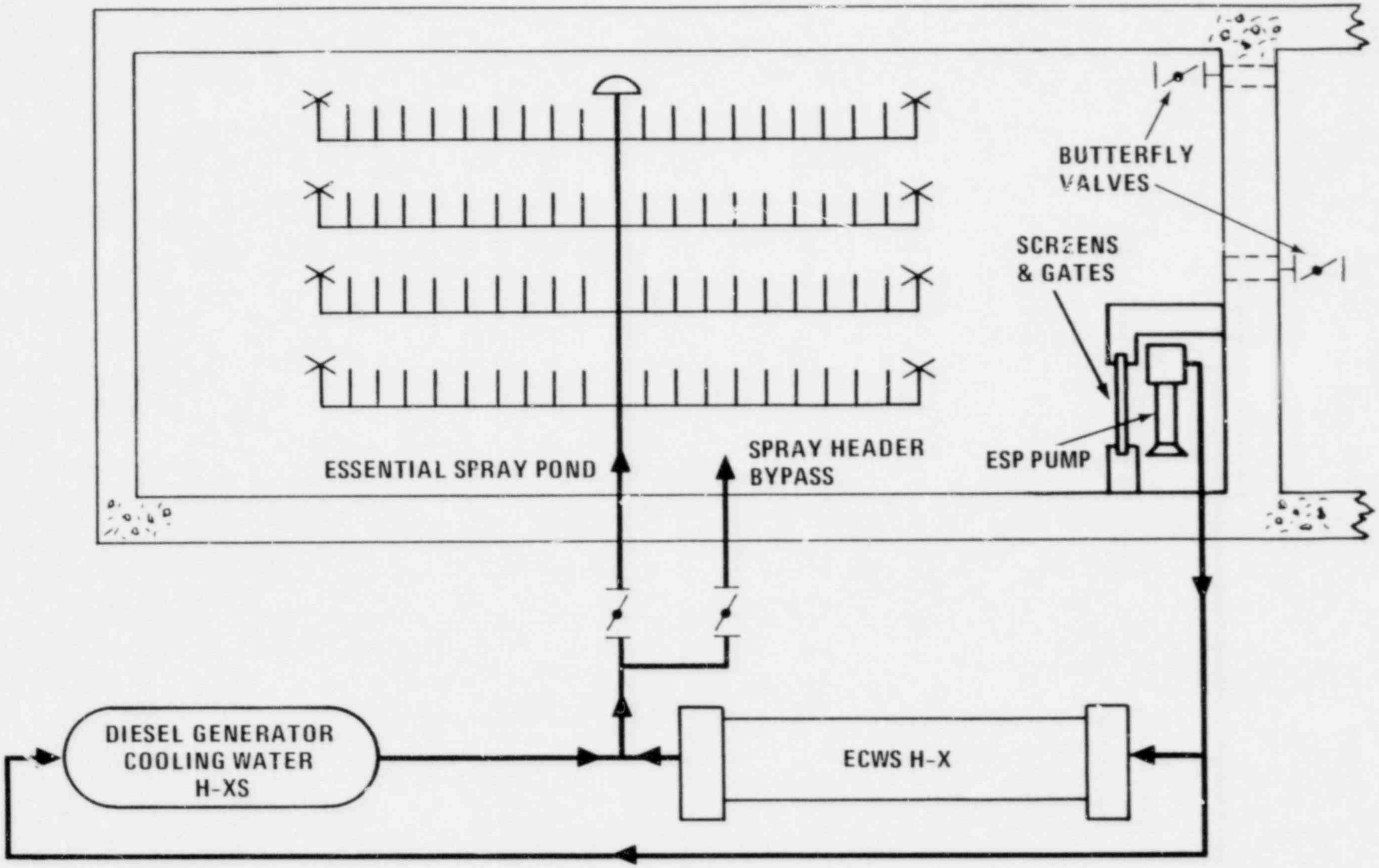
REQUIREMENT	DESIGN FEATURE
The component cooling water system shall be designated Seismic Category I and be designed to withstand the effects of the SSE and remain functional. The quality assurance requirements of Appendix B to 10CFR50 shall apply.	In compliance. The ECWS is Seismic Category I, except for the chemical addition tanks which are Seismic Category III and ECWS to NCWS piping which is Seismic Category II. Piping to/from the FPCS heat exchangers is Seismic Category I. All requirements of Appendix B to 10CFR50 are met for Seismic Category I components. Seismic Category II components meet similar quality assurance requirements.

BTP ASB 3-1, PROTECTION AGAINST POSTULATED PIPING FAILURES IN FLUID SYSTEMS OUTSIDE CONTAINMENT.

REQUIREMENT	DESIGN FEATURE
THE SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY SHALL BE APPROPRIATELY PROTECTED AGAINST DYNAMIC EFFECT, INCLUDING THE EFFECT OF MISSILES, PIPE WHIPPING AND DISCHARGING FLUIDS, THAT MAY RESULT FROM EQUIPMENT FAILURES AND FROM EVENTS AND CONDITIONS OUTSIDE THE CONTAINMENT.	IN COMPLIANCE. ECWS IS COMPRISED OF TWO SEPARATE TRAINS SEPARATED BY CONCRETE WALLS AND/OR DISTANCE. THE COMPONENTS ARE SHIELDED FROM POTENTIAL PIPE FAILURES BY CONCRETE WALLS OR DISTANCE. THE SYSTEM COMPONENTS ARE LOCATED AT AUXILIARY BUILDING ELEVATIONS OF 70 FEET AND HIGHER AND ARE PROTECTED FROM EFFECT OF PIPE BREAK-GENERATED FLOODING.

IV. ESSENTIAL SPRAY POND SYSTEM

(SERVICE WATER SYSTEM AND ULTIMATE HEAT SINK)



ESSENTIAL SPRAY POND SYSTEM
FIGURE 4-1

DESIGN CRITERIA
ESSENTIAL SPRAY POND SYSTEM

1) The Essential Spray Pond System (ESPS) shall consist of two redundant full capacity flow trains. Each train shall include a spray pond and all equipment necessary for safe shutdown of the plant during normal operations, and following a loss-of-coolant accident (LOCA) or forced shutdown.

2) Each train of the ESPS, in conjunction with the Essential Cooling Water System (ECWS), shall be capable of removing sufficient heat from the containment and reactor emergency core cooling auxiliaries to ensure a safe reactor shutdown coincident with a loss of offsite power (LOP).

3) Each train of the ESPS, in conjunction with the ECWS, shall be capable of removing sufficient heat following a postulated LOCA to mitigate the consequences of the LOCA coincident with a LOP.

4) The ESPS shall be designed to prevent or mitigate the consequences of an accident that could result in potential offsite exposures comparable to the guideline exposure of 10CFR100.

5) The ESPS shall be designed to ensure minimum water inventory.

6) The ESPS shall be designed to minimize the effects of long-term corrosion and organic fouling.

7) The ESPS, in conjunction with the ECWS, shall be capable of cooling the reactor coolant from 350 to 125F within 27-1/2 hours during normal shutdown.

EXHIBIT 4-1

8) All components of the ESPS shall be capable of being fully tested during normal plant operation. In addition, all parts and components shall be designed to conform to the requirements of ASME Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components.

9) Makeup water to the ESPS shall be provided by the cooling tower makeup and blowdown system and the domestic water system.

10) The ESPS shall be capable of operating for 30 days following a LOCA without requiring any makeup water or blowdown. Both spray ponds combined shall contain a water volume sufficient for 30 days of operation. Provisions shall be made to transfer water from one pond to the other at a sufficient rate to meet the system's 30-day operability requirement in the event that one spray system train fails.

11) The ESPS shall be capable of maintaining the ECWS temperature into the shutdown cooling heat exchangers at or below 125F following 1) a forced shutdown or 2) the design basis LOCA under the most adverse historical meteorological conditions consistent with the requirements of Regulatory Guide 1.27.

12) The ESPS, in conjunction with the ECWS, shall provide cooling capability for the spent fuel pool, reactor coolant pumps, control element drive mechanism (CEDM) air cooling units (ACUs), and the normal chillers when the nuclear cooling water system is not available.

13) All non-Seismic Category I equipment and piping interfacing the spray ponds shall be designed to preclude inadvertent drainage of the ponds.

EXHIBIT 4-2

14) All Q Class electrical and control cabling, motor control centers, load centers, and switchgear associated with the ESPS shall be located in a Seismic Category I structure or provided with adequate missile protection.

15) The ESPS, in conjunction with the ECWS, shall be designed to provide a maximum cooling water temperature of 105F to the shutdown cooling heat exchanger 27-1/2 hours after a normal shutdown.

16) The components, valves, and piping associated with pond water cleanup and chemistry control shall be designed to Seismic Category III. The remainder of the system shall be designed to Seismic Category I.

17) The following design codes and standards shall be met:

A. Spray Headers

- American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section III, Class 3.

B. Pumps, Piping, and Valves for Pond Water Cleanup and Chemistry Control

- ASME, Boiler and Pressure Vessel Code, Section VIII, Division 1
- American National Standards Institute (ANSI), B31.1

C. Filter Units

- American Petroleum Institute (API), Standard 650

D. Spray Nozzles and all other Pumps, Piping, and Valves

- ASME Boiler and Pressure Vessel Code, Section III, Class 3

E. Hypochlorite and Sulfuric Acid Tanks

- Hypochlorite Tanks: National Bureau of Standards, Voluntary Product Standard PS 15-69.
- Sulfuric Acid Tanks: ASME Boiler and Pressure Vessel Code, Section VIII.

F. Q-Class Components and Piping Testing and Inspection

- ASME Boiler and Pressure Vessel Code, Section XI

SYSTEM DESCRIPTION
ESSENTIAL SPRAY POND SYSTEM

1) ESPS

- Does not operate during normal power generation
- Removes heat from ECWS and diesel generator (DG) cooling water heat exchangers
- Dissipates heat to atmosphere via ESP
- Capable of supporting 100 percent of cooling functions required for safe shutdown following LOCA
- Consists of two redundant spray ponds and two separate, redundant flow trains, one flow train taking suction from and returning water to each spray pond. Each spray pond has a filtration train and chemical addition equipment.

2) Essential Spray Ponds (ESP)

- Function as separate, independent, redundant units
- Combined water inventory of both ponds required for 30-day emergency shutdown without makeup
- Two butterfly valves in common wall between ponds allow transfer of water from one pond to another. The valves are normally open; they can be closed when maintenance of one pond is required and drainage of both ponds is undesirable.

3) Filtration Train

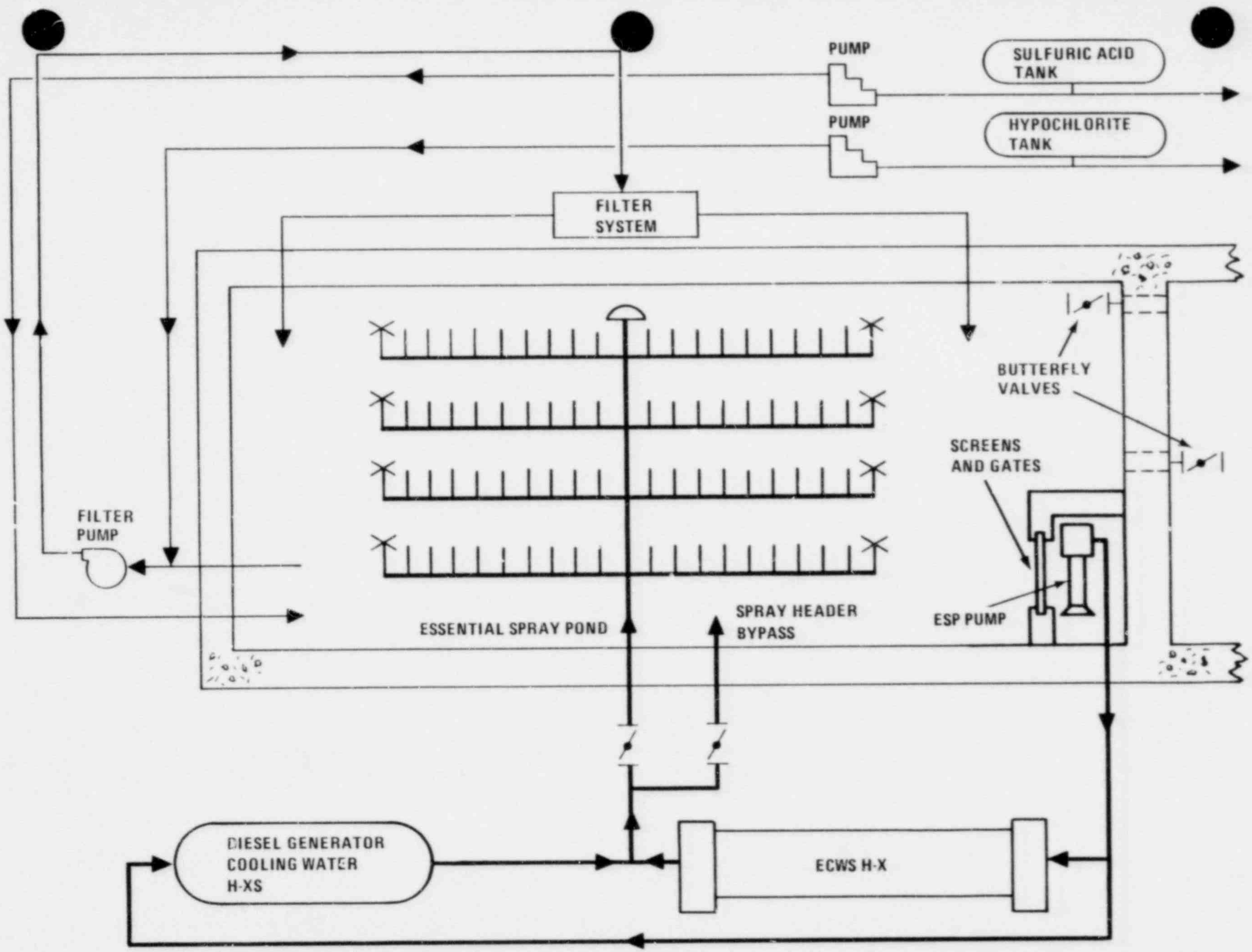
- Consists of one ESPS filter pump, two filter units piped in parallel, one filter backwash sump pump, piping, controls, and instrumentation.

4) Chemical Addition Equipment

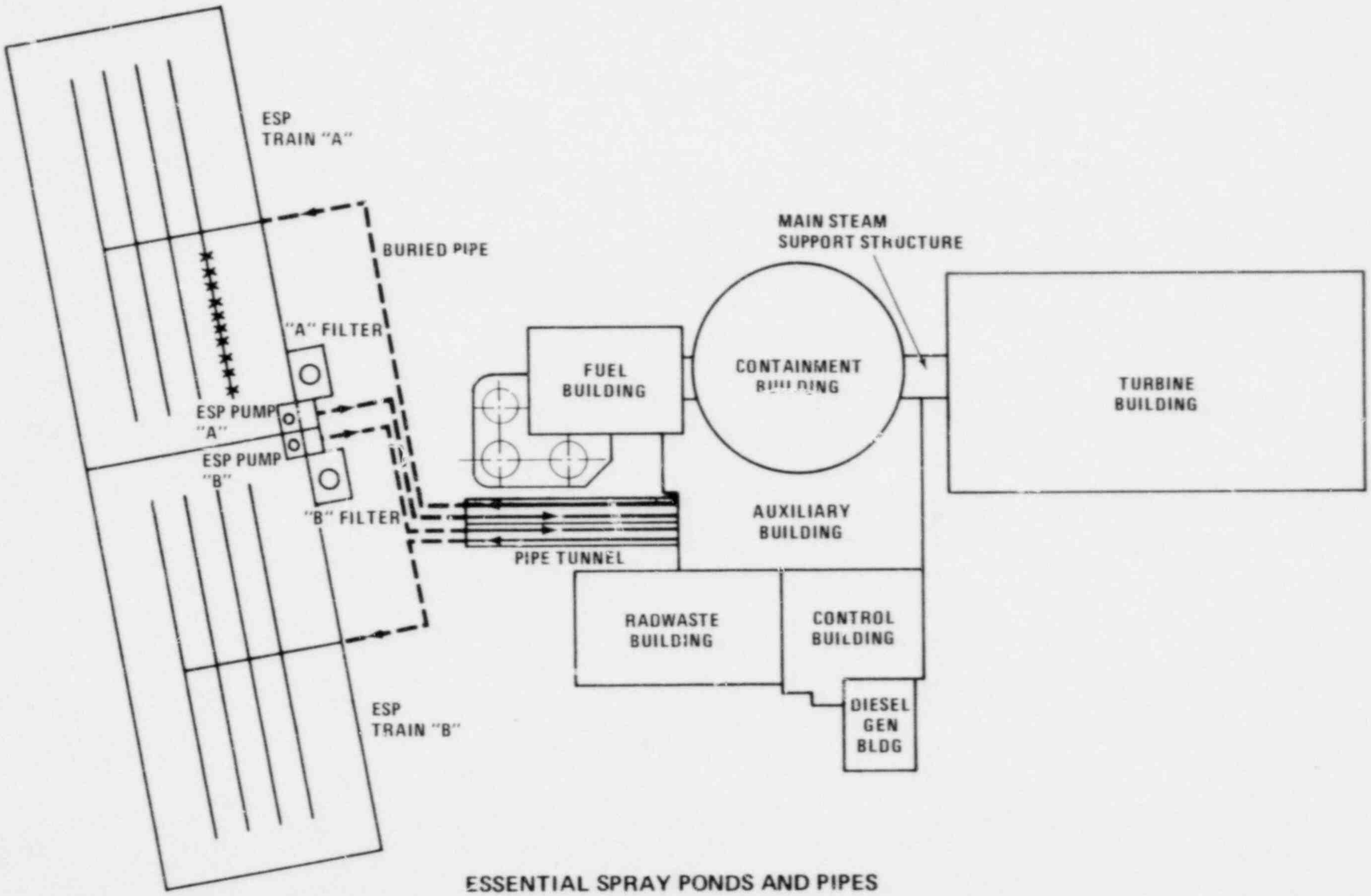
- Consists of one sulfuric acid metering pump, one hypochlorite metering pump, piping, valves, controls and instrumentation
- Metering pumps for the spray ponds take suction from common hypochlorite and sulfuric acid tanks

5) Makeup Water Sources

- Domestic water system (normal source)
- Station reservoir (backup source)

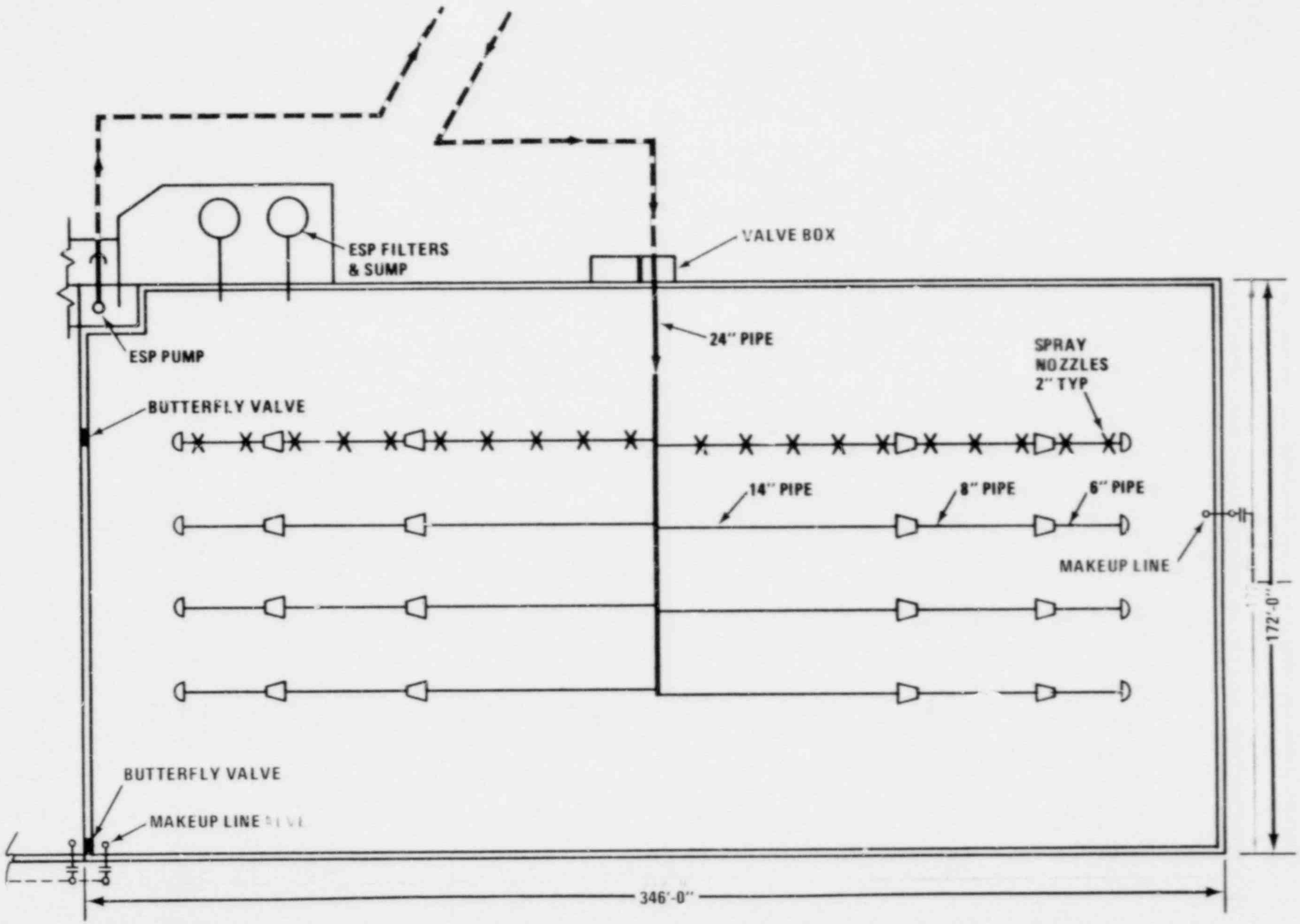


ESSENTIAL SPRAY POND SYSTEM (ONE OF TWO TRAINS)
FIGURE 4-2

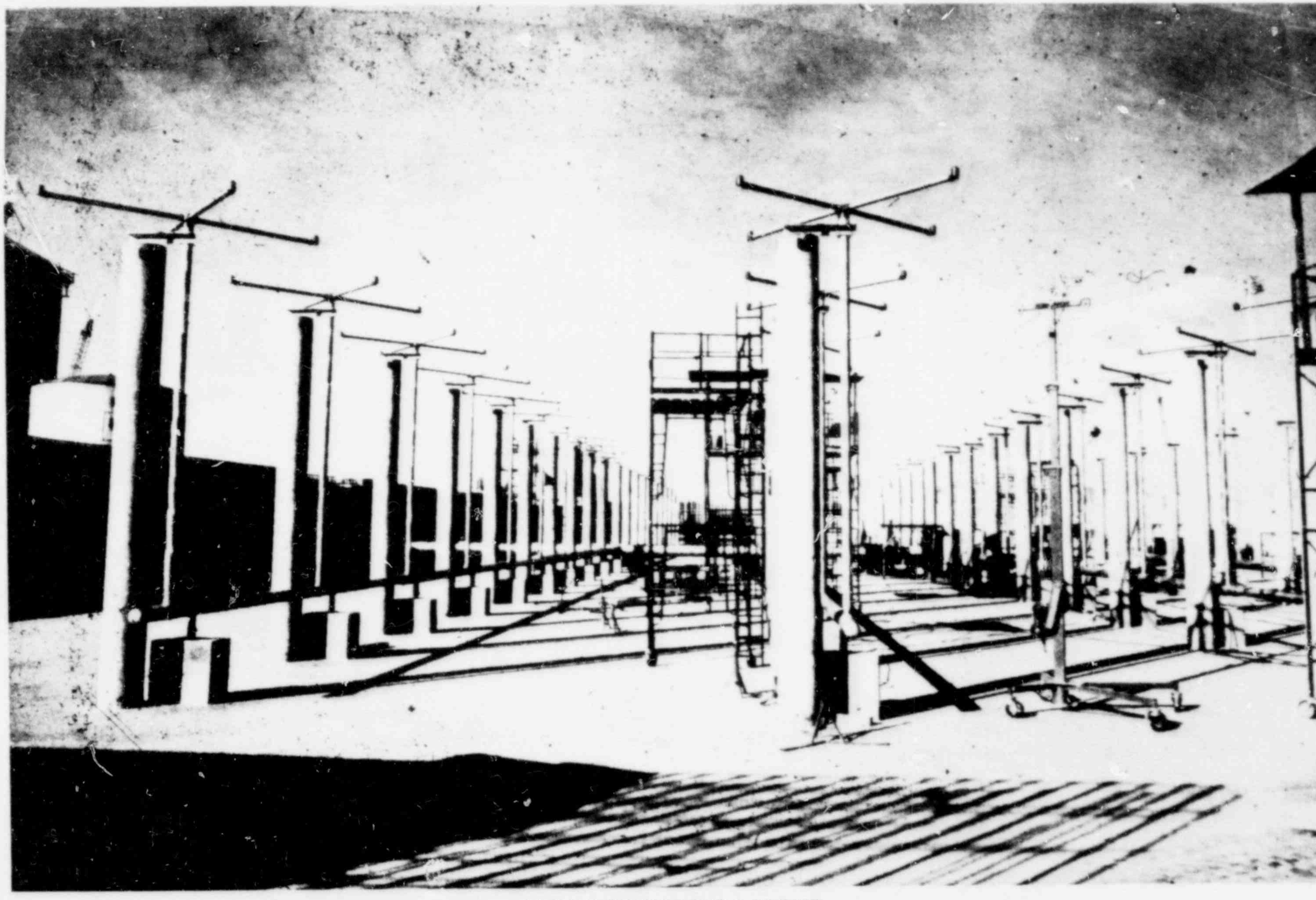


ESSENTIAL SPRAY PONDS AND PIPES

FIGURE 4-3

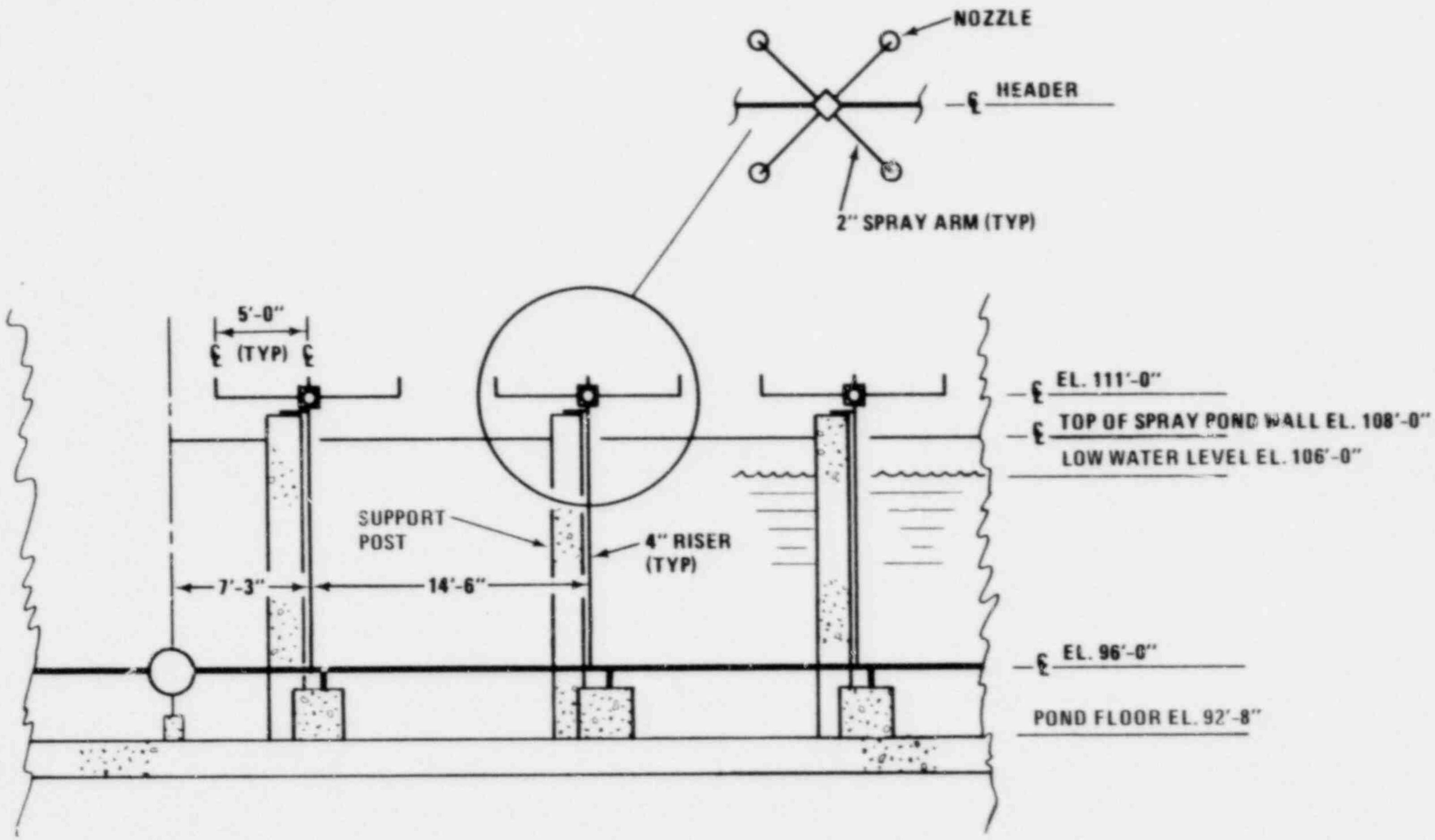


ESP – TRAIN "B"
FIGURE 4-4

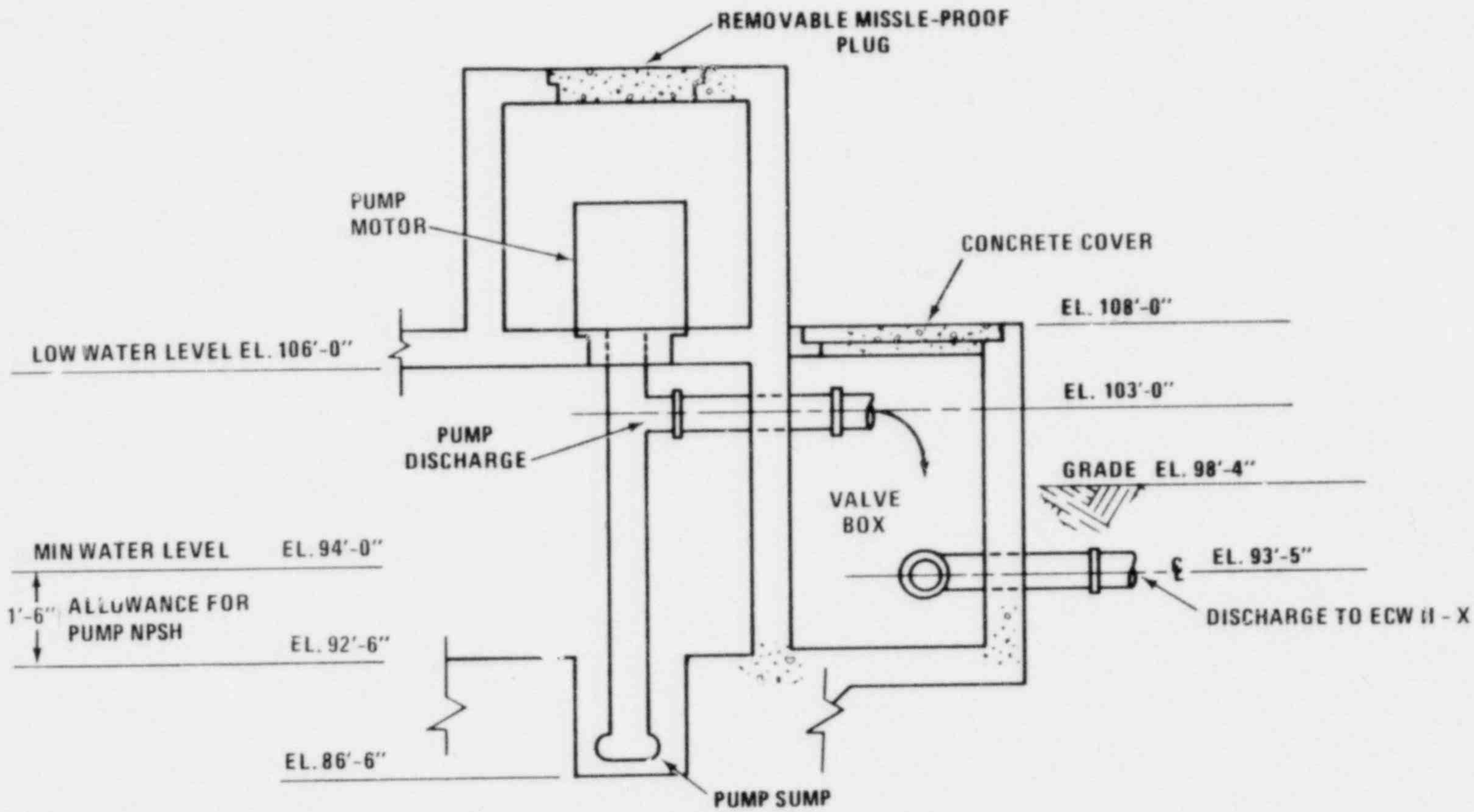


SLIDE 2 SPRAY POND LAYOUT

SLIDE 3 CLOSE-UP OF SPRAY HEADER & NOZZLES



ESPS – SPRAY SYSTEM
FIGURE 4-5



ESPS PUMP HOUSE & VALVE BOX

FIGURE 4-6

OPERATION
ESSENTIAL SPRAY POND SYSTEM

1) THE ESPS OPERATES ONLY DURING COLD SHUTDOWN, AN EMERGENCY, OR WHEN THE DIESEL GENERATOR IS RUNNING.

2) THE ESPS OPERATES TO SUPPLY COOLING WATER TO THE ECWS AND DG HEAT EXCHANGERS.

3) COOLING WATER FOR THE ESPS IS SUPPLIED FROM THE ESP. COOLING WATER FROM COMPONENTS SERVICED BY THE ESPS IS RETURNED TO THE ESP.

4) THE ESPS WILL OPERATE FOR 30 DAYS FOLLOWING A POSTULATED LOCA WITHOUT REQUIRING MAKEUP WATER.

5) ALTHOUGH AN EMERGENCY REACTOR SHUTDOWN IS USUALLY ACCOMPLISHED BY INITIAL OPERATION OF BOTH ESPS TRAINS, COOLDOWN AND SHUTDOWN OVER AN EXTENDED PERIOD OF TIME IS POSSIBLE AND PERMISSIBLE WITH THE USE OF A SINGLE TRAIN.

6) DURING OPERATION OF THE ESPS, FLOW CAN BE DIVERTED PERIODICALLY FROM THE SPRAY NOZZLE HEADERS DIRECTLY INTO THE POND. THIS PROCEDURE MINIMIZES THE WATER CONSUMPTION DUE TO EVAPORATION AND DRIFT WHEN THE POND WATER TEMPERATURE IS SUFFICIENTLY LOW TO ALLOW THIS DIVERSION. TEMPERATURE INSTRUMENTATION AT THE PUMP INTAKE STRUCTURE IN EACH POND, WITH TEMPERATURE SET POINT ALARMS IN THE CONTROL ROOM, INFORM THE OPERATOR OF THE NEED TO CLOSE/OPEN THE BYPASS.

EXHIBIT 4-7

7) The ESPS is actuated by any one or all of the following:

- LOP (Loss of offsite power)
- Diesel generator running signal
- SIAS (Safety injection actuation signal)
- CRVIAS (Control room ventilation and isolation actuation signal)
- CREFAS (Control room essential filtration actuation signal)
- Manual start from the switchgear or the control room

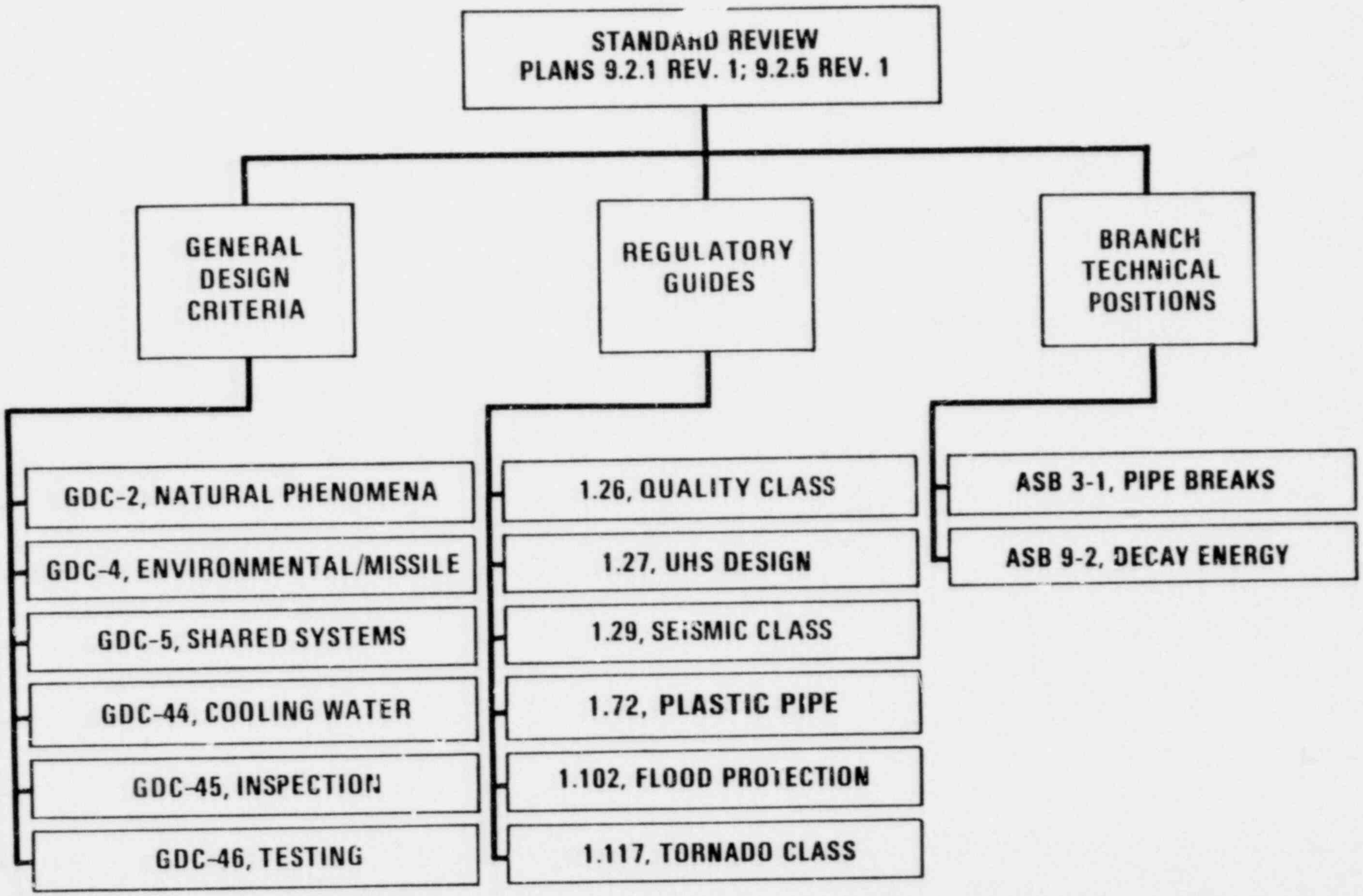
8) Both trains of the ESPS and the ECWS are automatically and simultaneously started by either the SIAS, CRVIAS, or CREFAS. A manual override is provided to permit manual start and stop actuation from the switchgear or the control room. Manual start and stop controls are provided for each of the two ESPS trains. This feature permits the removal of a train from operation after the automatic operation actuation, if the train is not required.

9) All manually operated control valves on the inlet and outlet lines of the ECWS heat exchangers and the individual diesel generator heat exchangers are locked open. The motor-operated spray header valves are normally open, while the motor-operated return flow bypass valve is normally closed.

10) While in operation, a LOP results in the shutdown and restarting of the ESPS in accordance with the DG load sequencing.

11) Flow differential is monitored between the ESPS pump discharge and the return line to the ESP to detect a pipe break. Each system being serviced by the ESPS is monitored to detect significant inleakage from the ESPS. Level instrumentation in each pond, with alarms in the control room, inform the operator of the need for adding makeup water to the ponds.

12) Each train will be periodically started and stopped to test system operability and component performance.



STANDARD REVIEW PLAN 9.2.1 REV. 1 AND 9.2.5 REV. 1

FIGURE 4-7

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 2, NATURAL PHENOMENA

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED TO WITHSTAND THE EFFECTS OF NATURAL PHENOMENA SUCH AS EARTHQUAKES, TORNADOES, HURRICANES, FLOODS, TSUNAMI, AND SEICHES WITHOUT LOSS OF CAPABILITY TO PERFORM THEIR SAFETY FUNCTIONS	IN COMPLIANCE.

EXHIBIT 4-10

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 4, ENVIRONMENTAL AND MISSILE DESIGN

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL BE DESIGNED FOR THE ENVIRONMENTAL CONDITIONS ASSOCIATED WITH NORMAL OPERATION, MAINTENANCE, TESTING AND POSTULATED ACCIDENTS, INCLUDING LOSS-OF-COOLANT ACCIDENTS. THEY SHALL BE APPROPRIATELY PROTECTED AGAINST DYNAMIC EFFECTS, INCLUDING THE EFFECTS OF MISSILES, PIPE WHIPPING, AND DISCHARGING FLUIDS, THAT MAY RESULT FROM EQUIPMENT FAILURES AND FROM EVENTS AND CONDITIONS OUTSIDE THE NUCLEAR POWER UNIT.	IN COMPLIANCE.

EXHIBIT 4-11

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 5, SHARED SYSTEMS

REQUIREMENT	DESIGN FEATURE
STRUCTURES, SYSTEMS, AND COMPONENTS IMPORTANT TO SAFETY SHALL NOT BE SHARED BETWEEN NUCLEAR POWER UNITS UNLESS IT IS SHOWN THAT THEIR ABILITY TO PERFORM THEIR SAFETY FUNCTIONS, INCLUDING, IN THE EVENT OF AN ACCIDENT IN ONE UNIT, AN ORDERLY SHUTDOWN AND COOLDOWN OF THE REMAINING UNITS.	IN COMPLIANCE.

EXHIBIT 4-12

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 44, COOLING WATER

REQUIREMENT	DESIGN FEATURE
A SAFETY SYSTEM SHALL BE PROVIDED TO TRANSFER THE COMBINED HEAT LOAD OF ESF STRUCTURES, SYSTEMS, AND COMPONENTS UNDER NORMAL OPERATING AND ACCIDENT CONDITIONS TO AN ULTIMATE HEAT SINK. SUITABLE REDUNDANCY IN COMPONENTS AND FEATURES, AND SUITABLE INTERCONNECTIONS, LEAK DETECTION, AND ISOLATION CAPABILITIES SHALL BE PROVIDED TO ASSURE THAT THE SYSTEM SAFETY FUNCTION CAN BE ACCOMPLISHED, ASSUMING A SINGLE FAILURE WITH OR WITHOUT A LOSS OF OFFSITE POWER.	IN COMPLIANCE. TWO REDUNDANT TRAINS ARE PROVIDED. EACH TRAIN IS CAPABLE OF REMOVING HEAT FROM THE REACTOR COOLANT AND BRINGING THE REACTOR TO COLD SHUTDOWN CONDITIONS, AS WELL AS PROVIDING COOLING FOR THE EMERGENCY DGs.

EXHIBIT 4-13

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 45, INSPECTION

REQUIREMENT	DESIGN FEATURE
THE COOLING WATER SYSTEM SHALL BE DESIGNED TO PERMIT APPROPRIATE PERIODIC INSPECTION OF IMPORTANT COMPONENTS, SUCH AS HEAT EXCHANGERS AND PIPING, TO ASSURE THE INTEGRITY AND CAPABILITY OF THE SYSTEM.	IN COMPLIANCE. ALL ASME PIPING AND COMPONENTS ARE CAPABLE OF INSERVICE INSPECTION EXCEPT FOR THE PORTIONS OF SUPPLY/RETURN LINES WHICH ARE BURIED. ANSI COMPONENTS AND NON-EMBEDDED ANSI PIPING CAN BE PERIODICALLY INSPECTED.

SRP ACCEPTANCE CRITERIA

GENERAL DESIGN CRITERION 46, TESTING

REQUIREMENT	DESIGN FEATURE
THE COOLING WATER SYSTEM SHALL PERMIT APPROPRIATE PERIODIC PRESSURE AND FUNCTIONAL TESTING TO ASSURE (1) STRUCTURAL AND LEAKTIGHT INTEGRITY OF COMPONENTS, (2) OPERABILITY AND PERFORMANCE OF ACTIVE COMPONENTS, AND (3) OPERABILITY OF THE SYSTEM AS A WHOLE AND PERFORMANCE OF THE FULL OPERATIONAL SEQUENCE FOR REACTOR SHUTDOWN AND FOR LOSS-OF-COOLANT ACCIDENTS.	IN COMPLIANCE.

EXHIBIT 4-15

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.26, QUALITY GROUP CLASSIFICATION

REQUIREMENT	DESIGN FEATURE
Cooling water systems that are not part of the reactor coolant pressure boundary and are designed for emergency core cooling, post-accident containment atmosphere cleanup or residual heat removal from the reactor shall meet the requirements of ASME B&PV Code, Section III, Class 3.	In compliance.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.27, ULTIMATE HEAT SINK

REQUIREMENT	DESIGN FEATURE
1) A SUFFICIENT CONSERVATISM SHOULD BE PROVIDED TO ENSURE THAT A 30-DAY SUPPLY OF WATER IS AVAILABLE AND THAT THE DESIGN BASIS TEMPERATURE OF SAFETY-RELATED EQUIPMENT ARE NOT EXCEEDED.	IN COMPLIANCE. COMBINED WATER INVENTORY OF TWO ESPS SUFFICIENT TO PROVIDE NECESSARY COOLING FOLLOWING A DESIGN BASIS LOCA FOR 30 DAYS WITHOUT WATER MAKEUP UNDER WORST HISTORICAL METEOROLOGICAL CONDITION. THE METEOROLOGICAL DATA FOR PHOENIX, ARIZONA, FROM 1948 TO 1973 WERE USED.

EXHIBIT 4-17

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.27, ULTIMATE HEAT SINK (CONT'D)

REQUIREMENT	DESIGN FEATURE
THE METEOROLOGICAL CONDITIONS RESULTING IN MAXIMUM EVAPORATION AND DRIFT LOSS SHOULD BE THE WORST 30-DAY AVERAGE COMBINATION OF CONTROLLING PARAMETERS, SUCH AS DEWPOINT, DEPRESSION, WINDSPEED, SOLAR RADIATION.	IN COMPLIANCE. THE WORST DAY FOR THE ESP WATER MASS IS AUGUST 8, 1969. THE WORST 29 CONSECUTIVE DAYS FOR THE ESPS POND WATER MASS ARE FROM JULY 12, 1971, TO AUGUST 9, 1971. THE FACTOR CONSIDERED FOR THE SELECTION PROCESS WAS THE MAXIMUM DIFFERENCE BETWEEN DRY BULB TEMPERATURE AND DEW-POINT TEMPERATURE CONCURRENT WITH THE HIGHEST WIND SPEEDS.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.27, ULTIMATE HEAT SINK (CONT'D)

REQUIREMENT	DESIGN FEATURE
THE METEOROLOGICAL CONDITIONS RESULTING IN MINIMUM WATER COOLING SHOULL BE THE WORST COMBINATION OF CONTROLLING PARAMETERS FOR THE CRITICAL TIME PERIOD UNIQUE TO THE SPECIFIC DESIGN OF THE SINK.	IN COMPLIANCE. THE WORST DAY FOR THE ESP THERMAL DESIGN IS AUGUST 14, 1955. THE WORST 29 CONSECUTIVE DAYS FOR THE ESP THERMAL DESIGN ARE FROM JULY 30, 1955, TO AUGUST 27, 1955. THE FACTOR CONSIDERED FOR THE SELECTION PROCESS WAS THE MINIMUM DIFFERENCE BETWEEN DRY BULB TEMPERATURE AND DEWPOINT TEMPERATURE.

EXHIBIT 4-19

REGULATORY GUIDE 1.27, ULTIMATE HEAT SINK (CONT'D)

REQUIREMENT	DESIGN FEATURE
2) ULTIMATE HEAT SINK SHOULD BE CAPABLE OF WITHSTANDING, WITHOUT LOSS OF SINK SAFETY FUNCTION, THE FOLLOWING EVENTS:	
A) THE MOST SEVERE EXTERNAL PHENOMENA EXPECTED AT THE SITE, WITH APPROPRIATE AMBIENT CONDITIONS, BUT WITH NO TWO OR MORE SUCH PHENOMENA OCCURRING SIMULTANEOUSLY.	A) IN COMPLIANCE. ESP IS SEISMIC CATEGORY I STRUCTURE LOCATED BEYOND EXTENT OF PROBABLE MAXIMUM FLOOD. HIGHLY IMPROBABLE THAT TORNADO AND DBA WOULD OCCUR SIMULTANEOUSLY. AS SUCH, NO WATER ALLOWANCE OR PROTECTION OF SPRAY HEADERS IS PROVIDED. FOR MORE PROBABLE CASE OF TORNADO OCCURRING SIMULTANEOUSLY WITH NORMAL SHUTDOWN, ESP PUMPS AND LINES ARE PROTECTED AGAINST TORNADO. MAKEUP WATER LINES TO THE ESP ARE UNDERGROUND AND TWO INDEPENDENT ON-SITE SOURCES OF WATER AVAILABLE.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.27, ULTIMATE HEAT SINK (CONT'D)

REQUIREMENT	DESIGN FEATURE
B) THE SITE-RELATED EVENTS THAT HISTORICALLY HAVE OCCURRED OR THAT MAY OCCUR DURING THE PLANT LIFETIME.	B) IN COMPLIANCE. THE FOLLOWING EVENTS HAVE LOW PROBABILITY • AIRPLANE CRASH • RAIL CAR ACCIDENT • OIL SPILL INTO ESP FIRE DETECTION IN THE ESPS INTAKE STRUCTURES IS PROVIDED. REMAINING ESPS COMPONENTS DO NOT CONTAIN COMBUSTIBLE MATERIALS.
C) [illegible]ASONABLY PROBABLE COMBINATIONS OF LESS SEVERE NATURAL PHENOMENA AND/OR SITE-RELATED EVENTS.	C) IN COMPLIANCE. THE SEISMIC CATEGORY I DESIGN OF THE ESPS ST[illegible]UCTURE AND COMPONENTS, CONCURRENT WITH CONSERVATIVE THERMAL/WATER MASS ESP DESIGN, PRECLU[illegible] LOSS OF ESP INTEGRITY OR CAPABILITY TO FUNCTION. TWO REDUNDANT TRAINS ARE PROVIDED.

EXHIBIT 4-21

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.27, ULTIMATE HEAT SINK (CONT'D)

REQUIREMENT	DESIGN FEATURE
d) A SINGLE FAILURE OF MANMADE STRUCTURAL FEATURES.	d) IN COMPLIANCE. FAILURE OF A SINGLE STRUCTURE CANNOT RESULT IN THE LOSS OF THE ESP SAFETY FUNCTION. REDUNDANT ESP AND THE REDUNDANT VALVES BETWEEN THE TWO ESPS PROVIDE THE CAPABILITY TO SUPPLY COOLING WATER IN THE EVENT OF FAILURE OF ONE TRAIN.
3) THE ULTIMATE HEAT SINK SHOULD CONSIST OF AT LEAST TWO SOURCES OF WATER, UNLESS IT CAN BE DEMONSTRATED THAT THERE IS EXTREMELY LOW PROBABILITY OF LOSING THE CAPABILITY OF A SINGLE SOURCE.	IN COMPLIANCE. TWO SEPARATE MAKEUP WATER LINES WERE PROVIDED TO EACH ESP FROM DOMESTIC WATER SYSTEM (PRIMARY SOURCE), AND STATION MAKEUP WATER RESERVOIR VIA COOLING TOWER MAKEUP AND BLOWDOWN SYSTEM (BACKUP SOURCE).

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.29, SEISMIC DESIGN CLASSIFICATION

REQUIREMENT	DESIGN FEATURE
The cooling water systems that are required for post-accident heat removal shall be designated Seismic Category I and be designed to withstand the effects of the SSE and remain functional. The quality assurance requirements of Appendix B to 10CFR50 shall apply.	In compliance.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.72, PLASTIC PIPE

REQUIREMENT	DESIGN FEATURE
SAFETY-RELATED SPRAY POND PIPING COMPONENTS MADE FROM FIBERGLASS-REINFORCED THERMOSETTING RESIN SHOULD COMPLY WITH ASME CODE CASE N-155-1 (1972-1).	NOT APPLICABLE. THE SPRAY POND PIPING ON THE PVNGS IS FABRICATED FROM AUSTENITIC STAINLESS STEEL, GRADE 316L.

EXHIBIT 4-24

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.102, FLOOD PROTECTION

REQUIREMENT	DESIGN FEATURE
SAFETY SYSTEMS SHOULD BE DESIGNED TO WITHSTAND THE MOST SEVERE FLCOD CONDITIONS RESULTING FROM SEVERE HYDROMETEOROGICAL CONDITIONS, SEISMIC ACTIVITY, OR BOTH.	IN COMPLIANCE.

SRP ACCEPTANCE CRITERIA

REGULATORY GUIDE 1.117, TORNADO DESIGN CLASSIFICATION

REQUIREMENT	DESIGN FEATURE
THE ULTIMATE HEAT SINK SYSTEMS SHOULD BE DESIGNED TO MAINTAIN THEIR CAPABILITY IN THE EVENT OF A DESIGN BASIS TORNADO.	IN COMPLIANCE. THE ESPS IS PROTECTED FROM THE EFFECT OF A DESIGN BASIS TORNADO IN CONJUNCTION WITH A NORMAL SHUTDOWN. SINCE THE ESP PUMPS AND LINES ARE PROTECTED AGAINST TORNADOES, THE MAKEUP WATER LINES TO THE ESP ARE UNDERGROUND, AND TWO INDEPENDENT ON-SITE SOURCES OF WATER ARE AVAILABLE, A TORNADO WOULD NOT IMPAIR ESP. IT IS HIGHLY IMPROBABLE THAT A TORNADO AND DBA WOULD OCCUR SIMULTANEOUSLY AND THEREFORE NO WATER ALLOWANCE OR PROTECTION OF THE SPRAY HEADERS IS PROVIDED.

BTP ASB 3-1, PROTECTION AGAINST POSTULATED PIPING FAILURES IN FLUID SYSTEMS OUTSIDE CONTAINMENT

REQUIREMENT	DESIGN FEATURE
THE SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY SHALL BE APPROPRIATELY PROTECTED AGAINST DYNAMIC EFFECT, INCLUDING THE EFFECT OF MISSILES, PIPE WHIPPING AND DISCHARGING FLUIDS, THAT MAY RESULT FROM EQUIPMENT FAILURES AND FROM EVENTS AND CONDITIONS OUTSIDE THE CONTAINMENT.	IN COMPLIANCE.

BTP ASB 9-2: RESIDUAL DECAY ENERGY

REQUIREMENTS

THE AUXILIARY SYSTEMS BRANCH HAS DEVELOPED ACCEPTABLE ASSUMPTIONS AND FORMULATIONS THAT MAY BE USED TO CALCULATE THE RESIDUAL DECAY ENERGY RELEASE RATE FOR LIGHT-WATER-COOLED REACTORS FOR LONG-TERM COOLING OF THE REACTOR FACILITY.

DESIGN FEATURE

IN COMPLIANCE. DECAY HEAT IS COMPUTED FROM EQUATIONS GIVEN IN BTP ASB 9-2.

EXHIBIT 4-28

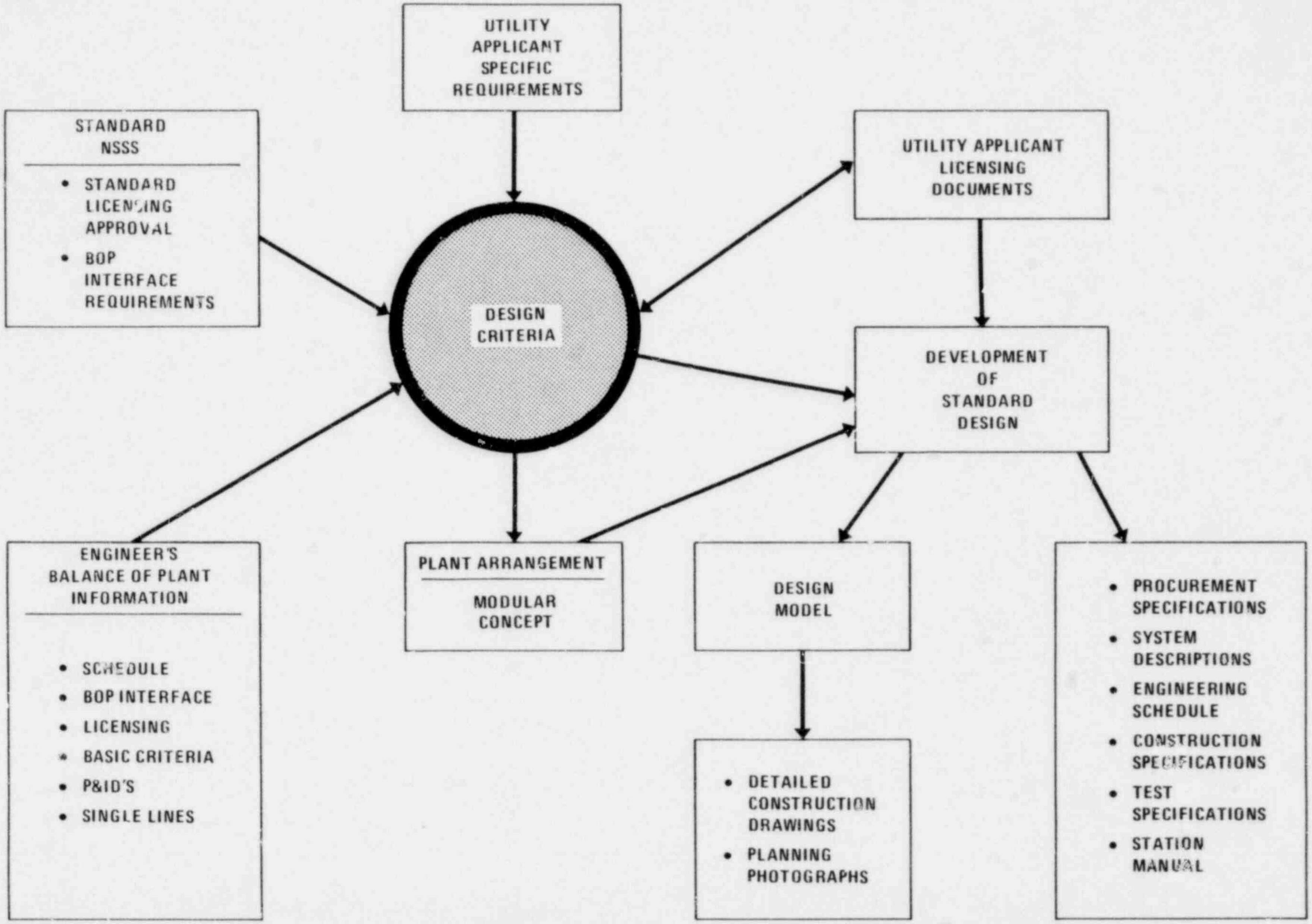
V.
BACKGROUND INFORMATION

PVNGS DESIGN DEVELOPMENT

THE PVNGS DESIGN DEVELOPMENT, REPRESENTED IN FIGURE B-1, IS CENTERED AROUND THE DESIGN CRITERIA, WHICH ACT AS THE HUB OF THE DESIGN. THESE CRITERIA ARE REVIEWED AND APPROVED BY THE OWNER AND ESTABLISH THE SCOPE OF THE SYSTEM. THEY ARE ASSEMBLED IN THREE VOLUMES ENTITLED "DESIGN CRITERIA MANUAL - PALO VERDE UNITS 1, 2 AND 3" AND REFLECT ALL THE DESIGN CRITERIA FOR THE PLANT. THIS IS A DYNAMIC DOCUMENT THAT IS UPDATED AS NEW CRITERIA ARE INCORPORATED INTO THE PLANT DESIGN. AS SHOWN IN FIGURE B-1, A SERIES OF DOCUMENTS ESTABLISH THE CRITERIA, INCLUDING UTILITY OR OWNER-APPLICANT'S SPECIFIC REQUIREMENTS, STANDARD NSSS SYSTEM 80 LICENSING AND BALANCE OF PLANT (BOP) INTERFACE REQUIREMENTS, AND THE ENGINEER'S BOP INFORMATION (SCHEDULE, INTERFACES, LICENSING, BASIC CRITERIA, P&IDS, AND SINGLE LINE DRAWINGS). THESE ALL SERVE AS INPUT TO THE DESIGN CRITERIA HUB, WHICH BY AN ITERATIVE PROCESS RESULTS IN APPLICANT LICENSING DOCUMENTS, DEVELOPMENT OF THE MODULAR PLANT ARRANGEMENT AND THE STANDARD DESIGN, AND FEEDBACK FROM THE REGULATORS. FROM THIS, PROCUREMENT SPECIFICATIONS, SYSTEM DESCRIPTIONS, SCHEDULES, CONSTRUCTION SPECIFICATIONS, TEST SPECIFICATIONS, AND THE STATION MANUAL ARE DEVELOPED. THE PLANT ARRANGEMENT IS ALSO DERIVED FROM THE DESIGN CRITERIA, AS REPRESENTED BY A THREE-QUARTER INCH TO THE FOOT SCALE MODEL OF THE PVNGS POWER BLOCK. THE MODEL IS USED TO DERIVE DETAILED CONSTRUCTION DRAWINGS AND PLANNING PHOTOGRAPHS.

IN SUMMARY, ONE SET OF DOCUMENTS ESTABLISH THE CRITERIA. FROM THIS SET, DESCRIPTIONS ARE PUT INTO LICENSING DOCUMENTS AND KEPT CURRENT BY CONTINUING REVIEW. MULTI-DISCIPLINE REVIEWS ARE CARRIED OUT WHERE DIFFERENT DISCIPLINES GET TOGETHER AT THE MODEL AND ANALYZE THE SYSTEMS, ASSESSING THE DESIGN, SAFETY, SEPARATION AND ALL CRITERIA, TO ENSURE THAT THE SYSTEM MEETS THE ESTABLISHED CRITERIA. THIS PROCESS GENERALLY TAKES TWO TO THREE YEARS TO ASSURE THAT THE DESIGN IS CORRECT AND REFLECTS ALL THE REQUIREMENTS.

EXHIBIT 5-1



PVNGS DESIGN DEVELOPMENT
FIGURE 5-1