June 30, 1981

Docket No. 50-237
LS05-81-06-131

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U.S. NUCLEAR REGULATORY COMMISSION

Mr. J. S. Abel
Director of Nuclear Licensing
Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60609

Dear Mr. Abel:

RE: SEP TOPIC IX-3, DRESDEN 2

Enclosed is a copy of our draft evaluation of Systematic Evaluation Program Topic IX-3, Station Service and Cooling Water Systems.

This assessment compares your facility, as described in Docket No. 50-237, with the criteria currently used by the regulatory staff for licensing new facilities. Please inform us if your as-built facility differs from the licensing basis assumed in our assessment within 30 days of receipt of this letter.

This evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility. This topic assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this topic are modified before the integrated assessment is completed.

Sincerely,

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
Draft SEO Topic IX-3

cc w/enclosure:
See next page

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SEP REVIEW

OF

STATION SERVICE AND COOLING

WATER SYSTEMS

TOPIC IX-3

FOR THE

DRESDEN NUCLEAR POWER PLANT UNIT 2

I. INTRODUCTION

The safety objective of Topic IX-3 is to assure that the cooling water systems have the capability, with adequate margin, to meet design objectives and, in particular, to assure that:

a. systems are provided with adequate physical separation such that there are no adverse interactions among those systems under any mode of operation;

b. sufficient cooling water inventory has been provided or that adequate provisions for makeup are available;

c. tank overflow cannot be released to the environment without monitoring and unless the level of radioactivity is within acceptable limits;

d. vital equipment necessary for achieving a controlled and safe shutdown is not flooded due to the failure of the main condenser circulating water system.

II. REVIEW CRITERIA

The current criteria and guidelines used to determine if the plant systems meet the topic safety objectives are those provided in Standard Review Plan (SRP) Sections 9.2.1, "Station Service Water System", and 9.2.2 "Reactor Auxiliary Cooling Water Systems".

III. RELATED SAFETY TOPICS AND INTERFACES

The scope of review for this topic was limited to avoid duplication of effort since some aspects of the review were performed under related topics. The related topics and the subject matter are identified below. Each of the related topic reports contains the acceptance criteria and review guidance for its subject matter.

II-2.A	Severe Weather Phenomena
II-3.B.1	Flooding of Equipment
III-3.B	Flooding of Equipment (Failure of Underdrain System)
VI-7.D	Flooding of Equipment (Long Term Passive Failures)
III-3.C	Inservice Inspection of Water Control Structures
III-4.C	Internally Generated Missiles
III-5	Mass and Energy Releases (High Energy Line Break)
VI-2.D	Mass and Energy Releases
III-6	Seismic Qualification
III-12	Environmental Qualification
VI-7.C.1	Independence of Onsite Power
VII-3	Systems Required for Safe Shutdown
VIII-2	Diesel Generators
IX-1	Fuel Storage
IX-6	Fire Protection
VI-10.B	Shared Systems For Multiple Unit Stations

The following topics are dependent on the present topic information for completion:

VI-3 Containment Pressure and Heat Removal Capability
IX-5 Ventilation Systems
XV-7 Reactor Coolant Pump Rotor Seizure

IV. REVIEW GUIDELINES

In addition to the guidelines of SRP Sections 9.2.1 and 9.2.2, in determining which systems to evaluate under this topic the staff used the definition of "systems important to safety" provided in Reference 1. The definition states systems important to safety are those necessary to ensure (1) the integrity of the reactor coolant pressure boundary*, (2) the capability to shutdown the reactor and maintain it in a safe condition, or (3) the capability to prevent, or mitigate the consequences of, accidents that could result in potential offsite exposures comparable to the guidelines of 10 CFR Part 100, "Reactor Site Criteria". This definition was used to determine which systems or portions of systems were "essential". Systems or portions of systems which perform functions important to safety were considered to be essential. It should be noted that this topic will be updated if future SEP reviews identify additional cooling water systems that are important to safety.

V. EVALUATION

In the course of this review, the staff considered the need to evaluate the Turbine Building Closed Cooling Water System (TBCCW) and the Fuel Pool Cooling System (FPC). The TBCCW system was not evaluated because, although it supplies cooling water to the plant instrument and service air compressors and control rod drive water pumps, the majority of equipment supplied by the system is associated with turbine control and electrical power generation. Even though most of this equipment is safety related, none of it is considered essential based on the definition of "important to safety." It should be specifically noted here that loss of cooling to the control rod drive water pumps does not adversely affect the safety function of the control rod trip system. The Dresden Unit 2 TBCCW system supplies cooling water to both the Unit 2 and Unit 3 Circulating Water Pumps.

The systems reviewed under this topic are the Reactor Building Closed Cooling Water (RBCCW) system, the Diesel Generator Cooling Water (DGCW) system, the Service Water System (SWS) and the Containment Cooling Service Water (CCSW) system.

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*Reactor Coolant Pressure Boundary is defined in 10 CFR Part 50 § 50.2(v).

A. <u>Reactor Building Closed Cooling Water System</u>

The RBCCW system is a closed loop system with two 50 percent capacity pumps and two 50 percent capacity heat exchangers. To provide component redundancy, a third 50 percent capacity pump and heat exchanger, which can be aligned to either the Dresden Unit 2 or Dresden Unit 3 RBCCW systems, can be made available by opening manual valves.

The system also has a surge tank which provides net positive suction head for the RBCCW pumps and a surge volume to accomodate system fluid thermal expansion and contraction. The RBCCW system cools the following equipment.

1. Recirculation pumps (2)
2. Containment Drywell Coolers (7)
3. Drywell Equipment Drain Sump Heat Exchanger
4. Shutdown Cooling System (heat exchangers and pump bearings) (3)
5. Fuel Pool Cooling System (2)
6. Drywell/Torus (differential pressure) Pumpback Compressors and after coolers (2)
7. Reactor Water Cleanup pumps and non-regenerative Heat Exchangers (4)
8. Cleanup Precoat Recirculation Cooler
9. Reactor Equipment Drain Tank Heat Exchanger
10. Waste Concentrator Condenser and Waste Collector Filter Recycle Cooler (2)
11. Floor Drain Filter Recycle Cooler and Concentrated Waste Tank
12. Containment Oxygen Analyzer and Containment Particulate Sampling System

The RBCCW system is not required to perform any post-accident heat removal functions. The system may be used to provide backup for certain emergency systems which are used for post-accident or safe shutdown heat removal functions.

Loss of RBCCW to a recirculation pump could result in pump seizure which would result in a rapid decrease in reactor recirculation flow rate (Ref. 2). This event will be evaluated during the SEP Design Basis Event (DBE) reviews for Dresden 2. At present, the staff does not consider RBCCW cooling of recirculation pumps to be an essential function because, even if pump seizure occurred, the event should not lead to significant offsite radiation doses.

The containment drywell coolers are not taken credit for in accident analyses for Dresden 2 and are not necessary for safe plant shutdown. Therefore, RBCCW flow to the coolers is not essential.

The Shutdown Cooling System is not required to bring the plant to a safe shut down or to achieve cold shutdown (see Ref. 3.)

RBCCW flow to the equipment cooled by the RBCCW (listed above) can be lost under both normal and post-accident conditions; and, although operator action may be necessary to restore flow to continue plant operation, the consequences are of little safety concern.

Based on our review of the RBCCW system, subject to the findings of the SEP recirculation pump seizure DBE, we have determined that the RBCCW system is not important to safety as defined in Reference 1.

B. Diesel Generator Cooling Water System

The Diesel Generator Cooling Water (DGCW) system consists of three pumps (designated 2-3903B and 3-3903B for Units 2 and 3 respectively, and 2/3-3903B for diesel generator 2/3), the components cooled by the system, and associated piping and valves.

The components cooled by the system are:

2-3903B: Diesel generator 2
Unit 2 HPCI* room cooler
Unit 2 Reactor Building emergency (LPCI room) coolers (2)

3-3903B: Diesel generator 3
Unit 3 HPCI room cooler
Unit 3 Reactor Building emergency (LPCI room) coolers (2)

2/3-3903B: Diesel generator 2/3

The pumps are located in the Circulating Water pump pit in the crib house. To prevent postulated flooding in the screen house from disabling the DGCW pumps, the orignal pumps have been replaced with submersible pumps.

Under normal operating conditions, the Service Water System (evaluated below) supplies flow to the DGCW system loads through check valves. Normally closed manual valves in the crib house can be opened to cross-connect the discharge piping of any DGCW pumps to any or all DGCW heat loads, except for the diesel generators. There are no power operated valves in the DGCW system. The DGCW pump jackets and bearings are cooled by the pumped fluid, and the pumps do not depend on other systems for cooling or lubrication.

The largest heat load on the DGCW system would occur during post-accident conditions during which the diesel generator, the HPCI pump, and reactor building air coolers are operating, and the Service Water System is not available to supply the DGCW system.

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*HPCI is the abbreviation for the High Pressure Coolant Injection System.

The DGCW pumps are normally operated during diesel generator testing which simulates post-accident diesel electrical load requirements. The pumps are also operated to cool the HPCI and LPCI pump rooms during operation of the HPCI and LPCI pump testing.

The Unit 2 pump receives electrical power from 480V MCC 29-2. The 2/3 DGCW pump normally receives power from MCC 28-3, but an automatic device connects the pump to MCC 38-3 (Unit 3) if MCC 28-3 is deenergized. The pumps can be operated in a manual mode or in automatic start mode.

C. Service Water System

The Service Water System (SWS) for Dresden Unit 2 and 3 consists of 5 pumps in the crib house (2 designated for Unit 2, 2 for Unit 3, and 1 swing pump designated 2/3). One SWS pump for Unit 2 is powered from bus 23; the other, from bus 24. The 2/3 pump can receive power from either bus 24 or Unit 3 bus 34. The pump rated capacity is 15,000 gpm each. All 5 SWS pumps discharge to a common 42" diameter discharge pipe. Three 30" diameter pipes, each containing a service water strainer, connect the 42" common discharge pipe to a 54" diameter header which runs from the crib house to the turbine building. The SWS piping branches from the 54" header to various components and systems in the Unit 2 and 3 turbine building, reactor building, and the radwaste buildings.

The components and systems which are cooled by or receive service water from the SWS are:

1. Control room air conditioning condenser (2)
2. Auxiliary electrical equipment room air conditioning condenser (1)
3. Fire protection system (1)
4. Reactor Building Closed Cooling Water heat exchangers (3)
5. Recirculation Pump Motor Generator oil coolers (4)
6. Steam Tunnel coolers (8)
7. Turbine Building Closed Cooling Water heat exchangers (2)
8. Turbine oil coolers (2)
9. Generator stator coolers (2)
10. Generator Hydrogen coolers (4)
11. Screen wash and chlorinator pumps (2)
12. Radwaste services

With the possible exception of Control Room and auxiliary electrical equipment room air conditioning, the SWS is not required to perform any post-accident function. The need for air conditioning in these spaces will be evaluated under SEP Topic IX-5, "Ventilation Systems" and under the review of SEP Design Basis Events. The safety significance of this function will be ascertained during those reviews; and, if the function is determined to be essential, this evaluation will be revised to include an assessment of the essential portion of the SWS.

The fire protection system is supplied by its own fire pumps (Ref. 7), and the SWS will be available as a backup source of fire protection water.

Loss of SWS cooling to the RBCCW heat exchangers would result in loss of the RBCCW functions. The RBCCW system has been previously evaluated in this report. If the conclusion regarding the safety significance of the RBCCW system is changed, the significance of SWS cooling of the RBCCW system will be reassessed. However, the RBCCW system is not considered essential.

SWS flow may be lost to the remaining components and systems supplied by the SWS under both normal and post-accident conditions; and, although operator action may be necessary to restore flow to continue plant operation, the consequences are of little safety concern.

Based on our review of the SWS (and subject to the findings of additional SEP reviews as noted above) we have determined that the SWS is not important to safety as defined in Reference 1.

D. Containment Cooling Service Water

The Containment Cooling Service Water (CCSW) system, also called the Emergency Service Water system, consists of four pumps (located in the condensate pit of the turbine building), two Containment Cooling heat exchangers (located in the reactor building basement), and associated piping and valves. The electrical power supplies for the pumps are 4kV Bus 23 for pumps 2A and 2B and 4kV bus 24 for pumps 2C and 2D.

During normal plant operation, the CCSW system is not operating. Following an accident or other plant evolution (such as a cooldown using the ECCS pressure relief system) which require containment heat removal, the CCSW system is started by the control room operator.

The staff reviewed the heat removal requirements of the CCSW system during post-accident conditions. The accidents considered were the Loss of Coolant Accident (LOCA) and the Steam Line Break (SLB) inside containment because these events result in the greatest potential accident heat loads on the CCSW system. Sections 5.2 and 6.2 of Reference 4 discuss the CCSW function following a LOCA. Energy is removed from containment by the Low Pressure Coolant Injection (LPCI) subsystem of the Emergency Core Cooling System (ECCS)*. The LPCI system pumps water from the containment suppression chamber through the CCSW heat exchangers to either or both the reactor recirculation system and/or the drywell or suppression chamber spray nozzles. The

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*The ECCS functions following an accident are evaluated under the SEP Design Basis Event review of the LOCA.

heat removed from the reactor core or from the containment by the LPCI is deposited in the suppression chamber (torus) water, and from there it is transferred to the CCSW system through the LPCI/CCSW heat exchangers (Fig. 1).

The sequence of actions followed by the operator to initiate CCSW cooling is to stop two of the LPCI pumps (all of which were automatically started by the ECCS actuation signal) and to start two CCSW pumps. The LPCI pumps must be stopped to provide sufficient electrical load capability on the emergency diesel generator to start the CCSW pumps. During this sequence, one LPCI pump must remain in operation to provide reactor core cooling.

The minimum combination of LPCI/CCSW pumps available occurs after a postulated loss of offsite power and the single failure of one of the emergency diesel generators. The cooling capability of the minimum combination (1 LPCI pump, 2 CCSW pumps) was analyzed in Section 5.2 of Reference 4 with the conclusion that adequate cooling was available to accomodate the post-LOCA heat input to containment.

During the initial period of energy release to the containment, the heat is absorbed in various passive heat sinks inside containment - mainly in the volume of water stored in the suppression chamber (torus). The torus water is capable of absorbing all the released energy during the initial blowdown phase of the LOCA (approximately 30 seconds) with the water temperature reaching 130°F.* The Reference 4 analysis concludes that the post-blowdown energy release rate is equaled by the CCSW heat removal rate with 1 LPCI and 1 CCSW pump operating at approximately 3 hours after the start of the accident (Figure 5.2.11 of Reference 4). The staff calculation of CCSW system capability using the minimum combination of LPCI and CCSW pumps (2 CCSW, 1 LPCI) shows that the heat removal capacity is sufficient to accomodate post-LOCA heat loads at approximately 95E6 BTU/hr.

The most severe temperature transient in the drywell is caused by a small break discharging steam only which does not cause reactor system depressurization or automatic operation of reactor trip or ECCS. This SLB event or a small LOCA which does not lead to automatic initiation of reactor trip or ECCS, depends upon operator action to initiate an orderly shutdown and cooldown of the plant to limit the quantity of energy released to the containment. The difference between a small LOCA or SLB and the large LOCA analyzed in Reference 4, from the standpoint of containment cooling, is the energy produced by the reactor core which is available to the containment. The large LOCA results in a quick reactor shutdown (trip), and the energy produced in the core following trip is core decay heat which procedes via the break to the containment. For a very small LOCA or SLB, the energy available to the containment includes both the core decay heat and the energy which enters containment prior to the operator initiated reactor trip.

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*The SEP will reevaluate the post-accident energy balance in containment under Topic VI-2.D, "Mass and Energy Release for Postulated Pipe Breaks Inside Containment."

Isolation of individual leaking components is accomplished by manual valves. Leakage from the CCSW system would result in flooding conditions in the turbine building condensate pit or reactor building basement.* The performance of an operating CCSW system would not be significantly impaired by a moderate energy line crack because the leakage rate calculated in accordance with Reference 6 (573 gpm) is a small fraction of one CCSW pump capacity.

The CCSW flow rate is indicated by means of flow transmitters (FT 2-150-1A & B) located in the reactor building corner rooms and flow indicators (FI 2-1542A & B) in the control room.

Detection of radioactive leakage through the CCSW heat exchanger from the LPCI system is accomplished by a radiation monitor (RE 2-1724) in the Service Water System at the discharge of the CCSW system. A leaking CCSW heat exchanger can be isolated by the control room operator by shutting the motor operated valve between the heat exchanger and the Service Water System.

VI. CONCLUSION

Based on our review of service and cooling water systems, we have concluded that the essential systems and functions are:

- Diesel Generator Cooling Water System: Diesel Generator Cooling, HPCI room cooler, reactor building emergency (LPCI room) cooler

- Containment Cooling Service Water: containment cooling heat exchangers

We have determined that the design of the above systems is in conformance with current regulatory guidelines and with General Design Criterion (GDC 44) regarding capability and redundancy of the essential functions of the systems. The systems also meet the requirements of GDC 45 and 46 regarding system design to permit periodic inspection and testing.

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*For a review of the effects of flooding see SEP Topic III-5.B, "Pipe Breaks Outside Containment", for Dresden 2.

TABLE 1. SYSTEM DESIGN PARAMETERS*

System/Reference	Parameters
Low Pressure Coolant Injection (Ref. 4, Section 6.2.4)	4 pumps - 5990 gpm (one pump) 2 CCSW heat exchangers - 102E6 BTU/hr each (with 10,700 gpm LPCI @ 165°F and 7,000 gpm CCSW @ 95°F)
Containment Cooling Service Water (Ref. 4, Section 6.2.4)	4 pumps - 3500 gpm each

*NOTE: Seismic and Quality Group Classification information is provided in SEP Topic III-1.

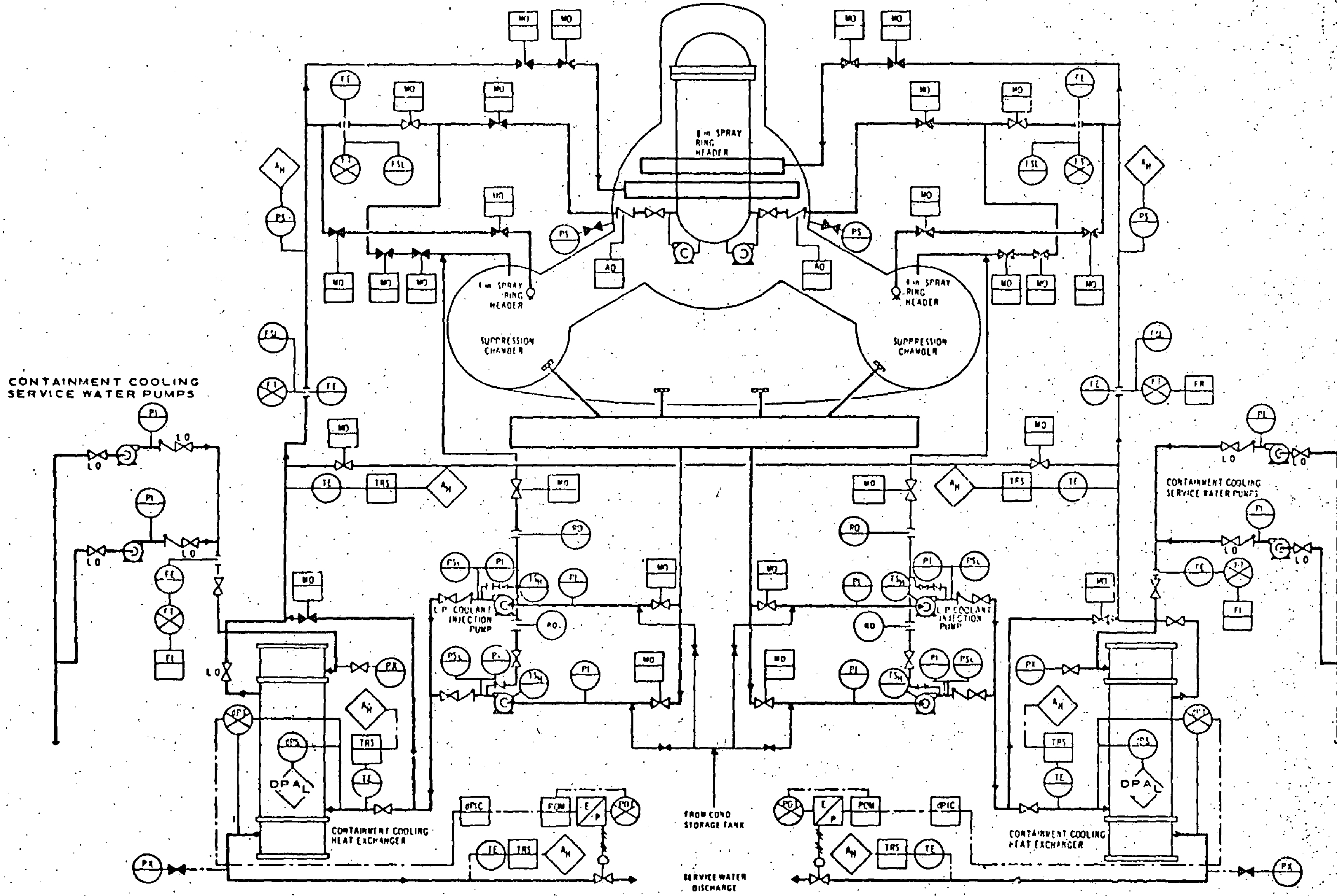

Figure / . Low Pressure Coolant Injection/Containment Cooling System P&ID

REFERENCES

1. Regulatory Guide 1.105, System Setpoints

2. CECo letter, C. Reed to T. Ippolito, dated August 3, 1979

3. SEP Review of Safe Shutdown Systems for the Dresden 2 Plant (SEP Topics VII-3, V-10.B, V-11.A, V-11.B, X)

4. Final Safety Analysis Report for Dresden Nuclear Power Station Units 2 and 3

5. Dresden Station Units 2 and 3 Inservice Inspection and Testing Programs, Revision 1, transmitted by CECo letter R. Janacek to T. Ippolito, dated June 26, 1979.

6. Branch Technical Position MEB 3-1, appended to Standard Review Plan 3.6.2.

7. NRC letter, G. Lear to C. Reed, dated March 22, 1978 transmitting Amendment Nos. 25, 36, and 33 to License Nos. DPR-2, DPR-19, DPR-25 for Dresden Units 1, 2, and 3.