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1. SCOPE

1.1 Purpose. This specification defines the requirements for the design, performance, configuration, and testing for the Passive Containment Cooling System (T15). It also defines the interface requirements with other systems in the complete nuclear system and with the balance of plant.

1.2 Use. The use of this design specification is applicable to the Simplified Boiling Water Reactor (SBWR) Project only.

2. APPLICABLE DOCUMENTS

2.1 Supporting and Supplemental Documents. The following documents form a part of this specification.

2.1.1 Supporting Documents.

		MPL NO.
a. Passive Containment Cooling System P&ID	(107E5160)	T15-1010
(Ansaldo document number: SBW5280DNJXN014001)		
b. Passive containment Cooling System Process Diagram	(107E6072)	T15-1020
(Ansaldo document number: SBW5280DNJXN015001)		

2.1.2. Supplemental Documents

2.1.2.1 Documents under the following identities are to be used in conjunction with this specification:

		MPL NO.
a. Isolation Condenser System Design Specification	(25A5013)	B32-4010
(Ansaldo document number: SBW5280SNPXN002000)		
b. Isolation Condenser System P&ID	(107E5154)	B32-1010
(Ansaldo document number: SBW5280DNJXNO12001/2)		
c. Gravity Driven Cooling System DS		E50-4010
(Ansaldo document number: SBW5240SNPXN001000)		
d. Fuel and Auxiliary Pools Cooling System Design Specification	(23A6921)	G21-4010
e. Fuel and Auxiliary Pools Cooling System P&ID	(103E1581)	G21-1010

f. Make-up Water System Design Spec.		P10-4010
g. System Design Specification Standard	(23A6857)	A00-3050
h. Pressure Integrity of Nuclear Components		A11-2029
i. Drywell Gas Recirculation System P&ID		T55-1010
j. Reliability, Availability & Maintainability (RAM) Criteria	(23A6899)	A18-1020
k. Equipment Environmental Data		A11-2020
l. Source Terms		A11-2052

2.1.2.2 The following documents are to be used in conjunction with this specification to the extent specified herein:

a. Composite Design Specification	(23A6723)	A11-5299
b. Generic Operations and Maintenance Requirements Specification	(23A6882)	A80-8010
c. Composite Design Specification Data Sheet	(23A6723AC)	A11-5299
d. Mechanical Equipment Separation for Engineered Safety Feature (ESF) Systems	(23A6932)	A11-2018

2.2 Codes and Standards. The following codes and standards form a part of this specification to the extent specified herein. The applicable code and standard edition dates together with exceptions to code and standard requirements are defined in reference 2.1.2.2.c.

2.2.1 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code

a. Section III: Nuclear Power Plant Components

b. Section XI: Rules for Inservice Inspection of Nuclear Power Plant

2.2.2 Institute of Electrical and Electronic Engineers (IEEE). None specified as part of this specification.

2.3 Laws and Regulations The following laws and regulations form part of this specification to the extent specified herein:

2.3.1 NRC Regulations. None specified as part of this specification.

2.3.2 Regulatory Guides. None specified as part of this specification.

8. DESIGN DESCRIPTION

8.1 Summary Description. The Passive Containment Cooling System (PCCS-T15) basically consists of three totally independent loops, each containing a heat exchanger that condenses steam on tube side and transfers heat to water in a large pool which is vented to atmosphere.

The PCCS operates by natural circulation. Its operation is initiated by the difference in pressure between the drywell and the wetwell, which are parts of the SBWR pressure suppression type containment system.

The condenser, which is open to the primary containment, can receive a steam-gas mixture supply directly from the drywell. The condensed steam is drained to the GDCS (Gravity Driven Cooling System) pool and the gas is vented through the line which is submerged in the pressure suppression pool.

A DGRS (Drywell Gas Recirculation System) suction line is connected to the PCCS vent line to recirculate reactor containment gas and steam, during post-LOCA recovery, increasing PCCS effectiveness.

The PCC loop does not have valves which must operate to allow the PCC to function, so the system is always in "ready standby".

8.2 Detailed System Description. The Passive Containment Cooling System (PCCS) maintains the Containment within its pressure limits for design basis accidents. The system is designed as a passive system with no components that must actively function, and it is also designed for conditions that equal or exceed the upper limits of containment reference severe accident capability.

The PCCS consists of three, low-pressure, totally independent loops, each containing a steam condenser (Passive Containment Cooling Condenser) as shown on the PCCS P&ID (ref. paragraph 2.1.1.a). The PCCS P&ID defines piping system interconnections, special arrangement requirements and system input sources and outputs.

Each of the three PCC Condensers is designed for 10 MWt capacity and is made of two identical modules. The three condensers limit containment pressure to less than its design pressure for at least 72 hours after a LOCA.

The units are located in a large water pool positioned above, and outside, the SBWR primary containment (drywell).

The PCC Condenser is configured as shown on the diagram (reference Paragraph 2.1.1.a)as follows:

A central steam supply pipe is provided which is open to the containment at its lower end, and it feeds two horizontal headers through two branch pipes at its upper end. Steam is condensed inside vertical tubes and the condensate is collected in two lower headers.

The vent and the drain lines from each lower header are routed to the drywell through a single containment penetration as shown on the diagram (reference Paragraph 2.1.1.a).

The condensate drains into an anular duct around the vent pipe and then flows in a line which connects to a large common drain line which also receives flow from the other header.

The PCCS loops receive a steam-gas mixture supply directly from the drywell. The PCCS loops are initially driven by the pressure difference created between the containment drywell and the suppression pool during a LOCA and then by gravity drainage of steam condensed in the tubes, so they require no sensing, control, logic or power-actuated devices to function.

A branch line from the PCCS vent line is connected to the DGRS which can be used to recirculate the drywell gas by drawing the gas through the PCCS and blowing it back into the drywell during post accident recovery operations.

The DGRS pipeline extension from the PCC vent line contains two locked closed shut off valves in series plus one check valve (as shown in ref. document 2.1.2.1.i) to assure that drywell gas does not bypass the PCCS during a LOCA.

The PCCS loops and the DGRS loops are an extension of the safety-related containment and do not have containment isolation valves.

Spectacle flanges are included in the drain line and in the vent line to conduct post maintenance leakage tests separately from Type A containment leakage tests.

Located on the drain line, downstream of the spectacle flanges, two small lines are provided: they supply condensate to the vacuum breakers water seal. The two lines feed different vacuum breakers and each vacuum breaker receives condensate from two separate PCCS units.

Located on the drain line and submerged in the GDCS pool, just upstream of the discharge point, is a loop seal: it prevents back flow of steam and gas mixture from the drywell to the vent line, which would otherwise short circuit the flow through the PCC heat exchanger to the vent line. It also provides long term operational assurance that the PCC condenser is fed via the supply line.

Each PCC condenser is located in a subcompartment of the IC/PCC pool, and all pool subcompartments communicate at their lower ends to enable full utilization of the collective water inventory, independent of the operational status of any given IC/PCC subloop.

A valve is provided at the bottom of each PCC subcompartment that can be closed so the subcompartment can be emptied of water to allow PCC condenser maintenance.

Pool water can heat up to about 101°C (214°F); steam formed, being nonradioactive and having a slight positive pressure relative to station ambient, vents from the steam space above each PCC Condenser segment where it is released to the atmosphere through large-diameter discharge vents.

A moisture separator is installed at the entrance to the discharge vent lines to preclude excessive moisture carryover and loss of IC/PCC pool water.

IC/PCC pool make-up clean water supply for replenishing level is provided from "Make-up Water System" (ref. 2.1.2.1.f).

Level control is accomplished by using an air-operated valve in the make-up water supply line. The valve opening/closing is controlled by water level signal sent by a level transmitter sensing water level in the IC/PCC pool.

Cooling/clean-up of IC/PCC pool water is performed by "Fuel and Auxiliary Pools Cooling System" (ref. 2.1.2.1.d and e). Several suction lines, at different locations, draw water from the sides of the IC/PCC pool at an elevation above the minimum water level that is required to be maintained during normal plant operation. The water is cooled/cleaned and is returned back to the pool.

On the return line for IC/PCC pool water recirculation flow, there is also a post-LOCA pool water make-up connection.

3.3 System Boundaries.

3.3.1 Includes. The Passive Containment Cooling System design scope includes the following:

a. PCC pool subcompartment interconnections (pipes and valves).

3.3.2 Excludes. The Passive Containment Cooling System design scope excludes the following:

a. IC/PCC Pool.

b. Pool instrumentation.

c. Outside vent to atmosphere.

d. Steam dryers in the pool vent flow path.

e. Pool make-up and water recirculation systems.

3.4 System Operation.

3.4.1 Normal Plant Operation. During normal plant operation, the PCC subloop is in "ready standby".

3.4.2 Plant Shutdown Operation. During refueling, the PCC heat exchanger maintenance can be performed, after closing the locked open valve which connects the PCC pool subcompartment to the common parts of the IC/PCC pool, and drying the individual partitioned PCC pool.

3.4.3 Passive Containment Cooling Operation. The PCCS receive a steam-gas mixture supply directly from the drywell; it does not have any valve, so it immediately starts into operation, following a LOCA event. Non condensables together with steam vapor enter the PC Condenser; steam is condensed inside PCC Condenser vertical tubes, and the condensate, collected in the lower headers, is discharged to the GDCS pool. The uncondensables are purged to the wetwell through the vent line.

3.5 System Interfaces. The document listed in paragraph 2.1.1.a. shows the mechanical interfaces of PCCS with other systems. The following paragraphs describe all PCCS interfaces with other systems.

3.5.1 Gravity Driven Cooling System (GDCS) (E50). The GDCS pool receives a steam condensed from the PCC Condenser.

The drain line for PCC system "A" shall go to the GDCS pool at 90° reactor building azimuth, and the drain line for PCC systems "B" and "C" shall go to the GDCS pool at 270° azimuth.

3.5.2 Drywell Gas Recirculation System (DGRS) T55). This system can be used to recirculate the drywell gas by drawing the gas through the PCCS and blowing it back into the drywell, during post accident recovery operations, to depressurize the containment.

Operation of this system is manually initiated after opening locked closed shut off valves.

3.5.3 Fuel and Auxiliary Pools Cooling System (FAPCS) (G21). This system performs a cooling/clean-up of IC/PCC pool water.

Several suction lines, at different locations, draw water from the sides of the IC/PCC pool at an elevation above the minimum water level that is required to be maintained during normal plant operation. The water is cooled/cleaned and is returned back to the pool.

On the return line for IC/PCC pool water recirculation flow, there is also a post-LOCA pool water make-up connection.

3.5.4 Make-up Water System (MWS) (P10). This system provides IC/PCC pool make-up clean water supply for replenishing level.

Level control is accomplished by using an air-operated valve in the make-up water supply line. The valve opening/closing is controlled by water level signal sent by a level transmitter sensing water level in the IC/PCC pool.

3.5.5 Isolation Condenser System (ICS) (B32). Passive Containment Cooling System and Isolation Condenser System do not have any functional interface. However, the PCC Condenser and Isolation Condenser will be located in a common pool (but in separate subcompartments) and will share the same pool water and steam discharge vent to atmosphere.

3.5.6 Containment System (CS) (T10). Two small lines, located on the drain line downstream of the spectacle flange, supply condensate to the water seal on the vacuum breakers: as long as the PCCS units are condensing steam, a relatively constant source of water is available for the water seal.

3.6 Instrumentation and Control. This paragraph is not applicable: PCC System does not have instrumentation, and control logic is not needed for its functioning (no sensing, no power actuated valves and, in general, no power-actuated devices).

4. FUNCTIONS AND REQUIREMENTS

4.1 Functions. The Passive Containment Cooling System, sized to remove the core decay heat rejected to the containment at approximately one hour after a LOCA, shall provide containment cooling for a minimum of 72 hours post-LOCA, with containment pressure never exceeding its design pressure limit of 379.2 kPa(g) (55 psig), and with IC/PCC pool inventory not being replenished.

The PCCS is an "Engineered Safety Feature" (ESF), and it is a safety related system.

4.2 General System-Level Requirements. The PCC Condensers shall be sized to maintain the Containment within its pressure limits for design basis accidents. The PCCS shall be designed as a passive system without power actuated valves or other components that must actively function and shall be constructed of steel to design pressure, temperature and environmental conditions that equal or exceed the upper limits of containment system reference severe accident capability.

4.2.1 Performance Requirements. For operating temperatures and pressures, system operating modes and performance requirements, see paragraph 3.4 and the document "PCCS Process Flow Diagram" (ref. paragraph 2.1.1.b).

The system and the heat exchanger shall be designed for the following thermal, pressure, vibration and dynamic load (including seismic) cycles:

4.2.1.1 Normal Condition (Planned Operation). Continuous operation at containment conditions of 0-13.8 kPa(g), 10°C to 60°C (0-2 psig, 50°F to 140°F) air or nitrogen with 50% relative humidity in tubes, and 10°C to 60°C (50°F to 140°F) pool water outside the tubes.

4.2.1.2 Upset Conditions (Moderately Frequent Transients). ASME Code Section III, Class 2, Level B Service Condition limits apply for the following:

a) Two steam and gas mixture (steam, nitrogen, oxygen and hydrogen) heatup cycles where pressure and temperature in the tubes increases to 379.2 kPa(g), 150.5°C (55 psig, 303°F) (see figure 4.1 for pressure versus time plot).

   Pool water coolant temperature outside the tubes rises from 10°C to 100°C (50°F to 212°F) in 10 minutes or more.

   The rationale for two cycles is: automatic depressurization occurs; then the plant operation is resumed with a 1 cycle allowance to justify continued operation.

b) 10 equivalent dynamic load excitation input cycles (including seismic) with 10 response acceleration cycles per excitation cycle (see figures 4.2 and 4.3).

4.2.1.3 <u>Faulted Conditions (Postulated Accidents) - Case 1</u>. The following conditions shall be analyzed (but not tested) for the following: maximum combined SSE, DPV/SRV, and LOCA loads (see figures 4.4 and 4.5) concurrent with a pressure and a temperature of 379.2 kPa(g), 150.5°C (55 psig, 303°F) (ASME Section III, Class 2, Level C Service Condition stress limits apply for this load combination).

Occurrences: less than or equal to 10E-06 events/year.

4.2.1.4 <u>Faulted Conditions (Postulated Accidents) - Case 2</u>. The following conditions shall be analyzed (but not tested) for the following: the steam and gas mixture (steam, nitrogen, oxygen and hydrogen) pressure and temperature in the tubes increases as in the cycle above during the initial 380 seconds (see figure 4.1 for pressure versus time plot); thereafter, the pressure and temperature in the tubes increase to 758.5 kPa(g), 171.1°C (110 psig, 340°F) in 72 hours (ASME Section III, Class 2, Service Level C stress limits shall apply for this load combination).

Pool water coolant temperature outside the tubes rises from 10°C to 100°C (50°F to 212°F) in 10 minutes or more.

Occurrences: less than or equal to 10E-06 events/year.

4.2.1.5 <u>Test Conditions</u>

	Occurrences
a) Containment pneumatic pressure test cycles at 448.2 kPa(g) ambient, 48.9°C max. (65 psig ambient 120°F max.) temperature.	5
b) Containment pneumatic leakage tests (10CFR50, Appendix J, Type A tests) at 379.2 kPa(g) ambient, 48.9°C max. (55 psig, ambient 120°F max.) temperature.	30
c) PCC pneumatic post maintenance leakage tests at 758.2 kPa(g), 60°C (110 psig, ambient 140°F max.).	60

4.2.2 <u>Configuration and Arrangement</u>.

4.2.2.1 The elevation difference between the IC/PCC pool bottom and the GDCS pool water surface shall be equal to or greater than that specified in supporting document paragraph 2.1.1.a.

4.2.2.2 The vent line submergence is defined by supporting document paragraph 2.1.1.a. The value is based on two opposite aspects: deep vent line end to avoid stratification phenomena, but not so deep that it stops the PCCS venting function.

4.2.2.3 The elevation difference between the vent line end and the top of the horizontal vents (DW-WW) is defined by supporting document paragraph 2.1.1.a.

4.2.2.4 According to the above elevation difference, the passive containment cooling loop pressure drop (heat exchanger and vent line piping and elbow) shall be limited: < 850 mm of water at suppression pool temperature, at the flow rate defined in "mode C" (Post-LOCA Quasi-Steady State conditions) of the ref. doc. 2.1.1.b. At this pressure drop value, bypassing of the PCC Condenser through the DW-WW horizontal vents can occur.

4.2.2.5 Vent line piping minimum slope to the suppression pool shall be equal to or greater than 1/25.

4.2.2.6 The drain line from the PCC shall not penetrate the GDCS pool below the GDCS water surface so drain line failure will not drain the GDCS pool.

The loop seal has to be 250 mm below the water level, during normal plant operation. Its length shall be at least 2500 mm to prevent the backflow of steam and gas mixture from the drywell to the vent line.

4.2.2.7 The 1/4 inch lines connections have to be made at the bottom of the horizontal run, in the 6" pipe, for condensate drainage.

4.2.2.8 System configuration shall permit inservice inspection. The physical arrangement and access of piping for inservice inspection is defined by reference 2.1.2.2.b.

4.2.2.9 System configuration shall permit component servicing in accordance with the plant servicing system requirements.

4.2.3 Safety.

4.2.3.1 The Passive Containment Cooling Condenser is an extension of the containment (drywell) pressure boundary and it is used to mitigate the consequences of an accident. This function classifies it as a safety related Engineered Safety Feature (ESF) per reference, Paragraph 2.1.2.2.a.

Therefore, ASME Code Section III, Class 2 and Section XI requirements for design and accessibility of welds for in-service inspection apply.

The system shall be designed to Seismic Category I.

The system shall also be arranged/protected as required by reference document 2.1.2.2.d, which includes protection against mechanical damage, fire and flood.

4.2.3.2 The common cooling pool that PCC Condensers share with the IC's of the Isolation Condenser System (B32) is a safety related Engineered Safety Feature (ESF), and it shall be designed such that no locally generated force (such as an IC system rupture) can destroy its function. The requirements of reference document 2.1.2.2.d which include arrangement/protection requirements against mechanical damage, fire and flood apply to the common IC/PCC pool.

4.2.3.3 As protection from missile, tornado and wind, the PCC System parts outside the containment (the Passive Containment Cooling Condenser itself) shall be located in a subcompartment of the safety related ICS/PCCS pool.

4.2.3.4 The PCC Condensers shall not fail in a manner that damages the safety related ICS/PCCS pool as a result of dynamic loads, including combined seismic, DPV/SRV or LOCA induced loads.

4.2.4 Design Life. Material and equipment selection for the system components shall be based on a useful life of 60 years.

Therefore each Passive Containment Cooling Condenser unit shall be designed for 60 years life and, if necessary, repair operations will be perform during refueling. However, in case of major damage of some component part, the module shall be easily removable.

4.2.5 System Interfaces.

4.2.5.1 Gravity Driven Cooling System (GDCS) (E50). See paragraph 3.5.1.

4.2.5.2 Drywell Gas Recirculation System (DGRS) T55). See paragraph 3.5.2.

4.2.5.3 Fuel and Auxiliary Pools Cooling System (FAPCS) (G21).

Description	Duration
Cooling and clean-up of ICS/PCCS pool	Intermittent

4.2.5.4 Make-up Water System (MWS) (P10).

Description	Duration
Water to maintain ICS/PCCS pool level	Intermittent

4.2.5.5 Isolation Condenser System (ICS) (B32). See paragraph 3.5.4.

4.2.5.6 Containment System (CS) T10). See paragraph 3.5.6.

4.2.6 Instrumentation and Control. This paragraph is not applicable: see paragraph 3.6.

4.2.7 Availability.

4.2.7.1 Since the plant average availability has to be no less than 87%, the allowable PCC system contribution to the total plant unavailability (plant forced outage time) shall be equal to or less than 0.02%, according to the document listed in paragraph 2.1.2.1.j.

4.2.7.2 The system maintenance has to be performed during refueling. (The maintainability criterion for SBWR is that regular refueling and planned plant maintenance can be accomplished in one 50-day outage every two years).

4.2.7.3 From the point of view of refueling outage time, the PCCS is not in a critical path.

4.2.7.4 The mean time between failures shall be, as objective, 60 years.

4.2.8 Environment.

4.2.8.1 Passive Containment Cooling System components (heat exchanger and piping) are required to function under emergency and faulted conditions. Therefore, it shall be designed to remain functional under the abnormal environmental conditions in addition to the normal conditions defined in document paragraph 2.1.2.1.k.

4.2.8.2 For purposes of radiation shielding design, Source Terms document (see paragraph 2.1.2.l) shall be used.

4.2.8.3 Passive Containment Cooling System is not provided with thermal insulation.

4.2.9 Maintenance. No preventive maintenance actions are expected to be performed during normal plant operation.

The PCC Condenser headers, PCC pool and piping shall be arranged so that the heat exchanger tubes can be plugged, if needed. Plugging will be done during plant shutdown.

If there is considerable damage to some component part of the PCC Condenser, each module of the unit shall be easily removable, after cutting the feed, drain and vent lines.

The pool water in the PCC condenser subcompartment shall be removable for PCC condenser cleaning, inspection and testing without emptying the entire ICS/PCCS pool.

4.2.10 Surveillance Testing and In-Service Inspection.

4.2.10.1 During plant outages routine ISI is required for the Passive Containment Cooling Condenser, piping, supports, and containment penetration sleeves according to ASME Code Section III and Section XI (requirements for design and accessibility of welds).

PCC condenser removal for routine inspection is not required.

Ultrasonic inspection is required for PCC Condenser tube/header welds.
PCC Condenser tubes shall be inspected by the Eddy current method.

Inspection and leak testing will be done during refueling outages.

4.3 Specific Requirements for Components

4.3.1 Passive Containment Cooling Condenser.

4.3.1.1 The Passive Containment Cooling Condenser shall consist of 3 units. Each unit may be made of two identical modules and shall be designed for 10 MWt capacity, nominal, at the following conditions:

- pure saturated steam in the tubes at 3.04 ata (absolute) and 134°C;
- pool water temperature at atmospheric pressure and 102°C.

4.3.1.2 Design pressure and temperature:
758.5 kPa (g) (110 psig),
171°C (340°F).
The temperature design value is based on the drywell response to a design basis loss-of-coolant accident.

4.3.1.3 The PCC Condenser is an extension of the containment (drywell) pressure boundary. Therefore, ASME Code Section III Class II and TEMA Class R apply.

4.3.1.4 Material shall be nuclear grade stainless steel or other material which is not susceptible to IGSC (Intergranular Stress Corrosion).

4.3.1.5 Pressure losses for condenser and vent line shall be limited: <850 mm of water at suppression pool temperature at the flow rate defined in "mode C" (Post-LOCA Quasi-Steady State Conditions) of the ref. document 2.1.1.b..

4.3.1.6 The PCC Condenser modules must be removable for replacement, if needed, during plant shutdowns.

4.3.2 IC/PCC Pool.

4.3.2.1 Both the Passive Containment Cooling Condensers and the Isolation Condensers are located in a large water pool, positioned above the drywell.

The large IC/PCC pool is partitioned but each IC and PCC Condenser must be able to draw water from the entire pool; the pool air/steam spaces and vent system to atmosphere are commonly used by all IC and PCC units.

4.3.2.2 The pool subcompartment interconnections shall be as follows: except for the IC and PCC pool compartments, all other pool subcompartments shall be interconnected below pool water level; the IC/PCC pool subcompartments shall be connected to the other pools below the water level by locked open valves, one for each subcompartment, which can be closed to isolate and empty it, using a portable pump. Emptying the subcompartment allows maintenance of the unit during refueling (see ref. paragraph 2.1.1.a).

4.3.2.3 The location of the PCC Condenser tubes in the PCC pool shall be such as to guarantee the required performance for 72 hours minimum. The requirement for IC System is more limiting for pool design (see ref. paragraph 2.1.2.1.a).

4.3.2.4 Locked open valve remote handwheels shall be extended above water level, to locations which are accessible to the operator.

4.3.2.5 The walls which contain the airspace flow path shall extend above the normal water level; this enhances the flow stability and heat removal of the condensers by establishing a flow path for the make-up water through the lower pipes.

4.3.2.6 For IC/PCC pool instrumentation, see ref. paragraph 2.1.2.1.d and 2.1.2.1.e.

4.3.2.7 For IC/PCC pool make-up, see paragraph 3.2 and ref. paragraph 2.1.2.1.f.

4.3.2.8 Steam dryers are required to remove carryover moisture from the ICS/PCC pool before it is released to atmosphere. The moisture content of the steam leaving the vent pipe shall not exceed 2% of the mass flow of the steam generated in the ICS/PCC pool.

4.4 Quality Assurance.

4.4.1 General.

Later.

4.4.2 Tests and Examination.

Later.

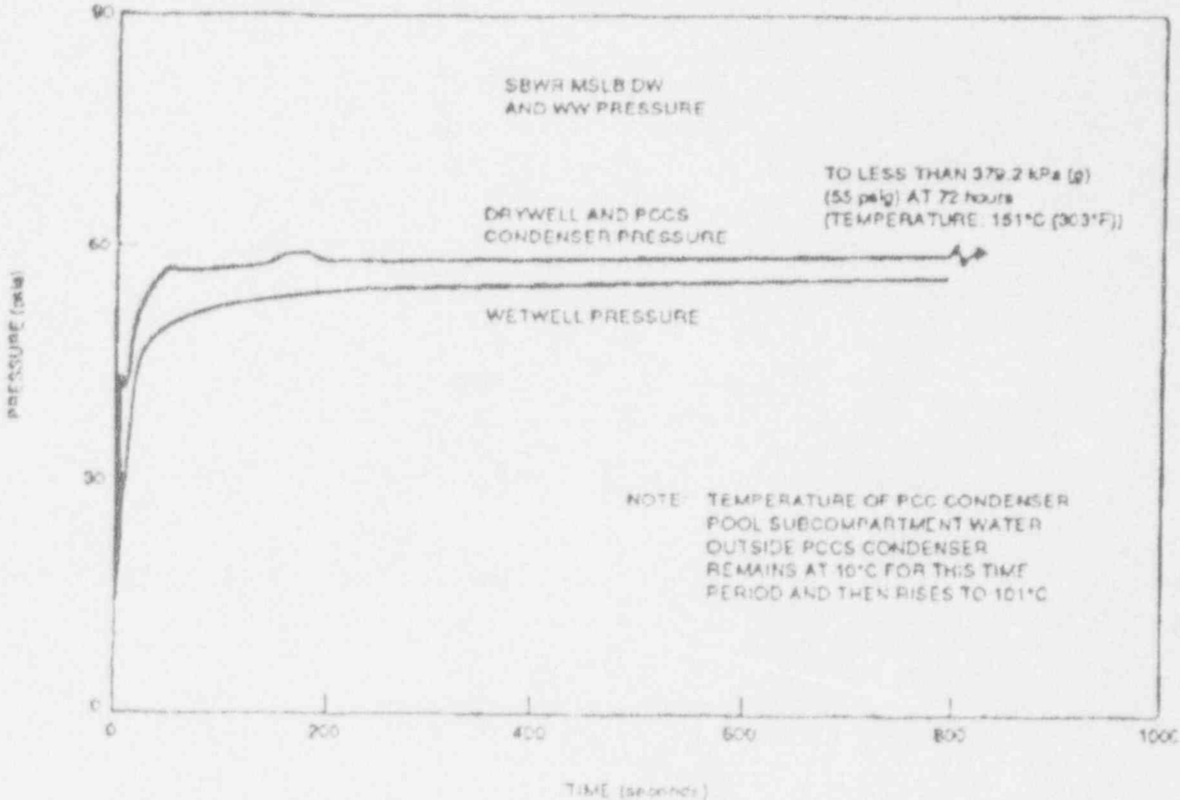

FIGURE 4.1. CONTAINMENT PRESSURE RESPONSE TO A MSLB

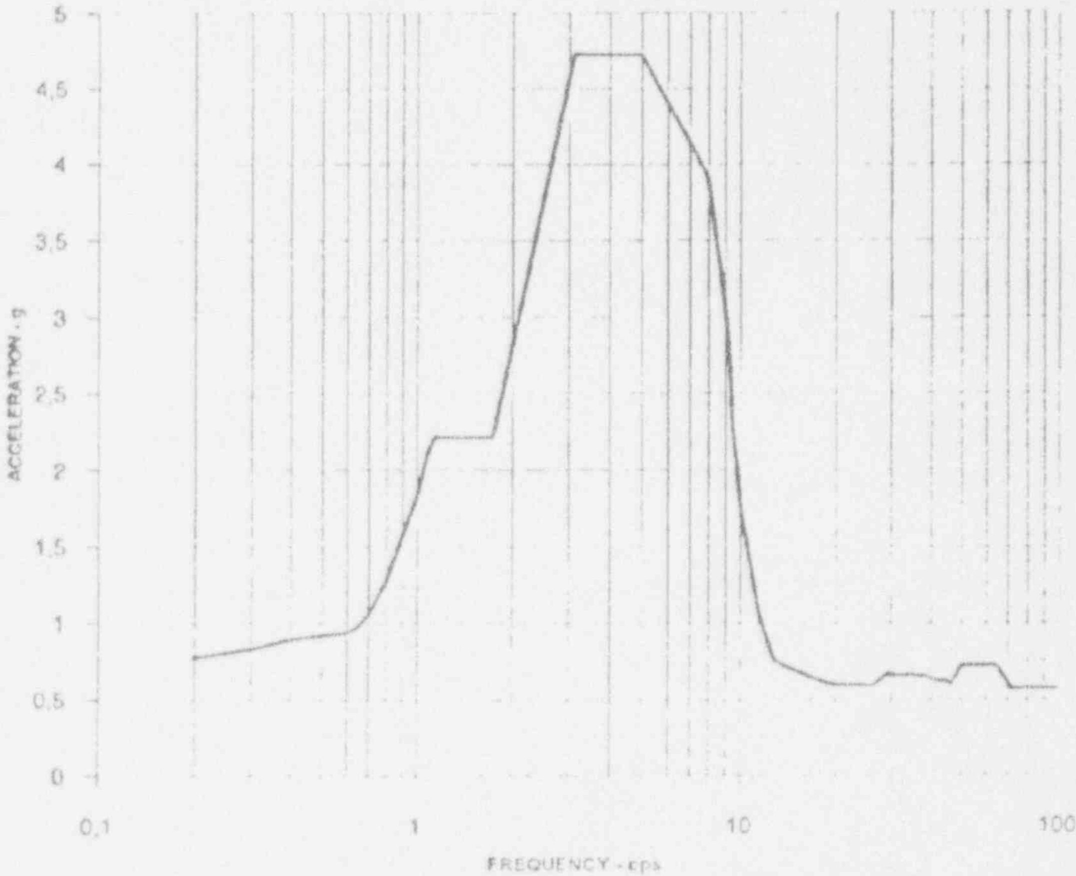

FIGURE 4-2. UPSET CONDITION DYNAMIC LOAD RESPONSE SPECTRA HORIZONTAL

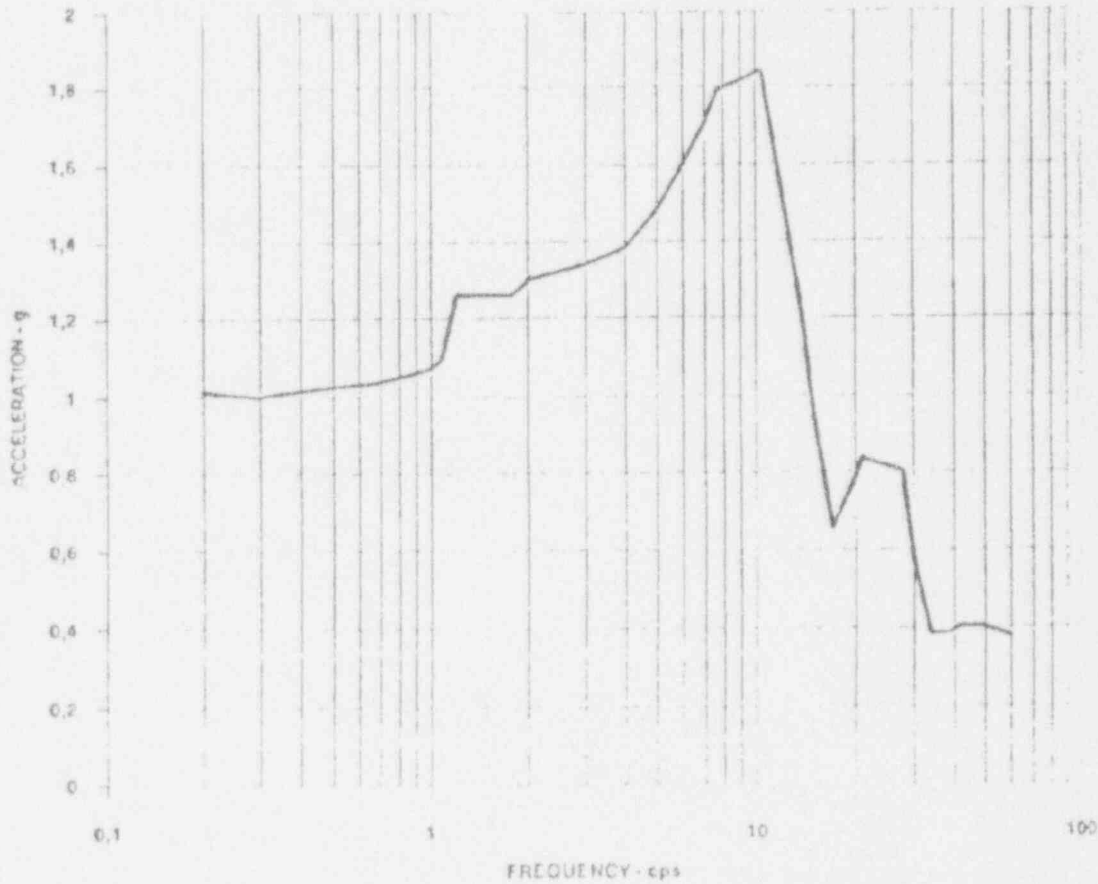

FIGURE 4-3. UPSET CONDITION DYNAMIC LOAD RESPONSE SPECTRA VERTICAL

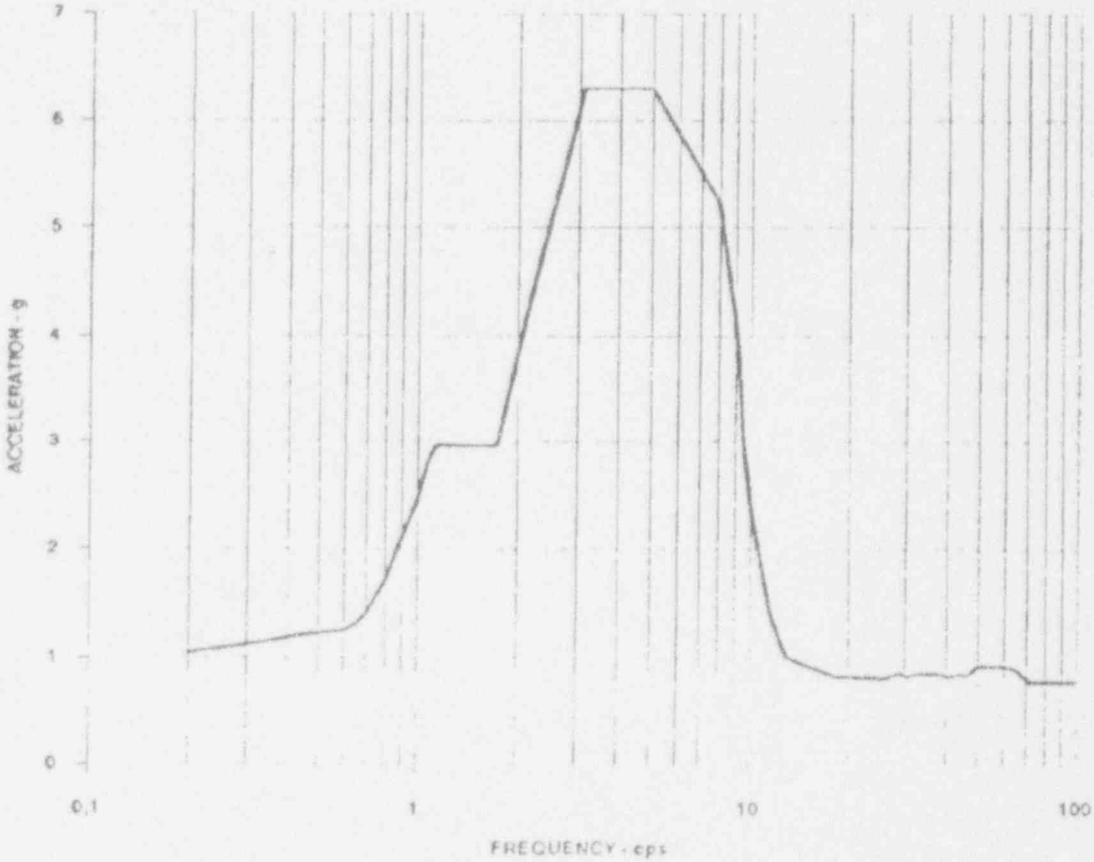

FIGURE 4-4. FAULTED CONDITION DYNAMIC LOADING HORIZONTAL
*Service Level C Limits Apply for the PCCS

FIGURE 4-5. FAULTED CONDITION DYNAMIC LOADING VERTICAL
*Service Level C Limits Apply for the PCCS

APPENDIX 10 SYSTEM TECHNICAL SPECIFICATIONS

The objective is to preserve the capability of PCCS to perform its function.

Limiting Conditions for Operation (LCO):

- 3 PCCS subsystems shall be available during operation at full reactor power;
- 2 PCCS subsystems shall be available during operation at ≤65% power;
- 1 PCCS subsystem shall be available during startup and during operation at 30% power;

and:

- in case of low suppression pool water level, take action according to "Suppression Pool Water Level LCO";
- in case of low IC/PCC pool water level, take action according to "IC/PCC pool Water Level LCO".